Local interactions in the prosodic structure of Ndebele verbs

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1 Introduction

- Ndebele[1] verbs exhibit morphological alternations sensitive to disyllabic minimality.
- For instance, a minimality effect is observed in imperative forms, where a monosyllabic verb must be augmented with the syllable *yi*, as shown in (1).[2]
- In contrast, disyllabic (and longer) stems don't allow *yi*-epenthesis (2).

(1) ROOT: -*ph*- 'give'
   a. *ph-a
      give-FS
   b. *yi*- ph-a
      yi- give-FS
      Give!

(2) ROOT: -*phek*- 'cook'
   a. **yi*- phek-a
      yi- cook-FS
   b. phek-a
      cook-FS
      Cook!

- Under the standard assumption that prosodic words dominate a foot in the Prosodic Hierarchy (Nespor & Vogel, 1986; Selkirk, 1986), disyllabic minimality falls out as a well-formedness condition on PWords, providing an account for the minimality effect in (1).
- However, as Downing (2001) points out, Ndebele verbs show minimality effects *below* the level of PWord. The passive stem (3) and the participial stem (4) are also subject to disyllabic minimality.

(3) Minimality effects in the passive stem
   a. *(i- [phwa])$_\omega$ ⇒ ✓(i- [phiwa])$_\omega$ *'it is given'*
      (infl [passive stem])$_\omega$
   b. ✓(i- [phekwa])$_\omega$ *(i- [phekiwa])$_\omega$ *'it is cooked'*
      (infl [passive stem])$_\omega$

(4) Minimality effects in the participial stem
   a. *(e- [pha])$_\omega$ ⇒ ✓(e- [sipha])$_\omega$ *'as he was giving'*
      (infl [participial stem])$_\omega$
   b. ✓(e- [pheka])$_\omega$ *(e- [sipheka])$_\omega$ *'as he was cooking'*
      (infl [participial stem])$_\omega$

[1] Bantu, Nguni, Zimbabwe (S44)
[2] Abbreviations: 1 = class 1 agreement prefix (and so forth), ACT= active voice, FS= Final Suffix, NEG= negation, OM= object marker, PROG= progressive aspect, PRT= participial, PSV= passive voice.

- (3) and (4) show that neither the passive stem nor the participial stem can be monosyllabic. If a passive stem is monosyllabic, as in (3-a), the vowel /*i*/ is used to augment the stem. This minimality effect is not found is stems that already satisfy disyllabic minimality, as in (3-b).

- Similarly, in participles we observe the insertion of the syllable *si* just in case the stem is monosyllabic.

- Crucially, the stem is not invariably a minimality domain. Compare, for instance, the active counterpart of (3) in (5), where a monosyllabic stem is grammatical.

(5) ***No*** minimality effects in the active stem

a. ✓ (i- [pha] $)_\omega$ *'it gives'*
(infl [active stem] $)_\omega$

b. ✓ (i- [pheka] $)_\omega$ *'it cooks'*
(infl [active stem] $)_\omega$

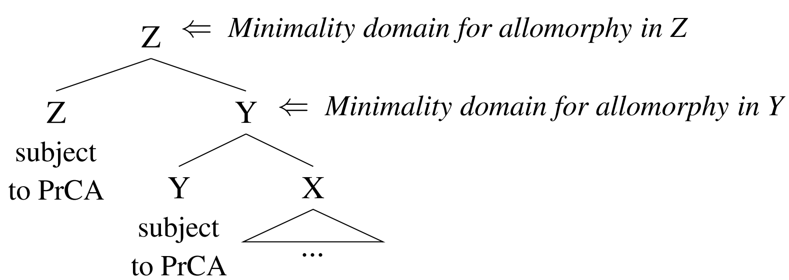
- Given the facts in (3)-(5), where ostensibly identical morphological constituents are sometimes but not always minimality domains, the question arises of how minimality domains should be defined.

Proposal

- Minimality effects in Ndebele verbs are an instance of **Prosodically Conditioned Allomorphy** (PrCA).

- The apparent word-internal minimality domains fall out from the syntactic position of each morpheme subject to PrCA.

(6) Dynamic determination of prosodic minimality domains:



- This means there is no need to *define* prosodic domains (e.g. as PStem, PMacroStem etc (Downing, 2001)). Rather, they are determined dynamically during spellout (6).

Plan:
2 Analysis of passives and participles
3 Predictions: Upward bleeding and domain variability
4 Against pre-defined minimality domains
5 Conclusion

2 Analysis

- The minimality effects in passives and participles are morpheme-specific, not domain specific (passive voice, progressive aspect).
- The morpheme-specific minimality effects stem from allomorphy in the relevant heads (7)-(8).

(7) Minimality in the passive stem

a. i- [$_{\text{Voice}}$ ph **-iw** -a]. *'it is given'*
9- give -PSV -FS

b. i- [$_{\text{Voice}}$ phek **-w** -a]. *'it is cooked'*
9- cook -PSV -FS

(8) Minimality in the participial stem

a. e- [$_{\text{Asp}}$ **si-** ph -a]. *'as he is giving'*
1.PRT- PROG- give -FS

b. e- [$_{\text{Asp}}$ $\varnothing^{\text{H}}$- phek -a]. *'as he is cooking'*
1.PRT- PROG- cook -FS

- Both [PSV] and [PROG] have two allomorphs (9), whose selection is determined by the computation of prosodic structure.

(9) a. [PSV] $\leftrightarrow$ $/u/$
b. [PSV] $\leftrightarrow$ $/iu/$
c. [PROG] $\leftrightarrow$ $/si/$
d. [PROG] $\leftrightarrow$ $\varnothing^{\text{H}}$ (floating tone)

- Assuming that terminal nodes in a complex head are subject to cyclic spelled-out (Embick, 2010; Svenonius, 2012), allomorph selection must take place as soon as the relevant morpheme is targeted by spell-out rules, in a bottom-up fashion.
- The assumed clause structure is in (10) (independently motivated for Bantu).

(10) Bantu clause structure (adapted from Julien 2002):

[$_{\text{T}}$ [$_{\text{Asp}}$ *Prog* [$_{\text{AgrO}}$ *OM* [$_{\text{Mood}}$ *FS* [$_{\text{Voice}}$ *Psv* [$_{\text{V}}$ *root*]]]]]]

- A morpheme is paired with a set of exponents, and phonological computation immediately determines which allomorph is chosen, based on the constraints and ranking in (11).

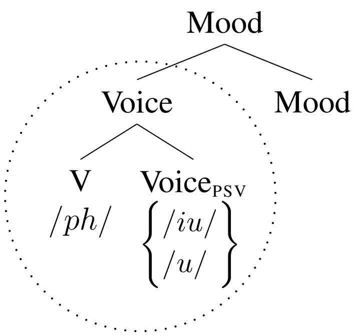
(11) **MinFoot** > ***STRUCTURE**

a. **MinFoot**: a minimality constraint penalizing forms smaller than a foot
b. ***STRUCTURE**: a markedness constraint penalizing segmental complexity

The derivation of passive and progressive allomorphs

- Upon vocabulary insertion in the Voice head, the only phonological material available is the form of the root, as shown in (12).
- Thus, the input to phonological calculation of the passive allomorph contains the root and the passive morpheme only. PrCA is derived by the competing constraints in (11), and is illustrated in (13).

(12) PrCA in passive voice:



minimality domain for allomorphy in Voice

(13) Allomorph selection in passive Voice

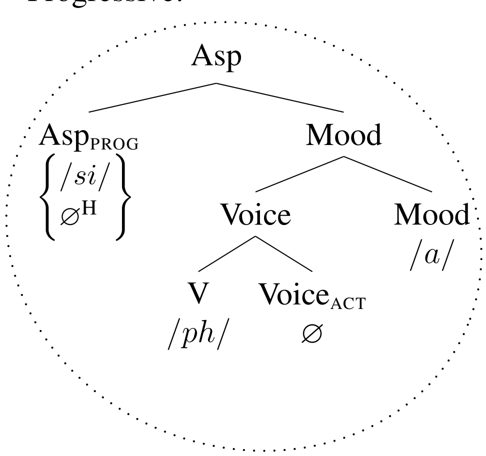
	/ph{*iu, u*}/	MinFoot	*STRUCT
☞	a. phi.u		*
	b. phu	*!	
	/phek{*iu, u*}/	MinFoot	*STRUCT
	c. phe.ki.u		*!
☞	d. phe.ku		

- If the root is subminimal (consonantal), like $/ph/$ 'give', passive Voice will be realized as the longer allomorph $/iu/$ as a result of the derivation in (13)a-b.
- Longer roots, like $/phek/$ 'cook', take the passive allomorph $/u/$, as shown in (13)c-d.
- The output candidates in (13) do not contain the Final Suffix (the exponent of Mood). After adding the Final Suffix *-a*, the forms in (7-a) and (7-d) resolve in *phiwa* and *phekwa*, respectively:

(14) a. phi.u + /a/ → phi.wa (ROOT: *ph* 'give')
b. phe.ku + /a/ → phe.kwa (ROOT: *phek* 'cook')

- The realization of [PROG] (a feature of Asp^0) is sensitive to the phonological material in a larger constituent: the part of the complex head whose highest node is Asp (15).
- Unlike allomorphy in Voice, allomorphy in Asp takes the Final Suffix (an exponent of Mood) as part of the phonological input in the calculation of prosodic minimality.(16) shows the derivation of the progressive forms in (8).

(15) Progressive:



minimality domain for allomorphy in Asp^0

(16) Progressive: (cf. (35))

	/{*si*, $\varnothing^H$}pha/	MinFoot	*STRUCT
☞	a. si.pha		*
	b. ^{H}pha	*!	
	/{*si*, $\varnothing^H$}pheka/	MinFoot	*STRUCT
	c. si.phe.ka		*!
☞	d. ^{H}phe.ka		

3 Predictions

(17) Core properties of the proposed system:

a. **Cyclicity of spell-out**: exponents are inserted in a bottom-up fashion.
b. **Minimality effects as allomorphy**: minimality effects arise if a given morpheme has allomorphs sensitive to prosodic structure.

(18) Predictions of the proposed system:

a. **Local interactions**: No interaction with hierarchically higher material (consequence of cyclicity).
b. **Domain variability**: A constituent X may be a minimality domain in one morphosyntactic context and not in another (consequence of minimality effects as allomorphy).

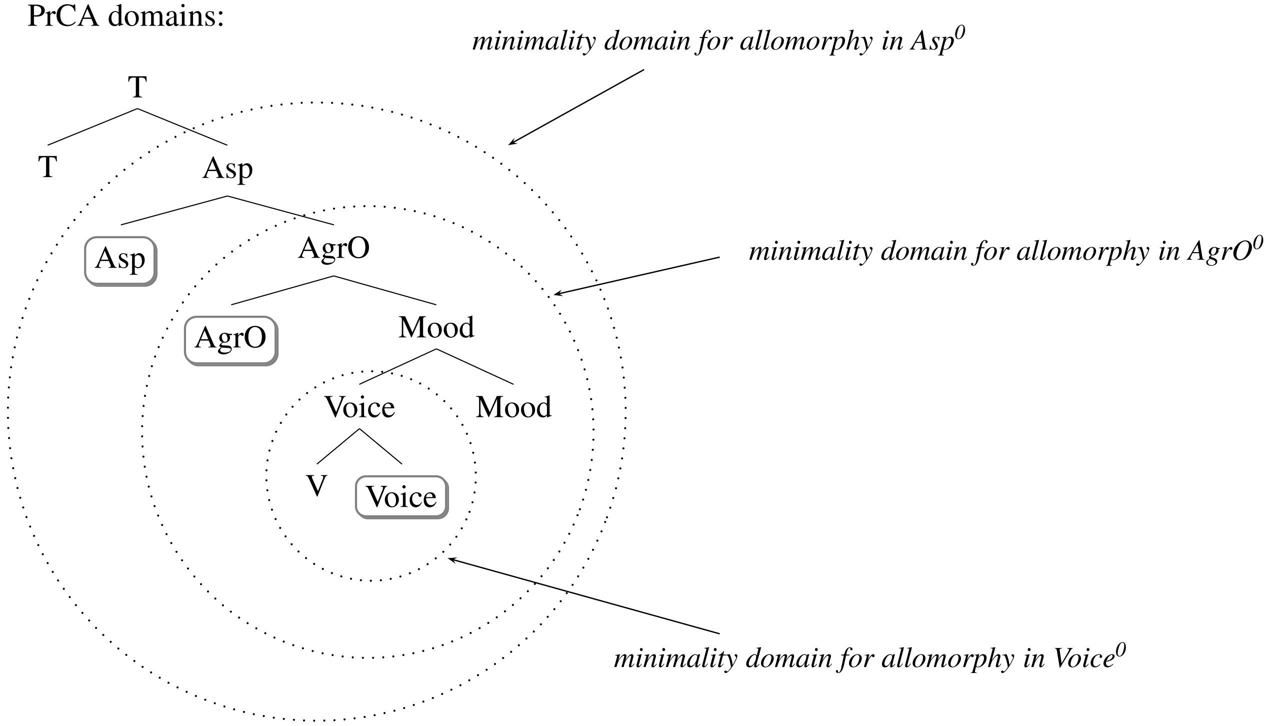
3.1 Local interactions

- Assuming that phonological exponents are inserted in terminal nodes in a botton-up fashion, phonologically conditioned allomorphy can be sensitive only to hierarchically lower material, and it cannot be conditioned by exponents of higher head (Embick, 2010). Prosodically Conditioned Allomorphy, an instance of Phonologically Conditioned Allomorphy, is subject to the same restrictions.

- This approach predicts that PrCA in Voice can be conditioned by the form of the root, PrCA in AgrO (object marker) is conditioned by exponents of the root, Voice and Mood, and so forth.

- As a consequence, the apparent word-internal minimality domains fall out from the hierarchical position of the morpheme subject to PrCA, as shown in (19).

(19) PrCA domains:



- Three of the heads in (19) exhibit PrCA in Ndebele: Voice, AgrO and Asp.
- Each of the three morphemes has two exponents, one of which is inserted to satisfy disyllabic minimality – I refer to this exponent as ***the augmenting allomorph*** (20).

(20) Prosodically conditioned allomorphs:

	Allomorphs: *elsewhere*	*augmenting*
Voice: [PSV]	/u/	/iu/
AgrO: [CL. 1]	/m/	/mu/
Asp: [PROG]	$\varnothing^{H}$	/si/

(21) The prediction of ***upward bleeding***: Selection of an augmenting allomorph in a lower head bleeds selection of an augmenting allomorph in a higher head, but not vice versa.

- This prediction is born out in the three PrCA contexts in (20).

1. The augmenting allomorph in Voice bleeds the augmenting allomorph in AgrO:

(22) a. u- [$_{AgrO}$ **mu-** ph -a]. *'you give him'*
2.SG- OM- give -FS

b. u- [$_{AgrO}$ **m-** ph *-iw* -a]. *'you were given him'*
2.SG- OM- give -PSV -FS

c. *u- [$_{AgrO}$ **mu-** ph *-w* -a]. *('you were given him')*
2.SG- OM- give -PSV -FS

- The Object Marker surfaces as the augmenting allomorph /mu/ if the stem is monosyllabic (22-a)
- The augmenting allomorph of Voice$_{psv}$ bleeds /mu/ (22-b).
- As predicted, there is no downward bleeding (22-c).

2. The augmenting allomorph in Voice bleeds the augmenting allomorph in Asp:

(23) a. e- [$_{Asp}$ **si-** ph -a]. *'as he is giving'*
1.PRT- PROG- give -FS

b. e- [$_{Asp}$ $\varnothing^{H}$- ph *-iw* -a]. *'as he is being given'*
1.PRT- PROG- give -PSV -FS

c. *e- [$_{Asp}$ **si-** ph *-w* -a]. ('*as he is being given*')
1.PRT- PROG- give -PSV -FS

3. An augmenting allomorph in AgrO bleeds an augmenting allomorph in Asp:

(24) a. e- [$_{Asp}$ **si-** ph -a]. *'as he is giving'*
1.PRT- PROG- give -FS

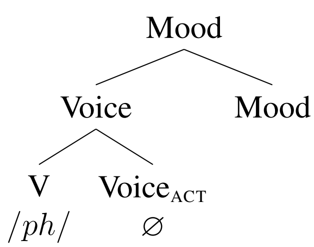
b. e- [$_{Asp}$ ∅^{H}- *mu-* ph -a]. *'as he is giving him'*
1.PRT- PROG- OM- give -FS

c. *e- [$_{Asp}$ **si-** *m-* ph -a]. (*'as he is giving him'*)
1.PRT- PROG- OM- give -FS

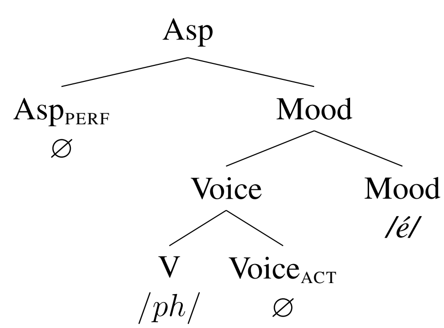
3.2 Domain variability

- Under the assumption that "minimality domains" are the result of allomorph selection, we predict that the not all subconstituent of the verbal complex head will be subject to minimality constraints. All constituents whose head is not subject to PrCA will not behave like a minimality domain.
- This prediction is born out, as well. Consider, as an illustration, the active voice and the perfect aspect.

(25) No PrCA in active voice (cf. (12)):



(26) No PrCA in perfect aspect (cf. (15)):



Variability in Voice

(27) i- [$_{Voice_{ACT}}$ ph -∅ -a]
9- give -ACT -FS
'it gives'

(28) a. *i- [$_{Voice_{PSV}}$ ph -w -a]
9- give -PSV -FS
'it is given'

b. i- [$_{Voice_{PSV}}$ ph -iw -a]
9- give -PSV -FS
'it is given'

Variability in Asp

(29) e- [$_{Asp_{PERF}}$ ∅- ph -é]
1- PERF- give -FS
'as he has given'

(30) a. *e- [$_{Asp_{PROG}}$ ∅^{H}- ph -a]
1- PROG- give -FS
'as he's giving'

b. e- [$_{Asp_{PROG}}$ si- ph -a]
1- PROG- give -FS
'as he is giving'

- Unlike [Voice:PSV], [Voice:ACT] has only one allomorph – a zero exponent. As predicted, the constituent headed by Voice does not show minimality effects and the active stem can be mono-syllabic. The same relation holds between [Asp:PROG] and [Asp:PERF].

(31) Domain variability in Voice:
  a. [PSV]: PrCA ⇒ minimality effects
  b. [ACT]: one exponent ⇒ no minimality effects

(32) Domain variability in Asp:
  a. [PROG]: PrCA ⇒ minimality effects
  b. [PERF]: one exponent ⇒ no minimality effects

(33) **Domain variability corollary**
In a complex head, a constituent X is a minimality domain if its head is subject to PrCA.

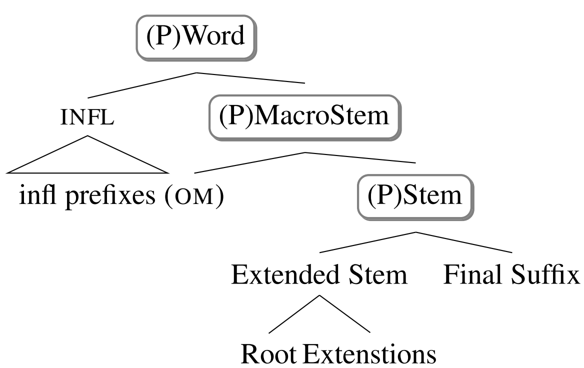
- In other words, the constituents of (19) headed by Voice and Asp are not invariably minimality domains. It depends on their featural specification and whether the exponents of the relevant features exhibit Prosodically Conditioned Allomorphy.

4 Arguments against pre-defined prosodic domains

- The minimality effects in Ndebele verbs discussed above have been analyzed as resulting from minimality constraints imposed on word-internal prosodic domains (Downing 2001).

- In particular, Downing proposes that, in addition to PWord, PMacroStem and PStem are minimality domains in Ndebele (34).

(34) A **PDomain=MinFoot** analysis: (from Downing, 1999)



- Minimality effects in the passive stem are accounted for by the constraint **PStem=MinFoot**

- Minimality effects in the progressive stem are accounted for by the constraint **PMacroStem=MinFoot**

- What I call *augmenting allomorphs*, Downing treats as epenthetic material.

(35) PMacroStem=MinFoot in participles:

a. *e- [$_{\text{PMcStem}}$ ph -a]. ⇒
1.PRT- give -FS

b. e- [$_{\text{PMcStem}}$ *si*- ph -a].
1.PRT- *ep*- cook -FS
'As he is giving him'

(36) PStem=MinFoot in passives:

a. *i- [$_{\text{PStem}}$ ph -w -a]. ⇒
9- give -PSV -FS

b. i- [$_{\text{PStem}}$ phek -*i*-w -a].
9- cook -*ep*-PSV -FS
'It is given'

4.1 Empirical objection: no global interactions

- An analysis based on pre-defined domains like PhStem, PhMacroStem etc, makes a wrong prediction. The relevant case involves forms where the Final Suffix is longer. The final suffix in an inflectional morpheme that co-varies with a range of inflectional categories: tense, aspect, mood, polarity. For instance, the FS in the present negative has the form *-i*, while in the past negative – *-anga*.

(37) a. a- ba- ph -i
NEG- 2- give -FS
'they don't give'

b. a- ba- ph -anga
NEG- 2- give -FS
'they didn't give'

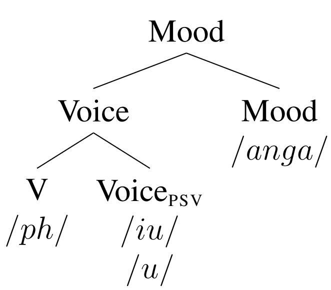
- Under standard assumptions, the Final Suffix is part of the PStem (as in (34)). An analysis where prosodic minimality is calculated for particular prosodic domains, such as PStem, predicts the suffix *-anga* to bleed any minimality effects – together with the root, *-anga* always forms a minimally disyllabic PStem. This prediction not borne out: the passive allomorph is such PStems exhibits the usual PrCA.

(38) a. *a- ba- [$_{\text{PStem}}$ ph -w -anga]
NEG- 2- give -PSV -FS
('they weren't given')

b. a- ba- [$_{\text{PStem}}$ ph -iw -anga]
NEG- 2- give -PSV -FS
'they weren't given'

- The present analysis correctly derives (38-b):

(39) Minimality in the passive ≠ minimality in PStem:



- Local calculation of minimality derives the necessity of the augmenting passive allomorph *ii*, since at the point where Voice^0 is spelled out, no phonological information about the final suffix is available. The only phonological context is the root /ph/ which, being subminimal, triggers the augmenting allomorph selection.

4.2 Resolutions of minimality

- A problem with the epenthesis-analysis: the lack of a single minimality resolution strategy.
- Rather, minimality violations are resolved by the insertion of *morpheme-specific material*.
- This lack of uniformity is not surprising under the analysis of minimality effects as allomorphy (20). The variation stems form lexical idiosyncrasy of particular exponents.

4.3 A correlation between prosodic domains and morphosyntactic features

- An analysis where minimality restrictions are imposed on pre-defined domains is too strong. It does not account for *domain variability*, observed, for instance, in Voice and Asp.

- A PDomain=MinFoot analysis requires a stipulation about which prosodic domain is "activated" by which morphosyntactic feature (PStem by passive voice; MacroStem by the progressive aspect). These stipulations must be stated as part of the constraints (Downing, 2001).

- The analysis proposed here shows that prosodic domains are not theoretical primitives; they come for free (Wagner, 2005; Pak, 2008);

- in particular, they fall out from the interaction of two parts of the grammar: the syntactic structure and idiosyncrasy of exponents.

5 Conclusion

- The analysis of minimality effects as allomorph selection correctly predicts how allomophy is resolved in forms that contain more than one morpheme subject to PrCA (**Upward bleeding** only).

- As such, it avoids the problem of predicted but unattested global interactions.

- It derives minimality domains, instead of stipulating them,

- and predicts the attested **domain variability**.

- Treating minimality effects as allomorph selection, non-uniform minimality resolutions are expected.

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