Accounting for height harmony in five-vowel Bantu languages:

Positional faithfulness and feature co-occurrence constraints

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Introducing Bantu height harmony

- Height harmony (HH) is extremely common among Bantu languages (e.g. Clements 1991, Hyman 1999, 2003).
- Work has tended to focus on the most frequently found variety: **"canonical" asymmetric HH** (e.g. Moto 1989, Hyman 1991, Scullen 1992, Harris 1994, 1997, Steriade 1995, Mutaka 1995, Downing 2010).
- Indeed, this has been described as '**a classic phonology problem**' (Downing & Mtenje 2017:75).

In this talk I will...

- Discuss five patterns from five five-vowel languages.
- Give some background on these languages.
- Introduce Beckman's (1997) analysis of HH in Shona:
  - Positional faithfulness and feature co-occurrence constraints.
  - Multiple linking allows for a reduction in the total number of tokens of a given autosegment or combinations of autosegments.
- Apply this to S. Kongo, Pende, Punu and Lozi.
- Show that this able to account for HH in S. Kongo and Pende.
- But not so for Punu and Lozi.

The chosen five

- **Shona** (S.12; Zimbabwe, Mozambique): canonical HH;
- **S. Kongo** (H.16a; Angola): non-canonical HH;
- **Pende** (L.11; D.R. Congo): non-canonical HH;
- **Lozi** (K.21; Zambia etc.): non-canonical HH;
- **Punu** (B.43; Gabon, R. Congo): no HH.
- (All Guthrie codes follow Maho 2009)

Geographical context

Some generalisations I

- Lowering of vowels in verbal suffixes by preceding stem vowels.
  - Commonly affected suffixes: causative, applicative, reversive etc.
  - High /i u/ lowered to mid /e o/ by preceding mid vowels.
- Final vowels fall outside the domain of harmony.
  - But, see seven-vowel Koyo (C.24), where final /a/ may be raised (Hyman 1999:240).
- Low /a/ is opaque and neither triggers nor undergoes lowering; it therefore seems to form a natural class with high /i u/.
  - Though, as we shall see, this is not *entirely* true for Pende.

Some generalisations II

- HH is also usually **asymmetric w.r.t. rounding** (or backness).
  - /i/ is lowered after both /e o/ whereas /u/ is lowered only after /o/.
  - This is both common currently and robust historically (Hyman 1999:238,245).

- Thus, for many languages, HH can, descriptively at least, be split into **front** (FHH) and **back height harmony** (BHH)

Canonical five-vowel Bantu HH

(1) a. Front height harmony: i → e / {e o} C_

b. Back height harmony: u → o / o C_

The present subset I

- The five systems dealt with today are summarised below.

Shona		**S. Kongo**		**Pende**		**Punu**		**Lozi**	
i·i	i·u	i·i	i·u	i·i	i·u	i·i	i·u	i·i/e	i·u
u·i	u·u	u·i	u·u	u·i	u·u	u·i	u·u	u·i/e	u·u
e·e	e·u	**e·e**	**e·o**	**e·e**	e·u	e·i	e·u	e·i/e	e·u
o·e	**o·o**	**o·e**	**o·o**	**o·e**	**o·o**	o·i	o·u	o·i/e	**o·o**
a·i	a·u	a·i	a·u	**a·e**	a·u	a·i	a·u	a·i/e	a·u

Table 1: Height harmony systems in five-vowel Bantu languages

- FHH contexts on the left; BHH contexts on the right.
- Bolding and underlining highlight changes in vowel height.

The present subset II

- The canonical pattern in Shona is overwhelmingly the commonest in five-vowel Bantu languages (Hyman 1999:236–46).
- Few languages lack HH, as Punu does, or exhibit non-canonical HH, such as Pende and Lozi.
- The symmetric pattern in S. Kongo is exceedingly rare among five-vowel Bantu languages, being limited to S. Kongo itself and closely related varieties (Hyman 1999:242).
- Incidentally, there are no (convincing) reported cases of a Bantu language with a "reverse Lozi" system (i.e. lacking BHH but having FHH; Hyman 1999:245).

Shona overview

- As reported in Beckman (1997) and elsewhere, Shona exhibits the canonical HH pattern for a five-vowel Bantu language.
- In FHH contexts, unrounded /i/ is lowered to /e/ after both /e o/.
- In BHH contexts, rounded /u/ is lowered to /o/ only after /o/ itself.
- Examples that follow illustrate this with the applicative and reversive suffixes.

FHH in Shona

(2)

a.	-ip-ir-a	‘to be evil for’
b.	-svetuk-ir-a	‘to jump in’
c.	-per-**e**r-a	‘to end in’
d.	-son-**e**r-a	‘to sew for’
e.	-vav-ir-a	‘to itch at’

(Fortune 1955 in Beckman 1997:10)

BHH in Shona

(3) a.	-kiy-inur-a	‘to unlock’
b.	-sung-unur-a	‘to untie’
c.	-pet-enur-a	‘to unfold’
d.	-mon-on**o**r-a	‘to uncoil’
e.	-nam-anur-a	‘to unstick’

(Dale 1999:165)

Canonical asymmetric HH: Shona, Chewa, Kisa etc.

- Many authors treat this as two distinct processes:
  - Moto (1989) on Chewa (N.31): triggers only permitted to spread [-high] to targets specified as [-round, -low] with the exception that [+round] triggers can only spread to targets specified as [+round, -low].
  - Nevins (2010:130–3) on Kisa (E.32) and Shona separates FHH and BHH, with only BHH being parasitic on [+round].
  - Mutaka (1995:43–4) and Hyman (1991) also use a parasitic stipulation.
  - Harris (1994) does not tackle asymmetry.
- Beckman's (1997) approach does not require this division.

S. Kongo overview

- Of the current subset, only S. Kongo has HH but *no* front–back asymmetry.
- Unrounded /i/ is lowered to mid /e/ after both /e o/.
- Rounded /u/ is also lowered to mid /o/ after both /e o/.
- Examples follow with the applicative and reversive suffixes.

FHH in S. Kongo

(4)	a.	-sik-il-a	‘soutenir, fortifier’
	b.	-vur-il-a	‘surpasser, l’emporter’
	c.	-leng-**e̲**l-a	‘dépérir, languir’
	d.	-somp-**e̲**l-a	‘s’attacher à’
	e.	-land-il-a	‘suivre’

(de Gheel 1652 in Hyman 1999:241)

BHH in S. Kongo

(5)	a.	-vil-ul-a	‘mouvoir, remuer’
	b.	-bub-ul-a	‘corrompre’
	c.	-lemb-**o**l-a	‘barrer, effacer’
	d.	-tomb-**o**l-a	‘faire monter’
	e.	-bang-ul-a	‘faire violence’

(de Gheel 1652 in Hyman 1999:241)

Pende overview

- In Pende, there *is* a front–back asymmetry
- However, it is of a different kind to Shona.
- Unrounded /i/ lowers not only after /e o/ but also after /a/.
- However, as in Shona (and Lozi), /u/ only lowers after /o/.
- This is seen with the applicative and reversive suffixes.

FHH in Pende

(6)	a.	-díg-íl-a	‘bâtir pour’
	b.	-túng-íl-a	‘vendre pour’
	c.	-bemb-**e̲**l-a	‘abandonner pour’
	d.	-lómb-**é̲**l-a	‘demander pour’
	e.	-sas-**e̲**l-a	‘hacher pour’

(Niyonkuru 1978 in Hyman 1999:242)

BHH in Pende

(7)	a.	-shit-ul-a	‘défaire (nœud)’
	b.	-vumb-ul-a	‘déterrer’
	c.	-seng-ul-a	‘absoudre’
	d.	-bóg-**ó**l-a	‘briser’
	e.	-kál-úg-a	‘gémir’

(Gusimana 1972 in Hyman 1999:242)

Bantu languages with no HH

- Among Bantu languages, only five-vowel languages lack HH (Hyman 1999:239).
  - A possible exception to this is seven-vowel Enya (D.14; see Hyman 1999:239, footnote 8).
- In these languages, ‘the distribution of mid vowels is severely restricted’ (Hyman 1999:239).

Punu overview

- Mid /e o/ are only found root-initially (Kwenzi-Mikala 1980:8 in Hyman 1999:240).
- Initial vowels therefore have no effect on the height of vowels in potential target suffixes.
- Thus, suffixes such as the applicative and reversive are always realised with high vowels.

No FHH in Punu

(8) a.	-kil-il-a	‘repasser’
b.	-sub-il-a	‘uriner sur’
c.	-ded-il-a	‘obéir à’
d.	-gol-il-a	‘se frotter avec’
e.	-gab-il-a	‘distribuer à’

(Blanchon 1995 in Hyman 1999:240)

No BHH in Punu

(9)	a. -kip-ul-a	‘découvrir’
	b. -fung-ul-a	‘révéler’
	c. -tes-ul-a	‘briser’
	d. -dob-ul-a	‘extraire, extirper’
	e. -gab-ul-a	‘séparer’

(Blanchon 1995 in Hyman 1999:240)

Lozi overview

- As in Shona and Pende, HH in Lozi is asymmetric.
- But is rather different from either as FHH is entirely absent.
- There is no lowering of underlying high front vowels.
- And no raising of underlying mid front vowels.
- But BHH in Lozi is the same as in Shona and Pende (i.e. /u/ is lowered only after /o/).
- HH is therefore extremely restricted as a change in vowel height is effected in just a single context.

No FHH in Lozi I

(10)

a.	-lif-is-a	‘to fine’
b.	-fuluh-is-a	‘to help paddle’
c.	-belek-is-a	‘to give employment’
d.	-fol-is-a	‘to wait till sunset’
e.	-bal-is-a	‘to teach to read’

(Jalla 1937, Fortune 2001)

No FHH in Lozi II

(11)

a.	-bih-el-a	‘to report to’
b.	-fuluh-el-a	‘to paddle towards’
c.	-fwek-el-a	‘to land at, on’
d.	-kolop-el-a	‘to scrub (the floor) for’
e.	-alaf-el-a	‘to nurse for’

(Jalla 1937, Fortune 2001)

BHH in Lozi

(12)

a.	-bip-ulul-a	‘to let fermented grain dry up’
b.	-lut-ulul-a	‘to unthatch’
c.	-ez-ulul-a	‘to do for the second time’
d.	-bof-**o**l**o**l-a	‘to outspan’
e.	-amb-ulul-a	‘to change one’s mind’

(Jalla 1937, Fortune 2001)

Preliminaries I

- Beckman's (1997) analysis of canonical HH in Shona employs positional faithfulness and feature co-occurrence constraints.
- She argues against analyses using alignment constraints (Beckman 1997:26–33).
- The mid vowels /e o/ are seen as being more marked than peripheral /i u a/.
  - Cf. Moto (1989) and Harris's (1994) treatments of Chewa, where mid vowels are also considered more marked in terms of their number of features.

Preliminaries II

- No featural underspecification for vowels:

(13) a. /i/ = [+high, -low, -round, -back]

b. /u/ = [+high, -low, +round, +back]

c. /e/ = [-high, -low, -round, -back]

d. /o/ = [-high, -low, +round, +back]

e. /a/ = [-high, +low, -round, +back]

Preliminaries III

- The ranking of the relevant constraints is as follows:

(14) IDENT(rd), IDENT(lo), IDENT-σ_1(hi) » *RoLo » *MID » *HIGH » IDENT(hi)

- These will be unpacked next.

Preliminaries IV

(15) a. IDENT(rd): Do not change values for the feature [±round] between input and output.

b. IDENT(lo): Do not change values for the feature [±low] between input and output.

c. IDENT-σ_1(hi): Do not change values for the feature [±high] between input and output for a segment in the root-initial syllable.

d. *ROLO: Segments should not be simultaneously specified as [+round] and [-high].

Preliminaries V

e. *Mid: Segments should not be simultaneously specified as [-high] and [-low].

f. *High: Segments should not be simultaneously specified as [+high] and [-low].

g. Ident(hi): Do not change values for the feature [±high] between input and output.

Preliminaries VI

- Note that this analysis does not use, e.g., alignment constraints.
- Harmony is a result of the interaction of positional faithfulness and marked feature combinations.
- To Krämer (2003:66), this analysis appeals because, not only does it 'impl[y] a typology of vowel harmony' but also because the constraints used are independently motivated.

Preliminaries VII

- Finally, a further key detail in Beckman's analysis is that, where possible, adjacent vowels share Aperture or VPlace nodes.
- Certain sequences of segments are therefore assigned fewer violations than if their nodes were not shared (since there are fewer tokens of certain autosegments).
- This minimisation of the number of autosegment tokens, along with the constraint ranking, is able to account for *asymmetric* HH.

Walkthrough I

- Undominated IDENT(rd) prohibits changes to the feature [±round].
- Similarly, IDENT(lo) prevents alterations to [±low].
- This prevents raising of /a/ in any position.
- And stops harmony from applying across an intervening low /a/.

Walkthrough II

(16)

/CoCaCiC/	Ident(lo)	*Mid	*High	Ident(hi)
☞ a. C o C a C i C [-lo] [-hi] [+lo] [-hi] [-lo] [+hi]		*	*	
b. C o C a C e C Aperture Aperture Aperture [-lo] [-hi] [+lo] [-lo]		**!		*
c. C o C e C e C Aperture [-lo] [-hi]	*!	*		*

Walkthrough III

- Since high-ranking IDENT-σ_1(hi) prevents changes being made to [±high] in initial syllables, alterations must be made to the right.
- Harmony therefore appears to propagate rightwards (as seen in the tableaux that follow).

Walkthrough IV

- Mid /e o/ are able to surface in initial syllables because IDENT-σ_1(hi) dominates *MID.

(17)

/CeC/	IDENT-σ_1(hi)	*MID	*HIGH	IDENT(hi)
☞ a. C e C [-lo] [-hi]		*		
b. C i C [-lo] [+hi]	*!		*	*

Walkthrough V

- And mid /e o/ surface in non-initial syllables following other mid vowels.
- This is thanks to multiple linking and the fact that both *Mid and *High outrank Ident(hi).

Walkthrough VI

(18)

/CeCiC/	Ident-σ_1(hi)	*Mid	*High	Ident(hi)
a. C e C i C [-lo] [-hi] [-lo] [+hi]		*	*!	
☞ b. C e C e C Aperture [-lo] [-hi]		*		*
c. C e C e C [-lo] [-hi] [-lo] [-hi]		**!		*
d. C i C i C Aperture [-lo] [+hi]	*!		*	*

Walkthrough VII

- But they are prevented from surfacing after high /i u/ for the same combination of reasons.

(19)

/CiCeC/	Ident-σ_1(hi)	*Mid	*High	Ident(hi)
a. C i C e C [-lo] [+hi] [-lo] [-hi]		*	*!	
☞ b. C i C i C Aperture [-lo] [+hi]			*	*
c. C i C i C [-lo] [+hi] [-lo] [+hi]			**!	*
d. C e C e C Aperture [-lo] [-hi]	*!	*		*

Walkthrough VIII

- Ranking *Mid above *High means that [i] not [e] surfaces after [a].
- Beckman states that this as an 'emergence of the unmarked effect (McCarthy & Prince 1994)'.

(20)

/CaCiC/	*Mid	*High	Ident(hi)
a. C a C e C [+lo] [-hi] [-lo] [-hi]	*!		*
☞ b. C a C i C [+lo] [-hi] [-lo] [+hi]		*	

Walkthrough IX

- *RoLo (= *[+round, -high]) militates against [o] surfacing. Beckman (1997:24) cites Kaun (1995:144) in support (see also Kaun 2004).
- It is this that prevents the inputs /e·u/ or /e·o/ from surfacing as [e·o].
- The multiple linking needed to avoid excessive violations is not possible in this instance.

Walkthrough X

(21)

/CeCuC/	Ident(rd)	*RoLo	*Mid	*High
☞ a. C e C u C Ap [rd] Ap [-lo] [-hi] [-lo] [+hi]			*	
b. C e C o C Aperture [rd] [-lo] [-hi]		*!	*	
c. C e C e C Aperture [-lo] [-hi]	*!		*	
d. C e C i C Aperture Aperture [-lo] [-hi] [-lo] [+hi]	*!		*	*

Walkthrough XI

- However, this *is* possible with the inputs /o·u/ or /o·o/.
- And so the above inputs result in the height-harmonic output [o·o].

Walkthrough XII

(22)

/CoCuC/	Ident(rd)	*RoLo	*Mid	*High	Ident(hi)
a. C o C u C Ap [rd] Ap [rd] [-lo] [-hi] [-lo] [+hi]		*	*	*!	
☞ b. C o C o C VPlace Ap [rd] [-lo] [-hi]		*	*		*
c. C o C o C Ap [rd] Ap [rd] [-lo] [-hi] [-lo] [-hi]		**!	**		*
d. C o C i C Ap [rd] Ap [-lo] [-hi] [-lo] [+hi]	*!	*	*	*	

Preview

- Now I'll apply Beckman's (1997) work to:
  - S. Kongo—symmetric HH;
  - Pende—asymmetric HH with lowering after /a/ in FHH;
  - Punu—no HH and mid vowels only root-initially;
  - And Lozi—only BHH and only after /o/.
- The feature specifications used are the same as for Shona.
- And the same stipulations on multiple linking apply.
- As previously mentioned, S. Kongo and Pende pose no problems.
- Punu and Lozi, however, do.

S. Kongo I

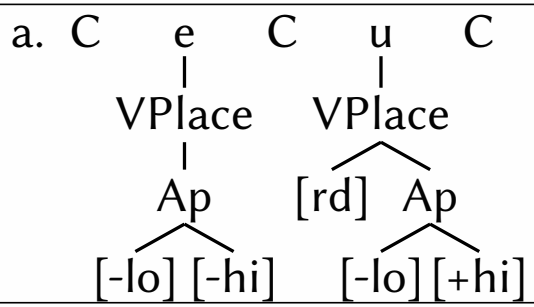
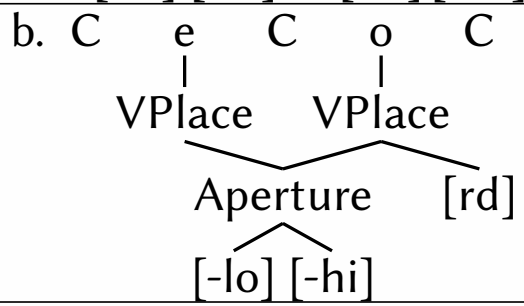
- The analysis of Shona is easily adapted to S. Kongo's symmetric HH system.
- This is accounted for by simply demoting *RoLo from a high- to a low-ranking position:

(23) IDENT(rd), IDENT(lo), IDENT-σ_1(hi) » *MID » *HIGH » IDENT(hi) » ***RoLo**

S. Kongo II

- This allows an input of /e·u/ or /e·o/ to surface as height-harmonic [e·o].

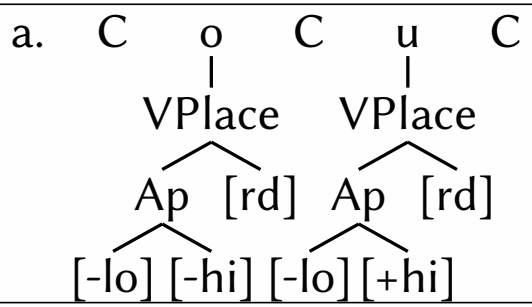
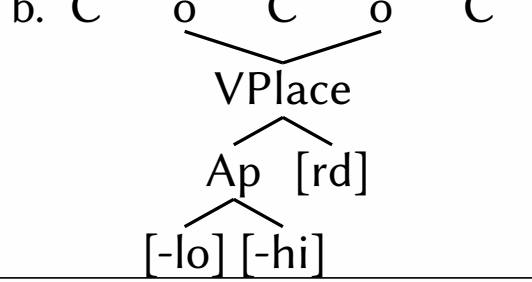
(24)

/CeCuC/	Ident(rd)	*Mid	*High	*RoLo
a. 		*	*!	
☞ b. 		*		*

S. Kongo III

- While all other outcomes remain the same as in Shona.
- E.g. the inputs /o·u/ or /o·o/ both surface as height-harmonic [o·o].

(25)

/CoCuC/	Ident(rd)	*Mid	*High	*RoLo
a. 		*	*!	
☞ b. 		*		*

S. Kongo IV

- Similarly, /i/ is lowered after both /e o/.
- And, mid /e o/ are not permitted to surface after high /i u/.

Pende I

- Pende also does not pose any problems.
- Firstly, as for Shona, ranking of *Mid and *High above Ident(hi) means that the inputs /o·u/ and /o·o/ surface as [o·o].

(26)

/CoCuC/	Ident-σ_1(hi)	*RoLo	*Mid	*High	Ident(hi)
a. C o C u C VPlace VPlace Ap [rd] Ap [rd] [-lo] [-hi] [-lo] [+hi]		*	*	*!	
☞ b. C o C o C VPlace Ap [rd] [-lo] [-hi]		*	*		*

Pende II

- But *RoLo prevents /e·u/ from surfacing as [e·o], yielding [e·u] instead.

(27)

/CeCuC/	Ident-σ_1(hi)	*RoLo	*Mid	*High	Ident(hi)
☞ a. C e C u C Ap [rd] Ap [-lo] [-hi] [-lo] [+hi]			*	*	
b. C e C o C Aperture [rd] [-lo] [-hi]		*!	*		*

Pende III

- The added wrinkle that /a·i/ surfaces as [a·e] is dealt with by ranking *High above *Mid ensures the sequence /a·i/ surfaces as [a·e].
- Recall that for Shona, *High above *Mid are the opposite way round.

(28)

/CaCiC/	Ident-σ_1(hi)	*RoLo	*High	*Mid	Ident(hi)
a. C a C i C [+lo] [-hi] [-lo] [+hi]			*!		
☞ b. C a C e C [+lo] [-hi] [-lo] [-hi]				*	*

Pende IV

- And /a·u/ is prevented from surfacing as [a·o] by high-ranking *RoLo.
- The observed output of [a·u] is therefore predicted.

(29)

/CaCuC/	Ident-σ_1(hi)	*RoLo	*High	*Mid	Ident(hi)
☞ a. C a C u C Ap [rd] Ap [+lo] [-hi] [-lo] [+hi]			*		
b. C a C o C Ap [rd] Ap [+lo] [-hi] [-lo] [-hi]		*!		*	*

Pende V

- Note that having *High outrank *Mid does not cause problems elsewhere.
- For example, /i·e/ still surfaces as [i·i] thanks to multiple linking.

(30)

/CiCeC/	Ident-σ_1(hi)	*RoLo	*High	*Mid	Ident(hi)
☞ a. C i C i C Aperture [-lo] [+hi]			*		*
b. C i C e C [-lo] [+hi] [-lo] [-hi]			*	*!	*

Pende VI

- Likewise, /e·i/ surfaces as height-harmonic [e·e].

(31)

/CeCiC/	Ident-σ_1(hi)	*RoLo	*High	*Mid	Ident(hi)
☞ a. C e C e C Aperture [-lo] [-hi]				*	*
b. C e C i C [-lo] [-hi] [-lo] [+hi]			*!	*	

Pende VII

- The constraint ranking for Pende is therefore:

(32) Ident(rd), Ident(lo), Ident-σ_1(hi) » *RoLo » ***High** » *Mid » Ident(hi)

Punu I

- It also appears that the constraint ranking is also relatively easily adapted for Punu.
- A lack of HH can be derived by placing Ident(hi) between *Mid and *High:

(33) Ident(rd), Ident(lo), Ident-σ_1(hi) » *RoLo » *Mid » **Ident(hi)** » *High

- This does not produce lowering of non-initial high vowels by initial mid vowels in the input.

Punu II

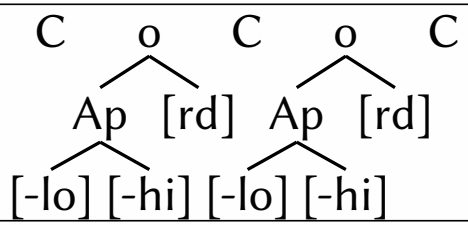
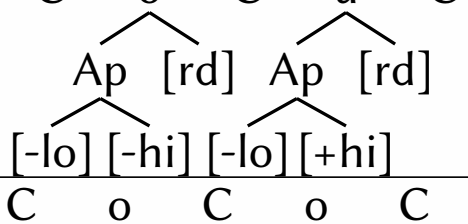
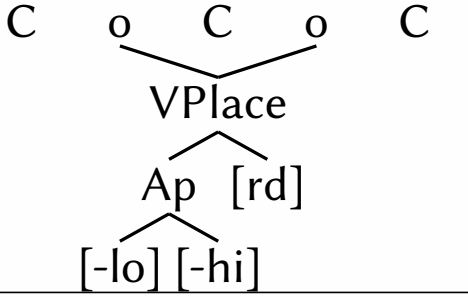
- This does not produce lowering of non-initial high vowels by initial mid vowels in the input.

(34)

/CeCiC/	IDENT-σ_1(hi)	*RoLo	*Mid	Ident(hi)	*High
a. C e C e C [-lo] [-hi] [-lo] [-hi]			**!	*	
☞ b. C e C i C [-lo] [-hi] [-lo] [+hi]			*		*
c. C e C e C Aperture [-lo] [-hi]			*	*!	

Punu III

(35)

/CoCuC/	Ident-σ_1(hi)	*RoLo	*Mid	Ident(hi)	*High
a. 		**!	**	*	
☞ b. 		*	*		*
c. 		*	*	*!	

Punu IV

- However, this arrangement requires limiting mid vowels in the input to initial syllables.
- Otherwise, non-initial mid vowels surface following initial mid vowels.
- The height-harmonic outputs are incorrectly preferred because of multiple linking.
  - 💣 designates a candidate which is incorrectly selected as a winner;
  - ☹ designates an actual surface form which incorrectly loses.

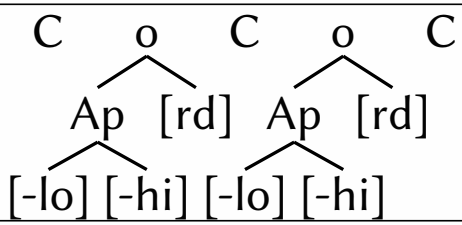
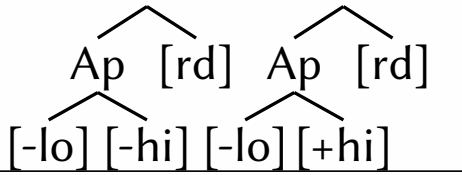
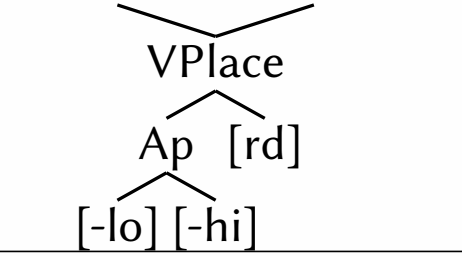
Punu V

(36)

/CeCeC/	Ident-σ_1(hi)	*RoLo	*Mid	Ident(hi)	*High
a. C e C e C [-lo] [-hi] [-lo] [-hi]			**!		
☹ b. C e C i C [-lo] [-hi] [-lo] [+hi]			*	*!	*
💣 c. C e C e C Aperture [-lo] [-hi]			*		

Punu VI

(37)

/CoCoC/	Ident-σ_1(hi)	*RoLo	*Mid	Ident(hi)	*High
a. 		**!	**		
☹ b. 		*	*	*!	*
💣 c. 		*	*		

Punu VII

- In reality, as previously noted, mid vowels in Punu are restricted to root-initial position.
- This problem is one created by multiple linking, which is necessary to account for Shona.

Lozi I

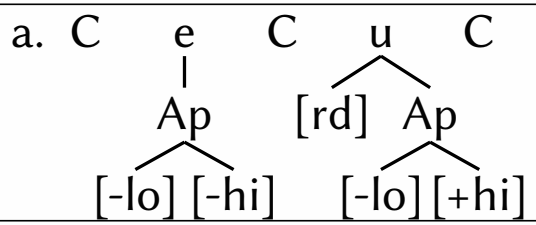
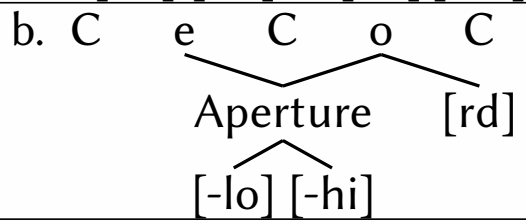
- The system found in Lozi poses even more of a challenge.
- The surface sequence [e·o] is disallowed.
- Thus, *RoLo must rank higher than *High.

(38)

/CeCuC/	Ident-σ_1(hi)	*RoLo	*Mid	*High
☞ a. C e C u C Ap [rd] Ap [-lo] [-hi] [-lo] [+hi]			*	*
b. C e C o C Aperture [rd] [-lo] [-hi]		*!	*	

Lozi II

(39)

/CeCoC/	Ident-σ_1(hi)	*RoLo	*Mid	*High
☞ a. 			*	*
b. 		*!	*	

Lozi III

- And, since lowering is lacking in all but one context, namely /o·u/, IDENT(hi) should rank higher than *HIGH.
- The tableaux that follow show that ranking IDENT(hi) over *HIGH prevents lowering in FHH contexts.

Lozi IV

- Firstly, a height-disharmonic input remains so in the output.

(40)

/CeCiC/	Ident-σ_1(hi)	*RoLo	*Mid	Ident(hi)	*High
☞ a. C e C i C [-lo] [-hi] [-lo] [+hi]			*		*
b. C e C e C Aperture [-lo] [-hi]			*	*!	

Lozi V

- And this produces the correct output when given a harmonic input.

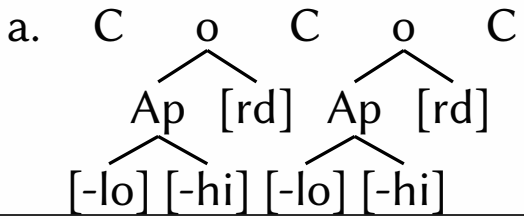
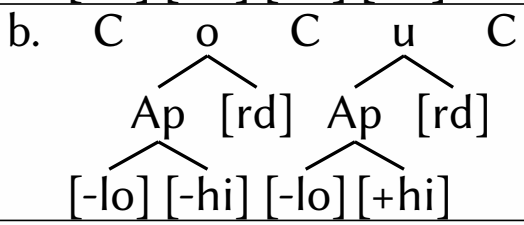
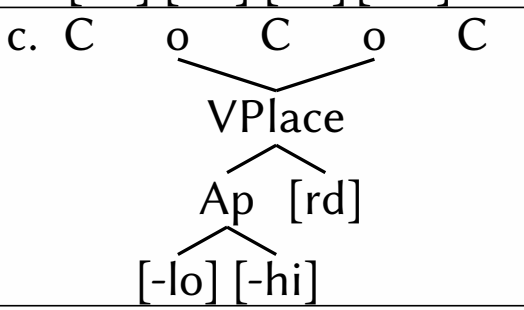
(41)

/CeCeC/	Ident-σ_1(hi)	*RoLo	*Mid	Ident(hi)	*High
a. C e C i C [-lo] [-hi] [-lo] [+hi]			*	*!	*
☞ b. C e C e C Aperture [-lo] [-hi]			*		

Lozi VI

- However, looking at BHH, for /o·u/ to surface as [o·o] rather than [o·u], IDENT(hi) paradoxically needs to be ranked lower than *HIGH.

(42)

/CoCuC/	IDENT-σ_1(hi)	*RoLo	*MID	*HIGH	IDENT(hi)
a. 		**!	**		*
b. 		*	*	*!	
☞ c. 		*	*		*

Lozi VII

- Swapping round IDENT(hi) and *HIGH results in the incorrect output with the input sequence /o·u/:

(43)

/CoCuC/	IDENT-σ_1(hi)	*RoLo	*MID	IDENT(hi)	*HIGH
a. C o C o C Ap [rd] Ap [rd] [-lo] [-hi] [-lo] [-hi]		**!	**	*	
💣 b. C o C u C Ap [rd] Ap [rd] [-lo] [-hi] [-lo] [+hi]		*	*		*
☹ c. C o C o C VPlace Ap [rd] [-lo] [-hi]		*	*	*!	

Lozi VIII

- Though it does not alter an already height-harmonic input of /o·o/.

(44)

/CoCoC/	Ident-σ_1(hi)	*RoLo	*Mid	Ident(hi)	*High
a. C o C o C Ap [rd] Ap [rd] [-lo] [-hi] [-lo] [-hi]		**!	**		
b. C o C u C Ap [rd] Ap [rd] [-lo] [-hi] [-lo] [+hi]		*	*	*!	*
☞ c. C o C o C VPlace Ap [rd] [-lo] [-hi]		*	*		

Lozi IX

- The two conflicting constraint rankings are:

(34) a. Ident(rd), Ident(lo), Ident-σ_1(hi) » *RoLo » *Mid » **Ident(hi)** » *High

b. Ident(rd), Ident(lo), Ident-σ_1(hi) » *RoLo » *Mid » *High » **Ident(hi)**

Summary and conclusions

- I introduced Beckman's (1997) analysis of HH in Shona.
- Applied this to HH in four further five-vowel Bantu languages.
- This encounters no problems for S. Kongo and Pende.
- But does for Punu and Lozi.
- However, these two cases do not have common problematic areas.
- Beckman's analysis of canonical asymmetric HH in Shona is unable to cover the complete subset of HH dealt with here.
- It is therefore not readily generalisable to all Bantu languages.

Future work

- Aim to find a solution applicable to all cases covered here.
- As well other five-vowel languages not yet discussed.
- And expand further to include seven-vowel languages (see Appendix).

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Appendix: Seven-vowel languages I

- Beckman's (1997) analysis appears to be generally applicable to seven-vowel languages.

Odden (2015)

Seven vowel languages have the potential for greater variation in vowel harmony.

- A(n incomplete) sample of such HH systems is provided next (data from Hyman 1999, Odden 2015 and elsewhere).

Appendix: Seven-vowel languages II

Kikuyu		**Nyamwezi**		**Kinga**		**Matumbi**		**Ndendeuli**		**Mongo-Nkundo**	
i·e	i·o	i·ɪ	i·ʊ	i·i	i·u	i·i	i·u	i·i	i·u	i·e	i·o
u·e	u·o	u·ɪ	u·ʊ	u·i	u·u	u·i	u·u	u·i	u·u	u·e	u·o
e·e	e·o	ɪ·ɪ	ɪ·ʊ	ɪ·ɪ	ɪ·ʊ	ɪ·ɪ	ɪ·ʊ	**e·e**	e·u	e·e	e·o
o·e	o·o	ʊ·ɪ	ʊ·ʊ	ʊ·ɪ	ʊ·ʊ	ʊ·ɪ	ʊ·ʊ	**o·e**	**o·o**	o·e	o·o
ɛ·ɛ	ɛ·o	**e·e**	e·ʊ	**ɛ·ɛ**	ɛ·ʊ	**ɛ·ɛ**	ɛ·u	**ɛ·ɛ**	ɛ·u	**ɛ·ɛ**	**ɛ·ɔ**
ɔ·ɛ	**ɔ·ɔ**	**o·e**	**o·o**	**ɔ·ɛ**	**ɔ·ɔ**	**ɔ·ɛ**	**ɔ·ɔ**	**ɛ·ɛ**	**ɔ·ɔ**	**ɔ·ɛ**	**ɔ·ɔ**
a·e	a·o	a·ɪ	a·ʊ	a·ɪ	a·ʊ	a·i	a·u	a·i	a·u	a·e	a·o

Table 2: Height harmony systems in seven-vowel Bantu languages

(Guthrie codes: Kikuyu (E.51), Nyamwezi (F.22), Kinga (G.65), Matumbi (P.13), Ndendeuli (N.101), Mongo-Nkundo (C.61).)

Appendix: Seven-vowel languages III

- It seems that the most immediate problem the current constraint set would encounter is that, in Kikuyu, [o] (= [+round, -high]) is found as the default harmonic back vowel in a system which is also asymmetric.
- Might this require that *RoLo = *[+round, -high] be accompanied by a similar constraint such as *RoLax = *[+round, -ATR]?
  - Would this additional constraint also be grounded? (i.e. à la Kaun)