Feature sensitive and context [in-]-sensitive glide formation and coalescence in hiatus resolution in isiNdebele

Collen Sabao[1]

Department of English and Communication, Midlands State University
P. Bag 9055, Gweru, Zimbabwe
sabaocol@gmail.com
sabaoc@msu.ac.zw
Cell: +263 915 125 125/ +263 733 823 604

Abstract

This paper argues for context and vowel-feature sensitive repair of hiatal configuration in isiNdebele, a Bantu language largely spoken in southern parts of Zimbabwe as well as parts of South Africa. Bantu languages by and large phonologically and/or phonetically repair vowel hiatus configurations arising from both phonological and morphophonological concatenations. The phonology of isiNdebele seems to largely favour an analysis that does not permit the surface realisation of clusters of segments of the form VV (vowel-vowel clusters). Observing such an analysis, which this paper argues to be largely ONSET motivated/triggered and the featural properties of the phonological structures of the languages under study, their reactions to such disprefered vowel clusters and their phonotactics are here examined within the framework of Optimality Theory (OT) as enunciated by Prince and Smolensky (1991, 1993), McCarthy and Prince (1999), Archangeli (1997) and Kager (1999) as well as Distinctive Features as discussed by Chomsky and Halle (1963). Repair strategies for such configurations such as glide formation, consonantal and/or glide insertions, vowel deletion and coalescence are discussed. The analysis adopted here implicates that the resolution of these disprefered configurations arises from incompatibities in the features of the vowels straddling a word boundary. It argues that these repair strategies are largely motivated by language internal constraint ranking systems which in Bantu languages seem to largely prefer the preservation of [-] features over [+] features and which are also contextually motivated/triggered.

---

[1] Sabao Collen is a lecturer of Linguistics in the English and Communication Department, Midlands State University

1.0. Introduction

Ndebele (or IsiNdebele) is a Bantu language belonging to the Nguni cluster and spoken in several southern African countries, but predominantly in South Africa and Zimbabwe. It is classified as belonging to the Nguni cluster (Zone S in the unit S44 according to Guthrie's 1967 classifications.

2.0. Ndebele vowel and syllable structure(s)

Ndebele/isiNdebele, like many other Bantu languages, is a five vowel phoneme system. The quality of *e* and *o* in Ndebele appears to match cardinal vowels 3 and 6, **[e]** and **[o]**, fairly closely, rather than numbers 2 and 7, **[e]** and**[o],** in most environments. There are no underlying long vowels in the language and neither are there long vowels that occur as a result of phonological processes such as elision and coalescence and/or other phonetic processes. Unlike in most Bantu languages, in Ndebele there is no compensatory lengthening of vowels in either the Underlying Representations (URs) and/or the Phonetic Representations (PRs) a phenomenon that results from attempts to preserve V-slots after phonological processes of deletion or merger of juxtaposed vowel. There are also no diphthongs in Ndebele. The vowels of Ndebele can be represented diagrammatically as below. The diagram illustrates a comparison between the places articulation of Ndebele vowels compared to cardinal vowels which in the diagram are marked 1 to 8 as reflected on the IPA chart.
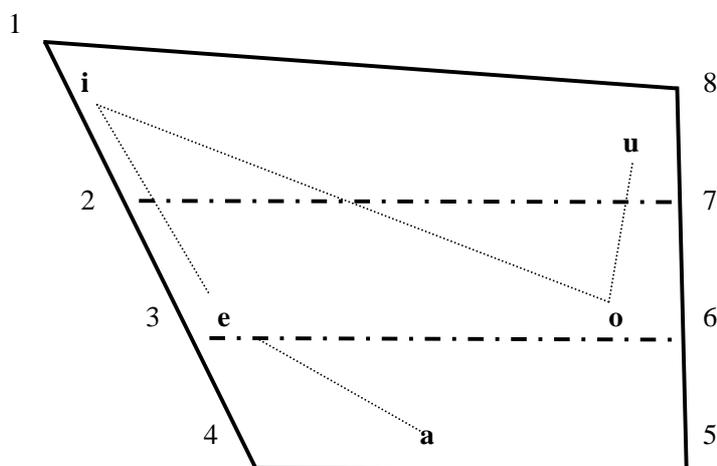
Fig. 1: Ndebele vowel structure

The low vowel /a/ in Ndebele seems to match the cardinal vowel, the low central /a/ whereas the mid front vowel /e/ and mid back vowel /o/ are articulated lower than their cardinal vowel equivalents, vowels 2 and 7 and also lower than those of other Bantu languages. The distinctive features of these vowels as represented on the above chart are as follows (**NB**: The features diagram also supplies redundant values);

	i	e	a	o	u
BACK	-	-	-	+	+
HIGH	+	-	-	-	+
LOW	-	-	+	-	-
ROUND	-	-	-	+	+

The basic syllable structure in Ndebele is the canonical CV syllable. It however can be argued that the basic structure could also be the V(CV) structure in light of the fact that most nouns in the language begin in a vowel since the language still has the IV (initial vowel) or pre-prefix as part of both is phonetic and orthographic inventories. This IV, it has been proposed is maintained from Proto-Bantu (Greenberg, 1963: Guthrie, 1967).

1. (i) *V(CV) structure*

    a) a.kha   'build
    b) e.nza   'do'
    c) i.nja   'dog'
    d) o.ma   'get dry/get thirsty'
    e) u.ba.ba   'father'

(ii) *CV structure*

    a) ma.ma   'mother'
    b) we.na   'you'
    c) mi.na   'me'
    d) lo.khu   'this;
    e) dhlu.la   'pass by'

3.0. Glide formation in Ndebele

Glide formation is one of the major hiatus resolution strategies in Ndebele. The most commonest example of contexts in which such a process occurs is when the high back vowel [u] of the infinitive prefix /uku-/ 'to' in isiNdebele juxtaposed with vowel commencing verbal forms undergoes glide formation. Unlike in other Bantu languages, in Ndebele glide formation does not result in a compensatorily lengthened surface vowel. This process in Ndebele is similar to the process referred to by Fortune (1985) as morphophonemic change and is in line with the [v→w/vowel] rule.

The rule that governs gliding in Ndebele (as is with many other southern Bantu languages) is that a [+high, -low] and [+round] vowel looses a mora (or glides) before another vowel. The second vowel in the sequence can be low, mid or high. Such a process is schematized as in **2** below:

2. *Gliding of initial high vowels in Ndebele*

σ   σ
| |
μ   μ
| |
[-cons, -low] [-cons]
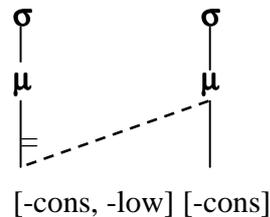
We can argue here that this process is triggered by language-internal phonological and morphophonological rules that disprefer the surfacing of vowel sequences in the PRs of the language. Not only does the language disprefer such hiatal configurations phonetically, it also seems to disprefer their occurrence in its orthographic forms. Let us consider the following examples in **3** below. Again, we note that as with other hiatus resolution mechanisms such as coalescence, in Ndebele glide formation does not result in long surface vowels. This again is in 'disregard' for, and in violation of place maintenance constraints and thus in violation of IDENT-IO and UNIFORMITY.

3.   (a) uk***u***- ***e***nza   [ukwenza]   /u_1#e_2/→ [w_1e_2] 'to do'
                inf- do
         (b) uk***u***- ***a***kha   [ukwakha]   /u_1#a_2/→ [w_1a_2] 'to build'
                inf- build
         (c) uk***u***- ***a***la   [ukwala]   /u_1#a_2/→ [w_1a_2] 'to refuse'
                inf- refuse
         (d) uk***u***- ***e***sula   [ukwesula]   /u_1#u_2/→ [u_1w_2] 'to wipe/rub'
                inf- wipe/rub

This kind of glide formation in which the high vowel [u] turns into a glide [w] in the face of all the other vowels except the mid back vowel [o]can be schematized as below:

4.   V$_1$ V$_2$

         Rt   μ   Rt   μ

[+high]
[+round]
[+back]
Glide formation: /u/→/w/ in Ndebele.

4
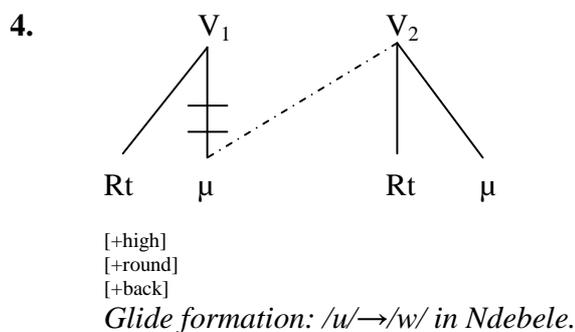
This happens through a process in which the V_1 (which has the features [+high] and/or [+round] and or [+back]) undergoes delinking with its associated mora, by which process which is mora preserving, attaches to V_2. V_1 however maintains its attachment to the root node thus preserving articulatory features.

We note that, like in other languages glide formation in Ndebele, if argued to be ONSET driven is also invariably in violation of *CG as well as IDENT-IO as illustrated in Tableau 1 below;

5. **ONSET**: *[$_\alpha$V: Syllables must have onsets
6. ***CG:** Avoid complex [Cw] and [Cy] onsets.
7. **IDENT-IO**: Corresponding input and output segments should bear identical specifications for feature(s)

Input: /uku-enz-a/	ONSET	*CG	IDENT-IO
(a) ☞/ukwe.nza/		*	*
(b) /uku.e.nza/	*!		

Tableau 1

We thus can argue that what really conditions and motivates glide formation here is the need to preserve segmental identity as well as featural identity between the input and the output. This is evidenced by the fact that the resultant glide is featurally identical to the initial vowel as it retains its [+high], [+back] and [+round] features. Glide formation here is elected above other possible resolution strategies because it maximizes featural as well as articulatory identity while in the process also successfully eliminating the dispreferred VV configuration. This is more vividly expressed in Tableau 2 below.

8. **PARSE[F']:** Preserve an input feature [F] in the output.

Input:/uku-e.nza/	ONSET	PARSE[F']	IDENT [±high]	IDENT[±low]	IDENT(μ)	UNIFORMITY
(a) /u.ku.e.nza/	*!					
(b)☞/u.kwe.nza/					*	**
(c) /u.ke.nza/		*!	*(!)		*	**
(d) /u.ku.nza/		*!	*(!)		*	**

Tableau 2

Here we note that candidate (a) is in fatal violation of ONSET due to heterosyllabification and thus is eliminated. Candidates (c) and (d), which could be showing either coalescence (symmetric fusion) or elision, are in fatal violation of PARSE[+high] and PARSE[-high] respectively. This is so because (c) fails to preserves the [+high] feature of the [+high, -low] prefix vowel /u/ while (d) fails to preserve the feature [-high] of the [-high, -low] of the V_2 vowel /e/. Both however manage to preserve the [-low] feature, a feature shared by both of the initial vowels. They however both get eliminated because, as with Chichewa data, they fail to reserve the [+back] and [-back] features of the input vowels respectively. Candidate (b) despite a violation of IDENT(μ), due to the changes in mora count manages to maximize featural and articulatory identity.

If however, the same infinitive prefix is juxtaposed with a vowel /o/ commencing verbal form, elision of the V_1 (the prefix final vowel) and consonantal epenthesis instead of glide formation/insertion variably occur. Consider the following example in which the former process (V_1 elision) occurs in **9** (a) and the latter (epenthesis) in **9** (b);

$\quad$ **9.** $\quad$ (a) uk***u***- ***o***ma $\qquad$ [ukoma] $\qquad$ /u$_1$#o$_2$/→ [o$_2$] 'to dry/get thirsty'

$\qquad\qquad$ inf- dry/thirst

$\qquad$ (b) uk***u***- ***o***na $\qquad$ [uku***b***ona] $\qquad$ /u$_1$#e$_2$/→ [u$_1$***b***$_e$o$_2$] 'to see'

$\qquad\qquad$ inf- see

I am not sure why, despite the conditions for elision being also satisfied by **9** (b) in as much as they are satisfied by **9** (a), epenthesis and not elision takes place. In the absence of such an explanation I would propose the existence of some language internal phonetic rule or at the least an oversight on the part of Ndebele orthographers and/or a shortcoming on the part of consistency within both the language's orthography and/or its phonological rules.

[I am however made to understand[2] that the correct way of writing as well as pronouncing the word for 'see' in Ndebele is not 'ona' but 'bona' [vona] and the variety of 'ona' [ona] used in the above example is only possible in South African languages like Suthu and Zulu, which share genetic descendency with the Zimbabwean variety of Ndebele under study here.

In this regard, I am informed that the process that occurs at such a boundary in the other languages is then elision and not epenthesis as follows:

$\quad$ **10.** $\quad$ uku- $\quad$ ona $\quad$ /ukona/ $\qquad$ 'to see'

$\qquad\qquad$ inf- $\qquad$ see

---

[2] This 'revelation' comes from social discussions with first language speakers of the language. It does not have scholarship backing and thus should not be viewed as conclusive and binding, but rather as an observation in obitur.

(V_1 elision in Zulu and/or Xhosa)

When the word occurs in Zimbabwean Ndebele as /ukona/ as in the above example, it does not mean 'to see' but rather 'to make mistakes',

11.   uku-   ona   /ukona/   'to make mistakes'

   inf-   make mistake

We therefore can thus argue for V_1 elision, precisely for this one example as opposed to consonantal epenthesis.]

The form of consonantal epenthesis exemplified in Ndebele by example **9** (b) also occurs at the same preposition – noun boundary that is discussed for coalescence in **13**. The reason why coalescence doesn't take place here as it does in **13** is because of the presence of the plural marker vowel /o/. Coalescence at such a boundary in Ndebele only takes place if the noun that provides V_2 commences in the initial vowels /i/, /u/ and /a/ (c.f. **13**). If the nouns begins with the vowel /o/, which could either be a plural marker or an agreement morpheme, consonantal epenthesis and not coalescence takes place. Consider the following examples in **12** regards that;

12.   (a) l*a*- *o*- mama   [la***b***omama]   /a_1#o_2/→ [a_1***b***$_e$$o_2$] 'with mothers'

   with/by/and- *pl*- mother

   (b) l*a*- *o*- mangoye   [la***b***omangoye] /a_1#o_2/→ [a_1***b***$_e$$o_2$] 'with cats'

   with/by/and- *pl*- cat

Epenthesis in the above contexts is triggered by the presence of the mid back vowel /o/ juxtaposed with the low central vowel /a/ of the prepositional prefix. We also can argue that this happens because the V_2 is not only a single segment morpheme but also a plural marker. This is so in light of the realisation that when those same words occur in the singular forms, coalescence and not epenthesis occurs. Compare **13** (a) and **13** (b) below:

13. *(a) Coalescence with singular forms*

   (i)   la-   umangoye   [a_1#u_2]→[o_3]   /lomangoye/ 'with/and/by a cat'
         with/and/by-1s-cat

   (ii) la-   umama   [a_1#u_2]→[o_3]   /lomama/   'with/and/by a mother'
         with/and/by-1s-mother

   (b) Epenthesis with plural forms

   (i)   la-   omangoye   [a_1#o_2]→[a_1*b*o_2] /labomangoye/   'with/and/by cats'
         with/and/by-1s-cat

(ii) la- omama $[a_1\#o_2] \rightarrow [a_1bo_2]$ /labomama/   'with/and/by mothers'
      with/and/by-1s-mother

We can account for this kind of epenthesis as follows:

Input:/la-o.ma.ma/	ONSET	PARSE[F']	PARSE[F]-1seg	IDENT-IO	DEP-IO	UNIFORMITY
(a) /la-o.ma.ma/	*!					
(b)☞/la-bo.ma.ma/				*	*	**
(c) /lo.ma.ma/		*!		*	*	**
(d) /la.ma.ma/		*!	*(!)	*	*	**

Tableau 3

We observe here that candidate (a) is eliminated because it violates ONSET (preserves the vowel sequence), candidate (c) not only deletes a segment but also deletes a single segment (the plural marker morpheme /o/). The problem is that such kind of deletion renders it impossible to distinguish this form from the singular form (c.f. **13** (a) above). Candidate (d) also deletes a segment and thus violates MAX and gets eliminated. The two candidate, (c) and (d) thus also violate PARSE[F'] (because (c) fails to preserve the [+low] feature of the input vowel /a/ while candidate (d) fails to parse the [-low] feature of the input vowel /o/) as well as PARSE[F]-1seg, MAX, MAX-V and DEP-IO and therefore get eliminated. The candidates thus het eliminated for a violation of PARSE[F']

This kind of consonantal epenthesis is evidence of the key observation that epenthesis and syllabification are inextricably connected (Selkirk 1981, Ito 1986, 1989). Epenthesis is largely motivated towards the elimination of onsetless syllables. Accordingly, an epenthetic segment thus is an empty structural position whose presence is required by the 'language specific syllable template' (Archangeli 1999). This syllabic make up blueprint dictates whether or not an onset is obligatory/necessary as exemplified by the examples in **13** above in which we can argue that the language's syllabic blueprint dictates the repair of ONSET in word medial syllables.

Kager (1999) proposes that such kind of epenthesis exemplified by the consonant /b/ insertion as discussed above is necessitated by 'an imperfect match between the input segments and the template'. The mismatch here arises from the realization of a vowel sequence in the UR which do not have an intervening consonant whereas the syllable blueprint obligates an onset.

Epenthesis, any form of epenthesis, involves the violation of faithfulness constraints. This is so because the epenthetic segment containing output diverges from the input by the presence of an epenthetic segment, one that 'is not sponsored by the lexical representation'. A schematic representation of the violation of DEP-IO through epenthesis is as follows:

14.   u-   k   u-   o   n-   a

u-   k   u-   ***b***   o   n-   a
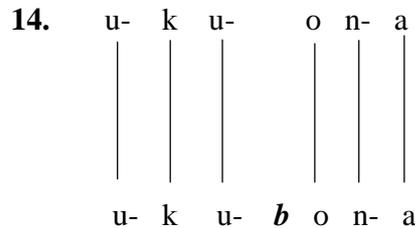
As a hiatus resolution mechanism, epenthesis here is triggered by the higher ranking of the constraint ONSET over DEP-IO.

This kind of ranking is illustrated by Tableau 4 below, containing only the two constraints ONSET and DEP-IO which functionally differ in the presence versus the absence of the epenthetic consonant respectively**.**

Input: /uku-on-a/	ONSET	DEP-IO
(a) ☞/u.ku.bo.na/		*
(b) /u.ku.o.na/	*!	

Tableau 4

Epenthesis in this regard can be argued to have been primarily motivated by the desire to eliminate onsetless syllables. NB: Because Ndebele is an IV using language, I observe that the IV always surfaces as an onsetless syllable and that the constraint ONSET only thus applies exclusively to word medial/internal syllables. Onsetless syllables are only allowed initially, but input hiatus cannot surface in the output. This in itself is a problem for an ONSET analysis, since only in word medial position is the ONSET violation repaired.

Bearing in mind that this discussion culminated from a discussion on glide formation in the language, we would also consider, that since in the same boundary, when the other vowel occur after the infinitive prefix /uku-/ glide formation occurs, the fact that in the same occurrence the occurrence of /o/ triggers epenthesis is an indication of a higher preference for epenthesis over glide formation is evidence of a higher ranking of ONSET above *CG. This ranking is illustrated in Tableau 5 below.

Input: /uku-on-a/	ONSET	*CG	DEP-IO
(a) ☞/u.ku.bo.na/			*
(b) /u.kw.o.na/		*!	
(c) /u.ku.o.na/	*!		

Tableau 5

Also, as indicated in the example, despite the fact that candidate (b) also still does not also violate ONSET, it fails to be the optimal candidate. The reason could be that in the environment under discussion, the occurrence of the /o/ must have triggered a rule that orders epenthesis over glide formation. I would again propose language internal constraints that militate against the occurrence of such complex onsets.

In the same vein we also consider example **9** (a) in which deletion and not glide formation occurs as is ordinarily supposed to. While I am still not sure why in the environment **9** (a) deletes and **9** (b) epenthesises, I would again propose as in **9** (b) that in **9** (a) deletion is triggered by the same desire to eliminate onsetless syllables. In many a language, elision is largely onset driven (c.f. Pulleyblank 1998). A failure to delete in this regard violates ONSET. The resolution of the vowel sequence through elision violates MAX-IO. A schematic representation of such a violation is as follows:

15. u- k *u*- o n- a

u- k o n- a
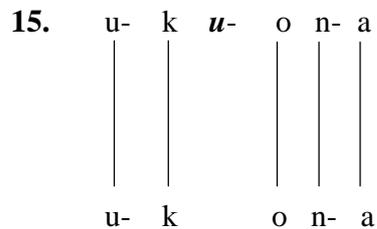
This can also be illustrated as in Tableau 6 below:

Input: /uku-om-a/	ONSET	MAX-IO
(a) ☞/u.ko.ma/		*!
(b) /u.ku.o.ma/	*!	

Tableau 6

10

Again the tableau contains only the two constraints describing what occurs in deletion environments. And because we observe this kind of deletion occurring in an environment that normally dictates glide formation, we observe that there must be a constraint ranking system that orders deletion above glide formation in the vowel /o/ occurring environments. We represent such a constraint ordering as below:

Input: /uku-on-a/	ONSET	*CG	MAX-IO
(a) ☞/u.ko.ma/			*
(b) /u.kw.o.ma/		*!	
(c) /u.ku.o.ma/	*!		

Tableau 7

I would maintain that I am still not sure why there is a variation between epenthesis and deletion in the examples discussed above.

4.0. Coalescence in Ndebele

Like with other Bantu languages such as Shona, Zulu and Chichewa, at the functional word-lexical word boundary involving prepositions and nouns, Ndebele resolves vowel sequences through coalescence. The most interesting thing to note however is that unlike in other languages such as Shona, Ndebele, at such a boundary, confronted with a /a+a/ sequences, opts for the coalesced vowel /a/ which is non-preferred in Shona contemporarily/synchronically but which we can argue to have been attested for within the language diachronically (as Shona would prefer a variation of the /e/ and the /o/). Consider the following examples in **16**.

16.   (a) l*a*- *u*mu- nthu   [lomunthu] $/a_1\#u_2/ \rightarrow [o_3]$ 'with/by/and a person'

       with/by/and- 1-person

     (b) l*a*- *u*m- ntwana   [lomntwana] $/a_1\#u_2/ \rightarrow [o_3]$ 'with/by/and a child'

       with/by/and- 1-child

     (c) l*a*- *u*m- fana   [lomfana] $/a_1\#u_2/ \rightarrow [o_3]$ 'with/by/and a young person'

       with/by/and- 1-young man/person

     (d) l*a*- *a*ba- ntu   [labantu] $/a_1\#a_2/ \rightarrow [a_3]$ 'with/by/and people'

       with/by/and- 2-people

     (e) l*a*- *a*ba- fazi   [labafazi] $/a_1\#a_2/ \rightarrow [a_3]$ 'with/by/and women'

with/by/and- 2-women

(f) l*a*- *a*ma- siko   [lamasiko]   /a_1#a_2/$\rightarrow$ [a_3]   'with/by/and nations'

     with/by/and- 4-nations

(g) l*a*- *i*- ndlu   [lendlu]   /a_1#i_2/$\rightarrow$ [e_3]   'with/by/and a house'

     with/by/and- 10-houses

(h) l*a*- *i*- nkomo   [lenkomo]   /a_1#i_2/$\rightarrow$ [e_3]   'with/by/and cattle'

     with/by/and- 10-cattle

(i) l*a*- *i*- nja   [lenja]   /a_1#i_2/$\rightarrow$ [e_3]   'with/by/and a dog(s)'

     with/by/and- 10- dog

Coalescence in Ndebele does not result in a compensatorily lengthened surface vowel. As a repair strategy in this regard invariably violates a constraint MAX-IO, which demands the preservation of all input vowel segments in the output. The constraint NLV which lengthens the surface vowel in a bid to maintain V-slots and in the process preserve segmental identity is thus ranked high in the language. In fact it must be ranked higher than MAX-V which aims at segmental identity as we observe that the output vowels are not compensatorily lengthened. Consider the following tableau in this regard:

Input: /la-inja/	ONSET	NLV	MAX-V	MAX-IO
(a) ☞/le.nja/			*	
(b) /le:.nja/		*		*

Tableau 8

Despite the fact that both candidates eliminate the hiatal configuration, and thus do not violate ONSET, candidate (b) gets eliminated because of its failure to preserve segmental identity and place.

This kind of coalescence in Ndebele (which is also height coalescence) can be described as being asymmetric, that is to say, sequences of /V_1 + V_2/ resolve differently depending on the feature specification of the two vowels: sequences of low + low vowels merge into a similar low vowel (as in examples **16** *(d) – (f))*, low + high vowel sequences result in a mid vowel (as in examples **16** *(a) - (c)* and **16** *(g) – (i))*. The resultant vowel, it should be noted agrees in rounding and/or backness with the second vowel of the sequence.

Asymmetric coalescence[3] can be distinguished from another form of coalescence called symmetric coalescence in that in the latter the resultant vowel from the vowel merger does not rely on the serial ordering of the vowels ion the sequence whereas in the former it does. In symmetric coalescence, the same vowel combinations will yield similar resultant vowel, for example, according to Tanner (2007), in the language Afar sequences of /u+e/ and /e+u/ would yield the coalesced vowel [o] irrespective of their differences in ordering.

Regards this, we observe that a change/reversal in the serial ordering of the vowels would yield or rather, trigger the ordering of other repair strategies before coalescence. For instance, while we note that the vowel sequence of the low [a] and the high back [u] would trigger coalescence, with the coalesced vowel being the mid [o], if the sequence is reversed i.e. the high back [u] occurring in V_1 position before a low [a], the high vowel undergoes gliding as in the following examples:

17. (a) uku- azi /ukwazi/ 'to know'

inf- know

(b) uku- akha /ukwakha/ 'to build'

inf- build

NB: An in-depth discussion of this process has been done in section 1.0. above.

We can, in line with such a thesis, summate the asymmetric coalescence that takes place in **16** *(d) – (f)* as follows:

18. V_1 [-high, +low] V_2 [-high, +low]

$V_{1,2}$ [+high, -low]

(Fusion of identical vowels /a+a/→/a/ in Ndebele)

Whereas that which occurs in the remainder of all the other examples in **16** as follows:

19. V_1 [-high, +low] V_2 [+high, -low]

V_3 [-high, -low]

(Fusion of dissimilar vowels /a+u/→/o/ and /a+i/→/e/ in Ndebele)

---

[3] For a more insightful discussion on these different kinds of coalescence, see Tanner (2007).

The resolution of vowel sequences through coalescence reflected in the above examples (**16**) and schematized as above (in **18** and **19**) result from a higher ranking of ONSET as well as a subsequent violation of the lower ranked IDENT-IO, MAX-IO and UNIFORMITY as exemplified below.

Input: /la-inja/	ONSET	IDENT-IO	UNIFORMITY
(a) ☞/le.nja/		*	*
(b) /la.i.nja/	*!		

Tableau 9

The ranking here is thus ONSET»IDENT-IO, MAX-IO. We also note that unlike in other Bantu languages in which hiatus resolution results in lengthening of the resultant vowel in a bid to preserve place (V-slots), in Ndebele the coalescence vowel is typically short. This is because, as earlier highlighted, there are no underlying and/or long vowels in the language. The non-occurrence of such long vowels in resolved contexts thus, as indicated in Tableau 9, is in violation of IDENT-IO and UNIFORMITY and fails to maximize segmental identity between input and output as well as articulatory features.

We also note in this regard that coalescence in the language is height sensitive, position sensitive and place sensitive. It is some form of segmental fusion in which two segments in the input correspond to a single segment in the output. Coalescence thus in line with this thesis yields resultant vowels whose features are dictated by a higher ranking of IDENT(-F) over IDENT(+F) in which equation (F) represents the vowel articulatory features [high] and [low]. I note, for example, from the example in Tableau 9 that despite the V_2 having the feature [+high], the resultant coalesced mid vowel [e] has the articulatory feature [-high] also a feature of the V_1 as indicated in **20** below.

20. $[a]_1$ [-high, +low] $[u]_2$ [+high, -low]

$[o]_3$ [-high, -low]
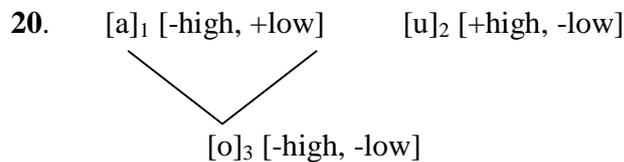
(Fusion of low vowel /a/ and high /u/ into mid vowel /o/ in Ndebele)

This kind of coalescence argued for here to be conditioned by the ranking of IDENT(-F) over IDENT(+F). In this regard, there is a constraint ranking hierarchy that would violate constraints aimed at preserving all segments of the lexical word, especially the [+high] feature and/or other features of the lexical word initial vowel in a bid to preserve the feature [-high] and or other

features of the prefix (functional word) final word vowel. The constraints used in determining the surface form from the inputs are PARSE[-high], PARSE[+high]-lex, PARSE[F']-lex and PARSE[F'].

Such being the case, we argue that the output forms here are as a result of the ranking of PARSE[-high] »PARSE[+high]-lex as illustrated below;

Input: /la-inja/	ONSET	PARSE[-high]	PARSE[+high]-lex	PARSE[F']-lex	PARSE[F']
(a) /l\<a>i.nja/		*!			*
(b) /la.\<i>nja/			*	*!	*
(c) ☞/le.nja/			*		*
(d) /la.i.nja/	*!				

Tableau 10

21. **PARSE[-high] :** Preserve an input feature [-high] of either the root or affix in the output.

22. **PARSE[+high]-lex:** A feature [+high] present in the input lexical (root) morpheme must be parsed in the output.

23. **PARSE[F']-lex:** Other features[4] of the root morpheme vowel must be parsed in the output.

24. **PARSE[F']:** Preserve an input feature [F] in the output.

In line with the argument that we have established so far, i.e. that deletion (and at times other asymmetric repair strategies) is conditioned by a higher ranking of feature [-high] over features [+high], we observe in the above tableau, that candidate (a) violates the undominated constraint PARSE(-high) and thus gets eliminated. Candidates (b) and (c) have almost identical violations in the table except that candidate (b) fails to preserve, in line with the established [-F] » [+F], the [-F] feature, i.e. the feature [-back] of the input vowel [i] and thus again gets eliminated.
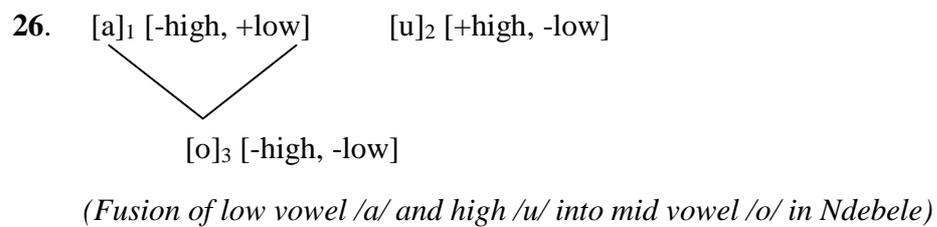
In the same manner that we have coalescence taking place at morphological boundaries involving the preposition /la-/ and a vowel commencing noun/verbal form, the same process also occurs when a hiatal configuration occurs involving the instrumental prefix /nga-/ and a vowel

---

[4] These other features of the vowels represented here by [F'] include such features as [+round], [+back], [+front], [+low] etc.

commencing noun. In such circumstances, the merger rules described in **18** and **19** above also apply. Consider the following examples in **25** below.

25.　(a) ng***a***- ***a***manzi　　[ngamanzi]　/a₁#a₂/→ [a₃] 'with water'

with- water

(b) ng***a***- ***i***litshe　　[ngelitshe]　/a₁#i₂/→ [e₃] 'with a stone'

with- stone

(c) ng***a***- ***u***mlomo　　[ngomlomo]　/a₁#u₂/→ [o₃] 'with the mouth'

with- mouth

Again the process as that which occurs with the prepositional prefix + stem boundary applies, thus;

26.　[a]₁ [-high, +low]　　　[u]₂ [+high, -low]

[o]₃ [-high, -low]

(Fusion of low vowel /a/ and high /u/ into mid vowel /o/ in Ndebele)

This process, at the surface level is also motivated by the need to eliminate disprefered vowel clusters, in the process incurring the violations represented below;

Input: /ng**a**-**u**mlomo/	ONSET	IDENT-IO	UNIFORMITY
(a) ☞/ngo.m.lo.mo/		*	*
(b)　/nga.u.m.lo.mo/	*!		

Tableau 11

We observe here, as is with the examples above and below, that the features of the coalesced vowels result from a ranking of the PARSE[-F] »PARSE[+F] as well as that of IDENT[-F] » DENT[+F].

Again the same kind of coalescence also occurs at the boundary between the possessive concord /wa-/ 'of' and a vowel commencing noun. The possessive concord in Ndebele is formulated by merging together the particle /-a-/ with the subject concord of the noun in question. The process

16

of coalescence here again yields the same vowel patterns as those hypothesized by Doke (1943) and discussed above. For evidence of this consider the following examples in **27** below.

27. (a) w*a*- *a*bafazi   [wabafazi]   /a_1#a_2/$\rightarrow$ [a_3] 'the women's'

       of- 3women

(b) w*a*- *i*nkazana   [wenkazana]   /a_1#i_2/$\rightarrow$ [e_3] 'for the girl/the girl's'

       of- girl

(c) w*a*- *u*mfana   [womfana]   /a_1#u_2/$\rightarrow$ [o_3] 'the young man's'

       of- young man

In the above examples of coalescence in Ndebele i.e. examples **16, 25** and **27**, we again observe that the sequences of low + high vowels that occur at word-internal morpheme boundaries are realized as mid vowels, with the backness and rounding of the resulting vowel corresponding to the rounding of the second vowel in the sequence. This second vowel is again the IV or the lexical word initial vowel.

Input:/wa-umfazi/	ONSET	PARSE[-high]	PARSE[+high]-lex	PARSE[F']-lex	PARSE[F']
(a) /w<a>u.m.fa.zi/		*!			*
(b) /wa.<u>m.fa.zi/			*	*!	*
(c)☞/wo.m.fa.zi/			*		*
(d) /wa.u.m.fa.zi/	*!				

Tableau 12

Again, as with the other examples discussed above, the same asymmetry rules, the same ranking hierarchy applies i.e. deletion is motivated by a higher ranking of feature [-high] over features [+high], we observe in the above tableau, that candidate (a) violates the high ranked constraint PARSE[-high] and thus gets eliminated. Candidates (b) and (c) have almost identical violations in the table except that candidate (b) fails to preserve, in line with the established PARSE[-F] » PARSE[+F], the [-F] feature, i.e. the feature [-back] of the input vowel [i] and thus again gets eliminated.

17

Casali (1996) deals with this kind of asymmetric coalescence evidenced here in Ndebele and discussed above, specifically positing that it arises when both feature-sensitive and position-sensitive constraints are active in the evaluation of output candidates; that is, the feature specification [-high] must be preserved in preference to [+high], otherwise all features of the V_2 are to be preserved (c.f. Casali, 1996 and Tanner, 2007).

5.0. Conclusion

We note, by observing instances in which coalescence occurs in Ndebele with dissimilar vowels that it is largely asymmetric coalescence, i.e. the resultant surface vowel is determined by the serial ordering of the vowels at the boundary (the feature specifications of the vowels in the VV sequence). It is also observed that in instances where coalescence takes place with dissimilar vowels the sequence of vowels would be that of a low vowel – high vowel and the resultant vowel being a non-high vowel (i.e). a mid vowel. Such a kind of coalescence which takes place in both Ndebele and Chitumbuka also follows in line with the [-F] » [+F] thesis established above in the sense that the resultant mid vowel neutralizes the [+F'] ([+] features) of both vowels, i.e. the [+low] of the low vowels and the [+high] of the high vowels resulting in a vowel that contains the features specifications [-high] and [-low]. On the other hand elision in Ndebele is height conditioned i.e. primarily motivated by the need to preserve the [-F'] (as we observe that in Ndebele there is deletion of low vowels if juxtaposed with non-low vowels containing the features [-high, -low]). Elision in Ndebele is thus explainable through the ranking system that subordinates the [-F'] constraints below the [+F] ones, in this case the ranking of IDENT[+F] below IDENT[-F].

REFERENCES

CASALI, R.   (1996) 'Resolving Hiatus'. Unpublished PhD Thesis, University of California, Los Angeles.

CASALI, R. (1997). 'Elision in Hiatus contexts. Which vowel goes.' in *Journal of Linguistic Society of America, Volume 73-Number 3* (Pages 493-533).

FORTUNE, G. (1985). *Shona Grammatical Constructions Volume 1*. Harare, Mercury Press.

GREENBERG, J. H. (1963). *The languages of Africa*. Bloomington, Indiana University.

GUTHRIE, M. (1967). *The classification of Bantu languages*. London, Dawson of Mall Pall.

KAGER, R. (1999). *Optimality Theory*. Cambridge, Cambridge University Press.

McCARTHY, J.J and PRINCE, A.S (1993b). *Prosodic Morphology, Constraint Interaction and Satisfaction*. New Jersey, Rutgers University.

MTENJE, A. D. (1980). 'Aspects of Chichewa derivational phonology and syllable structure constraints', Unpublished MA Thesis, University of Southern Illinois – Carbondale.

PULLEYBLANK, D. and ORIE, O.O. (1998). 'Vowel elision is not always onset driven', University of British Columbia and Tulane University.

TANNER, D. S. (2007). 'Context insensitive vowel hiatus resolution in Ciyao.' on Rutgers Optimality Archive. [ROA 458]. Accessed: July 23, 2007.

SABAO, C. (2005). '*Optimality Constraint Rankings and the Shona Language. Vowel*

Hiatus', Unpublished B.A (Honours) Dissertation, Midlands State University - Gweru.

SABAO, C. (2009). '***Constraint Interaction and Rankings in Vocalic Hiatus Contexts in Bantu languages'***, Unpublished MPhil Thesis, Midlands State University - Gweru.

SIBANDA, G. (2009). 'Vowel Processes in Nguni: Resolving the Problem of Unacceptable VV Sequences'. in Masangu Matondo et al. (eds) *Selected **Proceedings of the 38th Annual Conference on African Linguistics***, pages 38-55, Somerville, MA: Cascadilla Proceedings Project: pages 38 - 55.

SMITH, J.L. (1986) 'Phonological constraints are not directly phonetic'. In Proceedings of CLS 41, Vol 1

TANNER, D. S. (2007). 'Context insensitive vowel hiatus resolution in Ciyao'. on Rutgers Optimality Archive. [ROA 458]. Accessed: July 23, 2007.

TESAR, B. and SMOLENSKY, P. (1993). 'The learnability of Optimality Theory: An algorithm and some basic complexity results'. Technical Report CU-CS-678-93.. [ROA 2].