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AN OPTIMALITY THEORY ACCOUNT OF THE PHONOLOGICAL PROCESSES INVOLVED IN HIATUS RESOLUTION IN THE OLUTURA DIALECT OF LUYIA

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The aim of the present study was to determine if Optimality Theory (OT) constraint interaction was capable of explaining the phonological processes that are used in Hiatus resolution (HR) in Olutura, a dialect of Luyia, a Bantu language spoken in Western Kenya. HR refers to the strategies that are used to remove the unnatural pause that is created when two sound segments from different syllables come into contact. In the OT Correspondence Theory (CT) model, constraints are the conflicting forces whose ranking leads to the selection of the optimal or winning form from a list of possible candidates. The winning candidate is the one that satisfies the phonotactics of the language (in this case, Olutura) by meeting the specific requirements for HR which depend on the sound segments involved in the formation of the required syllable. The emergence of the best candidate reveals the specific phonological process that is used as a strategy for HR. Primary data was collected from first language speakers of Olutura, who were identified through purposive sampling. The results show that Olutura uses coalescence, glide formation, epenthesis, prothesis and deletion in HR and that the dialect allows a few cases of hiatus. The study concludes that the ranking of constraints in OT can help determine the phonological processes that are used as strategies for HR in the various environments where hiatus is not allowed in Olutura.

1. INTRODUCTION: *CONSTRAINT INTERACTION* AND *HIATUS* IN OPTIMALITY THEORY (OT)

In phonology, a constraint can be used to refer to the restriction on the sound segments that may occur together in syllable formation in a language. Constraints come from the operational constraint component of OT referred to as EVAL which selects one member from the other OT component called GEN. GEN puts forward a set of candidate output forms that are different from the input form so that EVAL selects the optimal one. The fact that there is an interaction of various candidates means that constraints can either be satisfied or violated because in OT, the correct forms of a language are realized from the optimal satisfaction of one of the

competing forms of candidates. About *constraint interaction,* the present study defines it as the forces that come alive in the constraints as they conflict with one another in order to fulfil the structural requirements of a particular language in terms of the optimal output. Regarding this conflicting interaction of constraints, Nathan (2008: 147) notes, "They conflict with one another, and some are more "powerful" within a particular language at a particular time than others, so in a conflict the more powerful one wins". According to McCarthy (2007: 6), the constraints concerned are arranged in "strict- domination hierarchies, in which superior performance on lower ranking constraints can never overcome inferior performance on higher-ranking constraints". While constraint ranking is language-specific because it depends on the grammar of a language, the OT model has a universal constraint component called CON which has two types of constraints: markedness and faithfulness. In a language, markedness constraints require that output forms meet some criterion of structural well formedness while faithfulness constraints require that there should be some similarity between the output and its input. This means that a conflict always arises as the two types of constraints interact so that the phonotactics of a language give rise to the optimal candidate which is the one that meets the structural requirements of the language. In the case of the current study, the structural requirements of Olutura demand that a surface representation (SR) does not realize tautosyllabic vowels, as this would cause either hiatus or diphthongs. Hiatus occurrence is very rare in Olutura and must be resolved when it is not required, while diphthongs are completely ruled out. For its part, *hiatus* is the pause that is created when two sound segments which occur in heterosyllabic syllables across a word boundary come into contact. *Hiatus resolution* (HR) is, therefore, the process that is used to remove that pause. The interaction of constraints causes conflict as competing candidate outputs must either violate or satisfy given constraints.

Regarding the issue of constraints, Nathan (2008: 147) notes that "What is crucial about the constraints in OT is that they are defeasible. This is a technical term from the logic meaning that they do not hold absolutely but can be overridden by a higher-ranking constraint". This in essence means that the constraints cannot all be optimal at the same time and so they conflict with each other in such a way that only one of them emerges as the winner. Therefore, every language uses

certain strategies to select output forms that violate lower-ranking constraints other than those that violate the higher-ranking ones. Consider Tableau 1.

Tableau 1: Constraint evaluation in Olutura

Input /ßa + -ona/	*HIATUS	*DIPH	DEP-IO(C)
a. ☞ [ßa,ko,na]			*
b. [ßa.o.na]	*!		
c. [ßao.na]		*!	

In Tableau 1, hiatus would occur if the Olutura underlying representation (UR) /-ona/, with the input /ßa +-ona/, had the surface realization (SR) (i.e. output) of the Olutura word meaning 'they sleep', as [ßa.o.na], which would make it have a meaning other than that intended. To resolve this, OT uses a mechanism called GEN to generate several prospective output candidate forms from which the optimal candidate can emerge. The OT mechanism for selecting the right candidate involves the hierarchical ranking of constraints which, according to Prince & Smolensky (2004: 2) should be in "strict dominance hierarchies". Steriade (1994: 29), Gussenhoven & Jacobs (1998: 209), McCarthy (2007: 5), and others, all state that "the higher-ranked constraints have priority over the lower-ranked ones" and that "the ranking of constraints is language-particular". Higher-ranked constraints are those that have properties that are not allowed in the language and so should not be violated by the winning candidate. This means that higher-ranked constraints should not be dominated. For their part, lower-ranked constraints have properties that the language allows and can, therefore, be violated by the winning candidate, an occurrence that is indicated by a pointing finger (☞). In OT terms, lower-ranked constraints are dominated by the higher-ranked ones. A candidate makes a fatal violation if it violates a constraint that is higher-ranked or undominated, an occurrence that is indicated by an exclamation mark beside the star of violation (*!). The candidates in each tableau represent the various possibilities that may be found in the language and the winner among them is the one that meets the structural requirements of the language in the particular circumstances. In Tableau 1, the prospective candidates are evaluated using the OT constraints *HIATUS which

bans hiatus), *DIPH which bans diphthongs, and DIP-IO(C) which bans the insertion of consonant segments that are not represented in the input. The constraints involved are ranked as *HIATUS, *DIPH >> DIP-IO(C). This, as shown in Tableau 1, means that the constraints *HIATUS and *DIPH have equal status but are ranked higher than DIP-IO(C).

From the ranking of constraints in Tableau 1, candidate (a) emerges as the optimal candidate by violating a lower-ranked constraint. Neither candidate (b) nor (c) can win because they both violate higher-ranked constraints, an occurrence that is indicated by the exclamation mark (!) which is the OT symbol for a fatal violation. Therefore, candidate (a) meets the structural requirements of Olutura. Kager (2004: 9) points out that "a form SATISFIES a constraint if it fully meets the structural requirement, while any form not meeting this requirement is said to VIOLATE it". Indeed, the interaction of the constraints in Tableau 1 reveals that in this case hiatus is resolved using the phonological process of prothesis, which allows the insertion of a segment that is not represented in the input. In this case, the input [ßa +ona] does not have the segment /k/ which only emerges in the winning candidate [ßa.ko.na], 'they sleep'.

OT has two types of constraints: faithfulness and markedness. According to McCarthy (2007: 6), "Faithfulness constraints are inherently conservative, requiring the output of the grammar to resemble its input". Markedness constraints on the other hand require that output forms meet some criterion of well-formedness. The faithful characteristic of the OT Correspondence Theory (CT) model states that correspondence is the input and output relation between the elements of the first structure (S_1) and the second structure (S_2), and that two representations which stand in correspondence can be evaluated by constraints which are violable (Kager 2004: 4 and Kawahara 2009: 2). What this implies is that optimal candidates may have relationships with elements that have feature changes by virtue of being different from their inputs. This means that although the elements of S_2 can vary from those of S_1, they must meet the structural requirements of the given language. In the case of Olutura, there are three structural requirements: a) all its syllables are open, by virtue of them ending with vowel sounds; b) syllables should not have diphthongs; c) hiatus should be resolved across the word boundary in all instances

where it is not required. (Note in passing that there are very few cases in which hiatus is allowed in Olutura.)

2. THE PHONOLOGICAL PROCESSES INVOLVED IN HIATUS RESOLUTION IN OLUTURA

According to McCarthy (2007: 6), "formerly, processes are neither triggered nor blocked; instead, the process component GEN supplies a broad array of possible outputs that reflect the results of applying various operations". Such operations are embodied in phonological processes which ensure the right syllabification in a language is achieved.

The present study's aim is to determine the phonological processes that Olutura uses to resolve hiatus at the morphophonemic word boundary when either two vowels or two consonants that belong to different syllables come into contact. Regarding vowels, this paper adopts the definition of HR by Vratsanos & Kadenge (2017: 176) which says that "vowel hiatus is a sequence of heterosyllabic vowels, $V_1.V_2$". V_1 refers to the last vowel in the first word while V_2 refers to the first vowel in the second word of a pair of words under analysis. According to Mudzingwa & Kadenge (2011: 236), hiatus does not only "create unnaturalness, but also difficulties in articulation", and that is why "a number of studies indicate that vowel hiatus is prohibited in many Bantu languages". Both Casali (2011: 17) and Vratsanos & Kadenge (2017: 176) observe that "languages that avoid hiatus resolve it through phonological processes such as coalescence, glide formation, epenthesis, prosthesis and elision". Generally, certain rules apply to remove complex representations and replace them with simpler ones. The phonotactics of a language forces it to find a way of repairing inputs that do not meet the phonotactic requirements of the language by removing such complex representations.

The data on which the present study is based revealed that HR in Olutura is achieved through the phonological processes of coalescence, glide formation, epenthesis, deletion, and prothesis, or a combination of some of these.

2.1 Coalescence in Olutura

Coalescence is a phonological process in which "two neighbouring sound segments are affected by one another" (Massamba 1996: 96). It is a frequent strategy used in hiatus resolution in many Bantu languages (Casali 1997: 493). With specific reference to vowel coalescence, Schane (1973: 55) writes that "vowel clusters are reduced to a single one, making the new syllable structure simpler". Coalescence is thus one of the phonological processes that affect the configuration of the optimal syllable in Olutura. In HR, coalescence occurs across a syntactic boundary that takes place within a phonological word. This process occurs in vowels that are adjacent to each other because the morphemes they belong to occur at the end and beginning of adjacent words. Two types of coalescence occur in Olutura: vowel-height coalescence and identity coalescence.

2.1.1 Vowel-height coalescence

This type of coalescence takes place when V_1 is a low vowel and V_2 is a high vowel in the underlying representation (UR). In the surface representation (SR), they both coalesce into a mid-vowel as illustrated in Example (1).

(1) Olutura low vowel /a/ and high /i/ vowel coalesce into mid-vowel /e:/

	Input	**UR**	**SR**	**Gloss**
(i)	/a+ i/	/ßa+ima/	[ße:ma]	they are standing
(ii)	/a + i/	/ ßa + ißa/	[ße:ßa]	they are stealing
(iii)	/a + i/	/ßa + isia/	[ße:sja]	they bring down
(iv)	/a + i/	/ßa + imba/	[ße:mba]	they sing
(v)	/a+ i/	/ba + ira/	[βe:ra]	they kill

From the data in 1, the two vowels /a/ and /i/ fuse into the mid-vowel /e/ and also acquire a new feature of length. They, therefore, lose their original features of [+ high] and [-high] and fuse into the mid vowel /e/. The new feature of length, however, preserves the moras from the input seen in both V_1 and V_2. In this paper, the numerals 1 and 2 are subscripted to indicate the vowels at the end of the first morpheme or word and beginning of the second morpheme or word, respectively,

in the pair under analysis. The resultant long vowel seen in all the examples in 1 are an indicator of how Olutura is able to avoid the occurrence of diphthongs, a combination of different vowels that is not allowed in this particular language. The occurrence of long vowels is in line with the phonotactics of Olutura which has long vowels in its vowel phonetic inventory. Vowel height coalescence in Olutura can also occur between a vowel that is [+low] and one that is [-high]. The second vowel in the pair is a mid-vowel as shown in (2).

(2) Olutura low and mid vowel coalescence

	Input	**UR**	**SR**	**Gloss**
(i)	/a +e /	/am**a** + **e**ŋga/	[ame:ŋgu]	ripe ones
(ii)	/a + e/	/am**a**+ **e**na/	[ame:na]	holes
(ii)	/a + e/	/am**a** + **e**so/	[ame:so]	awake
(iv)	/ a + e/	/ am**a** + **e**ra/	[ame:ra]	names

OT constraint interaction is used in Tableau 2 to show vowel height coalescence in Olutura.

Tableau 2: Constraint interaction in Olutura coalescence

/βa+ imba/	*HIATUS	*DIPH	IDENT(μ)	UNIFORMITY-IO
a. [βa.i.mba]	*!			
b. ☞ [βe:.mba]				*
c. [βai.mba]		*!		
d. [βe.mba]			*	*

From the analysis in Tableau 2, candidate (a) violates the constraint *HIATUS which is a serious violation because Olutura rarely allows hiatus and that is why the dialect uses coalescence as one of the strategies to avoid it. Candidate (c) violates *DIPH which is also a serious violation because diphthongs do not occur in the phonemic inventory of Olutura. Candidate (d) violates the constraint IDENT(μ) because the output has a short vowel as opposed to the input and has, therefore, lost one mora. The constraint IDENT(μ) stipulates that mora places between the UR and SR should be identical. It also makes a second violation of UNIFORMITY–IO and cannot, therefore, win. The constraint UNIFORMITY–IO requires that both UR and SR should be similar or uniform in all aspects. Candidate (b) emerges as the optimal candidate

for two reasons. The first one is that it only violates UNIFORMITY-IO which is a lower- ranked constraint and therefore, inconsequential because any candidate that competes favourably in the current analysis must violate it. The second reason is that candidate (b) maintains the mora places of the input despite it losing the original vowels, the moraic places are maintained through the resultant long vowel.

2.1.2 *Identity coalescence*

Identity coalescence occurs when identical short vowels merge into a long vowel. In this type of coalescence, identical vowels coalesce in a way that there is no change in the vowel quality in the output (Sabao 2013: 9). This type of coalescence is illustrated using the Olutura words in (3).

(3) Identity coalescence in Olutura

(i)	/i + i /	/ni + imba/	[ni:mba]	I am singing
(ii)	/ i + i /	/ni + iŋga/	[ni:ŋga]	I am pressing out
(iii)	/ u + u/	/ßu + ula/	[ßu:la]	reveal
(iv)	/o +o/	/ßo +olola/	[ßo:lola]	untie
(v)	/ a + a/	/ßa + amba/	[ßa:mba]	they massage

This shows a coalescence occurrence in which all the features of the input are retained in the output as shown in Figure 1.

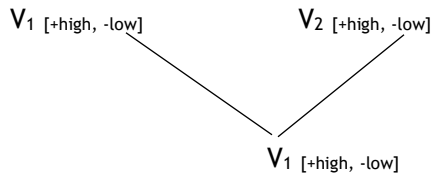


Figure 1: Olutura identity coalescence

The coalescence of the two identical vowels helps Olutura to avoid the surface realization of heterosyllabic vowels in some environments in the output. We note that although heterosyllabic sequences are allowed in Olutura in some environments, identity coalescence certainly helps to avoid the occurrence of diphthongs. This is what results in the occurrence of the CV: syllable structure

which is composed of a consonant and a long vowel in Olutura. In this case, coalescence is driven by the onset at the morphophonemic boundary. In actual articulation, it is in fact V_2 that fuses into V_1 because its non-assimilatory articulation is what would, otherwise, create hiatus due to the separate articulation of [ni] and [imba]. The interaction of constraints in OT has been used to bring out the occurrence of Olutura identity coalescence in Tableau 3. Apart from *HIATUS, which forbids hiatus, the other constraints that are relevant in the analysis of Tableau 3 are IDENT(μ) and DEP-IO. IDENT(μ) forbids the occurrence of moras that are not represented in the input. In this case, it is used to check whether every mora in the input has a correspondent in the output. DEP-IO, a constraint that forbids insertion, is used to check whether there is epenthesis of any segments in the output that do not occur in the input. The constraint *V: forbids the occurrence of long vowels and is relevant in this analysis because the vowel segments concerned lead to a long vowel. This is the constraint that is against coalescence of identical vowels, hence it must be violated by the winning candidate. For this case, the other constraint that is relevant is IDENT-IO(F) which stipulates that the features in the input and output should be identical. IDENT-IO(F) is used to evaluate whether the input and output bear identical specifications for the feature [+high, -low]. This is the feature that motivates the occurrence of the identity of coalescence. The constraint *HIATUS should not be dominated because it is the cause of the violations that the other constraints incur.

Tableau 3: Constraint interaction in Olutura identity coalescence

input /ni+itsa/	*HIATUS	DEP-IO(C)	IDENT-IO(μ)	IDENT-IO(F)	*V:
a. ni.i.tsa	*!				
b. ☞ **ni:.tsa**					*
c. ni.tsa			*	*	
d. ni.ni.tsa		*		*	

From Tableau 3, the input [ni +itsa] has four candidates and is evaluated using five constraints. The constraints *V: and IDENT-IO(F) are dominated because the change that they undergo is determined by the constraints that dominate them. Candidate

(a) violates the constraint *HIATUS which is un-dominated in the operational set of the constraints at hand. This is, therefore, a serious violation because Olutura, in this case, does not tolerate hiatus and that is why (a) cannot be optimal. Candidate (c) makes two violations of the constraints, IDENT-IO(μ) and IDENT-IO(F). Both violations are not serious although the candidate does not emerge as the optimal one. In the later violation, candidate (c) does not have the initial vowel which marks the feature [+high] in the lexical morpheme in the input and this is what causes it to lose out. Its violation of IDENT-IO(μ) makes candidate (c) to lose out on account of the moras which, compared to the input, are less in the output. Candidate (d) violates the constraints DEP-IO(C) and IDENT-IO(F) by inserting a consonant segment to have a CV instead of V syllable and by having an output that does not correspond to the features of the input, respectively. The constraints DEP-IO(C) and IDENT-IO(F) demand that a consonant that is not represented in the UR should not be inserted in the SR, that there should be identity between the UR and SR for a given feature, respectively. While the said violations are not serious, they yield an output that is not semantically permissible in Olutura. The winning candidate, (b), is optimal as it incurs only one violation of the constraint *V: which prohibits the occurrence of long vowels. Although the feature of the short vowel that occurs in the input is lost, the resultant output, which has a long vowel, maintains the mora places in the input and conforms to Olutura syllable formation. The ranking of the constraints resolves hiatus by yielding the long CV: syllable which is brought forth by the coalescence of the two identical [+high] vowels which were initially in the input. The long vowel ensures maintenance of the feature qualities that are in both vowels in the input. This means that there is segment identity between the input and output in terms of the feature [+high]. Therefore, in Olutura, coalescence as a strategy for HR occurs with identical vowels as observed in Tableau 2. This is seen in the merging of two identical vowels in the input.

2.2 Glide formation (GF) in Olutura

Another phonological process that is used as a strategy for HR in Bantu languages is glide formation (GF). With regard to GF, this study is in line with Sabao (2013: 28) who postulates that “if two vowels occur together, they both delete and if the first

vowel is [+ high], it will change into a glide as long as the following vowel is not identical". Glides are formed when a high vowel that is followed by another vowel, mostly a non-high vowel changes into a glide. In Olutura, glide formation results from the two glides /w/ and /j/ across the morphophonemic word boundary. In this dialect, glide formation resulting from the bilabial approximant /w/ occurs in three instances. Firstly, GL occurs when a [+high] vowel is followed by another [+high] vowel. In this case, V_1 changes into a glide while V_2 is retained but forms the nucleus of the resultant CGV syllable composed of a consonant, a glide and a vowel (see examples 4 (i) to (iii)). As opposed to the definition at the beginning of this section, this shows that in Olutura, Glide formation also occurs when two [+high] vowels are adjacent to each other at the morphophonemic word boundary. Secondly, it occurs when a [+high] vowel is followed by a [+low] vowel as seen in examples (4) (iv) to (vii). Just as in the first instance, V_1 becomes a glide while V_2 is retained. Thirdly, it involves a [+high] vowel as the V_1 and a [-high] [-low] vowel, in this case a mid-vowel as the V_2. This is shown in examples (4) (viii) and (ix).

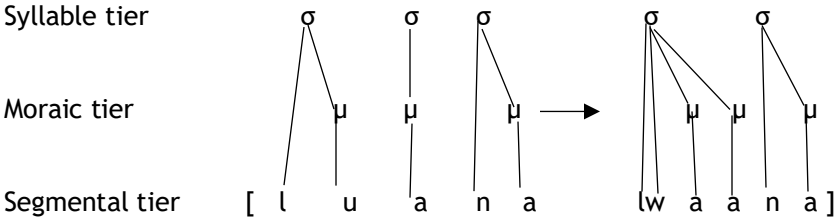
(4) [+high] vowel gliding in Olutura

		UR	**SR**	**Gloss**
(i)	[u + i]	/omu + imbi/	[omwimbi]	a singer
(ii)	[u + i]	/mu + iri/	[mwi:ri]	a killer
(iii)	[u + i]	/ omu + itsa /	[omwitsa]	a friend
(iv)	[u + a]	/omu + ana /	[omwana]	a child
(v)	[u + a]	/ lu + ana/	[lwa:na]	struggle
(vi)	[u +a]	/olu + asa]	[olwasa]	gap
(vii)	[u + a]	/ omu + anda/	[omwanda]	a road
(viii)	[u + o]	/ omu +oni/	[omwoni]	a sinner
(ix)	[u + e]	/ exu + eja/	[exwe:ja]	to sweep

The above examples show that in Olutura, glide formation may or may not result in compensatory lengthening. In examples (4) (i), (iii), (iv), (vi), (vii) and (viii), there is no compensatory lengthening. The [+high] vowel that moves to the onset is not compensated in the output. In these examples, the [+high] vowel /u/ is lost but is replaced by the glide /w/, an occurrence in which one mora place is actually lost since the input had two mora places, one in the prefix and the other in the stem.

However, in examples (4) (ii), (v) and (ix), compensatory lengthening takes place because V_1, which is a [+high] vowel /u/ is syllabified as part of the onset and loses its weight but this is compensated in the extra vowel that brings forth a long vowel. This occurrence in Olutura supports the observation by Goldsmith (1990: 53) [that the vowel slots, and in turn, the mora places are, therefore, preserved because] "moras play an autosegmental role and that is why they are not usually deleted". Sound segments that play an autosegmental role are vital in syllable formation because they convey meaning and so should not be deleted. Although V_1 is replaced by the non moraic [w], its mora is compensated in the lengthening of V_2. Glides are non moraic in Olutura because of their capability to form onsets in this dialect. Compensatory lengthening is shown in Figure 2.

Gloss



wrestle

Figure 2: Olutura compensatory lengthening GF

In Figure 2, the [+high] vowel /u/ becomes a glide and the mora that is lost when this happens is recovered in the output through compensatory lengthening which is realized through an extra [+low] vowel /a/. The syllable in the output is then realized as CV: from the CV.V that is represented in the input. Figure 2 shows that the middle zero onset syllable moves to the nucleus of the preceding CV syllable in the output. We observe here that glide formation changes the configuration of the syllable as HR happens.

There are times when the [+high] vowel /u/ fails to form a glide in the environment of the mid vowel /o/ in Olutura. When this happens, the first vowel/u/ does not elide but is instead syllabified as the nucleus of the CV syllable. This leaves the /o/ intact as an onsetless syllable in word medial position which means that HR does not take place. The lack of HR in Olutura is demonstrated in (5).

(5) Olutura non-glide forming /u/

(a)

(i) /xu+oma/ [xu.o.ma] to smoothen a floor using cow dung

(ii) /xu +ana/ [xu.ana] to give

(b)

(i) /xu + o.ma/ [xwo.ma] to dry up

(ii) /xu + a.na] [xwa.na] mow (like a cow)

This occurrence is used in Olutura as a meaning distinguishing strategy because the words in 5(a) change the meaning when the /u/ changes into a glide in 5(b).

In Olutura, GF involving the palatal glide /j/ takes place when the [+high] vowel /i/ comes before any [+high] or [-high] vowel as exemplified in 6. The [+high] vowel which is V_1 changes to the glide /j/ while V_2 is retained in the SR. If V_1 is the [+high] /i/, it is realized as a palatal glide /j/ in the SR. In Olutura, GF is also used to resolve hiatus when the prevocalic high vowel /i/ changes into the palatal glide /j/as shown in (6).

(6) Olutura pre-vocalic glide formation.

	Input	**UR**	**SR**	**Gloss**
(i)	[i + a]	/emi + aju/	[emjayu]	act of yawning
(ii)	[i + a]	/eβi + amo]	[eβjamo]	crops
(iii)	[i + a]	/ esi +aŋge	[esjaŋge]	mine
(iii)	[i +o]	/eβi + omu]	[eβjomu]	dry ones
(iv)	[i +e]	/eʃi + enda]	[esjenda]	I fetch it

In the case of /j/, glide formation occurs when the [+high] vowel /i/ in the UR is phonetically realized as a palatal glide in the SR. This occurrence always happens whenever the glide /j/ comes before a high, mid- or low vowel in all cases where hiatus must be resolved. It was observed that in Olutura, glide formation always leads to the segment change of V_1 and not V_2. The reason for this lies in the notion of positional faithfulness which protects V_2 as it is at the privileged word initial position where segments always resist phonological change of any kind.

GF and compensatory lengthening in Olutura are expounded using OT constraint interaction in Tableau 4. The constraint *HIATUS is ranked high here because Olutura is supposed to use the phonological process of labialization to resolve hiatus which the dialect prohibits in this context. *DIPH is necessary because the nature of the input can easily result in an output that has a diphthong, an occurrence that is not allowed. The constraint IDENT-IO(μ) is necessary in this analysis so as to evaluate the occurrence of moras which should be maintained in both the input and output. This is the constraint that should evaluate if there is compensatory lengthening in the output. The other constraint that is important in this analysis is *$COMP_{ONS(LAB)}$ which is used to evaluate the occurrence of labialization that should be there in the output. This particular constraint should be ranked lowest because the winning candidate should violate it. The ranking that is used in this analysis is as follows: *HIATUS,*DIPH >> MAX-IO(μ) >> $COMP_{ONS(LAB)}$, V:

Tableau 4: Olutura compensatory glide formation

/lu.$_{1+}$a$_{.2+}$ na/	*HIATUS	*DIPH	IDENT-IO(μ)	V:	*$COMP_{ONS(LAB)}$
a. [lua.na]		*!			
b. ☞ [lwa:na]				*	*
c. [lu.na]			*!		
d. [lu.ana]	*!				

Candidate (a) undergoes a serious violation of *DIPH, and as such, loses all the chances of winning for the foregoing reasons introduced in section 1. Similarly, candidate (d) also undergoes a serious violation of *HIATUS and loses out any chance of competing further. Candidate (c) fails to resolve hiatus by violating IDENT-IO(μ) because it has an output that is less with one mora as compared to the input. This happens due to the loss of one of the moras that was initially in the input but fails to emerge in the output. This is caused by the deletion of the [-high] vowel /a/ which is not compensated in the output. The violation of IDENT-IO(μ) is serious because the loss of one mora results in a word that does not occur in Olutura. This means that the extra mora in the input carries meaning and, thus, should not be lost. The optimal candidate from this set of candidates is (b), which makes two violations: *$COMP_{ONS(LAB)}$ and V: The former constraint prohibits the occurrence of

onsets with complex labialized segments while the latter prohibits the occurrence of long vowels. However, the constraints that (b) violates are lower-ranked and it must necessarily violate them. This is because labialization which happens through the realization of the [+high] vowel /u/ as a glide is what Olutura must use to resolve the hiatus that is seen in the input. In this analysis, although the [+high] vowel /u/ loses its mora by moving to the onset as a glide, compensatory lengthening is achieved through the violation of the constraint V: by realizing a long vowel.

2.3 Epenthesis in Olutura

This dialect uses consonant and vowel epenthesis to repair sound combinations to make them conform to its optimal syllable. In general terms, epenthesis is the insertion of a segment in a position other than word initial position. Lass (1984: 184) says that "all epentheses can be interpreted as a 'replacement of zero' by something" and Kager (2004: 98) concurs, saying that "the epenthetic segment has no counterpart in the input". Certainly, the motivation for epenthesis is to repair inputs that do not meet the phonotactic or structural requirements of a language. The reasons for these requirements depend on specific languages but both Massamba (1996: 99) and Jensen (2004: 57) agree that they revolve around the ease of consonant perception and pronunciation, giving words the required number of syllables and avoiding complicated segmental sequences. In Olutura, epenthesis is used as a strategy for HR, taking cognizant of the definition of hiatus given in section 1 in which hiatus is also created through the contact of, not just vowels, but also consonants. In this section, we demonstrate how hiatus is created whenever a UR needs to have a morphophonemic SR of a different grammatical function. When this happens, HR is achieved through the epenthesis of consonants, vowels or entire syllables.

2.3.1 Syllable epenthesis

Piggott (1995: 286) notes that "If syllable structure restrictions prevent a consonant from combining with a vowel to form the optimal syllable, depending on the language, the epenthesis of a syllable may be realized if the concerned syllable is

not deleted altogether" We observed the epenthesis of the CV syllable at either word medial or word final position in Olutura lexical items. Epenthesis in Olutura is determined by the morphological classes of number, possession, noun class and case. This means that the constituents of the epenthetic CV syllable are determined by the grammatical category. In Olutura different CV syllables (shown in bold in the SR) are used to realize the singular as they also remove hiatus as shown in (7).

(7) Olutura CV syllable epenthesis

	Input	**UR**	**SR**	**Gloss**
(i)	/la/	/e.+la/	[ekwena e**la**la]	one crocodile
(ii)	/la/	/e+la/	[ekina e**la**la]	one stone
(iii)	/la/	/mu+kona/	[mu**la**kona]	you will sleep
(iv)	/li/	/mu+ßira/	[mu**li**ßira]	you will pass

In (7) the epenthesis is formed by a CV syllable that has the consonant /l/ in the onset. The vowel elements in the syllable are /a/ and /i/.

(8) Olutura CV epenthesis

	Input	**UR**	**SR**	**Gloss**
(i)	[xu]	[oxu + saßa/	[xu**xu**saa]	to ask from you
(ii)	[mu]	/oxu + saßa/	[xu**mu**saßa]	to ask from (2nd person)
(iii)	[ßa] (3rd person)	/oxu +sandja/	[xuß**a**sandja]	make them suffer
(iv)	[na]	/oxu +raŋga/	[xuraŋga**na**]	bother each other

In (8), the epenthesis of the CV syllable happens between the prefix /xu/ which is an indicator meaning 'to' and the verbal stem. It brings out the meaning of 'making or causing someone to do something' and thus creates the grammatical aspect of person. We observe here that the prefix 'xu' and the verbal stems in (i) to (iii) are similar and it is only the epenthesis of the CV syllable that changes the meaning. The epenthesis of the [na] which occurs word finally in the output is mopho-phonemic and it brings out the meaning of 'each other' from the input /xusaßa +na/ to [xusaßana]. The epenthesis that results in the alternation of sound sequences and the change of phonological features was also observed in Olutura.

In the current discourse, the study answers the question of what determines the syllable that is used in epenthesis in Olutura, whether it is the morphological class or not. OT constraint interaction is used in Tableau 5 to answer this question. The constraints involved are; *HIATUS- which is meant to evaluate the occurrence of hiatus, DEP-IO(V), to check against the insertion of vowels and IDENT-IO which stipulates that output segments must be identical to the input. The constraints that are used in this analysis are ranked as follows: *HIATUS>> DEP-IO >> IDENT-IO.

Tableau 5: Olutura CV epenthesis

/xu_1 +saβa/	*HIATUS	DEP-IO(V)	IDENT-IO
a. /xu.asaβa/	*!	*	
b. ☞ [xu.mu.sa.βa]			*
c. [xu.aβa]	*!		*
d. [xu.asa]	*!		*

In Tableau 5, candidate (a) is a viable candidate in Olutura phonology but incurs a serious violation of the constraint *HIATUS by having an output that can only be valid through the insertion of a whole syllable as a strategy for HR. It also violates DEP-IO(V) by inserting a vowel which is not in the input. Both candidates (c) and (d) violate a higher-ranked constraint, *HIATUS, and, therefore, cannot win. The two also violate IDENT-IO by having outputs that are not identical to the input. The optimal candidate, (b), violates only one lower-ranked constraint, IDENT-IO, because the output is not identical to the input. However, this is a necessary violation in Olutura because it is what the language uses to avoid hiatus to achieve the grammatical category of person.

2.3.2 Consonant epenthesis

In Olutura, the addition of the consonants /ß/ and /j/ to the zero-onset syllable in word medial position creates a CV syllable in the SR. This is the epenthetic syllable that is then used in HR to repair inputs that do not meet the phonotactic requirements of this dialect. The epenthesis of /j/ in Olutura is demonstrated in (9).

(9) Consonant epenthesis in Olutura

	Input	**Output**	**Gloss**
(i)	si + ola	[si. ßo.la]	it is getting rotten
(ii)	/ßa + ira/	[ßa.**j**i.ra]	they are taking
(iii)	/i+inja/	[i.**j**i.nja]	it is removing (e.g. an animal)
(iv)	/ßa + iima/	[ßa.**j**ii.ma]	they are hunting
(v)	/ßa + aja/	[ßa.**l**a.ja]	they are cheering
(vi)	/ßa + ina/	[ßa.**j**i.na]	tempting him to fight

From the examples in (9), the consonant that is inserted in the epenthesis process is determined by the word class as well as the environment. Example 9 (i) refers to [-animate] whereas the rest of the examples in the same series refer to [+animate] entities. However, in the event that [-animate] entities perform the action of taking, then they also take on the epenthetic /ji/. An OT analysis is used in Tableau 6 to show how this happens in Olutura. The constraints concerned are DEP-IO (C), *DIPH and *HIATUS. The last two are necessary in this analysis because they induce the violation of DEP-IO(C) to enable the emergence of the optimal candidate. They are ranked as follows: *DIPH, *HIATUS >>DEP-IO (C).

Tableau 6: Constraint interaction in Olutura consonant epenthesis

/ si + ola/	*DIPH	*HIATUS	DEP-IO(C)
a. [si.o.la]		*!	
b. ☞ [si. ßo.la]			*
c. [sio.la]	*!		

Epenthesis of the consonants /ß/ and /j/ in Olutura is a necessary violation of the constraint DEP-IO(C) and that is why it must be dominated by the constraints *DIPH and * HIATUS. In Tableau 6, candidate (a) makes a serious violation of *HIATUS by having two dissimilar vowels adjacent to each other which results in a wrong construction in this particular case. Candidate (c) makes a serious violation of *DIPH because diphthongs do not occur in the phonology of Olutura. The optimal candidate is (b) makes the necessary violation of the lower-ranked DEP-IO(C) because the dialect allows epenthesis to repair hiatus.

2.3.3 Glide epenthesis

The epenthesis of the glide /j/ at the end of a verb causes a change in the meaning of the word and also resolves hiatus. In fact, the glide/j/ takes the place of the [+high] vowel /i/ that forms the nucleus of the second CV syllable in the UR. Consequently, the syllable type changes from CV to CGV. This occurrence is exemplified in (10).

(10) Olutura glide epenthesis

	UR	**Gloss**	**UR**	**SR**	**Gloss**
(i)	/ki.ŋga/	carry	/kingi +ja/	[ki.ŋg**j**a]	make one to carry
(ii)	/ke.nda/	walk	/ kendi+ja/	[ke.nd**j**a]	help them walk
(iii)	/hamba/	get infected	/hambi+ja/	[hamb**j**a]	infect sb
(iv)	/iŋɟira/	enter	/iŋɟiri+ja/	[i.ŋɟi.s**j**a]	cause something to enter
(v)	/imba/	sing	/imbi+ja/	[imb**j**a]	make sb sing

From the examples in (10), we demonstrate that the glide /j/, which was not initially in the examples in the first UR in (10) is epentheted to the verbs immediately after the last CV syllable in the SR. This occurrence is what is used to resolve hiatus from the input words in the second UR in (10), an occurrence that also results in words with a different meaning in Olutura.

Olutura glide epenthesis is analysed using OT constraint interaction in Tableau 7. The constraints that are relevant in the case of Tableau 7 are: *DIPH, *HIATUS, DEP-IO(C), DEP-IO. In this analysis, the constraint that prohibits insertion of vowels DEP-IO (V) must be dominated by the markedness constraints *DIPH and *HIATUS. This constrain should be violated by the winning candidate and it should be dominated by the general anti-insertion constraint DEP-IO. The constraints involved are ranked as *DIPH, *HIATUS >> DEP-IO >> DEP-IO(V).

Tableau 7: Olutura glide epenthesis

/ko +na/	*DIPH	*HIATUS	DEP-IO	DEP-IO(V)
(a) /ko.$_1$nia/	*!			*
(b) ☞ /ko.nja.$_1$/				*
(c) /ko.ni.$_1$ja/		*!	*	
(d) /ko.ni.$_2$a/		*!		

In the analysis of Tableau 7, candidate (a) incurs a serious violation of *DIPH by having two dissimilar vowels in the same syllable. As already established in this study, Olutura does not allow diphthongs in its phonology. In fact, candidate (a) seems right even after violating DEP-(V) but its surface realization which syllabifies the epenthetic /i/ in the onset of the second syllable is what rules it out. Candidate (c) incurs the violation of the general anti-insertion constraint *DEP-IO by the epenthesis of two segments that do not occur in the input. Candidate (c) also incurs a serious violation of *HIATUs by juxtaposing the vowel at the end of the second syllable to the glide at the start of the next syllable, an occurrence that results in hiatus. Candidate (d) incurs a fatal violation of *HIATUS. This happens when the vowel /a/ is articulated as a separate zero onset syllable from the rest of the word. The winning candidate (b) violates the constraint DEP-IO(V) when the glide [j] is inserted between the nasal /n/ and the [-high] vowel /a/. The epenthesis of /j/ in the second syllable in (b) to have the CGV type is what is used to resolve hiatus in the analysis in Tableau 7.

2.4 Deletion in Olutura

Deletion, and, in particular, vowel deletion, is also one of the processes that are used in many Bantu languages in HR. Vratsanos & Kadenge (2017: 176) state that "phonological rules in most Bantu languages stipulate that a vowel deletes when followed by another vowel at the morphological boundary". Similarly, Lass (1984: 186) says the following: "If segments can emerge from zero, they can also merge with it, i.e. delete". In this paper, deletion is the elision of one or more sounds, such as a vowel, a consonant or a whole syllable from a UR. It is noted that some of the Bantu languages that use deletion as a repair strategy in their phonotactics

elide either V_1 or V_2 in all HR cases while others delete V_1 or V_2 in different circumstances. In Olutura, the deletion of both V_1 and V_2 in different environments was observed. As already mentioned in section 1, the subscription of the numerals 1 and 2 are used at the word boundary to indicate the vowels at the end of the first word and beginning of the second word in the pair under analysis, respectively. The subscription is what clearly shows the vowel that is not elided in the SR. The deletion of both V_1 and V_2 is used as a strategy for HR in different environments in Olutura.

2.4.1 Olutura V_1 deletion

In Olutura the deletion of V_1 has two instances; one is that V_1 is elided when the function word precedes the lexical word while the second instance is that V_1 also elides when the function word comes after the lexical word. The two occurrences are shown in the examples in 11(a) and (b), respectively.

(11) Olutura V_1 elision

a)

	UR	**SR**	**Gloss**
(i)	/ ojo$_1$+e$_2$tsa/	[oje:$_2$ +tsa]	That one is coming
(ii)	/ejo$_1$+e$_2$mbi/	[eje:$_2$embi]	That one is bad
(iii)	/ejo$_1$+a$_2$mbi/	[eja:$_2$mbi]	That way is near

b)

(i)	/enda$_1$+e$_2$ji/	[ende:$_2$ji]	this louse
(ii)	/omwana$_1$+o$_2$jo/	[omwano:$_2$jo]	that child
(iii)	/omulaβi$_1$+ o$_2$kwo/	[omulaβo$_2$kwo]	that vine
(iv)	/omuleyi$_1$+o$_2$kwo/	[omulejo$_2$kwo]	the long one

The words in the examples in 11(a) are either a basic verb, an adjective or a pronoun and a demonstrative. In the examples in (a), V_1 which is the vowel in the 2nd syllable in the function word is deleted, leaving V_2 which is the vowel in the zero onset and first syllable of the verb, adjective or pronoun. In 11(a), the mid low vowel /o/ elides leaving the mid low front vowel /e/. This shows that in Olutura the elision of V_1 can be of a mid-vowel. Considering the conventional vowel trapezium, this case, actually, shows a back to front kind of elision, owing to the

fact that the back vowel, /o/, which is on the right of the pair of words under analysis, elides and leaves the front one, /e/ which is a front vowel.

Elision of V_1 also occurs when the function word comes after the lexical word as shown in 11 (b). In examples 11(b) (i) and (ii), which are common nouns, the [+low] vowel /a/ is deleted. The [-low] vowels /e/ and /o/ are not. In example (b) (iv), the word in which V_1 occurs is an adjective just like in example (ii) in 11(a). Therefore, V_1, which happens to be at the final word position, is targeted for deletion, irrespective of whether the vowel occurs in the lexical or function word. V_2, which is at word initial position is preserved, irrespective of whether it is in a lexical or a function word.

In 11(b) elision occurs between a noun and a function word and V_1 that is in the lexical word, in this case, the vowel in the noun is elided. The output shows that V_1 elides in quick speech when two words from different word classes end up as one in the phonotactics of Olutura. In 11 (b), V_1 is a low vowel /a/ in the second CV syllable of the noun while V_2 is either the mid back vowel /o/ or the mid front vowel /e/. There is the elision of the [+low] vowel /a/ while the mid vowels are left intact in the UR. Examples 11 (b) (iii) and (iv) show that elision also targets the [+high] vowel /i/ which leaves the [-high] vowel /o/ in the SR intact. It was observed that the elision process in Olutura that targets V_1 always ends up with the preservation of the [-high] vowels /o/, /e/ or /a/.

The best way to show the vowel that gets elided is using constraint interaction in OT. We have used the constraints *HIATUS, *DIPH because they are important in analyses where elision is targeted as a process that leads to the desired syllable structure. Therefore, in the analysis in Tableau 8, the constraints HIATUS and *DIPH must be un-dominated because Olutura does not allow hiatus in this case and diphthongs are ruled out in its phonology. The ranking that is adopted in this set of constraints is as follows: *HIATUS, *DIPH >>MAX-IO_{FUNC} >>MAX-$IO_{LEX.}$ *HIATUS, in this case, is the constraint that triggers the elision of V_1 and must not be dominated. The constraints MAX-IO_{FUNC} and MAX-IO_{LEX} stipulate that a function or lexical word that is represented in the UR should not be deleted from the SR, respectively.

Tableau 8: Olutura V_1 elision

Input /omwana$_1$+o$_2$jo/	*HIATUS	*DIPH	MAX-IO$_{FUNC}$	MAX-IO$_{LEX}$
a. [o.mwa.na$_1$.o$_2$jo]	*!			
b. ☞ [o.mwa.no$_2$.jo]				*
c. [o.mwa.na$_1$.jo]			*!	
d. [o.mwa.na$_1$o$_2$.jo		*!		

From Tableau 8, candidate (a) violates *HIATUS by having the very structure that Olutura is trying to do away with because it fails to elide either V_1 or V_2. This is a serious violation and so it fails to win. Candidate (c) violates MAX-IO $_{FUNC}$ by deleting V_2 which is the vowel from the function word. This is what makes this violation gross because it is the verb that Olutura needs in this case to resolve hiatus and that is why (c) loses. Candidate (d) also incurs a gross violation of the constraint *DIPH because it has an output that syllabifies V_1 and V_2 in the same syllable, a structure that does not occur in Olutura and so it loses to (a). Candidate (a) violates MAX-IO$_{FUNC}$ by its elision of V_1 from the lexical word.

2.4.2 Olutura V_2 deletion

In Olutura HR, the process of deletion also targets V_2 at the morpheme boundary in Olutura. As it is with the deletion of V_1, the deletion of V_2 also involves a lexical and a function word at the morphophonemic boundary. The deletion of V_2 occurs at the boundary between a lexical and a function word, notwithstanding the word that comes first; the elision will take place on the first vowel of the second word. The examples in (12) show the elision of V_2 from either the lexical or the function word.

(12) Olutura V_2 deletion

a)	**UR**	**SR**	**Gloss**
(i)	/e.ko.ndi$_1$+e.$_2$rjo/	[e.ko.ndi.$_1$rjo]	that sheep
(ii)	/mu.ndu.$_1$+o.$_2$jo/	[mu.ndu.$_1$jo]	that person
(iii)	/mu.suŋgu.$_1$+o.$_2$no/	[mu.su. ŋgu.$_1$no]	this white man
(iv)	/i. ŋgu. ßo$_1$ +i.$_2$nda.mbi/	[i. ŋgu. ßo$_1$nda.mbi]	a long dress
(v)	/i.mbwa$_1$+i.$_2$nda.ji/	[i.mbwa$_1$.nda.ji]	a good dog

b)	**UR**	**UR**	**Gloss**
(i)	/xu$_1$+o$_2$mwa.nda/	[xu.$_1$mwa.nda]	on the road
(ii)	/xu$_1$+e.$_2$i ɲa.nza/	[xu.$_1$ɲa.nza]	on the lake
(iii)	/o.le$_1$+i.$_2$tsa/	[o.le.$_1$tsa]	will you come?
(iv)	/o.li.$_1$+o.$_2$mu.la.ji/	[o.li.$_1$mu.la.ji]	you are good
(v)	/o.ju$_1$+o.$_2$mwi.ri/	[o.ju$_1$mwi.ri]	this one is a murderer

It was observed that the mora place of the vowel that elides is lost because there is no compensatory lengthening in the output. The elision of V_2 is analysed using the OT approach in Tableau 9. The same constraints as those used in the elision of V_1 are used. In Tableau 9, the constraint MAX-IO$_{FUNC}$ must dominate MAX-IO$_{LEX}$ because in Olutura, and in the current case, it is better to delete the vowel from the lexical word than the function word because it is a redundant feature and its lose does not affect the meaning of the SR. The constraint MAX-IO$_{LEX}$ is relevant in the analysis to trigger the constraint conflict that must be there between competing constraints because the morpheme from which the vowel deletes can either be a lexical or functional. The ranking of the constraints is: *HIATUS, *DIPH >> MAX-IO$_{FUNC}$ >> MAX-IO$_{LEX}$.

Tableau 9: Olutura V_2 elision

/xu$_1$+i.$_2$mo.ni/	*HIATUS	*DIPH	MAX-IO$_{FUNC}$	MAX-IO$_{LEX}$
a. [xu$_1$.i$_2$mo.ni]	***!**			
b. ☞ [xu.$_1$mo.ni]				*
c. [xui$_1$.$_2$mo.ni]		***!**		
d. [xi.$_2$mo.ni]			***!**	

From the analysis in Tableau 9, candidate (a) makes a serious violation of *HIATUS because of its failure to elide either V_1 or V_2. Candidate (c) makes a serious violation of *DIPH by having two vowels that are not similar in the same syllable and that is why it cannot emerge as a winner. Candidate (d) also fails to resolve hiatus when it elides V_1 which is the vowel that Olutura needs to retain so as to do away with hiatus in the current analysis. This now leaves candidate (b) to emerge as the

winner through its violation of the lowest ranked constraint in the hierarchy, MAX-IO$_{LEX}$. Its violation of MAX$_{LEX}$ is necessary because this is what results in the elision of V_2 as opposed to that of V_1 by the optimal candidate in Tableau 9.

2.5 Prothesis in Olutura

The discussion on the phonological process of prosthesis in this paper was guided by the definition from Massamba (1996: 99) which states that:

> In some languages, certain segment clusters are disallowed in actual articulation because, among other reasons, they make the segmental sequences rather complicated [and also] certain consonant clusters cannot occur word initially […] and to overcome such problems, certain segments are either inserted […].

Both Lass (1984: 184) and Lyle (1998: 33) concur with Massamba that prothesis is the occurrence in which "new segments appear from zero in formerly unoccupied marginal positions in a word or morpheme or between two previously abutting segments". As mentioned in the introduction, such an insertion is meant to ease articulation or remove unwanted segment clusters in some languages. However, in Olutura, prosthesis is not just meant to ease pronunciation or avoid unwanted consonant clusters but, most importantly, it plays a grammatical function as it resolves hiatus at the morpho-phonemic word boundary. In this dialect, prothesis involves syllables or single sound segments as exemplified in this section.

2.5.1 Syllable prothesis

Olutura reports a 3rd class noun class system in which there occurs a prefix that marks different aspects of the noun. The aspects concerned indicate, for example, whether the object is [+ animate] or [-animate], plant or animal. In the examples in (13), various CV syllables are prefixed to the stem to indicate these aspects. The prothesis of the CV syllable removes the unnatural pause or hiatus that would otherwise occur.

(13) Olutura CV noun class prothesis

	UR	CV syllable	SR	Gloss
(i)	/lala/	[si]	[siβiriti **si**lala]	one match box
(ii)	/lala/	[mu]	[omwalo **mu**lala]	one river
(iii)	/lala/	[mu]	[omwana **mu**lala]	one child
(iv)	/lala/	[nda]	[iŋgwe **nda**la]	one leopard

It should be noted from (13) that aspects of the same occurrence are realized through the epenthesis of different CV syllables. The UR is the same for all the examples in (13), though (i) and (iv) realize different prothetic CV syllables in the SR from those in (ii) and (iii). This irregular realizations of the prefixes in the SR is seen through the emergence of different consonant elements in the syllable onset at the beginning of the second word in the pair under analysis. In (13), hiatus would occur if the inputs in the UR were articulated without the epenthesis of the CV syllable.

In Olutura, the morphological class of number, has only two instances of the CV syllable prosthesis, that is, /si-/ for singular and /βi-/ for plural as shown in (14). Apart from indicating number, the epenthesis of the CV syllable removes the hiatus that would occur at the boundary between the nouns and the adverbs in (14) if the adverbs were articulated without the CV syllable shown in bold in the SR.

(14) CV syllables indicating number in Olutura

	UR	CV syllable	SR	Gloss
(i)	/lala/	/si/	[**si.**la.la.]	one
(ii)	/βiri/	/βi/	[**βi.** βi.ri]	two
(iii)	/ne/	/βi/	[**βi**.ne]	four
(iv)	/taru/	/βi/	[**βi**taru/	three
(v)	/ŋgi/	/βi/	[**βi.** ŋgi]	many

The examples in (15) demonstrate that the morphological class of possession in Olutura can also be used as a strategy for HR through the multiple phonological processes of prothesis, epenthesis and coalescence, all at once.

(15) Multiple processes of possession in Olutura

	Input	CV syllable	UR	SR	Gloss
(i)	/aŋge/	/si/	/**ßi**aŋge/	[ßjaŋge]	mine
(ii)	/efwe/	/si/	/**ßj**efwe/	[ßjefwe]	ours
(iii)	/aŋge/	/ki/	/**ku**ange/	[**kw**aŋge]	mine
(v)	/eɲwe/	/ki/	/**ki**eɲwe/	[**kj**eɲwe]	yours
(vi)	/aŋge/	/lu/	/luange/	[**lw**aŋge]	mine
(vii)	/aŋge/	/ßi/	/**ßj**ange/	[ßjaŋge]	mine (many)

From the SR realizations in (15), /si/, /ki/ and /ßi/ have been prefixed to the stem /ŋge/ in the phonological process of prothesis. These are then followed by the zero-onset syllable /a/ or /e/ in the phonological process of epenthesis and lastly there is the coalescence of the two vowels /i/ and /a/ in the SR. The coalescence happens when the [+high] vowel /i/ and, either the mid vowel /e/ or low vowel /a/ are joined in the SR. We wish to take note of the observation that the [+high] vowel /i/ is realized as the glide /j/ (see 3.1). Similarly, the UR inputs that have /ku/ or /lu/ prefixed to the stem /ŋge/ undergo prothesis which is followed by the epenthesis of the zero onset syllable that coalesces with the vowel element in the preceding CV syllable. Glide formation also takes place to complete the grammatical aspect of possession in HR in Olutura.

2.5.2 Vowel prothesis

The occurrence of Olutura vowel prothesis, which is shown in (16), happens when a vowel is put at the word initial position before the basic word. In Olutura the prothetic vowel (in bold type) occurs as the V_2 at the morpho-phonemic word boundary and it is what gives meaning to the pair of words involved as it removes the hiatus that happens when there is no V_2.

(16) Vowel prothesis in Olutura

	UR	SR	Gloss
(i)	/ola +kaßa/	[ola **a**kaßa]	he is distributing
(ii)	/esje +kuula/	[esje **e**ŋgu:.la]	I am roofing
(iii)	/ewe + kona/	[ewe **o**ko.na]	you are sleeping

(iv)	/nije +xiŋga/	[nije **a**xiŋga]	he is shielding
	/ewe +lima/	[ewe **o**lima]	you are digging

The V syllable structure in Olutura results from the phonological process of prothesis whenever it occurs in word initial position. This is the verbal prefix that changes the basic verb in the grammatical category of person. The prothesis of consonants in Olutura is exemplified in (17).

(17) Consonant prothesis in Olutura

	Singular	**Gloss**	**Plural**	**Gloss**
(i)	/asja/	he is grinding	/ßa.sja/	they are grinding
(ii)	/afwa/	he is dying	/ßa. fwa/	they are dying
(iii)	/eeja/	sweep	/ße:.ja/	they are sweeping
(iv)	/aßala/	he is counting	/ßaßaja/	they are counting
	/akwa/	he is falling	/ßa.kwa/	they are falling

An OT analysis of consonant prothesis is done using the Olutura input /-ola/ in Tableau 10. In this dialect, different consonants can be prefixed to this input to get words with different meanings. Since prothesis is about insertion, the constraint against insertion of consonants, DEP-IO(C), must be dominated by the markedness constraints although ideally it should be dominated by the faithfulness constraint against insertion of whole syllables, MAX-IO(σ). MAX-IO(σ) is important in the current analysis because it takes care of the occurrence of candidates with insertions of more than one segment. This gives rise to the ranking *HIATUS, *DIPH >> MAX-IO(σ) >> DEP-IO(C).

Tableau 10: Constraint interaction in Olutura consonant prosthesis

/ola/	*HIATUS	*DIPH	MAX-IO(σ)	DEP-IO(C)
a. ☞[ßo.la]				*
b. [ßi.o.la]	*!		*	
c. [ßio.la]		*!	*	

In the interaction of the constraints in Tableau 10, candidate (b) incurs one serious violation of *HIATUS by having two dissimilar vowels adjacent to each other but in different syllables and this is what makes it to lose out. Candidate (b) also violates MAX-IO(σ) by inserting a syllable that is not in the input. Candidate (c) also makes one serious violation of *DIPH by having two dissimilar vowels in the same syllable which Olutura does not allow in its phonology besides violating DEP-IO by having two segments that are not represented in the input. The winning candidate (a) makes one violation of a lower-ranked constraint DEP-IO(C) through the prothesis of the consonant /ß/, which does not occur in the input. This is a necessary violation as it results in the required word [ßo.la] (rot).

3. MULTIPLE PROCESSES IN HR IN OLUTURA

HR in Olutura sometimes involves several processes at once. An OT analysis is done using the constraints in Tableau 11 to illustrate that the right candidate undergoes several processes to emerge the winner. The constraint ranking that stands in this case is: *HIATUS, *DIPH>> DEP-IO >> *$COMP_{ONS(LAB)}$.

Tableau 11: Olutura multiple-processes constraint interaction

/ŋge/	*HIATUS	*DIPH	DEP-IO	*$COMP_{ONS(LAB)}$
a. [lu.a. ŋge]	*!		*	
b. ☞ [lwa. ŋge]			*	*
c. [lua. ŋge]		*!	*	

The analysis in Tableau 11 is such that candidate (a) makes a serious violation of *HIATUS and does not therefore stand a chance of winning. Candidate (a) also violates the general anti-insertion constraint DEP-IO by having the insertion of, not just a syllable, but also a vowel, both which are not represented in the input. Candidate (c) undergoes three violations and just like (a), makes one serious violation of *DIPH which makes it to lose out to candidate (b). The optimal candidate, (b) incurs two violations of DEP-IO and *$COMP_{ONS(LAB)}$ by having an output that has the insertion of a syllable and also an onset that is internally complex

because it has the labialized /w/. The two violations are, however, not serious and so it wins. Candidate (b) indeed goes through the three phonological processes of prothesis, epenthesis and gliding discussed in the preceding paragraph. Prothesis happens when a CV syllable is added in word initial position while epenthesis occurs with the insertion of the vowel prefix /a/ as exemplified in (18).

(18) Multiple processes of possession in Olutura HR

	Input	CV syllable	output	Gliding	Gloss
(i)	/ŋge/	/si/	[si+a+ŋge]	[sjaŋge]	mine
(ii)	/fwe/	/si/	[si+e+fwe]	[sjefwe]	it is ours
(iii)	/ŋge/	/ki/	[ki+a+ŋge]	[kjaŋge]	mine (e.g. ropes, loaves of bread, etc.)
(iv)	/fwe/	/ki/	[ki+e+fwe]	[kjefwe]	ours (many)
(v)	/ŋge/	/ku/	[ku+a+aŋge]	[kwaŋge]	mine
(vi)	/ŋge/	/lu/	[lu+a+^{ŋ}ge]	[lwaŋge]	mine
(vii)	/ŋge/	/iß/	[ßi+a+ŋge]	[ßjaŋge]	mine (many)
(viii)	/fwe/	/ßi/	[ßi+e+fwe]	[ßjefwe]	ours (many)

From the output realizations in (18), /si/, /ki/ and /ßi/ have been prefixed to the stem /ŋge/ in the phonological process of prothesis. These are then followed by the zero-onset syllable /a/ or /e/ in the phonological process of epenthesis and lastly there is GF of the two [+high] vowels /i/ and /a/ in the output. GF happens when the [+high] vowel /i/ and /u/ are realized as glides in the first syllable of the output. The inputs that have /ku/ or /lu/ prefixed to the stem /ŋge/ undergo prothesis which is followed by the epenthesis of the zero-onset syllable that leads to GF in the output. The prothesis process in which a CV syllable is prefixed is vital here because anything contrary would not yield the correct word in Olutura.

4. EXCEPTIONS TO HR IN OLUTURA

Although the current discussion is on HR, this paper acknowledges the observation that Olutura allows hiatus in a few cases. The occurrence of hiatus is exemplified in (19) in which the vowel /u/ fails to form a glide as a way of HR.

(19) Olutura hiatus occurrence

	A	Gloss	B	Gloss
(i)	[o.xu.e.ja]	promiscuity	[o.xwe.ja]	to sweep
(ii)	[o.xu. oma]	to smear the floor with cow dung	[o.xwo.ma]	to dry
(iii)	[o.xu.ana]	to give (e.g. a cow)	[o.kwa.na]	to mow
(iv)	[o.mu.i.ri]	one who takes	[o.mwi.ri]	a killer

In (19 A), hiatus is not resolved because Olutura needs to have words with a different meaning from those in column B. This means that Olutura speakers have to contend with the articulation difficulty that comes with hiatus.

5. CONCLUSION

This study concludes that the ranking of constraints in OT can be used to determine the particular phonological process that is used as a strategy for HR in the various environments where hiatus is not allowed in Olutura. In Olutura, phonological processes determine the configuration of the optimal syllable at the morphophonemic word boundary, and are, therefore, pivotal in its phonology. The structural requirements in the phonology of this dialect demand that the five processes of coalescence, glide formation, prothesis, epenthesis and elision are used to resolve hiatus. The five processes were found to complement each other in HR such that one or the other is used and sometimes more than one of them are used at the same time. In particular, the study concludes that the two types of coalescence that occur in Olutura are not only used as strategies for HR, but also to avoid the emergence of diphthongs, an occurrence that is not allowed in its phonology. Regarding coalescence, this study is in line with the conclusion by Casali (1997: 18) that "coalescence is a form of elision" since in Olutura, both coalescence and elision complement each other to resolve hiatus. With regard to GF, the present study concludes that there are instances in the phonology of Olutura when HR does not take place for the sake of distinguishing meaning. In Olutura, epenthesis as a strategy for HR involves vowels, consonants or whole syllables. Prothesis in Olutura is not just meant to ease pronunciation or avoid unwanted consonant clusters, but,

most importantly, it plays a grammatical function. On the part of the phonological process of deletion, the study concludes that in Olutura, both V_1 and V_2 are targets for deletion and the vowel that elides can be from either the lexical or function word.

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