HIATUS RESOLUTION IN NDAU

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Abstract

This study focuses on the strategies that are employed to resolve hiatus and the contexts where hiatus is tolerated through an analysis of the morpho-syntactic and phonological settings in which Ndau vowel sequences occur. This research establishes five strategies that Ndau utilizes to resolve hiatus; namely: glide formation, secondary articulation, elision, vowel coalescence and spreading. The findings of this study demonstrate that Ndau exclusively bans hiatus in nominals. In verbs, it is banned when V_2 is an affix vowel but is permitted when V_2 is a verb stem-initial vowel. Hiatus resolution is blocked when V_2 is verb stem-initial because ALIGN ($ROOT_{VERB}$, L, σ, L) outranks ONSET in the verbal domain. Hiatus is also maintained in the verbal domain between the relative marker and tense sign boundary. In the cliticization domain hiatus is tolerated when V_2 is a vowel of a host of a copulative proclitic /*ndí*-/ and its allomorphs because MAX-COP outranks ONSET.

Keywords: hiatus resolution, clitic, copulative, Optimality Theory, nominals, verbs, Ndau.

1. Introduction

This study analyses hiatus resolution patterns of Ndau, providing the phonotactic rules of the language in the process. Hiatus refers to a hetero-syllabic sequence of adjacent vowels. Here, it is shown that apparently conflicting repair strategies like glide formation, glide epenthesis, secondary articulation, vowel elision and vowel coalescence are well-motivated, phonologically and morpho-syntactically. It is demonstrated that these morphophonemic processes have only one goal: to achieve the typical or preferred phonological structures of Ndau; namely, the consonant-vowel (CV) syllable structure. This study adopts a syllable-based approach to hiatus because it attributes hiatus resolution to the ill-formedness of onset-less syllables in word medial position. As noted by Goldsmith (1995), the syllable is a natural domain for the statement of many phonotactic constraints (p. 25). This study seeks to examine how hiatus is eliminated in some morpho-syntactic domains and how it is tolerated in yet other well-defined contexts.

As noted in Bantu literature, like Karanga (Mudzingwa, 2010; Mudzingwa, 2013), Zezuru (Mudzingwa, 2010; Mudzingwa & Kadenge, 2014) and ciNsenga (Simango & Kadenge, 2014), in Ndau, hiatus resolution creates an onset for the second onset-less vowel (V_2) because the second syllable lacks onset. Onset-less syllables are generally marked in the world's languages and the resolution of vocalic

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hiatus is generally attributed to the high ranking markedness constraint ONSET, which requires syllables to have onsets, thus disallowing hetero-syllabic $V_1.V_2$ sequences which would arise where hiatus is maintained (Casali, 2011; Ito, 1989; Prince & Smolensky, 2004).

Many languages do not readily tolerate adjacent hetero-syllabic vowels. Vowel sequences may be subject to any one of several possible hiatus resolution strategies that include glide formation, vowel coalescence, secondary articulation, consonant epenthesis (default insertion and spreading), assimilation and vowel deletion (Casali, 1996, 1997; Kadenge, 2010; Mtenje, 2007; Mudzingwa, 2010; Myers, 1990; Orie & Pulleyblank, 2002; Rosenthall, 1997; Sibanda, 2009). All these hiatus resolution processes show that syllables play an important role in Optimality Theory (OT) because they are motivated to satisfy the constraint ONSET; hence, they are triggered to maintain the syllable structure of the language under investigation.

The morpho-syntactic approach to hiatus resolution adopted in this research was first developed by Mudzingwa (2010) who argued that different hiatus resolution strategies operate in different morpho-syntactic and phonological contexts (cf. Mudzingwa and Kadenge, 2014; Mudzingwa, 2013; Mudzingwa & Kadenge, 2011; Kadenge & Simango, 2014). These studies conclude that Zezuru and Karanga have a complete ban on hiatus resolution in all morpho-syntactic contexts and the languages employ five strategies, that is, vowel coalescence, glide-formation, secondary articulation, elision and spreading to make sure that it does not appear. However, Mtenje (2007), argued that hiatus is resolved in some domains and tolerated in others in three Malawian languages namely, Cindali, Citonga and Cinyika (p.35). Following the same debate, Simango & Kadenge (2014) and Kadenge & Simango (2014) argued that in ciNsenga, hiatus is completely banned in the nominals; that is, between the prefix and the noun stem, but is tolerated in the verbal domain exclusively between the inflectional stem and macro-stem. Building on these studies, the present study seeks to utilize Optimality Theory to explain hiatus resolution in Ndau, which completely bans hiatus in the nominal domain and tolerates it in some specific morpho-syntactic contexts in verbal and clitic domain. The main argument is that in Ndau, vowel hiatus is selectively tolerated. The contribution of this research to the literature is typological as it adds to the languages that tolerate hiatus in certain contexts.

2. Methodology

The primary source of data in this research is intuition since the researcher is a native speaker of Ndau. Intuition is the data gathering method that is used widely in generative grammar studies (Haegeman, 1991). This introspective approach where a writer, as in the present case uses oneself as an informant in the accumulation of

data is what Newmeyer (1986) commented upon as follows "the typical practice of generativists has been to use themselves as informants in collecting data about the acceptability and interpretation of grammatical constructions (p.23)." The linguistic competence of the researcher is a language ability that he shares with other speakers of the Ndau language. It cannot be expected that the researcher's introspective judgments on Ndau constructions will always be accurate. With this view in mind, the researcher, where he deemed necessary, therefore checked on the grammaticality and/or acceptability of utterances against the collective linguistic and/or grammatical competence of other native speakers in Chipinge District. In doing so, the researcher intuitively wrote down one hundred words and phrases that have undergone some phonological processes and a list of potential phonological processes. After compiling the above-mentioned lists, the researcher asked ten native speakers of Ndau to confirm the phonological processes on the prepared list of words. The researcher also collected some data from Ndau written materials such as Jones (1911) and Mkanganwi (1973).

3. Theoretical framework

The Theoretical Frameworks adopted in this study is Optimality Theory (Prince & Smolensky, 1993) in which syllabification is a consequence of best-satisfying syllable structure well-formedness constraints. These theories offer an account of hiatus resolution by showing that surface outputs can be accounted for in terms of optimal satisfaction of a universal set of violable constraints (Casali, 1996; Rosenthall, 1994). Three diverse morpho-syntactic settings determine Ndau hiatus resolution strategies. As noted by Mudzingwa (2013), "coalescence operates in the cliticization domain. Spreading occurs in the verbal domain, which comprises the verb word and deverbal nouns (p.17)."

The major strength of Optimality Theory (OT) is that attention is now directed towards phonological conspiracies, that is, several phonological rules together aim at the same representational goal. In an output-based approach, such as OT phonology, constraints on surface forms can express these conspiracies. Not only does OT allow us to acknowledge the existence of conspiracies, it also enables us to formalize the idea that these conspiracies are a result of interaction of grammatical tendencies which exist within as well as across languages. On the one hand, while rule-based phonologies describe different outputs of conspiracies, they fail to account for the fact that such conspiracies all strive to come up with an optimal output. OT, on the other hand, captures such regularities by postulating a single output constraint. Following the arguments outlined above, the major strength of OT as a theory is that it allows constraints to be violable, unlike other approaches such as Classical Generative theory of Universal Grammar, where they were not.

4. Data analysis

4.1. Nominal domain

In the nominal domain, hiatus occurs in the formation of pronominal possessives, nouns, quantitatives and demonstratives (see, for example, Mudzingwa & Kadenge, 2011). The term nominal here refers to the lexical class of nouns, adjectives, quantitatives, enumeratives, selectors and possessive words (Fortune, 1984, 1980, 1955; Mkanganwi, 2011). These nominals, which Fortune (1955) and Mkanganwi (2011) called substantives, form a natural class based on their structure. The following is a typical morphological structure associated with nominals:

class prefix + nominal stem

Within the nominal domain, different morpho-syntactic contexts determine the preferred strategy among glide formation, secondary articulation and elision, that is, across a class prefix and a nominal stem. The fact that these three strategies operate in the same morphological constituent means that they compete against each other to resolve hiatus.

Glide formation

Glide formation results when the initial vowel of the underlying two vowels is realized as a glide. Glide formation occurs when a word-initial high V_1 is realized as a glide which serves as an onset for V_2 and is 'restricted' to the high vowels /u/ and /i/ when each of these is V_1 and a consonant cannot immediately preceded it (Mudzingwa, 2013). Glide formation is a process where a labial or a coronal is turned into a glide when there is no consonant immediately preceding V.

(1) (a) /ù–á ké/ [wáké]
CL.1-his/ hers
'His/hers'

(b) / ù-áŋgú/ [wáᵑgú]
CL.1-mine
'Mine'

(c) /ì-áᵑgú/ [jáᵑgú]
CL.9-mine
'Mine'

(d) /ì-ósé/ [jósé]
CL.3-all
'All'

Data in example (1) show that glide formation occurs in the formation of possessive pronouns.

Secondary articulation

In the nominal domain, secondary articulation is a preferred strategy to resolve hiatus when glide formation fails due to phonotactic constraints. Secondary articulation is used when V_1 has an onset. In this context glide formation is blocked because it leads to complex onsets which are not allowed in Ndau. Secondary articulation is used to resolve hiatus in nouns, possessives, quantitatives and demonstratives as illustrated below:

(2)

(a) /mù-áná/	[m^{wá}ná]
CL.1-child	
'Child'	
(b) /mù-ámúná/	[m^{w}ámúná]
CL.1- husband	
'Husband'	
(c) /tù-á^{ŋ}gú/	[t^{w}á^{ŋ}gú]
CL.13-mine	
'Mine'	
(d) /tù-ávó/	[t^{w}ávó]
CL.13-theirs	
'Theirs'	
(e) /mù-égá /	[m^{w}égá]
CL.1- one	
'Only you'	

Example (2) shows secondary articulation in which V_1 is /u/ and it is immediately preceded by a consonant that can be labialized. The difference between glide formation and secondary articulation is phonological because glide formation occurs when V_1 is onset-less and secondary articulation occurs when V_1 is preceded by a consonant.

Vowel elision

In instances where a coronal vowel is immediately preceded by an alveopalatal consonant, Ndau employs elision to resolve hiatus. In instances where V_1 is a pharyngeal vowel /a/, Ndau elides the vowel. However, Ndau has no instances of labial vowel /u/ elision. Vowel elision is utilized in a situation where the consonant immediately preceding V_1 is not compatible with secondary articulation since that creates complex onsets which are not allowed in Ndau. Vowel elision is evident in Ndau for demonstratives, verbs, quantitatives and possessives as illustrated below:

(3) (a) /ì –j**í-ó**/ [ìjó]
CL.3- ‘that one’
‘That one’

(b) /ì-r**í-ó** / [ìró]
CL.5- ‘that one’
‘That one’

(c) /v**à-**é ʃé / [ʊéʃé]
CL.2- all of you
‘All of you’

(d) /ʮ**ì-**éʃé / [ʮéʃé]
CL.7-all of them
‘All of them’

(e) /ʮ**ì-**áᵑgú/ [ʮáᵑgú]
CL.7-mine
‘Mine’

It is important to note that in each example in (3) it is V_1 which is elided to resolve hiatus. This means Ndau is a V_1 deleting language.

4.2. Verbal domain

Glide formation, secondary articulation and elision also occur in Ndau verbs when V_2 is an affix vowel, specifically between the subject marker and the tense marker.

Glide formation

Glide formation applies in verbs but exclusively within the inflectional stem, across the subject prefix and tense-aspect-mood (TAM) boundary as shown in (4a-d).

(4) (a) / ù -á-rír-á/ [wárírá]
CL.1-.SM-PST-cry-fv
‘He/she cried’

(b) /ù-á -rʲ-á / [wárʲá]
CL.1- SM-PST-eat-fv
‘He/she ate’

(c) / ù-á-kájém-á/ [wákájémá]
CL.1-SM-PRESENT-stand-fv
‘/he/she is standing’

(d)/ ì-á-wóm-à/ [jáwómà]
CL. 4-SM-PST-dry -fv
‘It had dried’

Secondary articulation

Secondary articulation is also evident in Ndau verbal domain specifically within the inflectional stem bearing affixes like subject, tense, aspect and mood. Consider the following example.

(5) (a) /mù-á-wúj-á/ [m^{w}áwújá]
CL.1- SM-PRNT-come-fv
'you have come'

(b) /mù-ó-tór-á / [m^{w}ótórá]
CL.1-SM-PRNT-take-fv
'Take'

The verbs in (5) indicate that it is possible to resolve hiatus because V_2 is an affix vowel; in other words V_2 is the tense sign. In Ndau, vowel hiatus in verbs is resolved only when V_2 is a non-root vowel. Example (5) shows secondary articulation in which V_1 is /u/ and is immediately preceded by a consonant that can be labialized. This conditioning factor can be clearly captured by the following rule:

/Cu+V/ = [C^{w}V]

The above rule shows that, following an observation by Mudzingwa (2013), "secondary articulation occurs when a V_1 labial vowel is immediately preceded by a consonant that allows secondary articulation (p.17)."

Elision

In the verbal domain, vowel elision occurs when the subject marker and the tense sign are next to each other; and when V_1 is /i/ and follows a consonant as shown below.

(6) (a) /^{n}d **ì** – á-r^{j}á / [^{n}dár^{j}á]
CL.1- I PST ate (1st person singular)
'I ate'

(b) /t **ì** –á r^{j}á/ [tár^{j}á]
CL.1- we -PST-ate (1st person plural)
'We ate'

From example (6), the vowel of the subject marker is deleted when it occurs before the tense morpheme, which is itself a vowel.

Spreading in verbs

Like glide-formation, secondary articulation and elision, spreading operates at the word level. Spreading resolves hiatus in deverbal nominal and verb domains. Spreading is where all or some of the features of the epenthetic segment are supplied by one of the input segments. Default segmentism is the opposite; it is where all the

features of the epenthetic segment are inserted. Following Mudzingwa (2010), this study argues that spreading is the preferred strategy at the Prosodic Stem edge. In the default strategy, glide formation is blocked by an alignment constraint that requires the left edges of the Prosodic Stem and the syllable to be aligned.

(7) (a) /wà-é^{n}zá n-á/ [wà{jé^{n}záná}]
CL.3- SM-it did the same/it is of the same size-fv
'It did the same/ it is of the same size'

(b) tà-éré^{ŋ}g-á/ [tà {jéré^{ŋ}gá}]
CL.1-SM-we have read-fv
'We have read'

(c) /và-ón-á/ [ʋà {wóná}]
CL.2- SM-see-fv
"They see"

(d) /tà-ót^{s}ír-á/ [tà {wót^{s}irá}]
CL.1-SM -'we have sneezed-fv
'We have sneezed'

From example (7), a phonological rule operating intervocalically inserts the glides. Example (7) illustrates that the second vowel in the sequence is the one that is spreading. When V_2 is /i/ or /e/, it spreads the glide /j/ and if it is /u/ or /o/ it spread the glide /w/. The phenomenon demonstrated in (7) can be described as the insertion of glides homorganic with the second vowel in hiatus (cf. Booij, 1995; Itô, 1989; Pater, 2001; Rosenthall, 1994 and Selkirk, 1981 for similar phenomena in other languages). All the environments listed above are where hiatus breaking actually takes place. The goal to eliminate onset-less syllables has been the principal motivation for epenthesis where the presence of an epenthetic segment may be considered as an empty structural position in line with the dictates of the language specific syllable template.

4.3. Cliticization domain

Vowel coalescence occurs at post lexical level. In this study, vowel coalescence is considered as elision of V_1 with preservation of the feature [open], which is passed on to V_2 (Snider, 1985). Mudzingwa & Kadenge (2014), stated that "coalescence is the preferred strategy across a prosodic word boundary, precisely across a host-clitic boundary" (p. 127). In the cliticization domain, either in proclitics or in enclitic, the preferred hiatus resolution strategy is coalescence, which is restricted to this domain. The left and right edges of the host are crucial because when the same clitics occur in other contexts, hiatus is resolved by spreading. In procliticization, the proclitic attaches to a Prosodic Word to form a Clitic Word. The examples in (8) illustrate

coalescence in proclitics; coalescence occurs across a prepositional proclitic and its host. In all these examples, V_1 is consistently /a/ and V_2 is /u/, /i/ or /a/. In the examples provided in (8), the prosodic word in square brackets and the clitic group in angled < > brackets.

	/a1 + i2/	=	**[e2]**	
(8)	(a) /ná=ì-ní /		[néní]	<ná= [ìní]>
	ASSOC-1SG- PRONOUN			
	'With me '			
	(b) /ná= ì-sù/		[nésù]	<ná= [ìsù]>
	ASSOC-CL1.PL-PRONOUN.			
	'With us'			

Example (8) shows that when the proclitic in the form of CV is attached to its host which has a VCV shape it results in coalescence. The examples in (8) show that if the low-front vowel /a/ is fused with the high-front vowel /i/ the result is the middle-front vowel /e/. That is [a+i=e].

	/a1 + a2/	=	**[a2]**	
(9)	(a) /ná=à-vó/		[návó]	<ná=[àvó]>
	ASSOC-CL1.PL-DEM.AFFIX			
	'With these ones'			
	(b) /sá=á-k-ó/		[sákó]	<sá=[àkó]>
	ASSOC-STAB.-DEM.AFFIX			
	'Like this one			

Example (9) shows that when (V_1) of the proclitics is a low-front vowel /a/ and is in sequence with the initial onset-less syllable which is also /a/, the two vowels fused together to form a single low-front vowel /a/. The fusion of identical vowels, referred to by Bakovic (2007) as 'Identity Coalescence' or 'Coalescence under identity', results in no changes in vowel quality. This is evidenced by the fact that the output correspondents, indexed to a single output segment, remain faithful to their respective input correspondent in featural identity.

	/a1 + u2/	=	**[o2]**	
(10)	(a) ná=ù-j-ú/		[nójú]	<ná= [ùjú]>
	ASSOC=STAB-CL1.DEM.AFFIX			
	'With this one'			
	(b) /sá= ù-m-ú/		[sómú]	<sá= [ùmú]>
	ASSOC-STAB-CL18.DEM.AFFIX			
	'Like inside this'			

Data in example (10) show that when the low-front vowel /a/ merges with the high-

back vowel /u/, it results in the middle-back vowel /o/. The combination of the vowels in a sequence determines the vowel in the output. Height is the important feature that determines the output vowel.

This study observes that encliticization in Ndau occurs in verbs, in which the clitic is attached to the back of the verb. The VCV enclitics described in this section are 1st and 2nd pronouns that cliticize to a verb. Similar to procliticization, the boundary between the enclitic and its host is a Prosodic Word boundary, and hiatus now is consistently resolved through coalescence. Consider the following example.

(11) (a) /ù-nó-ró^{n}z-á = ì-ɲí/ [ù nóró^{n}zéɲí] <[ùnóró^{n}zá]=ìɲí>
CL.1- SM-PRES PAST-say-FV+ STAB-PRONOUN- what
'What do you say?'

(b) /vànódáná = ì-ɲí/ [ʋànódánéɲí] <[ʋànódáná]=ìɲí >
CL.2-SM- PRES-shy-fv –STAB-PRONOUN- what
'What are they shy of?'

Example (11) illustrates the process of vowel coalescence which shows that a + i = e. When the verb that ends with a terminal vowel /a/ is joined with the clitic that have the initial vowel /i/, the two vowels merge to form a unique vowel segment /e/.

Another observation is that spreading occurs between a V-final host and a V-clitic. In this situation, the spreading of the glide operates in the clitic groups where the clitic of the shape V is attached to the verb that ends with –V. The following examples show the spreading of the palatal glide /j/ in enclitization.

(12) (a) /ɓát-á=í / [ɓá.tá.jí]
touch-FV-PL/HON
'Touch!'

(b) /àró^{n}zér-é=ízẹ́/ [à.ró.^{n}zé.jí.zẹ́]
CL.1-SM- tell- FV CLITIC- again
'What did he say again'

(a) / à-nóɗ-é=í/ [à.nó.ɗĕ.jí]
CL.1-SM- want-FV- CLITIC QUESTION
'What does he/she want?'

Example (12) shows that the clitic /i/ is attached to the verb which ends with –V; and that the palatal glide /j/ is spreading from the coronal vowel /i/. In Ndau, the spreading of the glide is restricted to the palatal glide /j/.

5 Non-resolution of Hiatus

There are other morpho-syntactic contexts where hiatus is tolerated. This indicates that Ndau is both a hiatus prohibiting grammar as well as a hiatus permitting grammar. In situations where hiatus is tolerated the constraint that drives the ban of hiatus in

Ndau is relegated to be the least ranked constraint. The constraint is schematized as follows:

[1] ONSET
[ó V (syllables must have onsets)]
(Itô, 1989; Prince & Smolensky, 2004, p. 106)

This constraint – ONSET – requires all Ndau syllables to begin with onsets. However, this constraint is ranked low in situations where hiatus is allowed.

*5.1 **Verbal domain***

In the verbal domain, Ndau blocks hiatus resolution across the inflectional stem and macrostem boundary. In other words, hiatus between the object marker and the stem is not resolved, which leaves the stem-initial vowel onset-less (Simango & Kadenge, 2014; Kadenge & Simango, 2014). In the verbal domain where hiatus is allowed the markedness constraint against hiatus is lowly ranked as compared to alignment constraint *ALIGN (ROOTVERB, L,σ,L) which requires perfect matching of the left edge of the verb root and the left edge of the syllable.

[2] ALIGN (ROOTVERB, L, σ, L)
(The left edge of a verb root (=stem) corresponds to the left edge of a syllable)
(Kadenge & Simango, 2014, p. 93)

This constraint is ranked above ONSET as shown in [3].

[3] *ALIGN (ROOTVERB, L, σ, L)> ONSET

The implication of the above constraint ranking is that hiatus is allowed in some Ndau verbs. Ndau consistently tolerates vowel hiatus in verbs whose roots start with a vowel. Consider the following examples:

(13) (a) /ʋè-jí-à-émér-á/ [ʋè.jí.à. {é.mé.rá}]
CL2.SUB-TENSE-OBJ- ROOT-TV while they were waiting for them-FV
'While they were waiting for them'

(b) /ⁿdì-ʧĩ-ʋà-é-mér-á/ [ⁿdì.ʧĩ.ʋà.{é.mé.rá}]
CL.1- SM-TENSE-ROOT-FV while waiting for them
'While waiting for them'

(c) /tà-á-kón-á / [tà.á.{kó.ná}]
CL.1-SM-CL6.OBJ-manage-FV
'We managed them'

(d). /tì-á-tór-é/ [tì.á.{tó.ré}]
1SG.SUBJ-CL6-OBJ-take-FV
'We should take them'

(e). /mù-á-ɓát-é/ [mù.á.{ɓá.té}]
CL.1-SM-CL.6-OBJ-hold-FV
'You should hold them'

Just like in ciNsenga, example (13) shows that Ndau blocks hiatus resolution across the Inflectional Stem and macrostem boundary. In other words, hiatus between the object marker and the root in each of these examples is not resolved, which leaves the root-initial vowel onset-less (Simango & Kadenge, 2014). What should be taken into consideration is the fact that the root must belong to the verb category; in the nominal domain vowel hiatus is not tolerated, hence it is eliminated. Therefore, in this verbal domain, hiatus resolution applies between prefixes but not between a prefix and a root.

The different hiatus resolution strategies available in Ndau such as glide formation, secondary articulation and vowel elision, are all blocked because they would cause a mismatch between the left edge of the verb root and left edge of the syllable. There is a typological similarity between ciNsenga and Ndau because these two linguistics varieties permit hiatus between the inflectional and macrostem boundary. Therefore, following Kadenge & Simango (2014), the research proposes that Ndau has a "high ranking constraint ALIGN ($ROOT_{VERB}$, L, σ, L), which requires the left edge of a verb root to coincide with the left edge of a syllable" (p. 121). This undominated morpho-phonological constraint requires the left edge of a verb root and the syllable to be aligned. Since all hiatus resolution strategies violate this constraint, they are blocked when the V_2 is the stem initial vowel. This morpho-phonological constraint is undominated, therefore it is mandatory not to resolve hiatus when V_2 is a verb stem. Tableau 1 is a formal analysis of / ⁿdì-ʧĩ-ʋà-é-mér-á/ which is realized as [ⁿdì.ʧĩ.ʋà.$_1$é$_2$.mé.rá.] 'While waiting for them.'

Tableau 1: Hiatus non resolution in verbs

/ⁿdì-ʧĩ-ʋà$_1$-é$_2$-mér-á/ 'while waiting for them'		ALIGN ($ROOT_{VERB}$, L,σ,L)	ONSET
(a)	→[ⁿdì.ʧĩ.ʋà$_1$.é$_2$.mé.rá.]		*
(b)	[ⁿdì.ʧĩ.ʋà$_1$.jé$_2$.mé.rá.]	*!	
(c)	[ⁿdì.ʧĩ.ʋà$_1$.mé.rá.]	*!	
(d)	[ⁿdì.ʧĩ.ʋé$_2$.mé.rá.]	*!	

The first candidate is the optimal candidate because it satisfies the highest ranked constraint ALIGN ($ROOT_{VERB}$, L, σ, L. Therefore, this candidate is the winner because the input is identical to the output since it satisfies the highest ranked faithfulness constraint. All other candidates (b), (c), (d) which epenthesize glide /j/, elides V_2 and V_1 respectively are disqualified because they are misaligned with the input.

Hiatus is also maintained in the inflectional stem, specifically between a relative marker and a tense marker. Consider the following examples:

(15) (a) zạ̀-á-tór á [zạ̀.á.{tó.rá}]
RELM-TENSE- took-FV
'Which he/ she took'

(b) zạ̀-á-rʲá [zạ̀.á.{rʲá}]
RELM-TENSE-ate-FV
'Which he/she ate'

(c) zạ̀-á-rówá [zạ̀.á.{ró.wá}]
RELM-TENSE- be witched-FV
'Which he/ she be witched'

(d) zạ̀-á-éⁿdér á [zạ̀.á.{é.ⁿdé.rá}]
RELM-TENSE- went for-FV
'Which he/ she went for'

(e) zạ̀-á- ḍán- á [zạ̀.á.{ḍá.ná}]
RELM-TENSE- shy of -FV
'Which he/ she is shy off'

(f) /zạ̀-áɓ á / [zạ̀.{á.ɓ á}]
RELM-TENSE-steal-FV
'Which he/she stole'

In OT terms, hiatus is maintained in the inflectional category when V_2 is a tense marker of a relative phrase. The reason for this is morphological because each syllable in (15) carries morphological information that cannot be tempered with. Therefore, any repair strategy is blocked because it will alter the morphemes that are in a word. Any hiatus resolution strategy in this morpho-syntactic context is blocked by the constraint

[4] MAX REL
(The vowel of the tense marker of a relative phrase should have correspondent in the output)

This constraint requires the morphological information contained in the underlying representation to have phonological representation on the surface. The morpheme-specific constraint MAX REL explains the non-resolution of hiatus in this morpho-syntactic context. Given the fact that MAX REL requires phonological parsing of underlying morphemes, this constraint is ranked higher than ONSET. In the same vein, the deletion of the second vowel is prevented by Max-RV, which does not allow deletion the rightmost vowel in a sequence of two or more vowels. Tableau 2 presents a non-resolution of hiatus between a relative prefix and tense marker.

Tableau 2: Hiatus between a relative marker and tense sign

/ zà$_1$.á$_2$.ɓ á /	MAX REL	ONSET	MAX RV
(a) zà$_1$.á$_2$.ɓ á		*	
(a) zà$_1$.ɓ á	*!		*
(b) zá$_2$.ɓ á	*!		

In Tableau 2, candidate (a), which is fully faithful and has a hetero-syllabic sequence of vowels, violates ONSET. It is the winner because it satisfies the high-ranking constraint MAX REL which does not allow the resolution of hiatus in this context. The second and third candidates are eliminated because they violate the highest ranked constraint though satisfying the low ranked constraint –ONSET.

5.2 Cliticization domain

Hiatus is created and tolerated in some morpho-syntactic contexts in the cliticization domain. It is tolerated when the copulative affix (proclitic) is attached to the nouns in class 2a, demonstratives and pronouns (hosts). This is illustrated in the following examples.

Nouns in class 2a

Class 2a nouns have /à/ as the honorific noun prefix. Consider the following examples:

(16) (a) /à-mójó/
CL.2a-mr mojo
'Mr Mojo'

(b) /à-tété/
CL.2a-aunt
'Aunt'

(c) / à-pénéséra/
CL.2a-Mr Penesera
'Mr Penesera'

(d) / à -m úɬáⁿgá/
Cl. 2a- Mr Mhlanga
'Mr Mhlanga'

However, in the copulative, Ndau uses the copulative affix /*ndí*-/ with class 2a nouns which creates hiatus as shown below:

(17) (a) /nᵈí-à-mójó/ [nᵈí. à. mo.jo.] *[nᵈamójó]
COP AFFIX-CL.2a-mr moyo
'It's mr Mojo.'

(b) /nᵈí-à-tété/ [nᵈí.à.té.té.] *[nᵈàtété]
COP AFFIX-CL.2a-aunt

'It's aunt.'

(c) /nᵈí-à-pénéséá/ [nᵈí. à.pé.né.sé.rá] *[nᵈ àpénéséá]
COP AFFIX-CL.2a-Mr Penesera
'It's Mr Penesera.'

(d) /nᵈí-à-múłáᵑgá / [nᵈí.à.mú.łá.ᵑgá] *[nᵈàmúłáᵑgá]
COP AFFIX-CL.2a- Mr Mhlanga
'It's Mr Mhlanga.'

Although the proclitic is in the form of CV and attaches to a host, which has VCV shape, the serial ordering of the vowels does not condition vowel coalescence because V_1 of the proclitic is not /a/ but /i/. Even as we acknowledge that the low [a] and the high front vowel [i] sequence would trigger coalescence, with the coalesced vowel being the mid vowel [e], if the sequence is reversed, that is, the high front [i] occurring in V_1 position before a low [a], the high vowel will undergo elision. In other words, the serial ordering of the vowels in the above examples would yield, or rather, trigger other repair strategies like vowel elision and spreading. Although the conditions of coronal elision are met, vowel elision is not employed because this would be too costly—the morphological information carried by the vowel would all be lost, and ungrammatical forms would result. Spreading is blocked by Optimality Contour Principle (OCP) constraint. This constraint is defined as follows.

[5] Optimality Contour Principle
(Sequencing of a homorganic glide and vowel is prohibited)
(Mudzingwa, 2010)

This constraint avoids the sequencing of a glide and a vowel with the same place feature to be near each other.

Again, in the cliticization domain, hiatus is allowed when the copulative affix/ *ngá-*/, which has phonologically determined allomorphs [ngá-, ngé-, ngó-], is attached to demonstratives and pronouns. Consider the following examples:

Demonstratives

(18) (a) /ᵑgé-ì-jí/ [ᵑgé.ì.jí.]
COP AFFIX-CL.9- STAB-this one
'It's this one.'

(b) /ᵑgò-ù-wú/ [ᵑgò.ù.wú.]
COP AFFIX- CL.3-STAB-this one
'It's this one.'

(c) /ᵑgé-àpá/ [ᵑgé.à.pá.]
COP-AFFIX-CL.16-STAB-this place
'It's this place.'

(d) /ᵑgé-àwá/ [ᵑgé.à.wá.]

COP AFFIX-CL.6- these ones
'It's these ones.'

Possessive pronouns

(19) (a) /ŋgé-àngú/ [ŋgé.à.ngú.]
COP AFFIX-CL.6-they are mine
'They are mine.'

(b) / ŋgé-àké/ [ŋgé.à.ké.]
COP AFFIX-CL.1-they are his or hers
'They belong to him or her.'

(c) /ŋgé-àvò/ [ŋgé.à. ʊò.]
COP AFFIX-CL.1-they belong to them
'They belong to them.'

(d) /ŋgé-èdù/ [ŋgé.è.dù.]
COP AFFIX-CL.1-they belong to us
'They belong to us.'

Again, from examples (18) and (19), vowel coalescence is not possible because V_1 is not /a/. Therefore, the serial ordering of V_1 and V_2 does not condition vowel coalescence. If we elide V_1 or spread , we will have ungrammatical forms such as

(20) (a) /ŋgé-ì-jí/ [ŋgé.ì.jí.] *[ŋgìjí] *[ngéjìjí]
COP AFFIX-CL.9- stab-this one
'It's this one.'

(b) /ŋgò-ù-wú/ [ŋgò.ù.wú.] *[ŋgùwú] *[ngòwùwú]
COP AFFIX- CL.3-STAB-this one
'It's this one.'

(c) /ŋgé-àpá/ [ŋgé.à.pá.] *[ŋgàpá] *[ngé?pá]
COP-AFFIX-CL.16-STAB-this place
'It's this place.'

(d) /ŋgé-àwá/ ŋgé.à.wá.] *[ŋgàwá] *[ngé?àwá]
COP AFFIX-CL.6- these ones
'It's these ones.'

(e) /ŋgé-àngú/ [ŋgé.à.ngú.] *[ŋgàngú] [nge?angu]
COP AFFIX-CL.6-they are mine
'They are mine.'

(f) / ŋgé-àké/ [ŋgé.à.ké.] *[ŋgàké] *[ngé?àké]
COP AFFIX-CL.1-they are his or hers
'They belong to him or her.'

(g) /ŋgé-àvò/ [ŋgé.à. ʊò.] *[ŋgàʊò] *[ngé?àʊò]
COP AFFIX-CL.1-they belong to them
'They belong to them.'

The constraint that blocks the resolution of hiatus in this morpho-syntactic context is MAX-COP which is ranked higher than ONSET. This constraint is defined as follows.

[6] MAX-COP
(The vowel of the copulative affix in the input should have a correspondent in the output)

This constraint militates against the repair of hiatus when V_2 belongs to the host of the copulative proclitic. In the same vein, the deletion of the second vowel is prevented by Max-RV, which does not allow deletion of the rightmost vowel in a sequence of two or more vowels. This can be taken to be a case of positional faithfulness where the rightmost vowel is always in a 'strong' position[2]. In the cliticization domain, hiatus is tolerated as long as V_2 is the vowel of the host of a copulative affix. Clearly this suggests that hiatus is tolerated so long as V_2 is part of the host of the copulative proclitic. The strategy employed is not to repair hiatus under such circumstances. The hiatus between vowel sequences means that surface violations of ONSET are compelled under the duress of satisfying the highest ranked constraint Max COP. Tableau 3 presents a formal of hiatus in cliticization.

Tableau 3: Hiatus in cliticization

/n^{d}í$_1$-à$_2$ múɬáᵑgá/ 'it's Mr. Mhlanga'	MAX-COP	ONSET
(a) n^{d}í$_1$. à$_2$ mú.ɬá.ᵑgá		*
(b) n^{d}í$_1$ mú.ɬá.ᵑgá	*!	
(c) n^{d}à$_2$ mú.ɬá.ᵑgá	*!	

In Table 3, candidate (a), which is fully faithful to the input is the winner because it satisfies the high-ranking constraint MAX-cop that does not allow the resolution of hiatus when V_2 is a vowel of host of a copulative proclitic. The second and third candidates are eliminated because they violate the highest ranked constraint although they satisfy the low ranked constraint –ONSET.

6 Conclusion

The findings of this study are that Ndau tolerates hiatus in specific morpho-syntactic contexts in the verbal and clitic domain. Hiatus is completely eliminated in the nominal domain. The data presented have shown that hiatus is tolerated in the verbal domain between the inflectional and macrostem boundary. In the same domain, hiatus is maintained between the relative marker and the tense sign. The study has also established that hiatus is tolerated in copulative proclitics. In all other domains, Ndau employs five hiatus resolution strategies, which are glide formation, secondary articulation, vowel deletion, vowel coalescence and spreading. These

2. For a discussion on positional faithfulness, see Beckman (1997).

strategies operate in restricted morphological environments. This research concludes that hiatus resolution in Ndau is governed by the following constraint ranking.

(6) ALIGN ($ROOT_{VERB}$, L, σ, L), MAX REL, MAX COP, OCP>> ONSET >> MAX RV

The major finding of this study is that Ndau has a complete ban of vowel hiatus in nominals; but it is allowed in some well-defined morpho-syntactic contexts in verbal and clitic domain. A follow-up study is envisaged as there is still a need to establish whether the vowels in hiatus are stressed or not.

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