Polarity in Western Nilotic

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Phonological Aspects of Mutation Morphology
EGG 2008

Basic Pattern

Voiceless → Voiced

	singular		**plural**	
[–voiced]	a. ari**p**	‘milky way’	ari**b**-e	[+voiced]

Voiced → Voiceless

	singular		**plural**	
[+voiced]	b. co**g**o	‘bone’	co**k**-e	[-voiced]

More Data

[–voice] → [+voice]

	sg	**pl**		
a.	bat	bed-e	‘arm’	(Okoth-Okombo, 1982:30)
b.	luθ	luð-e	‘walking stick’	(Okoth-Okombo, 1982:30)
c.	ɐri:p	ɐri:b-e	‘milky way’	(p. 128)
d.	guok	guog-i	‘dog’	(Okoth-Okombo, 1982:30)

[+voice] → [–voice]

	sg	**pl**		
a.	ki:dí	kí:t-ê	‘stone’	(p. 128)
b.	ɔkɛ̂:bɛ	okɛ́:p-ɛ̂	‘tin can’	(p. 127)
c.	cogo	cok-e	‘bone’	(Okoth-Okombo, 1982:30)

Distinctivity-Based Analyses

Alderete (2001): ¬IDENT[voice]

Base		Derivative	¬IDENT[voice]	IDENT[voice]
a./arip/	☞	i. arib-e	*	
		ii. arip-e		*
b./cogo/	☞	i. cok-e	*	
		ii. cog-e		*

(Similar: de Lacy, 1999,2008; Kurisu, 2001; Wolf, 2005)

Basic Claim

Voicing polarity is phonological

Luo (Dholuo; Okoth-Okombo,1984; Tucker,1994; Heusing,2004)

- Nilosaharan language of the Western Nilotic branch
- Spoken by more than 3 million speakers around Lake Victoria (Kenya,Uganda, Tanzania)
- Tone language with complex morphophonology
- All data in this talk are from Tucker (1994) unless otherwise noticed

Important Phonological Facts

- Word-final obstruents in bare roots are always voiceless
  e.g. **bet**, but not ***bed**
- Roots are either (C)V.CV, (C)VC , or (C)V.CVC,
  e.g. **bet**, and **ari**, but not ***be** or ***ber.te**
- **Basically:** CV**C** or CV.**C**V

Outline

A Closer Look at the Data

		singular	**plural**
V-final Root	a.	[+voice]	[–voice]
	b.	[–voice]	[–voice]
	c.	[–voice]	[+voice]
	d.	[+voice]	[+voice]
C-final Root	e.	[–voice]	[+voice]
	f.	[–voice]	[–voice]
	g.	[+voice]	[+voice]
	h.	[+voice]	[–voice]

Under a distinctivity-based analysis,
a.,c.,e. and h. should be productive
while b.,d., f. and g. should be unattested

a. V-final [+vc] ⟶ [–vc]

	sg	**pl**		
a.	ki:dí	kí:t-ê	‘stone’	(p. 128)
b.	ɔkɛ̂:bɛ	okɛ́:p-ɛ̂	‘tin can’	(p. 127)
c.	cogo	cok-e	‘bone’	(Okoth-Okombo, 1982:30)

- Well-documented
- **Correctly predicted by distinctivity accounts**

b. V-final [–vc] → [–vc]

	sg	**pl**		
a.	cu:pɐ	cú:p-ê	‘bottle’	(Swahili; p. 130)
b.	ɔθî:θɔ	ɔθî:θ-ɛ̂:	‘small thing’	(p. 130)
c.	osi:kí	osí:k-ê	‘stump’	(p. 130)
d.	ɔkɔ̂:cɔ	ɔkɔ̂:c-ɛ̂	‘neck rest of sisal trunk’	(p. 130)

- Well-documented
- **Incorrectly predicted to be impossible by distinctivity accounts**

c. V-final [–vc] → [+vc]

	sg	**pl**		
a.	agɔ:kɔ	agɔ́g-ɛ̂	‘chest’	(p. 491)
b.	koti	kod-e	‘coat’	(English; Okoth-Okombo, 1982:54)
c.	ongeti	onged-e	‘blanket’	(English; Okoth-Okombo, 1982:54)

- a. is the only example of this type in Tucker’s grammar and has a second plural variant without voicing (agɔ́k-ɛ̂, p.491)
- b. and c. are loanwords cited in Okoth-Okombo (1982)
- **incorrectly predicted to be productive by distinctivity accounts**

d. V-final [+vc] ⟶ [+vc]

ŋu**d**i (sg.) ŋu**d**-e (pl.) ‘neck of meat’

- Only this single example
- **Roughly the correct prediction by distinctivity accounts**

e. C-Final [–vc] → [+vc]

	sg	**pl**		
a.	bat	bed-e	‘arm’	(Okoth-Okombo, 1982:30)
b.	luθ	luð-e	‘walking stick’	(Okoth-Okombo, 1982:30)
c.	ɐri:p	ɐri:b-e	‘milky way’	(p. 128)
d.	guok	guog-i	‘dog’	(Okoth-Okombo, 1982:30)

- Well-documented
- **Correctly predicted by distinctivity accounts**

f. C-Final [–vc] → [–vc]

a. i:**p** (sg.)	i:**p**-e (pl.)	‘tail’	
b. le**p** (sg.)	le**p**-e (pl.)	‘tongue’	
c. la:k	lé:k-e	‘tooth’	(p. 130)
d. bă:θ	bɛ́:θ-ê/bé:θ-ê	‘side’	(p. 130)

- Well-documented
- **Incorrectly predicted to be impossible by distinctivity accounts**

g. C-Final [+vc] → [+vc] and h. C-Final [+vc] → [–vc]

	singular		**plural**	
[+voiced]	*ba**d**		*be**d**-e	[–voiced]

	singular		**plural**	
[+voiced]	*ba**d**		*be**t**-e	[–voiced]

- Non-existent (due to restrictions on voicing)
- **Incorrectly predicted by distinctivity accounts**

Voicing patterns in Luo

		singular	plural	
V-final Root	a.	[+voice]	[–voice]	**well-attested**
	b.	[–voice]	[–voice]	
	c.	[–voice]	[+voice]	**marginal**
	d.	[+voice]	[+voice]	
C-final Root	e.	[–voice]	[+voice]	**well-attested**
	f.	[–voice]	[–voice]	
	g.	[+voice]	[+voice]	**not attested**
	h.	[+voice]	[–voice]	

Predictions of distinctivity accounts are largely wrong

Containment Theory in General

- Underlying phonological material which is not pronounced is not deleted in the phonology
- Instead, it is marked as phonetically inert and (mostly) disregarded by the phonetics
- **History:**
  - Original version of OT in Prince & Smolensky (1993)
  - Abandoned with the advent of Correspondence Theory (McCarthy & Prince, 1994,1995)
  - Resurrected in a modified way (“Coloured Containment”) in recent work by van Oostendorp and Revithiadou

The Version of Containment Theory Used Here

- A variant of Coloured Containment which is closer to the original model
- Standard Autosegmental Representations instead of Turbidity Theory (Goldrick, 2000)
- Deletion and epenthesis are interpreted as invisibility at the interfaces:
  - Deletion = invisibility at the phonetic interface
  - Epenthesis = invisibility at the morphological interface

Typology of Phonological Visibility

		morphologically visible	
		+	**–**
phonetically visible	**+**	realized underl. material	epenthetic material
	–	unrealized underl. material	

Wellformedness Conditions on Phonetic Visibility

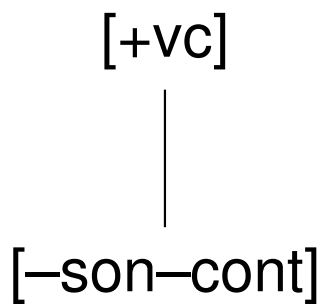
- Phonological objects are either morphologically or phonetically visible (or both)
- Phonetically visible links connect only phonetically visible structure
- Phonetic structure must be phonetically linked to higher phonetic structure (if there is any)

Representation of Epenthesis and Deletion

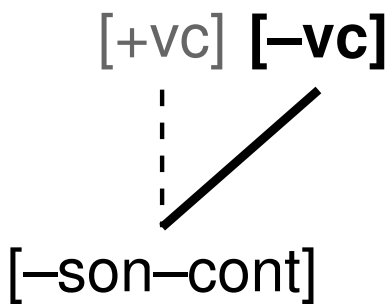
Underlying /bete/ Surfacing [bete]	Underlying /bet/ Surfacing [bete]	Underlying /betep/ Surfacing [bete]
b e t e	b e t **e**	b e t e p

Representation of Featural Changes

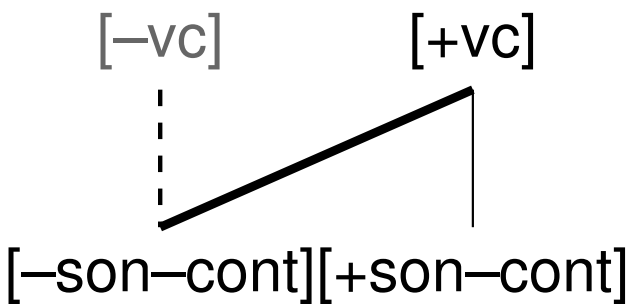
Underlying /t/
Surfacing [t]



Underlying /d/
Surfacing [t]



Underlying /tn/
Surfacing [dn]



Faithfulness Constraints on Voicing

ID [+vc]: Every segment which is morphologically associated with [+vc] is phonetically associated with [+vc]

ID [–vc]: Every segment which is morphologically associated with [–vc] is phonetically associated with [–vc]

Licensing Voiced Obstruents (Lombardi,1994,1995;Steriade,1997)

LICENSING CONSTRAINT:
A [+vc] obstruent should be phonetically visible through a phonetically right-adjacent sonorant in the same voicing span.

Constraint on Stop-Nasal Voicing

(TN): Stops and phonetically right-adjacent nasals should be linked to the same voicing feature.

Voicing of Prenasal Stops in Tangale

(Kidda,1993;Kenstowicz,1994)

	'N'	**'the N'**	**'my N'**	
a.	bugat	bugat-i	bugad-no	'window'
b.	aduk	aduk-i	adug-no	'load'
c.	tugat	tugad-i	tugad-no	'berry'
d.	kuluk	kulug-i	kulug-no	'harp'

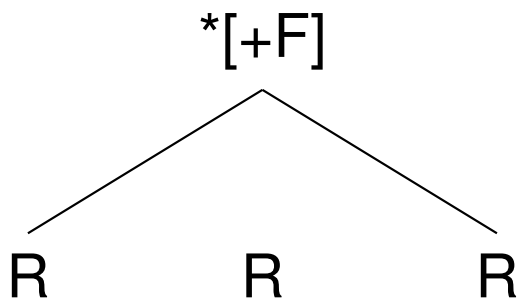
Constraints on Autosegmental Skipping

NoSkipping-Vis:
Phonetically visible association spans
should not skip phonetically visible root nodes

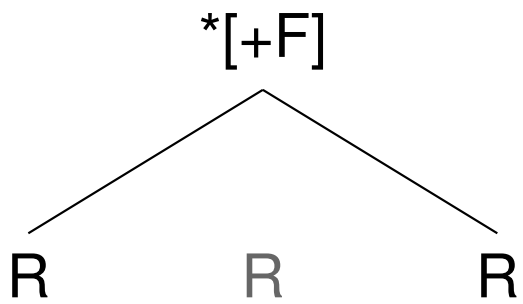
NoSkipping:
Phonetically visible association spans
should not skip root nodes

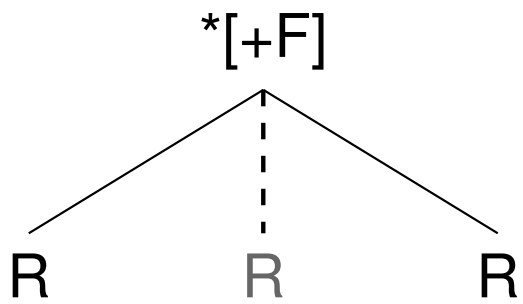
Relevant Skipping Configurations

violates NoSkipping-Vis and NoSkipping



violate only NoSkipping





Blocking of Place Assimilation in Hellendoorn Dutch

(van Oostendorp, 2004:2-3)

		Underlying	**Surface**
a.	'to work'	wɛrk-n	wɛrkŋ
b.	'we worked'	wɛrk-t-n	wɛrkn̩
c.	'to hope'	hop-n	hopm̩
d.	'we hoped'	hop-t-n	hopn̩

Blocking of Place Assimilation in Aalst Dutch

(van Oostendorp, 2004:17)

		Underlying	**Surface**
a.	‘handsome guy’	schoo/n/ ventje	schoo/ŋ/ ventje
b	‘beautiful woman’	schoo/nə/ vrouw	schoo/n/ vrouw

NO-SKIPPING at Work in Hellendorn Dutch

Input: wɛrk-n, ‘to work’

	NoSkip	SharePlace
a. wɛrk-n		*!
☞ b. wɛr(k-ŋ)		

Input: wɛrk-t-n, ‘we worked’

	NoSkip	SharePlace
☞ a.wɛrkt-n		*
b. wɛr(kt-ŋ)	*!	

Basic Analyis

- All roots which don't alternate are underlyingly voiceless
  All roots which alternate are underlyingly voiced

- Underlyingly voiced roots are devoiced
  in the singular if C-final, and in the plural if V-final

- Singular devoicing =
  unlicensed voicing in word-final position

  Plural devoicing =
  unlicensed voicing by an intervening deleted segment

Underlyingly Voiced C-final Root

Input: ɐrib, ‘milky way’

	ID [–vc]	(TN)	NOSKIP	LIC	ID [+vc]
☞ a. ɐrip					*
b. ɐrib				*!	
c. ɐr(ib)				*!	

Input: ɐrib-e, ‘milky way (pl.)’

	ID [–vc]	(TN)	NOSKIP	LIC	ID [+vc]
☞ a. ɐri(b-e)					
b. ɐrip-e					*!
c. ɐrib-e				*!	

Underlyingly Voiced V-final Root

Input: kidi, ‘stone’

	ID [–vc]	(TN)	NOSKIP	LIC	ID [+vc]
☞ ki(di)					
kidi				*!	
kiti					*!

Input: kidi-e, ‘stone (pl.)’

	ID [–vc]	(TN)	NOSKIP	LIC	ID [+vc]
a. ki(di-e)			*!		
b. ki(di)-e				*!	
☞ c. kiti-e					*

Underlyingly Voiceless C-final Root

Input: ip, ‘tail’

	ID [–vc]	(TN)	NOSKIP	LIC	ID [+vc]
☞ ip					
ib	*!			*	

Input: ip-e, ‘tail (pl.)’

	ID [–vc]	(TN)	NOSKIP	LIC	ID [+vc]
☞ ip-e					
i(b-e)	*!				
ib-e	*!			*	

Underlyingly Voiceless V-final Root

Input: osiki, ‘stump’

	ID [–vc]	(TN)	NOSKIP	LIC	ID [+vc]
☞ osiki					
osigi	*!			*	
osi(gi)	*!				

Input: osiki-e, ‘stump (pl.)’

	ID [–vc]	(TN)	NOSKIP	LIC	ID [+vc]
☞ osiki-e					
osigie	*!			*	
osi(gie)	*!		*		

Plurals in -ni

	sg	**pl**		
a.	gɔ:gɔ́	gɔ:g-nɪ	“lump of clay”	(p. 126)
b.	pɛ́:dɔ̂	pɛ:d-ni	“thorny rambler”	(p. 127)
c.	aba:já	ɐbe:ɟ-ni	“large spear”	(p. 127)
d.	oké:bé	oke:b-nî	“rich man”	(p. 127)
e.	pɔ́:kɔ̂	po:k-ni	“gourd”	(p. 127)
f.	ŋgɐ́:tó	ŋge:t-ni	“clog”	(p. 127)
g.	fú:kó	fu:k-ni	“mole”	(p. 126)
g.	kúé:sí	kue:s-ni	“pipe”	(p. 126)

Insufficiency of LICENSING and NO-SKIP

Input: gɔgɔ-ni, ‘lump of clay (pl.)’

	NoSkip	LC	Id [+vc]
☛ a. gɔ(gɔ-n)ɪ	*!		
☞ b. gɔkɔ-nɪ			*
c. gɔgɔ-nɪ		*!	

Plural in -ni – Underlyingly Voiced Stop

Input: gɔgɔ-ni, 'lump of clay (pl.)'

	ID [–vc]	(TN)	NOSKIP	LC	ID [+vc]
☞ a. gɔ(gɔ-n)ɪ			*		
b. gɔgɔ-nɪ		*!		*	
c. gɔkɔ-nɪ		*!		*	*

Input: gɔgɔ, 'lump of clay'

	ID [–vc]	(TN)	NOSKIP	LC	ID [+vc]
☞ g(ɔgɔ)					
gɔgɔ				*!	
gɔkɔ					*!

Plural in -ni – Underlyingly Voiceless Stop

Input: pɔkɔ, ‘gourd’

	ID [–vc]	(TN)	NOSKIP	LC	ID [+vc]
☞ pɔkɔ					*
p(ɔgɔ)	*!				
pɔgɔ	*!			*	

Input: pɔkɔ-ni, ‘gourd’

	ID [–vc]	(TN)	NOSKIP	LC	ID [+vc]
☞ pɔkɔ-nɪ		*			
pɔgɔ-nɪ	*!	*		*	
pɔ(gɔ-n)ɪ	*!		*		

Marginal/Exceptional Patterns

		singular	plural	
V-final Root	a.	[+voice]	[–voice]	**well-attested**
	b.	[–voice]	[–voice]	
	c.	[–voice]	[+voice]	**marginal**
	d.	[+voice]	[+voice]	
C-final Root	e.	[–voice]	[+voice]	**well-attested**
	f.	[–voice]	[–voice]	
	g.	[+voice]	[+voice]	**not attested**
	h.	[+voice]	[–voice]	

Analysis: Exceptional cases are due to root suppletion

Non-alternating Voiced Obstruent

ŋu:di (sg.) ŋu:d-e (pl.) ‘neck of meat’

ŋudi-e, ‘necks of meat (pl.)’

	ID [–vc]	(TN)	NOSKIP	LIC	ID [+vc]
☛ a. ŋu(di-e)			*!		
☞ b. ŋuti-e					*
c. ŋudi-e				*!	

Suppletive stem allomorphs

sg	**pl**		
a. ðá:kɔ	mó:n	‘woman’	(p. 126)
b. dá:lâ	mie:r	‘village’	(p. 126)
c. ðɪa:ŋ	ðo:k	‘cow’	(p. 126)
d. ɲá:kɔ	ɲi:r-i	‘girl’	(p. 126)
e. lɪɛ:l	líét-ê	‘anthill, grave’	(p. 129)
f. we:r	we:nd-e	‘song’	(p. 129)

Non-alternating Voicing as Suppletive Stem Allomorphy

necks ↔ ŋud /____Plural
necks ↔ ŋudi

Input: ŋud-e, ‘necks of meat (pl.)’

	ID [–vc]	(TN)	NOSKIP	LIC	ID [+vc]
☞ ŋu(d-e)					
ŋut-e					*!
ŋud-e				*!	

Vowel-final Roots with [–vc] → [+vc] Alternation

	sg	**pl**		
a.	agɔ:kɔ	agɔ́g-ɛ̂	‘chest’	(p. 491)
b.	koti	kod-e	‘coat’	(Okoth-Okombo, 1982:54)
c.	ongeti	onged-e	‘blanket’	(Okoth-Okombo, 1982:54)

Inverse-alternating Roots as Suppletive Allomorphy

coat ↔ kod /____Plural

coat ↔ kot

Inverse-alternating Roots as Suppletive Allomorphy

Input: koti, ‘coat’

	ID [–vc]	(TN)	NOSKIP	LIC	ID [+vc]
ko(di)	*!				
kodi	*!			*	
☞ koti					

Input: kod-e, ‘coats (pl.)’

	ID [–vc]	(TN)	NOSKIP	LIC	ID [+vc]
☞ ko(d-e)					
kote					*!
kod-e				*!	

What do we learn from Loanwords?

- **Ernestus and Baayen (2003):** Dutch speakers experimentally confronted with non-words ending in a voiceless obstruent often reanalyze these as ending underlyingly in the corresponding voiced obstruent based on the lexical frequency of similar words in the language.
- **Nevins and Vaux (2006):** Similar results for Turkish
- Luo also has final devoicing, and regularly patterning loanwords, hence it is difficult to draw any conclusions from the behaviour of loanwords

Regularly patterning loanwords

	sg	**pl**		
a.	cak	cag-ɛ	‘chalk’	(English; Okoth-Okombo, 1982:54)
b.	buk	bug-e	‘book’	(English; Okoth-Okombo, 1982:54)

Nominal Possession Forms

Bare Root	ki:**d**i		‘a stone’
	stone		
Possession Form	ki**t**	gôt	‘a stone from a hill’
	stone	hill	

Bare Root	o:**t**		‘a nest’
	nest		
Possession Form	o**d**	winyó	‘a bird’s nest’
	nest	bird	

Problem: Word-final [+voiced] obstruent

Pronominal Possession Forms

o:**t** , ‘house’

	sg		pl	
1	o:**d**-á	‘my house’	o:**d**-wá	‘our house’
2	o:**d**-í	‘your (sg.) house’	o:**d**-ú	‘your (pl.) house’
3	o:**d**-e	‘his house’	o:**d**-gí	‘their house’

ki:**d**i, ‘stone’

	sg		pl	
1	ki:**t**-á	‘my stone’	ki:**t**-wá	‘our stone’
2	ki:**t**-í	‘your (sg.) stone’	ki:**t**-ú	‘your (pl.) stone’
3	ki:**t**-e	‘his stone’	ki:**t**-gí	‘their stone’

Analysis of Nominal Possession Forms

- At the word-level nominal possession forms have the same morphology as pronominal possession forms which is truncated at the phrase level
- “Polarity” is phonologically transparent at the word level and opaque at the phrase level

Derivation of Nominal Possession Forms

Root	**Affixation**	Pron.Poss.	**Truncation**	Nom.Poss.
o:**t**	→	o:**d**-e	→	o**d**
ki:**d**i	→	ki:**t**-e	→	ki**t**
		Voicing Alternations		

instead of

Root	**Truncation + Polarity**	Nom.Poss.
o:**t**	→	o**d**
ki:**d**i	→	ki**t**

Evidence for the 2-Step Derivation

Root	**Plural**	**Pron. Poss**	**Nom.Poss.**	
í:p	i:p-e	í:**w**-ê	í**w**	‘tail’
mo	mó:dh-î	mó**r**-ê	mó**r**	‘oil,fat’
rawe:ra	rawé:r-ê	rawe:**c**é	rawe**c**	‘boy’

➔ Irregular stem changes of Nom.Poss.
always follow stem change of Pron.Poss.

Apparent Manner Polarity

	sg	**pl**		
a.	bɐ:wo	bɐ́:p-ê	‘plank’	(Swahili, p. 127)
b.	lă:w	lé:p-ê	‘cloth’	(p. 128)
c.	lɛ́:p	le:w-e	‘tongue’	(p. 128)

The General Picture

- The lɛ́:p → le:w-e case is exceptional
- All other cases of manner alternations involve consistent stopping of sonorants

Regular Manner Alternations in C-final Nouns

	sg	**pl**		
a.	i:m	i:mb-e	‘ram’	(p. 129)
b.	tê:n	te:nd-e	‘neck rest’	(p. 129)
c.	pí:ɲ	pɪ:ɲɟ-ɛ	‘country’	(p. 129)
d.	wa:ŋ	wé:ŋg-ê	‘eye’	(p. 129)
e.	bu:l	bu:nd-e	‘drum’	(p. 129)
f.	bʊ:r	bʊ:c-ɛ	‘ulcer’	(p. 128)
g.	ɔ:r	ɔ́:c-ɛ̂	‘brother-in-law’	(p. 128)

Regular Manner Alternations in V-final Nouns

	sg	**pl**		
a.	ja:mɔ	jé:mb-ê	‘wind’	(p. 129)
b.	pɪ:nɔ	pí:nd-ɛ̂	‘wasp’	(p. 129)
c.	ɲɪ:ɲɔ	ɲí:ɲɟ-ɛ̂	‘iron’	(p. 129)
d.	lɔ:ŋɔ	lɔ́:ŋg-ɛ̂	‘hernia’	(p. 129)
e.	hʊ:la	hʊ́:nd-ɛ̂	‘wax’	(p. 129)
f.	ga:ra	gé:c-ê	‘leg bell’	(p. 128)
g.	gɐ:ri	gé:c-ê	‘vehicle’	(p. 128)

Other Alleged Cases of Polarity Mutation

- Nichols (1971): exchange of *s* and *ʃ* in Sahaptin diminutive formation – data are unclear (Cole, 1987:43-45)
- Consonant alternations in Southern Lwoo languages (Adhola, Alur, Acholi, Kumam, and Lango)
- Tiberian Hebrew Stem-Vowel Allomorphy
- Vowel length exchanges in Western Nilotic (e.g. Nuer & Dinka)
- Vowel length exchanges in other languages

Consonant Alternations in Other Southern Lwoo Languages

Adhola			Alur			Acholi			Kumam			Lango		
sg	**→**	**pl**	**sg**	**→**	**pl**	**sg**	**→**	**pl**	**sg**	**→**	**pl**	**sg**	**→**	**pl**
t		d	t		ɗ	t		d	t		d	t		d
k		g	k		g	k		g	k		g	k		g
θ		ð	θ		ð									
p		w												
									c		j			
									b		p			
												d		t
r		c	r		c	r		c	r		c	r		c
						j		c				j		c
m		mb												
n		nd̪												
m		nd												
ŋ		ŋg	ŋ		ŋg									

Stem Vowel Polarity in Tiberian Hebrew (SPE:356)

	Alternation	**Perfect**	**Imperfect**	
Class1	a → o	lam**a**d	jilm**o**d	‘learn’
Class2	o → a	qat**o**n	jiqt**a**n	‘be small’
Class3	e → a	zaq**e**n	jizq**a**n	‘age’

Morphological Analysis of Tiberian Hebrew Stem-Vowel Allomorphy

Class1	$\leftrightarrow$	o /____Imperfect
Class2	$\leftrightarrow$	o /____Perfect
Class3	$\leftrightarrow$	e /____Imperfect
Class	$\leftrightarrow$	a

Length Exchange in Nuer/Dinka Plural Formation

"The morphological alternations of the noun in Nuer (especially of the nominative singular and plural) are of specific typological interest as they demonstrate a rate of irregularity that is highly unusual. I have shown that no singular process can be invoked to account for even a quarter of the data with regards to singular and plural." (Wright, 1999)

Similar results for Dinka in Ladd & al. (2007)

Summary

Voicing polarity in Luo . . .

- is problematic for distinctivity-based accounts
- reduces to phonological constraints and opacity

Polarity mutation . . .

- might well be non-existent

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