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HIATAL CONFIGURATIONS AND THEIR RESOLUTION IN KINSHASA_LINGALA: EVIDENCE FROM SONGS BY TPOK JAZZ BAND

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Abstract

*This paper is a constraint-based description of hiatal configurations in Kinshasa Lingala and the strategies used to resolve them in connected speech. The study is grounded in Optimality Theory (Prince & Smolensky, 1993/2004) from which the notion of constraint ranking was used to analyse the phonological processes elicited to resolve hiatal configurations. The data were obtained from the lyrics of 15 songs composed and performed by the TPOK Jazz Band. The findings show that hiatal configurations occur in the underlying forms of words, phrases and clauses and since they are marked in connected speech, the dialect employs the processes of glide formation, vowel deletion, glide epenthesis and vowel coalescence to resolve them. Each of these processes results from the interaction between markedness and faithfulness constraints in which the anti-hiatus markedness constraint *HIATUS dominates all faithfulness constraints to ensure that the optimal outputs of the processes do not bear hiatal configurations. As such, the output in each process must satisfy a hierarchy of the relevant constraints by satisfying the greatest number of the high-ranking constraints. The paper concludes that hiatus resolution is chiefly motivated by the need to preserve the basic syllable structures of the dialect. The paper contributes to scholarship on the nexus between music and language.*

Keywords: *hiatal configurations, connected speech, Optimality Theory, Kinshasa Lingala, TPOK Jazz Band*

Introduction

Lingala is spoken mainly in the Democratic Republic of Congo (DRC), the Republic of Congo, Angola and the Central African Republic. It is one of the four national languages in DRC and is spoken by approximately 20 million native speakers, and an additional 20-25 million speakers who use it as a lingua franca (Meeuwis, 2020). It is classified in Zone C36D in Guthrie's system of classification of Bantu languages (Batota-Mpeho, 2013p.20). Lingala is generally a seven-vowel language comprising /i/, /e/, /ɛ/, /a/, /u/, /o/, and ɔ/. However, the Kinshasa Lingala (KL) upon which this paper is based uses only five of these vowels which are /i/, /u, /e/, /o/ and /a/ (Meeuwis, 2020). The table below shows the distinctive features of these vowel phonemes.

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Table 1

The Vowel Phonemes of Kinshasa Lingala (Meeuwis, 2020p.35)

	Front	Central	Back
High	i		u
Mid high	e		o
Low		a	

All these vowels are oral and short since nasal and long vowels are prohibited in this dialect. In addition, the occurrence of these vowels in words is in form of monophthongs or pure vowels since diphthongs and triphthongs are not allowed in Kinshasa Lingala. Regarding consonants, Kinshasa Lingala has a total of twenty-three consonants in its inventory as shown in table 2

Table 2

Properties of Lingala consonants (adapted from Batota-mpeho, 2012)

Manner of Articulation ↓	→ **Place of Articulation**									
	Bilabial		Labio-dental		alveolar		Palatal		Velar	
Plosives	p	b			t	d			k	g
Prenasalized Stops		^{m}b				^{n}d				^{ŋ}g
Fricatives			f	v	s	z	ʃ			
Prenasalized Fricatives						^{n}z				
Nasals		m				n		ɲ		ŋ
Liquids						l, r				
Glides		w						j		

The prenasalized stops and fricative are all regarded as single units in KL as opposed to consonant clusters (Meeuwis, 2020p.47). In terms of syllable structure, all syllables in KL are derived from the template (C) (G) V which implies that the only compulsory part is the nucleus. The three syllable types from the above template are therefore V, CV, and CGV, where V is made of a single vowel while CV and CGV are respectively composed of a consonant plus a vowel and a consonant plus a glide plus a vowel.

According to Mufwene (2008), Lingala has a highly agglutinating morphology just like other Bantu languages. This therefore means that several morphemes combine to form words, phrases, and clauses. As such, a vowel-ending morpheme may combine with another vowel-commencing morpheme to create a sequence of vowels referred to as vowel hiatus, hiatus or hiatal configuration (Lee, 2018p.89). Previous studies have reported that hiatal configurations are prohibited in many languages and only occur in limited contexts. Mtenje (2011) reports that Sukwa disallows hiatal configurations and therefore triggers the processes of vowel deletion, glide formation and secondary articulation to resolve them. He uses Optimality Theory and its strand of Cophonology to account for the conflict between vowel deletion and glide formation processes in Sukwa where glide formation occurs in the nominal domain by converting a high vowel in V_1 position into a homorganic glide while vowel deletion takes place in the verbal domain where V_1

in the hiatus does not surface in connected speech. The conflict arises because the process of vowel deletion takes place in the phonological environment where glide-formation is supposed to occur. Atikonda (2018) says that Cindali uses the processes of glide formation, secondary articulation and vowel elision to repair sequences of adjacent vowels in the underlying forms of utterances.

Regarding hiatus resolution in Lingala, Batota-Mpeho (2012p.19) illustrates how a sequence of the mid-back vowel /o/ and another dissimilar vowel is converted into the labiovelar glide [w] in order to resolve the resulting hiatus in the underlying forms /mo-ana/, /mo-indo/ and /mo-ela/ to respectively form the surface forms [mwana] 'child', [mwindo] 'black', [mwela] 'a disabled person'. except glide formation within words, this study however does not mention describe any process of resolving hiatal configurations. Meeuwis (2020p.39) reports that hiatal configurations occur in three-word positions, namely, initially, internally and finally. He explains that in word-final position, the high front vowel /i/ always occurs in the hiatal configuration as V_2 as these examples show: sai 'joy', litoi 'ear', bomoi 'life', molai 'long', motei 'preacher', ngai 'me', epai 'place' etc. to resolve such hiatus, he says that a glide gets inserted between two vowels so as to disambiguate or create emphasis in speech. Regarding the occurrence of hiatal configurations in word-initial and word-internal positions, Meeuwis (2020) observes that depending on the vowels forming the configuration, the hiatus may be left unresolved or resolved through phonological processes such as glide formation, vowel deletion or vowel coalescence. Some of these observations are in line with the data from Kinshasa Lingala but others contradict them. First, the fact that hiatal configurations are resolved through phonological processes such as glide formation, vowel deletion or vowel coalescence is attested in the songs. However, the observation that hiatal configurations may be left unresolved does not apply in connected speech since all hiatal configurations are usually resolved in connected speech.

Theoretical Framework

This study was conducted within Optimality Theory as explicated in Prince and Smolensky (1993/2004). The basic idea in OT is that Universal Grammar consists of a set of conflicting constraints that interact to produce optimal (well-formed) surface structures in a given language (Kager, 1999p.xi). That is, the surface forms manifested in a language result from resolutions of conflicts among competing constraints. The theory therefore investigates and accounts for changes that take place from the speech sound inputs in the brain (underlying form) up to the speech production stage (surface form) and it operates on five fundamental principles: universality, optimality, violability, ranking and parallelism (Prince & Smolensky, 1993/2004). The principle of universality of constraints implies that all languages utilize the same set of constraints but rank them differently to produce optimal surface forms. Optimality implies that surface forms are those that have the least serious violations of the ranked set of constraints in a given language. Violability means that all candidates including the one chosen as optimal violate some constraint - All surface forms violate at least some constraints. Constraints conflict in the sense that the satisfaction of some markedness constraints necessarily leads to the violation of some faithfulness constraints and the vice versa is true. Parallelism means that candidates are assessed simultaneously by all constraints. In order to resolve these conflicts each language ranks its relevant constraints in a strict dominance hierarchy so as to determine the optimal outputs from the candidates generated from the underlying form of a given linguistics structure. Structurally, Optimality Theory is made up of four components, namely, the lexicon or input, the generator (GEN) function and the evaluator (EVAL) function and the constraint set (CON) (Archangeli, 1997). The lexicon provides the underlying structures of a given language while GEN generates candidates from the underlying structures. Using a set of constraints, the EVAL function assesses the violation of a set of constraints by the candidate set generated by the function GEN and determines the optimal surface form which is the candidate that violates the fewest high-ranking constraints.

Methodology

The study employed qualitative research approach and descriptive research design to describe hiatal configurations in Kinshasa Lingala and the strategies it employs to resolve them in connected speech. The data were in form of songs (and their lyrics) done by TPOK Jazz Band. Fifteen songs were purposively sampled and downloaded from a website called YouTube while their lyrics and their translations in English were collected from two websites, namely, Musixmatch and Facebook. The correctness of the lyrics translations was confirmed by two native speakers of Kinshasa Lingala. Each hiatal configuration was coded depending on its location in the songs; for example, TPOK 3/4/5 means a song done by TPOK Jazz Band and the hiatal configuration is found in song three, stanza four, line five of the song. Data analysis was conducted using OT's tableaux in which the upper row comprised the constraints arranged from the most important to the least important while the first column comprised the candidate set. Each of these candidates was evaluated by a hierarchy of constraints and the one that satisfied the greatest number of high-ranking constraints was selected as the optimal output of the process.

Data Presentation and Analysis

This study aimed to provide a constraint-based description of hiatal configurations and the strategies that Kinshasa Lingala uses to resolve them in connected speech. The findings show that hiatal configurations occur within morphemes and across morphological and syntactic boundaries when morphemes combine to form words, phrases and clauses. Within morphemes, a hiatal configuration is formed when phonemes combine to form a word-root as the following examples show:

	Word	Deliberate Speech	Gloss	Source
1.	mai	[m**ai**]	water	TPOK 3/8/4
2.	minei	[min**ei**]	four	TP OK 2/1/3
3.	matoi	[mat**oi**]	ears	TPOK 3/5/2

The words in the dataset above contain hiatal configurations /a.i/, /e.i/ and /o.i/ respectively when they are pronounced in citation form or in deliberate speech. However, these configurations are resolved in connected speech as expressed in 4.3 below. Across a morpheme boundary, hiatal configurations are created by the concatenation of morphemes to form words as the examples below show.

	Prefix	Stem	Hiatus	Gloss
4.	mo-	-ana	/m**o**.**a**.na/	child
5.	mo-	-asi	/m**o**.**a**.si/	woman
6.	ma-	-ino	/m**a**.**i**.no/	teeth
7.	ma-	-iso	/m**a**.**i**.so/	eyes

Across a word boundary, hiatal configurations are created by the concatenation of words to form phrases and clauses as the examples below show

Phrase/Clause	Underlying form	Gloss	Source
8. motuka oyo	/mo.tu.k**a**.**o**.jo/	this motor car	TPOK 9/7/3
9. biloko ebele	/bi.lo.k**o**.**e**.be.le/	many things	TPOK 5/8/2
10. nsoso eleli	/so.s**o**.**e**.le.li/	The cock has crowed	TPOK 7/1/1

The hiatal configurations /a.o/ and /o.e/ in the dataset above are highlighted in the underlying forms of phrases (8) and (9) and a clause in (10). To resolve these hiatal configurations, Kinshasa

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Lingala employs various phonological processes such as glide formation, vowel deletion, glide epenthesis and vowel coalescence. The choice of a phonological process depends on the qualities of the vowels comprising the hiatal configuration. The following is a description of these processes.

Glide Formation

The process of glide formation involves the conversion of a high vowel (or a mid-vowel in some languages) into a homorganic glide when it precedes another non-identical vowel in a hiatus (Odden, 2005p.102). Glides are of two types, namely, the palatal glide /j/ and the labiovelar glide /w/ and they are regarded as semi-vowels because they respectively share some articulatory qualities with the high vowels /i/ and /u/ from which they are derived. In Kinshasa Lingala, the palatal glide /j/ is derived from the high front vowel /i/ or the mid front vowel /e/ while the labiovelar glide /w/ is derived from the high back vowel /u/ as well as the mid back vowel /o/ on condition that these vowels precede another non-identical vowel in the hiatus as the examples below show:

Underlying form		Surface form	Gloss	Source
11. /mokili ojo/	→	[mokiljojo]	this world	(TPOK 3/3/5)
12. /mwasi ojo/	→	[mwasjojo]	this woman	(TPOK 2/1/2)
13. /soso eleli/	→	[sosweleli]	The cock has crowed.	(TPOK 7/1/1)
14. /koko akufa/	→	[kokwakufa]	Grandma died.	(TPOK 9/1/6)
15. /zabulu aje/	→	[zabulwaje]	The devil has come.	(TPOK 10/2/2)
16. /masumu eleki/	→	[masumweleki]	sins have surpassed	(TPOK 7/10/4)
17. /mo -ana/	→	[mwana]	child	(TPOK 6/4/6)
18. /mo -asi/	→	[mwasi]	woman	(TPOK 11/5/4)

In examples (11) and (12), the hiatal configuration /i.o/ is formed in the underlying form of the noun phrases when the noun is modified by the proximal demonstrative pronoun *oyo* 'this/these' which is resolved by converting the high front vowel /i/ into the palatal glide [j] when it precedes the mid back vowel /o/ across a word boundary. Examples (13) to (16) show that the labiovelar glide /w/ is formed across a noun and a verb when they combine to form sentences and are resolved by converting the mid back vowel /o/ and the high back vowel /u/ into the labiovelar glide [w]. It is also formed in the nominal domain when a prefix is attached to a nominal root as examples (17) and (18) show. In OT terms, hiatus resolution through glide formation is motivated by the markedness *HIATUS which states as follows:

(1) *HIATUS: *Two adjacent heterosyllabic vowels ($V_1.V_2$) are prohibited (Pulleyblank, 2003).*

This constraint bans hiatal configurations and as such it ranks the highest in languages that prohibit such configurations like Kinshasa Lingala. The second markedness constraint is *DIPH which prevents the resyllabification of the two vowels into the nucleus of a syllable as stated below:

(2) *DIPH: *Two vowels in one nucleus are prohibited (Prince & Smolensky 1993)*

Another relevant markedness constraint is NLV (No Long Vowels) which prohibits the lengthening of the second vowel when the first one is converted into a glide and resyllabified into the onset of the syllable. This constraint states as follows:

(3) NLV: *Assign a violation for any vocalic melody in the output that is associated to more than one mora (Rosenthall 1997p.146).*

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This means that compensatory lengthening is not allowed in Kinshasa Lingala since the dialect does not have long vowels in its inventory. Glide formation also creates the consonant cluster CG that is prohibited by the markedness constraint *COMPLEX which states as follows:

(4) *COMPLEX$_{ONSET}$: *Complex onsets are prohibited. (McCarthy 2005p. 261)*

Since this constraint bans the occurrence of consonant clusters in Kinshasa Lingala, it has to be ranked the lowest in order to allow the process of glide formation to take place. On the other hand, the anti-hiatus constraint *HIATUS should rank the highest in order to instigate the resolution of the hiatal configuration. These constraints are therefore arranged as follows: *HIATUS, *DIPH >> NLV >>*COMPLEX$_{ONSET.}$ The tableau below illustrates how this hierarchy evaluates the underlying form /mo -asi/ to realize the surface form [mwasi] 'woman' (TPOK 11/5/4).

Tableau 1

The Formation of the labiovelar glide [w]

/mo -asi/	*HIATUS	*DIPH	NLV	*COMPLEX$_{ONSET}$
a.[mo.a.si]	!*			
b.[moa.si]		!*		
c.[mwa:.si]			*!	
☞d.[mwa.si]				*

In the tableau above, candidate (a) fatally violates constraint *HIATUS by retaining the hiatal configuration /i.o/ in its bid to remain fully faithful to the input form. Similarly, candidate (b) fatally violates constraint *DIPH for resolving the hiatus by resyllabifying the two vowels into the peak of the first syllable while candidate (c) fatally lengthens the V_2 in the process of compensatory lengthening thus violating the constraint NLV. Finally, candidate (d) satisfies the three high ranking constraints but violates the lowest ranked *COMPLEX$_{ONSET}$. It is therefore selected as the optimal output of glide formation process since violation of the lowest ranked constraint is not fatal. The same hierarchy can also be used to account for the formation of the palatal glide just like the formation of the labiovelar glide.

Vowel Deletion

The term deletion refers to a situation in which a sound that would be present in the deliberate pronunciation of a word in isolation is omitted in the pronunciation of the word in connected speech (Yule, 1985). Connected speech involves rapid pronunciation of words which leads to the loss of some sounds in order to achieve efficiency in speech production. In Kinshasa Lingala, it is the first vowel that is usually deleted to ensure that hiatal configurations do not surface in connected speech as the following examples show:

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Underlying form		Surface form	Gloss	Source
19. /ma -iso/ cl.6-eye	→	[miso]	eyes	TPOK/2/13/10
20. /ma -ino/ cl.6-tooth	→	[mino]	teeth	TPOK/4/5/1
21. /bana ojo /	→	[banojo]	these children	TPOK 2/3/3
22. /maloba ojo/	→	[malobojo]	these words	TPOK 9/1/9
23. /libala esila/	→	[libalesila]	the marriage ended	TPOK 8/2/3
24. /motema eboja/	→	[motemeboja]	the heart dislikes…	TPOK 1/7/1
25. /liwa ezali nzela/	→	[liwezali nzela]	death is the way…	TPOK 3/16/3

From the dataset above, the process of vowel deletion takes place across a morpheme boundary in the nominal domain when a prefix is attached to a nominal root that begins with a vowel in order to form nouns as examples (19) and (20) show. The resulting hiatal configuration /a.i/ in the underlying forms of the words are resolved by deleting the vowel at the end of the prefix. It also takes place at the word boundary between the determiner *oyo* 'this/these' and a noun in a noun phrase as examples (21) and (22) show. The resulting hiatal configuration /a.o/ in the underlying forms of the phrases is resolved by deleting the low vowel /a/ at the end of the nouns. The process also takes place across a word boundary between a noun and a verb as they combine to form clauses as examples (23) to (25) show. The resulting hiatal configuration /a.e/ in the underlying forms of the clauses is resolved by deleting the low vowel /a/ at the end of the nouns. This is the case since Lingala is a V_1 deleting language.

In OT terms, vowel deletion process is motivated by the markedness constraint *HIATUS which bans hiatal configurations. The other markedness constraint is the anti-diphthong constraint *DIPH since Kinshasa Lingala does not allow diphthongs in its syllables. In addition, the NLV which prohibits long vowels is also relevant since Kinshasa Lingala does not permit them in its syllables. In order to prevent the merging of the low vowel /a/ and the high vowel /i/ in examples (19) and (20) in the process of vowel coalescence, there is the need to include the anti-coalescence constraint UNIFORMITY-IO which states as follows:

(5) UNIFORMITY-IO: No element of the output has multiple correspondents in the input. (McCarthy & Prince 1995)

The other faithfulness constraint that is relevant is MAX-IO (V) which checks the process of vowel deletion. This constraint is expressed as follows:

(6) MAX-IO: Every segment of the input has a correspondent in the output (McCarthy & Prince, 1995)

The positional faithfulness constraint MAX-V (MI) is also required in this analysis to ensure the vowel that is deleted is V_1 while V_2 is preserved since Lingala is a V_1 deleting language. This constraint guarantees input-output correspondence by ensuring that morpheme initial vowel is preserved in the output and it is expressed as follows:

(7) MAX-V (MI): Every morpheme initial vowel in the input has a correspondent morpheme initial vowel in the output

These markedness constraints *HIATUS, *DIPH and NLV are ranked higher than the faithfulness

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constraints UNIFORMITY-IO, MAX-IO (V) and MAX-V (MI). On the other hand, MAX-V (MI) should dominate MAX-IO (V) to ensure the preservation of V_2 which means that MAX-IO (V) should be the lowest ranked constraint so as to allow vowel deletion process to take place. The following is therefore the constraint hierarchy that guides the vowel deletion process in Kinshasa Lingala: *HIATUS, *DIPH, NLV ≫ UNIFORMITY-IO ≫ MAX-V (MI) ≫ MAX-IO (V). This hierarchy can be used to evaluate candidates generated from the underlying form /ma-/ + /-ino/ to produce the optimal output [mino] 'teeth' as shown in the tableau below:

Tableau 2

Vowel Deletion Process in Kinshasa Lingala

/ma-/ + /-ino/	*HIATUS	*DIPH	NLV	UNIFORM -IO	MAX-V(MI)	MAX-IO (V)
a. [ma.i.no]	*!					
b. [mai.no]		*!				
c. [mi:.no]			*!			
d. [me.no]				*!		
e. [ma.no]					*!	
☞f. [mi.no]						*

In tableau 2 above, candidate (a) violates the highest ranked anti-hiatus constraint *HIATUS which leads to its fatality. Similarly, candidate (b) violates the high-ranking anti-diphthong constraint *DIPH hence it is eliminated from the contest. Candidate (c) loses V_1 but lengthens V_2 to compensate the length of V_1 that is lost. This leads to its elimination since it violates the markedness constraint NLV that prohibits long vowels. On the other hand, candidate (d) merges the low vowel /a/ and the high vowel /i/ to surface as /e/ in the process of vowel coalescence hence violating constraint UNIFORM-IO. This leads to its elimination as well. Candidate (e) deletes V_2 instead of V_1 hence it violates the faithfulness constraint MAX-V (MI). Candidate (f) satisfies all constraints except the lowest ranked MAX-IO (V) which bans deletion of vowels in the output form. It is therefore chosen as the optimal output since the constraint it violates is ranked lowest in the hierarchy to mean its violation is not fatal.

Glide Epenthesis

Hiatal configurations are also resolved by inserting either the palatal glide /j/ or the labiovelar glide /w/ in words. The difference between glide epenthesis and glide formation is that in the former process, a glide that was not present in the underlying form of the word is inserted while in glide formation, a glide is derived from high or mid vowels in order to resolve a hiatal configuration. In glide epenthesis, the epenthetic glide is determined by the quality of the second vowel (V_2) in the hiatus. The palatal glide /j/ is used to resolve the hiatus if V_2 is the high front vowel /i/ while the labiovelar glide /w/ is used if V_2 is the high back vowel /u/ as the examples below show:

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	Word	Deliberate Speech	Connected Speech	Gloss	Source
26.	moi	[moi]	[moji]	day	TPOK 6/1/2
27.	matoi	[matoi]	[matoji]	ears	TPOK 3/5/2
28.	nkoi	[koi]	[koji]	leopard	TPOK 4/5/4
29.	mai	[mai]	[maji]	water	TPOK 3/8/4
30.	ngai	[ngai]	[ngaji]	me	TPOK 5/17/4
31.	epai touti	[epai touti]	[epaji towuti]	place we've come from	TPOK 4/14/1

The words above are pronounced differently depending on the mode of pronunciation. In slow deliberate speech, the words are pronounced with hiatal configurations which are resolved in connected speech. A palatal glide is inserted when V_2 is the high front vowel as the examples above show. The labiovelar glide on the other hand is inserted when V_2 is the mid back vowel /o/ as the second word in example (16) shows. An OT account of glide epenthesis process requires the anti-hiatus constraint *HIATUS and the anti-diphthong constraint *DIPH to be ranked the highest so as to ensure that the hiatus is resolved and that the two vowels do not form a diphthong. Other constraints are the faithfulness constraints MAX-IO (V) and DEP-IO (C) expressed below:

(8) MAX-IO (V): An input vowel must have a correspondent in the output. (McCarthy & Prince 1995)

(9) DEP-IO (C): An output consonant must have a correspondent in the input. (McCarthy & Prince 1995)

Constraint MAX-IO (V) is relevant since it bans the deletion of the first vowel in the hiatus since the phonological context of the two vowels is favourable for deletion process. On the other hand, DEP-IO (C) is relevant because it bans the insertion of consonants so as to eliminate the hiatus. MAX-IO (V) should therefore dominate DEP-IO (C) to ensure the hiatus is not resolved through deletion process. The other faithfulness constraint that is relevant in this process is AGR[pl] which requires the inserted glide to assimilate the place of articulation feature of the vowel succeeding the epenthetic site as stated below:

(10) AGR[pl]: A glide and a succeeding vowel across the syllable boundary must agree in [place] feature specification.

This constraint therefore requires the insertion of the palatal glide [j] if the second vowel in the hiatus is a high or mid front vowel. On the other hand, the labiovelar glide [w] is inserted if second vowel is the high or mid back vowel. This constraint must rank above MAX-IO (V) and DEP-IO (C) but below *HIATUS and *DIPH in order to form the hierarchy *HIATUS, *DIPH, AGR[pl] >> MAX-IO (V) >> DEP-IO (C). This hierarchy can be used to evaluate candidates generated from the underlying form /to + uti/ to produce the optimal output [towuti] 'we have come from' as shown in the tableau below

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Tableau 3

Constraint interaction in the process of Glide Epenthesis

/to_1 + $u_2$ti/	*HIATUS	*DIPH	AGR[pl]	MAX-IO (V)	*DEP-IO (C)
a. /to_1.u_2.ti/	*!				
b. /to_1u_2.ti/		*!			
c. /to_1j$u_2$ti/			*!		
d. /tu_2.ti/				*!	
☞e. /to_1.wu_2.ti/					*

In the tableau above, candidate (a) violates the highest ranked constraint *HIATUS by retaining the hiatal configuration /o.u/ and thus it is eliminated from the contest. Candidate (b) also gets eliminated for violating the high-ranking *DIPH by forming the diphthong /ou/ in the nucleus of the first syllable. Candidate (c) inserts glide [j] which is non-homorganic to the high back vowel /u/ hence it is eliminated from the contest. Candidate (d) also makes a fatal violation of the faithfulness constraint MAX-IO (V) by deleting the first vowel in the hiatus. Finally, candidate (e) satisfies all constraints except the lowest ranking faithfulness constraint DEP-IO (C) hence it is chosen as the optimal output of the process since the violation of the lowest ranked constraint is not fatal.

Vowel Coalescence

Gunnink (2022p.62) defines vowel coalescence as the fusion of two adjacent vowels to realize a third one that combines the qualities of both vowels. For vowel coalescence to take place, the initial vowel (V_1) has to have the height feature [+low] while the second vowel (V_2) has to have the height feature [+high]. This means that vowel coalescence involves the contact between low vowel /a/ and the high vowels /i/ and /u/ to give rise to the configurations /a.i/ and /a.u/ respectively. This fusion of two polar opposite height features results into a compromise mid high vowel /e/ when /a/ and /i/ or /o/ when /a/ and /u/ merge. The context in which Lingala employs the process of vowel coalescence to resolve hiatal configurations is across a morpheme boundary in the verbal domain when a verb ending with the low vowel /a/ is suffixed to a morpheme that begins with the high front vowel /i/. Consider the following examples:

29. /moto # a + wa + i/ person-3SG-die-pres.per	→	[motwawe]	A person has died.	(TPOK 12/4/2)
30. /zabulu # a + ja + i/ devil-he-come-pres.perf	→	[zabulwaje]	The devil has come.	(TPOK 10/2/2)
31. /na + ja + i # kobina/ 1SG-come-pres.perf dance	→	[najekobina]	I have come to dance	(TPOK 11/11/2)

In the examples above, the low vowel /a/ fuses with the high vowel /i/ to realise the mid vowel /e/ in line

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with Gunnink's (2022) definition of vowel coalescence given above. This means that the low and the high vowels do not surface in the pronunciation of words that have undergone this process as the examples above show. To account for vowel coalescence in OT, the markedness constraint *HIATUS is ranked the highest in the hierarchy in order to ensure that the hiatus is resolved. The anti-diphthong constraint *DIPH is also relevant since Kinshasa Lingala does not allow diphthongs in its inventory. The other relevant markedness constraint is NLV (No Long Vowels) which ensures that the resulting vowel does not get lengthened since the dialect does not allow compensatorily lengthened surface vowels. On the other hand, the fusion of the two vowels leads to the incorrespondence between the two segments of the input /a/ and /i/ and the one output segment /e/. This means that the process is a violation of the faithfulness constraint UNIFORMITY-IO which prohibits the fusion of two adjacent vowels. As a result, this constraint ranks the lowest in order to allow vowel coalescence process to take place. The interaction of these four constraints therefore takes place in the following hierarchy: *HIATUS, *DIPH >> NLV >> UNIFORMITY-IO. This hierarchy can be used to evaluate the candidates generated by function GEN in order to come up with the optimal output [naje] from the underlying form /na + ja + i/ when the present perfect tense suffix /-i/ is added to the verbal root *ya* [ja] 'come' as shown in the tableau below.

Tableau 4

Constraint Evaluation in the process of Vowel Coalescence (/a + i/ → [e])

/na + ja + i/	*HIATUS	*DIPH	NLV	UNIFORMITY-IO
a. [na.ja.i]	!*			
b. [na.jai]		*!		
c. [na.je:]			*!	*
☞d. [na.je]				*

In the tableau above, candidate (a) retains the two vowels in the hiatus and hence it violates the anti-hiatus constraint *HIATUS which ranks the highest in the hierarchy. It thus gets eliminated from the contest. Candidate (b) violates constraint *DIPH by forming a complex syllable peak and therefore gets eliminated from the contest. On the other hand, candidate (c) violates constraints NLV and UNIFORMITY-IO and therefore gets eliminated. By merging the two vowels into the short mid vowel /e/, candidate (d) satisfies all the high-ranking constraints but violates the lowest ranked UNIFORMITY-IO. This candidate is therefore chosen as the optimal output of the process since violation of the lowest ranked constraint is not fatal.

Discussion

The analysis above indicates that hiatal configurations occur in the underlying forms of words, phrases and clauses. However, since the phonology of Kinshasa Lingala does not allow them to surface in its syllables, they are eliminated through glide formation, glide epenthesis, vowel deletion, and vowel coalescence processes. Odden (2005p.244) therefore refers to these processes as syllabically constrained phonological processes because they reorganize segments in the underlying forms of morphological and syntactic structures in order to achieve the preferred syllabic structures of a given language. In vowel coalescence process, the findings are partly in agreement with the findings from other Bantu languages where the low vowel /a/ fuses with either

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the high front vowel /i/ or the high back vowel /u/ to respectively realize the mid front vowel /e/ and the mid back vowel /o/. The process takes place in the verbal domain where a verb ending with the low vowel is suffixed to the causative morpheme which begins with the high front vowel /i/. However, the process is blocked in the nominal domain when the low vowel in the prefix comes into contact with the high front vowel /i/ at the beginning of nominal root as in this affixation process of plural formation: /ma + iso/ → [miso] 'eyes' and /ma + ino/ → [mino]. In these cases of affixation, the hiatal configuration /a.i/ creates the phonological environment for vowel coalescence. However, Kinshasa Lingala employs the process of vowel deletion instead of the expected vowel coalescence. In contrast to Kinshasa Lingala, Tonga allows vowel coalescence in the same domain as Mabugu et al. (2020p.90) illustrate in these three examples: /ma + iso/ → [meso] 'eyes', /ma + iɲo/ → [meɲo] 'teeth', /ma + ija/ → [meja] 'nakedness'. This further proves that languages differ in the strategies they employ to resolve hiatal configurations.

Regarding the process of glide formation, Lingala converts both the high and mid vowels into their corresponding glides when they occupy the V_1 syllable position while the V_2 position is occupied by a non-identical vowel as the analysis above shows. However, languages differ in the vowels that undergo glide formation. According to Casali (1996), some languages derive glides from high vowels only while others derive them from both high and mid vowels. In Chicano Spanish, just like in Kinshasa Lingala, both the high and mid vowels form glides as these examples show: /mi # ultima/ → [mjultima] 'my last one', /tu # epoka/ → [twepoka] 'your time', /komo # eβa/ → [komweβa] 'like Eva' (Baković, 2007). Kinyarwanda also glides both the high and the mid vowels as these examples show: /ku + iβa / → [kwiβa] 'to steal', /ku # isoko/ → [kwisokó] 'at the market', /ingó # eβjiri/ → [ingwéβjiri] 'two houses' (Macharia 2009). Other languages such as Tonga (Mabugu, 2020), Chichewa (Sabao, 2013), Ndebele (Sabao, 2015) form glides from the high vowels only.

Regarding the choice of the epenthetic material as hiatus breakers, Lingala uses glides as opposed to other consonants. Casali (2011) gives three segments that languages use as epenthetic material. These are a glide which shares the same roundness or frontness as either V_1 or V_2 in the hiatus, a glottal fricative ([h]) or stop ([ʔ]) or a coronal consonant (eg. [t]) or a rhotic (eg. [r]). Kinshasa Lingala uses the first option since glides are considered as extensions of some phonological features present in one of the vowels in the hiatus. Therefore, the epenthetic glides used must agree in their place and manner features with adjacent vowels. In vowel deletion, the findings show that Kinshasa Lingala is a V_1 deleting dialect. Here, the initial vowel is deleted mainly due to the anticipatory articulation of V_2. However, languages differ with regard to the vowel they delete; while there are some languages that delete V_1, there are others that delete V_2. According to Casali (1996), languages that delete V_1 only include Ciyao, Swahili, Tsonga, Chumburung, and Zulu while those that delete either V_1 or V_2 depending on context of occurrence include Luganda, Chichewa, Shona and Yoruba.

Conclusion

The study concludes that hiatus is a dispreferred configuration in Lingala, like in many other languages of the world, and that the language uses the processes of glide formation, glide insertion, vowel deletion and vowel coalescence to resolve such configurations. In all these strategies, Kinshasa Lingala does not preserve mora through compensatory lengthening of V_2 since vowel length is not contrastive unlike in most other Bantu languages. These strategies have only one goal: to achieve the language's CV and CGV syllable structures. They are therefore regarded as syllable structure optimization processes since they transform illicit hiatal configurations into the preferred syllable types of the language. This study further concludes that constraint ranking in OT can be used to account for each phonological process used to resolve hiatal configurations.

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