# Ghost Segments in Nguni

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## 1. Introduction

Nguni languages (Ndebele, Swati, Xhosa and Zulu) have a number of segments that alternate with zero. It has been argued or assumed in previous works that these ghost consonants (especially glides) and vowels surface for various reasons such as minimality requirements for a prosodic word and the onset requirement in the imperative mood (Downing 1998 & 1999, Sibanda 2004). While reasons have been given for their surfacing, what has not been clear is why these particular segments and not others surface. Besides presenting the ghost segments, this paper investigates their source and also provides a brief analysis of the data. Note that the term 'ghost segment' is used loosely here to refer to any segment that alternates with zero whether or not it overtly surfaces. Some of the segments may, of course, not have been treated as such in previous works. They may, for example, have been treated as epenthetic segments or cases of glide insertion. The various cases of segment-zero alternation are conveniently treated together here because they have similar historical origins and pose similar phonological problems (creating predictability problems and blocking normal phonological processes). For these reasons a similar solution in dealing with all of them is argued for in this paper. However, the paper does not assume that a ghost segment lacks a timing unit or consists only of features not linked to a V or C slot as in some previous accounts (see, for example, Hyman 1985, Zoll 1998) but, instead, argues for an approach that shows some consistence with diachronic data.

Note that most of the examples used in this work are from Zimbabwean Ndebele although in the majority of cases the same examples can be used for the other three languages. Examples that do not apply to Ndebele will be pointed out. Proto Bantu forms used are from Guthrie (1967-1971) and Meeussen (1967, 1969). The [i̧] and [u̧] in some of them represent super close vowels while [i] and [u] stand for the regular [+high] vowels that are also still in use in Nguni, the former having been lost. In examples ghost segments are in parentheses and the examples themselves are in standard Nguni orthography, with regular keyboard <a> used in the paper rather than [+low] vowel [ɑ].

The paper is organized as follows. Ghost vowels are presented in Section 2 and ghost consonants in section 3. Section 4 focuses on the source of these ghost segments while Section 5 provides a brief analysis of the data within the Optimality Theory (OT) framework. (See Prince and Smolensky 1993, McCarthy & Prince 1994, 1995, 1998 and others). Section 6 is the conclusion.

## 2. Ghost Vowels

In order to get a clear picture of where ghost vowels are realized let us first consider a few examples without ghost vowels. In 1(a- b) the sub-minimal -C- verb roots are preceded by the class 1 subject marker [u] while in 1(c- d) the same verb roots are preceded by the class 9 subject marker [i]. In all the four examples the root is followed by default final vowel [a].

(1) -C- root preceded by a high vowel

    a.   u-z-a    →  uza    's/he comes …'
    b.   u-m-a   →  uma    's/he stands …'
    c.   i-z-a    →  iza    'it comes …'
    d.   i-m-a   →  ima    'it stands …'

As can be seen, when the root is preceded by [+high] vowels, no unusual or interesting phonological process occurs.

       In 2 the same roots with default final vowel [a] are employed as in 1 but preceded by relative prefixes in place of subject markers. While the class 1 relative concord [o] is used in 2(a- b)., in 2(c- d) it is the class 9 relative concord [e] which precedes the root.

(2) -C- root preceded by a mid-vowel

    a.   o-z-a   →  oza  '(the one) who comes …'
    b.   o-m-a  →  oma  '(the one) who stands …'
    c.   e-z-a   →  eza  '(the one) that comes …'
    d.   e-m-a  →  ema  '(the one) that stands …'

Again here there is nothing phonologically interesting or unusual even though the vowels preceding the roots are now mid.

       The situation is, however, different where the class 6 subject prefix [a] precedes the root as two groups of verbs can be observed. For one group that includes most verbs no unusual or phonologically interesting process occurs. Here are some examples.

(3) -C- and longer roots preceded by a low vowel

    a.   a-f-a       →  afa       *efa      'they died'
    b.   a-dl-a     →  adla     *edla     'they ate'
    c.   a-lal-a    →  lala     *lela     'they sleep'
    d.   a-fak-a   →  afaka    *afeka    'they put'
    e.   a-phakam-a →  aphaphama  *aphephama, *aphephema, *aphaphema  'they wake up '
    f.   a-khathaz-a →  akhathaza  *ekhatheza  *akhetheza  *akhatheza   'they bother'

Note that verbs with roots longer than -C- (3(c- f)) are also included to make it clear that aCa triggers no interesting phonological process even when it is not in a word-initial position. However, something phonologically interesting can be seen in the second group illustrated with two examples in 4.

 (4) -C- root preceded by a low vowel

    a.   a-z-a   →  eza /aza   'they come …'
    b.   a-m-a  →  ema /ama  'they stand …'

As can be seen, there are now two possible outcomes for each example, the expected one following what we have seen above and another where the subject prefix [a] appears to change to [e]. It may be tempting to view this as a case of dissimilation whereby the first of the two identical low vowels is raised to <u>e</u>. However, examples in 3 make it clear that this is not the case. Both verbs with -C- roots (3(a- b)) and those with longer roots (3(c- f)) show that a form that does not raise [a] to [e] before another [a] is acceptable but not the one that does.  To argue for dissimilation in 4 one would have to explain why it fails in 3. In fact, in Nguni languages there is no known synchronic vowel process that raises [a] to [e] but the latter occurs independently or may be a result of the coalescence of [a] and [i], (i.e. [a] + [i]→ [e]) as in 5 where in 5a associative formative /la/ is prefixed to the noun <u>isitha</u> 'enemy', in 5b. class 16 prefix /pha/ precedes the class 6 noun <u>izulu</u> 'rain, heaven', in 5c. the class 14 subject marker /bu/ is followed by the possessive prefix [a] and the class 9 noun <u>inkomo</u> 'cow', in 5d the class 4 adjective prefix is formed by adjective formative [a] plus class 4 noun prefix /imi/, and in 5e the class 9 adjective prefix is formed by  combining the adjective formative [a] with the class 9 prefix /in/.

(5) Coalescence
|     |     |     |     |     |
| --- | --- | --- | --- | --- |
| a. | la + isitha | → | lesitha | 'and/with the enemy' |
| b. | pha + izulu | → | phezulu | 'up, above; on top of' |
| c. | bu+a+ inkomo | → | benkomo | 'of the cow' [bu+a+inkomo >bwenkomo > benkomo] |
| d. | a + imi | → | emi- | 'class 4 adjective prefix (as in <u>emikhulu</u> 'the big ones')' |
| e. | a + in | → | en- | 'class 9 adjective prefix (as in <u>enkulu</u> 'the big one')' |

It therefore appears as if there is an epenthetic ghost vowel [i] (sometimes referred to as 'latent' [i] (Doke 1965)) in 4 between the subject prefix [a] and the root consonant in forms that surface with [e] as illustrated in 6 where the ghost vowel is in parentheses.

(6) -C- root preceded by a low vowel
|     |     |     |     |     |
| --- | --- | --- | --- | --- |
| a. | a-(i)-z-a | → | eza | 'they come …' |
| b. | a-(i)-m-a | → | ema | 'they stand …' |

In the other forms where the prefix [a] is maintained it can be assumed that the ghost vowel does not play any role. Examples of this nature are found wherever the verb roots in 6 and similar ones (to be provided later) are preceded by vowel [a]. Verbs in the remote past tense such as those in 7 are another good example as this tense is marked by the prefix [a].

(7) -C- roots preceded by a subject maker and remote past tense [a]

|     |     |     |     |     |     |     |
| --- | --- | --- | --- | --- | --- | --- |
| a. | lu-a-(i)-z-a | → | lweza /lwaza? | 'it came' |  |  |
| b. | lu-a-(i)-m-a | → | lwema/lwama | 'it stood' |  |  |
| c. | si-a-(i)-z-a | → | syeza | → | seza /saza ? | 'it came' |
| d. | si-a-(i)-m-a | → | syema | → | sema/sama | 'it stood' |

In 7(a- b) the remote past tense morpheme is preceded by the class 11 subject prefix /lu/ and in 6(c- d) by the class 7 subject prefix /si/. In Ndebele forms that surface with [e] in the first syllable are the preferred ones and those with question marks are rarely used if at all.

A class 6 relative prefix [a] also triggers the same process when prefixed to the roots in question as shown below.

(8) -C- root preceded by class 6 relative prefix [a]
|     |     |     |     |     |
| --- | --- | --- | --- | --- |
| a. | a-(i)-z-a | → | eza /aza | '(the ones) who come …' |
| b. | a-(i)-m-a | → | ema/ama | '(the ones) who stand …' |

This clearly shows that this is a phonological process not necessarily restricted to a specific prefix.

The process seen in in 6, 7 and 8 is not restricted to verbs but also occurs, for example, when the stem is locative adverb /kho/. Consider examples in 9 where the negative prefix [a] is followed by a subject marker.

(9) Locative adverb stem /kho/
|     |     |     |     |     |
| --- | --- | --- | --- | --- |
| a. | a-zi-kho | → | azikho | 'they are not there' |
| b. | a-lu-kho | → | alukho | 'it is not there' |
| c. | a-ka-(i)kho | → | akakho/akekho | 's/he is not there' |
| d. | a-ba-(i)kho | → | abakho/abekho | 'they are not there' |

In 9a and 9b where the subject markers are class 8 /zi/ and class 11 /lu/, respectively, the surface forms are the expected ones. There are, however, two possible surface forms in 9c and 9d where the subject

markers are class 1 /ka/[1] and class 2 /ba/, respectively, both of which are Ca-. The first in each case is the expected one with [a] in the second syllable but the variant has [e] in the same position, suggesting that the original [a] has combined with ghost vowel [i].

In cases we have seen above the ghost vowel [i] is realized immediately before the verb root or locative stem. The [i] preceding nouns stem such as those in 10 seems not to be any different from the ghost vowel [i] above.

(10) Noun stems with initial [i]
  a.  ama-iva    →   ameva  (singular: iliva)
  b.  ama-ihlo   →   amehlo (singular: Ndebele ilihlo; Zulu & Xhosa: i(li)so)

Unfortunately, unlike verb roots, noun stems cannot be immediately preceded by many different prefixes. If it were possible we would test to see what happens when the vowel that immediately precedes the stem vowel [i] is high vowel [u] or a mid vowel. In other words, with a vowel other than [a] immediately preceding the stem, would the stem surface as /iva/ or /va/? The [i] of the singular prefix /ili/ or [i] (Class 5) does not help here as identical vowels in Nguni coalesce to form a single monomoraic one (See Sibanda 2009). Although no conclusion can be drawn about the status of stem [i] here we will return to these examples in our discussion in the next section.

For other parts of speech a clearer case involving ghost vowels can be found in SiSwati. (For SiSwati grammar and vocabulary, see, for example, Ziervogel and Mabuza 1976; Taljaard, Khumalo and Bosch 1991 and Rycroft 1981). Before getting to the more specific examples in 12, consider first the SiSwati nouns in 11 formed by prefix plus stem.

(11) SiSwati Nouns
  a.  li+ sango    (class 5)    →    lisango     'gate'
  b.  si + hambi   (class 7)    →    sihambi     'visitor'
  c.  ti + hambi   (class 8)    →    tihambi     'visitors'
  d.  tin + dlovu  (class 10)   →    tindlovu    'elephants'
  e.  lu + khuni   (class 11)   →    lukhuni     'firewood'
  f.  bu + hlalu   (class 14)   →    buhlalu     'beads'
  g.  ku + dla     (class 15)   →    kudla       'food'
  h.  ba + fati    (class 2)    →    bafati      'women'

As can be seen, the prefix in each of the classes illustrated is CV- or CVC and no unexpected process occurs when it is combined with the stem to form a noun. Now consider the relative concord in 12 formed by relative formative /la/ plus noun class prefix.

(12) SiSwati relative concords
  a.  la + li-  (cl.ass 5)   →  leli-   leliwako      'the one that is falling'
  b.  la + si-  (class 7)    →  lesi-   lesihambako   'the one that is walking'
  c.  la + ti   (class 8)    →  leti-   letihambako   'the ones that are walking'
  d.  la + tin- (class 10)   →  leti-   letidlako     'the ones that are eating
  e.  la + lu-  (class 11)   →  lolu-   loluwako      'the one that is falling'
  f.  la + bu-  (class 14)   →  lobu-   'lobuwako     'the one that is falling'
  g.  la + ku-  (class 15)   →  loku-   lokumnandzi.  'that is delicious'
  h.  la + ba-  (class 2)    →  laba-   labapheka     'who are cooking …'

These examples can be treated together with the SiSwati demonstrative pronoun illustrated in 13 as the crucial facts for both are the same.

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[1] It is possible that /ka/ is the negative prefix that has switched positions with the class 1 vowel subject marker [a]. In prefixes, irregular phonological processes are usually found in class 1. Whatever the case, however, is not important here as the focus is on just how [a] combines with ghost vowel [i].

(13) SiSwati demonstrative Pronoun
  a.  la + li-   (class 5)    →  leli   'this (one)'
  b.  la + si-   (class 7)    →  lesi   'this (one)'
  c.  la + ti-   (class 8)    →  leti   'these'
  d.  la + tin-  (class 10)   →  leti   'these'
  e.  la + lu-   (class 11)   →  lolu   'this (one)'
  f.  la + bu-   (class 14)   →  lobu   'this (one)'
  g.  la + ku-   (class 15)   →  loku   'this (one)'
  h.  la + ba-   (class 2)    →  laba   'this (one)'

12(a- d) and 13(a- d) present nothing new as it can be assumed here again that vowel [a] of /la/ combines with ghost vowel [i] resulting in the [e] seen in the relative concord and demonstrative pronoun. In 12(e- g) and 13(e- g) the vowel [o] in /loku/ suggest that there is a ghost vowel [u] as [o] in Nguni often results from the coalescence of [a] and [u] (i.e. [a] + [u] → [o]) as in the following examples that apply to SiSwati and other Nguni languages although the noun prefix is sometimes shortened to /um/ in both class 1 and class 3.

(14) Coalescence: [a] + [u] → [o]
        Relative concords
  a.  la + umu- (class 1) → lo-    SiSwati:              lohambako   'the one who is walking'
                                   Xhosa/Ndebele/Zulu: ohambayo    'the one who is walking'
  b.  la + umu- (class 3) → lo-    SiSwati:              lowako      'the one that is falling'
                                   Ndebele/Xhosa/Zulu: owayo       'the one that is falling
        Demonstrative Pronoun
  c.  la + umu- (class 1) → lo 'this (one)'   SiSwati:           umntfu lo   'this person'
                                             Xhosa:             umntu lo    'this person'
                                             Ndebele/Zulu:      umuntu lo   'this person'
  d.  la + umu-    (class 3)    →  lo    'this (one)'   SiSwati:    umuti lo 'this village'
                                                       Xhosa       umzi lo  'this village'
                                                       Ndebele/Zulu:  umuzi lo 'this village'

Note that, although the output of [a] + [u] is now [e] in many SiSwati cases, as will be seen in some examples below, the normal output in all Nguni languages is [o] as is illustrated here. The nasal [m] and the vowel after it are dropped in the output and [l] of the relative formative /la/ has been lost in Ndebele, Xhosa and Zulu. Note that in SiSwati all other noun class prefixes begin either with a consonant or a vowel other than [u]. Most of them are provided in 12 and 13 and locative classes 16, 17 and 18 are irrelevant to issues discussed here since they do not behave like other classes in terms of agreement although they do in some non-Nguni Bantu languages. Class 6 whose noun prefix is /ema/ appears to have a ghost vowel or to be an exception. The fact that the relative concord is /la/ and the demonstrative pronoun is /la/ like in other Nguni languages where the noun prefix is /ama/ (/la/ + /ama/ > /la/) calls for further investigation. It is not clear why SiSwati has an initial e- in the prefix and yet aCa (including /ama/ as in khotsama 'bend down') is permitted in the language.

     What happens in 12h and 13h is less obvious since the result of combining /la/ and /ba/ is the expected /laba/ we see. However, the other relevant examples with CV prefixes suggest that there is also a ghost vowel before /ba/. The ghost vowel is [a] but since it combines with another [a] the result is just monomoraic [a] as normally happens in Nguni languages (i.e. [a] + [a] → [a]). While arguing for the presence of ghost vowel [a] might look superfluous, ignoring it would be drawing an inaccurate conclusion as evidence presented in Section 4 will show.

     Examples similar to those in 12 and 13 are also found in the SiSwati instrumental where the instrumental formative /nga/ immediately precedes the noun class prefix as illustrated in 15. There is no need here to go through all the classes again as the crucial facts are the same as what we saw above.

Three examples with the three different ghost vowels should suffice. While in 15a. /nga/ precedes the class 7 prefix /si/, in 15b and 15c it is followed by the class 15 and 2a noun prefixes /ku/ and /bo/ , respectively.

(15) SiSwati instrumental

    a.   nga + (i)si- (class 7)       →  ngesi-                             ngesihlangu 'with a shield'
    b.   nga + (u)ku- (class 15)    →  ngeku-  (-o- has been fronted)     ngekudla 'with food'
    c.   nga + (a)bo- (class 2a)    →  ngabo-                           ngabobabe 'with fathers'

As can be seen, examples 15a and 15c present nothing new but confirm what we have already seen above. However, 15b (as are other similar cases involving [a]+[(u)] in the instrumental) is irregular in that where [o] is expected from the coalescence of [a] and [u] there is [e] instead. The fronting of [o] to [e] occurs in many situations in SiSwati and other Nguni languages. Consider the locative illustrated in 16, for example.

(16) Nguni locative

    a.   Ndebele/Swati/Xhosa/Zulu:     a+ikhaya    →  ekhaya 'at home'
    b.   Zulu:                             a+ulwandle  → olwandle 'at the sea/ocean'
    c.   Ndebele/Swati/Xhosa:           a+ulwandle  → olwandle → elwandle 'at the sea/ocean'

These examples show that Zulu still maintains regular coalescence in the locative while in the other three Nguni languages both [a]+[i ] and [a]+[u] now yield [e]. The [a]+[u] → [o] → [e] change we see in 16c. seems to be the same process we see in 15b where [u] is a ghost vowel.

    Before leaving this section let us look at another case involving a ghost vowel occurring in all the four Nguni languages in question although examples are Ndebele/Zulu. Before getting to more specific examples consider first the nouns and their corresponding copulative forms in 17.

(17) Nouns and their copulative forms

       Noun                                 Copulative
    a.   abantu   'people'     (class 2)        ng-abantu   '(they) are people'
    b.   isitha    'enemy'     (class 7)        y-isitha     '(it) is an enemy'
    c.   omama   'mothers'   (class 2.a)     ng-omama   '(they) are mothers'

As can be seen, a bare noun or a noun preceded by a consonant shows nothing unexpected. Now see in the next set of examples what happens when a noun immediately follows a vowel such as possessive [a].

(18) Subject Marker + Possessive [a] + Noun

    a.   zi-a-abantu       (class 2)     →  zabantu     'people's'
    b.   zi-a-isitha        (class 7)     →  zesitha      'the enemy's'
    c.   zi-a-(ab)omama  (class 2a)    →  zabomama  *zomama 'mothers''

While surface forms in 18(a- b) are the expected ones after vowel combinatorial processes have taken place (Ciaa → Cyaa→ Cya → Ca and Ciai → Cyai → Cye → Ce), the form that surfaces in 18c has an unexpected consonant [b]. From the prefixes we see in 18(a- b). and from what we saw in 15c, it can be assumed that there are ghost segments /ab/ in 18c. The presence of ghost vowel [a] is not obvious because it combines with the preceding possessive [a]  (Ciaa → Cyaa → Cya → Ca). While it can be left out of the analysis as it is redundant, its omission would be an inaccurate representation of the class 2a prefix as will be seen in Section 4. Note that in SiSwati [b] is not a ghost consonant but actually part of the class 2a prefix (i.e SiSwati class 2a prefix = /bo/ (not [o])).

    The ghost vowel [a] accompanied by ghost consonant [b] is also present in the associative marked by /la/ 'and, with' in Ndebele and /na/ 'and, with' in other Nguni languages. Here are some Ndebele examples where the associative formative is prefixed to the noun.

(19) The Ndebele associative marked by /la/ (/na/ in other Nguni languages)
- a.  la+abantu        (class 2)    →  labantu  'and/with the people'
- b.  la+isitha        (class 7)    →  lesitha   'and/with the  enemy'
- c.  la+(ab)omama   (class 2a)   →  labomama , *lomama  'and/with the mothers'

As can be seen in 19c, when there is a preceding [a] the ghost segments /ab/ surface in class 2a but not in the other classes exemplified in 19(a- b). A form in which the [a] of the associative formative /la/ is dropped following normal vowel combinatorial processes in Nguni ( [a]+[o] → [o]) is disallowed.

In short, this section has shown that high vowels [i] and [u], and the low vowel [a] are sometimes ghost segments in Nguni languages especially [i]. However, the extent to which each of these three segments can be a ghost vowel varies from language to language within the Nguni group.

## 3. Ghost consonants

Having seen the ghost vowels above, we now turn to ghost consonants. We have already seen in the preceding section under what circumstances ghost consonant [b] surfaces. Therefore, there is no need to focus on it again here. However, there are other interesting cases involving ghost consonants, specifically glides that are often treated as epenthetic, but before we get to them consider the Ndebele example below.

(20) Words are at least disyllabic and V syllables are acceptable
- a.  ba-hamb-a     →  bahamba      'they walk, go'
- b.  a-khumbuz-a   →  akhumbuza    'they remind'
- c.  u-dl-a        →  udla         's/he eats'
- d.  ba-el-a       →  bela         'they winnow'
- e.  a-akh-a       →  akha         'they build'

As seen in 20, verbs in Ndebele (and other Nguni languages) are at least two syllables long and a V syllable is acceptable (20b,c,e). In 20d the [a] of the class 2 subject marker /ba/ cannot surface and is dropped because a sequence of two vowels within a single phonological word is disallowed. In 20e the class 6 subject prefix [a] coalesces with the following [a] of the root to also avoid unacceptable VV.

When there is no object marker the singular imperative is simply the root plus default final vowel [a] as illustrated in 21.

(21) Forms in the singular imperative
- a.  hamb-a     →  hamba       'walk, go'
- b.  khumbuz-a  →  khumbuza  'remind'

Whether the verb root is CVC- as in 21a or longer as in 21b, suffixing [a] makes it a complete word. When the verb root is vowel initial we also expect suffixing [a] to be sufficient in the formation of a complete phonological word since V syllables are acceptable in Nguni. However, as seen in 22, after suffixing [a] the verb is still an incomplete word requiring an initial segment.

(22)    Vowel initial verbs in the imperative mood
- a.  -el-a    →  (y)ela              'winnow'
- b.  -end-a   →  (y)enda            'marry, take a husband'
- c.  -akh-a   →  (y)akha            'build'
- d.  -ab-a    →  (y)aba             'share'
- e.  -on-a    →  (w)ona/(y)ona     'spoil, sin'
- f.  -oma     →  (w)oma/(y)oma   'be/become dry'

There seems to be an additional requirement that in the imperative every syllable must have an onset, the ghost consonant [y] surfacing before [-round] vowels [a] and [e] (16(a- d) while [w] is seen before

[+round] [o] (16(e- f)). However, for some people ghost consonant [y] is prefixed to all V-initial verbs in the imperative. More will be said about what seems to be ghost consonants [y] and [w] in the next section that, among other things, discusses what exactly happens in the imperative.

Subject markers such as class 3 [u], class 6 [a] and class 9 [i] in 23 prefixed to -khul- 'grow' also provide another interesting case.

(23) Subject markers prefixed to the verb
   a.   u-khul-a      →   ukhula       'it grows …'
   b.   a-khul-a      →   akhula       'they grow…'
   c.   i-khul-a      →   ikhula       'it grows…'

As can be seen, all three V subject markers surface without undergoing any change. However, if there is a preceding vowel as in 24 where the subject marker follows the negative prefix /ka/, the two successive vowels in each case are separated by a ghost consonant.

(24) Subject markers in the negative
   a.   ka-u-khul-i   →   ka(w)ukhuli      *kokhuli      'it does not grow'
   b.   ka-a-khul-i   →   ka(w)akhuli      *kakhuli      'they do not grow'
   c.   ka-i-khuli    →   ka(y)ikhuli      *kekhuli      'it does not grow'

The ghost consonant is [w] before [+back] [u] and [a] (24(a- b)) and [y] before [-back] [i] (24b). Coalescence is expected in these cases of unacceptable VV, not glide insertion. However, if there is coalescence ([a]+[u] → [o], [a]+[a] → [a], and [a]+[i] → [e]) the result is the unacceptable forms marked with asterisks.

Similar but less obvious cases of ghost consonants are those observable when vowel subject markers are prefixed to the quantitative pronoun stem -o-dwa 'only, alone' or -o-nke 'all' as in 25.

(25) Subject Marker + Quantitative prefix [o] + Quantitative Pronoun stem -dwa or -nke
   a.   u-o-dwa →   wodwa   *odwa          'only, alone'
   b.   i-o-nke →   yonke   *onke          'all'
   c.   a-o-dwa →   odwa ~ (w)odwa         'only, alone'
   d.   a-o-nke →   onke ~ (w)onke         'all'

In (25)a-b. where the subject markers are class 3 [u] and class 9 [i], vowel changes are the expected ones: a [+high] vowel glides before another vowel. In 25(c-d) /odwa/ and /onke/ are the expected surface forms, not /wodwa/ and /wonke/ as a [+low] vowel is normally dropped before a mid-vowel. The initial [w] in the latter is a ghost consonant whose origins will be dealt with in the next section. It will also be argued that the initial glides in the examples in 25(a- b) could also be viewed as ghost consonants.

The ghost consonants identified in this section are [b], [y] and [w]. The next section, as already alluded to, will focus on the origins of these consonants and the ghost vowels we saw in the preceding section.

## 4. The sources of ghost segments

The main problem in the analysis of Nguni ghost segments is that the environment in which they are realized is sometimes unpredictable and they may also block regular phonological processes.

Let us consider first ghost vowel [i]. While it is clear that ghost vowel [i] has an overt effect when there is a preceding [a] there is no way of telling which consonants, roots or stems it will precede. For instance, the consonants of the four subminimal -C- verb roots I am aware of in 26 do not form a natural class.

(26) Subminimal -C- roots normally preceded by ghost vowel [i] when there is a preceding [a]

    a.    -z-       'come'                          [PB. *-jɨ̀ j- 'come']
    b.    -m-      'stand, stop, wait'         [PB. *-jɨ́m- 'stand, stop]
    c.    -z$^w$-    'hear,understand, taste'    [PB. *-jɨ́gʋ - 'hear']
    d.    **-s-**      'dawn'                      [PB. *-ké- dawn'] ; [PB. * -jek- 'shine']

They are neither a class of both fricatives and nasals nor a class of both labials and coronals as there are -C- roots whose consonants fall into these classes but that never co-occur with ghost vowel [i], for example, -f- 'die' and -n- 'rain'. Assuming that [i] is epenthesized in these forms is problematic as there is no principled way for epenthesis since there is no clear environment the ghost vowel is associated with. Suggesting that it is present in the underlying structure of all words with -C- roots or -CV stems but is then deleted in most of the words would also not be helpful as the reason for its deletion would be unclear. For instance, the expected surface forms when the root -iz- 'come' is preceded by the class 1 subject marker [u] as in 27a and class 11 subject marker /lu/ as in 21b. are the unacceptable ones with asterisks.

(27) When the root is -iC-
    a.    u-iz-a → uza *wiza
    b.    lu-iz-a → luza *lwiza

Evidently, there is no straightforward way of explaining why [i] is deleted in the acceptable forms given that [u]+[i] normally yields /wi/. In other words, given [u]+[i], it is unclear whether the unacceptable VV sequence should be resolve through glide formation or vowel deletion.

    To solve the problem of unpredictability each of the roots in 26 can be treated as a consonant with a floating [i] that may be optionally attached when there is a preceding [a]. It can also be posited that the root is vowel initial but the [i] is circumscribed so that most phonological rules have no access to it except coalescence when the vowel preceding the root is [a]. If there is no [a] preceding the root, the circumscribed [i] is eventually stray erased. (For more details on 'prosodic circumscription' and its implementation, see, for example, McCarthy and Prince 1986, Hyman and Mchombo. 1992 and Katamba 1993).

    Perhaps, the most straightforward way is treating the root as having two allomorphic forms, an -iC- form surfacing only if the root is immediately preceded by [a] and -C- allomorphic form without this restriction. In other words the latter should be treated as the default root. In fact the variation in the shape of the root appears to reflect the use of the default synchronic root (to be referred to simply as the 'synchronic root') versus the root that might have been preferred in the past but now restricted to a specific environment (to be simply referred to as a 'diachronic root'). As can be seen in 26, the bracketed Proto Bantu (PB) roots begin with *ji except the root -s- 'dawn' in 20d which, however, seems to be related to *-jek- 'shine', beginning with *je that it might have been confused with[2]. Since in some environments root or stem initial *j and *g became glide y [j] that was subsequently dropped (See Sibanda 2008), the roots in question must have been vowel initial at some stage. As already seen above, synchronically the stems are generally C initial with the vowel still surfacing only when there is a preceding [a].

    As for nouns ameva 'thorns' and amehlo 'eyes' there do not appear to be a ghost vowel because the stem that is maintained is the one beginning with [i] since the prefix /ama/ has the required [a] that coalesces with the [i] and the [i] of the singular prefix /ili/ would not make any difference as pointed out above. As can be seen in 28 the PB equivalents of these words began with *-ji- with the *-j- being subsequently lost like in the case of verbs with -C- roots just discussed.

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[2] It also seems likely that -s- 'dawn' was preceded by a vowel at some stage, perhaps a Pre-Proto Bantu stage.

(28) Nouns with ghost vowel [i]

    a.   ameva  'thorns'       [PB *-jɪ́gʉ̀à / jɪ̀gʉ̀à / jɪ́bà]

    b.   amehlo  'eyes'         [PB. *-jɪ́co 'eye']

If it were possible to attach other prefixes with different vowels the roots would most likely surface without the [i], making the [i] in <u>ameva</u> and <u>amehlo</u> look like a ghost vowel.

       For the other cases of ghost vowel [i] such as those involving <u>-kho</u> 'there' we saw above, it is also likely that the stems were vowel-initial at some stage. Treating them as having allomorphic forms like the -C- verb roots just discussed seems most appropriate. SiSwati ghost vowels [u], [a] and [i] are recoverable from other Nguni languages. CV- prefixes such as class 15 /ku/, class 2 /ba/ and class 7 /si/ actually surface as VCV- prefixes /uku/, /aba/ and /isi/, respectively, in other Nguni languages. SiSwati ghost vowels can therefore be treated as vowels that are present in allomorphic forms.

       The historical origins of /ab/ are also clear. While the Ndebele/Zulu class 2a prefix is [o] and for Xhosa it is /oo/ ([o:]), in SiSwati it is /bo/. This shows that the [b] must have been originally part of the prefix. In fact the full prefix /abo/ is still in use in South African Ndebele. Thus having /ab/ in some variant forms is also supported by historical evidence. Otherwise there would be no reason for just inserting it.

       Ghost consonants give rise to similar unpredictability problems we saw with ghost vowel [i]. For ghost consonants that surface in the imperative mood the problem is not obvious until one has looked at the general grammar of the languages in question. Epenthesis or glide insertion is normally not a solution in Nguni when there are phonologically unacceptable forms including VV. When the problem of onsetless syllables is resolved by what seems to be glide insertion it is therefore necessary to check what really is going on. Consider the following forms we saw in 22 but now with their Proto Bantu equivalents.

(29) Vowel initial verbs in the imperative mood

    a.   -el-a   →  (y)ela 'winnow'                [PB. *-jèd- 'winnow']

    b.   -end-a  →  (y)enda 'marry, take a husband'   [PB. *-gènd- 'walk; travel; go; go away']

    c.   -akh-a  →  (y)akha 'build'               [PB. *-ják- 'build']

    d.   -ab-a   →  (y)aba 'share'               [PB *-gàb- 'distribute, divide']

    e.   -on-a   →  (w)ona/(y)ona 'spoil'      [PB. *-jón- 'spoil tr.; spoil cultures']

    f.   -oma    →  (w)oma/(y)oma 'be/become dry'  [PB. *-júm-/-jóm-/-gùm- 'become dry

                                                          and/or hard']

 As can be seen, the glides are in fact reflexes of Proto Bantu *j and *g. In 29(e-f) the glide seems to have taken the place features of the following vowel [o] (i.e. if we ignore /gùm/ in 29f). The glides can therefore be taken to be consonants present in the underlying structure of roots used in the imperative, the allomorphic roots without glides being the elsewhere case. (For some statistics on vowel initial roots with their Proto Bantu cognates (where available) see Sibanda 2004).

       Perhaps the clearest problem is seen when V subject markers are preceded by vowels as we saw in 24. The problem is illustrated by the examples in 30.

(30) Resolving unacceptable [a] + V

    a.   a + i    →   e

    b.   a + i    →   ayi

    c.   a + u   →   o

    d.   a + u   →   awu

While 30a and 30c show what normally happens when a [+low] vowel combines with a [+high] one, the other two examples illustrate what happens when a ghost consonant is brought in instead. From the examples in 30 it cannot be predicted when coalescence occurs and when a glide is inserted between the two vowels that form an unacceptable VV sequence. This is a problem that even detailed studies on

ghost and latent segments such as Zoll (1998) and Rowicka (1999) do not seem to address as they do not consider cases of coalescence and potential coalesce such as the ones above. Again here the problem can be resolved by considering historical changes. Consider the Ndebele subject markers with their Proto Bantu equivalents and object markers in 31. Ndebele noun class prefixes from which synchronically subject and object markers appear to be derived are also included with Proto Bantu equivalents.

(31) The Subject and Object Markers together with Noun Prefixes (all H tone)

| NOUN CLASS | PREFIX | | SUB. MARKER | | OM |
|---|---|---|---|---|---|
| | PB | NDEB. | PB | NDEB. | NDEB. |
| 3. | mu- | umu- | gu- | (w)u- | (w)u- |
| 4. | mi- | imi- | gu - | (y)i- | (y)i- |
| 6. | ma- | ama- | ga- | (w)a-, e- | (w)a- |
| 9. | n- | iN- | ji - | (y)i- | (y)i- |

As seen in 31, Proto Bantu Subject markers for the relevant classes began with either *g or *j both of which later became glides in Ndebele. The glides were eventually dropped word-initially. However, where there were preceding vowels they survived, the ghost consonants we now see. Thus, rather than treating the Nguni prefixal glides as epenthesized consonants V- and -CV- subject and object markers must be considered allomorphs occurring in the environments just described.

Finally, there is also need to comment on enumerative pronouns before going to the next section. The forms we saw in 25 are presented here again but now with also CV- prefixes. The CV- prefixes in 26(a,b,c) (the second example in each case) are class 3 /wu/ (from PB *gu-), class 9 /yi/ (from PB *ji-) and class 6 /wa/ (from PB *ga-), respectively.

(32) Enumerative pronouns
  a.  u-o-dwa      →  wodwa      *odwa      'only, alone'
     wu-o-dwa    →  w$^w$odwa → (w)odwa   'only, alone'
  b.  i-o-nke      →  yonke      *onke      'all'
     yi-o-nke    →  y$^y$onke  →  (y)onke   'all'
  c.  a-o-dwa     →  odwa                  'only, alone'
     wa-o-dwa   →  (w)odwa             'only, alone'
  d.  a-o-nke      →  onke                  'all'
     wa-o-nke   →  (w)onke             'all'

In 32(a- b) the outcome is the same whether the default synchronic subject markers (to be referred to as simply 'synchronic subject markers') [u] and [i] or the corresponding ones that might have been preferred in the past (to be referred to simply as 'diachronic subject markers) /wu/ and /yi/ are used. Surface forms with no initial glides are unacceptable. For 32(c- d) the synchronic subject marker [a] and its diachronic equivalent /wa/ produce different results. The glide [w] we identified as a ghost consonant in the previous section is seen only when the diachronic variant is used. Thus, while it is not obvious from 32(a-b) that two allomorphic forms of the subject marker are used, this is clearly evident in 32(c- d).

It is clear from this section that ghost segments in Nguni have historical origins. In a synchronic analysis, if we appeal to allomorphy then the problems of unpredictability and blocking of application of regular processes we pointed out at the beginning of this section disappear.

## 5. Brief OT analysis of the data

In Optimality Theory (OT) having only one form of the root, stem or prefix where ghost segments such as those described above are involved is also problematic. For instance, where ghost vowel [i] surfaces before -C- roots one may be forced to come up with an ad hoc constraint and/or say the normally non-violable constraint Dep that penalizes insertion of new segments in the output is violated and yet the environment where it is violated is unpredictable. In other words there is no principled way of determining where the constraint Dep can be violated by inserting [i]. With one stem as an input, for instance, Dep would have to be ranked below some constraints for some cases to allow for epenthesis but be ranked above the same constraints to block this process in other cases. Having two allomorphic forms, on the other hand, means that in an OT analysis each of the roots, stems or prefixes identified above has two possible inputs (supported by synchronic and diachronic facts) that make it possible to avoid a constraint ranking paradox within the same grammar.

Besides Dep there are a number of other identifiable constraints from the discussion above. Two of them are *VV and Uniformity (Unif) as we noted that a sequence of two or more vowels is disallowed within a single phonological word and the ill-formed sequence may be repaired through coalescence. Coalescence does not only violate Unif but violates Ident as well, a constraint that requires input segments to maintain their features in the output. A disallowed VV sequence may also be repaired by deleting the vowel that comes first as we saw with, for example, /a-o-dwa/ → /odwa/ above and this is a violation of Max, a faithfulness constraint that forbids deletion of input segments in the output. Note that the vowel on the right is protected by a non-violable faithfulness constraint, Max Rightmost Vowel (Max-RV). In fact in Nguni languages and other Bantu languages such as Shona the rightmost vowel is never deleted in a sequence of two or more. This can be taken to be a case of positional faithfulness where the rightmost vowel is always in a 'strong' position. (For a discussion on positional faithfulness see for example Beckman 1998). A list of the constraints is provided in 33.

(33) Constraints.

*VV   A sequence of two or more vowels is disallowed within a single phonological word.

Max-RV  Do not delete the rightmost vowel in a sequence of two or more vowels.

Max   Do not delete segments.

Dep   Do not insert new segments.

Ident   Segments in the output are identical to segments in the input. (No modification).

Unif   No coalescence (No element in the output has multiple correspondents in the input)

Normally, *VV, Dep and Max-RV cannot be violated and therefore must be ranked highest. Max can be violated in order to avoid violating a higher ranked constraint *VV. However, Max cannot be violated if coalescence is possible. In other words it is better to violate Unif and Ident than to violate Max. This means that both Unif and Ident must be ranked below Max. Unif and Ident appear to be freely ranked. The ranking of constraints is summarized in 34 where *VV, Dep and Max-RV are ranked highest and the constraints Ident together with Unif lowest.

(34) Constraint ranking

*VV, Dep, Max-RV >> Max >> Ident, Unif

To see how these constraints interact we need to look at a few tableaux. Let us consider first a situation where a ghost consonant [w] is treated as an epenthetic segment although this is not the analysis that will be ultimately adopted. In this case DEP would have to be ranked lowest to allow for epenthesis

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while blocking coalescence. In 35 where the input is /ka-u-khul-i/ 'it does not grow' five candidates are evaluated.

(35) Epenthesis is optimal.

| Input  / ka-u-khul-i/ | *VV, Max-RV | Max | Ident, Unif | Dep |
|---|---|---|---|---|
| a.   kaukhuli | *! (*VV) | | | |
| ☞  b.   kawukhuli | | | | * |
| c.   kakhuli | *! (Max-RV) | * | | |
| d.   kukhuli | | *! | | |
| e.   kokhuli | | | *!*** | |

The first candidates to be eliminated are 35a and 35c which violate undominated constraints *VV and Max-RV. They are followed by 35d which violates Max by deleting the first vowel in a VV sequence. Two candidates are then left to compete. Although <u>kawukhuli</u> 35b violates Dep it emerges as the winner since kokhuli 35e is penalized for violating higher ranked constraints Ident and Unif.

Now consider the evaluation of input /a-ikhaya/ with the same constraint ranking as in 35. For this input we expect normal coalescence to take place.

(36) Coalescence must be optimal.

| Input  / a-ikhaya / | *VV, Max-RV | Max | Ident, Unif | Dep |
|---|---|---|---|---|
| a.   aikhaya | *! (*VV) | | | |
| 💣 ☞  b.  ayikhaya | | | | * |
| c.   akhaya | *! (Max-RV) | * | | |
| d.   ikhaya | | *! | | |
| e.   ekhaya | | | ****! | |

As seen in 36, 36a,c, d, e are penalized for violating higher ranked constraints *VV, Max-RV, Max, Ident and Unif. A wrong candidate, 36b, which violates only the lowest ranked constraint Dep wins as it epenthesizes a glide. The candidate expected to win is in fact 36e where regular coalescence occurs.

Let us see what happens when we now use the constraint ranking in 34. In 37 the candidates we saw in 35 are evaluated again with the constraint ranking in 34 but the input now already has the glide. In other words, for the subject marker, the allomorph /wu/ discussed above is used rather than /u/.

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(37) Epenthesis is not optimal

| Input  / ka-wu-khul-i/ | *VV, Dep, Max-RV | Max | Ident, Unif |
|---|---|---|---|
| a.   kaukhuli | *! (*VV) | * | |
| ☞  b.   kawukhuli | | | |
| c.   kakhuli | | *!* | |
| d.   kukhuli | | *!* | |
| e.   kokhuli | | *! | **** |

As can be seen, <u>kawukhuli</u> 37b still wins and this time it violates no constraint while other candidate violate at least one of the constraints. Although 37e is a strong candidate it is ruled out as it violates Max by deleting the glide in the subject marker and for violating Ident and Unif twice each. Note that if the input is / ka-u-khul-i/ then normal coalescence occurs and the wrong candidate <u>kokhuli</u> wins.

When candidates in 36 are evaluated again but with the constraint ranking in 34 a different candidate wins as 38 shows.

(38) Coalescence is optimal

| Input  / a-ikhaya/ | *VV, DEP, Max-RV | Max | Ident, Unif |
|---|---|---|---|
| a.   aikhaya | *! (*VV) | | |
| b.   ayikhaya | *! (DEP) | | |
| c.   akhaya | *! (Max-RV) | * | |
| d.   ikhaya | | *! | |
| ☞ e.   ekhaya | | | **** |

Candidates 38(a- c) are eliminated first as they violate the highest ranked constraints, *VV, Dep and Max-RV, respectively. Candidates 38d is penalized for violating Max which 38c also violates. Although candidate 38e violates Ident and Unif twice each it wins as these constraints are ranked lowest. Indeed, <u>ekhaya</u> 'at home is the right candidate to win since vowels [a] and [i] must coalesce.

It is clear from the tableaux in this section that if there is to be consistency in constraint ranking then allomorphy must be taken into account. Allomorphy makes it possible to use the correct input thereby avoiding a situation where Dep is ranked lowest where ghost segments are involved and yet in the rest of the grammar it is normally ranked highest. In other words, if allomorphy is not recognized then the wrong conclusion may be drawn, that the constraint Dep can be violated in Nguni in order to avoid violation of the higher ranked constraint *VV. We would have to recognize two grammars for Nguni, one in which Dep cannot be violated and another in which it can be. Having the diachronic variant as one of the input forms clearly solves the problem and is consistent with Kenstowicz's (1994:115) observation that "underlying representations of the synchronic grammar … often reflect earlier surface pronunciations".

## 6. Conclusion

Previous works on ghost and latent segments such as Zoll (1998) and Rowicka (1999), while properly characterizing ghost segments at a global level, seem to have focused on cross-linguistic generalizations, and it is unclear how they would deal with predictability or constraint ranking

problems that could arise in the analysis of a single language (or a language family) such as the ones we saw above. They can both be viewed as reducing the surfacing of ghost segments to cases of epenthesis. For instance, a latent vowel may be epenthesized to rescue an unparsable consonant (Zoll 1998), and a ghost vowel can be represented by an empty nucleus that may materialize phonetically (ie. fill an empty V slot in the Strict CV plane) (Rowicka 1999). However, as was demonstrated above, epenthesis may not be a satisfactory solution when other parts of the grammar are taken into account. As we saw with Nguni data above, it is not clear in which environment a ghost vowel will surface. Also, there are cases where the process that resolves hiatus can be unpredictable if the surfacing of a ghost consonant is treated as epenthesis as both coalescence and glide insertion would occur in exactly the same environment.

In this paper it has been argued that ghost segments are not randomly chosen for epenthesis or selected on the basis of their synchronic environment but have to do with historical changes. They can in fact be treated as being present in the underlying structure of a word. As such, while there are various ways of looking at the morphophonological processes involved when these ghost segments surface such as treating them as floating features, prosodic circumscription, using alignment constraints to deal with alignment mismatches, using a "Strict CV Appoach" (Rowicka, Grazyna. 1999) and treating them as lacking a root node (Zoll 1998), this paper considers the most appropriate analysis in dealing with such cases to be the one that takes allomorphy into account. Forms associated with ghost vowels and those normally associated with onsetless syllables are treated as having allomorphic forms, one form normally treated as regular and the other with a ghost segment. Thus in an Optimality Theory (OT) analysis, the paper assumes that there are two possible inputs for a Nguni word, root, stem or affix that sometimes surfaces with a ghost segment.

In many other Bantu languages (for example, Shona and Chichewa) there are cases where expected vowel combination rules fail to apply resulting in what appears to be epenthesis or simply failure of vowels to combine in the expected way. Such cases can most likely be resolved by appealing to historical facts and allomorphy similar to what has been presented above. It is likely that ghost segments in many other languages of the world have clear historical origins like the Nguni ones discussed in this paper. It is also possible that in many cases where linguists have had to place the burden on theories in solving problems of ghost segments, the focus could be shifted to the data or morphology as has been done here.

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