

Shilluk (Gilley 1992)

Shilluk is a Western Nilotic language from the Northern Luo sub-group. It is spoken in southern Sudan. The following is a brief review of the Luo language from Wikipedia (<http://en.wikipedia.org/wiki/Luo>):

“Origins in Sudan

According to ethnologists, linguists and [oral history](#), the Luo are part of the [Nilotic](#) group of tribes who separated from the [East Sudanic](#) family of tribes about 3000 BCE. More than eight centuries ago, the Luo people occupied the area that now lies in eastern [Bahr el Ghazal](#). The reason for their dispersion from this area is not known. Internal conflicts or population explosion could have driven them from this region. The Luo moved to nearly all the countries neighbouring [Sudan](#), resulting in many separate groups with variation in language and tradition as each group moved further away from their kin.

A branch of the Luo, the [Shilluk](#) (or Chollo) nation, comprising more than one hundred clans and sub-tribes, was founded by Nyikango sometime in the middle of the [15th century](#). They evolved a nation with a feudal-style system. Nyikango and his nation moved northward along the Nile (towards [Kush](#) and [Rip](#)) to re-conquer and settle the land their ancestors had lost to the [Arabs](#) and [Europeans](#).

The rest of the Luo groups rejected Nyikango's idea and kept a south and westwards migration.

Uganda

Around 1500, a small group of Luo known as the Biito-Luo led by a Chief called Labongo whose full title became Isingoma Labongo Rukidi (sometimes named as Mpuga Rukidi), encountered Bantu-speaking peoples living in the area of [Bunyoro](#). These Luo settled peacefully with the Bantu and, through political influence, established the Babiito dynasty. Labongo, the first in the line of the Babiito kings of [Bunyoro-Kitara](#) is said to have been the twin brother of Kato Kimera, the first king of [Buganda](#). These Luo were assimilated by the Bantu, and they lost their language and culture.

Later in the 16th century, other Luo-speaking people moved to Northern Uganda, forming the [Alur](#) (who also live in North-Eastern [DR Congo](#)) and [Acholi](#). There they encountered the [Lango](#) who had been living in the region. Soon conflicts developed, and the Lango settled north of [Lake Kyoga](#). Lango also speak the Luo language, but their origins are somewhat obscure. It is generally held that they are an [Eastern Nilotic Ateker](#) people who originated from [Abyssinia](#) in [Ethiopia](#) around A.D. 1600, adopting the Luo language of their Acholi neighbours - sometimes it is said they are part of the Luo from [Bahr el Ghazal](#) who migrated eastwards from Sudan to [Anuak](#) in Ethiopia and onwards to Uganda. [Kumam](#) also speak Luo, but belong to the Ateker family along with the [Teso](#) and [Karamojong](#).

Between the middle of the 16th century and the beginning of the 17th century, some Luo groups proceeded eastwards. One group called [Padhola](#) (or *Jopadhola* - people of Adhola), led by a chief called Adhola, settled in [Budama](#) in Eastern Uganda. They settled in a thickly forested area as a defence against attacks from Bantu neighbours who had already settled there. This self-imposed isolation helped them to maintain their language and culture amidst Bantu and Ateker communities.

Kenya and Tanzania

Between 1550 and 1800, other Luo groups crossed into [Kenya](#). They inhabited the province of [Nyanza](#) on the banks of [Lake Victoria](#), and today some Luo also live in [Tanzania](#). According to Kenyan Luo oral history, a warrior chief named Ramogi Ajwang led them from present-day Uganda into present-day Kenya circa 400 years ago.

As in Uganda, some non-Luo people in Kenya have adopted the Luo language. A majority of the [Bantu Suba](#) people in Kenya speak Luo (albeit mostly as a second language).

The Luo in [Kenya](#), who call themselves [JoLuo](#) (aka *Jaluo*, people of Luo), are the third largest community in Kenya after the [Kikuyu](#) and [Luhya](#). They call their language [Dholuo](#), which is mutually intelligible the languages of the Lango, Kumam and Padhola of Uganda, Acholi of Uganda and Sudan and Alur of Uganda and Congo.”

Shilluk Segments

This language has a rather large surface segment inventory - 80 to 99 segments depending on how one interprets Cj and Cw (clusters, CV sequences or consonants with secondary articulations). I will take the conservative view that there are no phonological secondary articulations in this language and that consonants can form clusters with glides. This leaves us with 60 consonants and 20 vowels, as shown in (1) and (2).¹

(1) Phonetic consonant inventory (60)

bilabial				labio-dental	dental				alveolar				palatal				velar			
voi	asp	tns	lng		voi	asp	tns	lng	voi	asp	tns	lng	voi	asp	tns	lng	voi	asp	tns	lng
p	b	p ^h		p:		t	d	t ^h		t:	t	d	t ^h		t:	c	j	c ^h		c:
											tʃ	dʒ	tʃ ^h		tʃ:	cç	jz	cç ^h		cç:
					f	v					ʃ					ç	z			
	m		m'	m:		ɱ		ɱ'	ɱ:		n		n'	n:		ɲ		ɲ'	ɲ:	
											l		l'	l:						
											r		r'	r:						
	w		w'	w:												j		j'	j:	

(2) Phonetic vowel inventory (20)

	Front		Central	Back/round	
High	i i:	ɨ ɨ:			u u:
High-mid					o o:
Low-mid		ɛ	ɜ ɜ:		ɔ ɔ:
High-low			æ:	ɐ	
Low			a a:	ɑ:	

Let us begin by looking more closely at the vowel system. First, the phonetic inventory makes use of four degrees of duration, where the ATR vowels are longer than non-ATR

¹ This is a tonal language, and tone plays a vital role both within the phonology and morphology. However, I will ignore tone here while acknowledging the risk of potentially missing vital information about the segmental phonology that tones may provide. Part of the motivation for this is that Gilley does not always transcribe tones, and part of the motivation is because I have not had enough time to figure out the tonal system.

vowels. Second, there is an asymmetry in the distribution of ATR and non-ATR vowels. In the back/round area, there are no non-ATR high vowels and no ATR low-mid vowels. In the central area, there is no non-ATR short vowel in the high-low area and no short ATR vowel in the low area. Finally, there is no long non-ATR vowel in the low-mid area and no short non-ATR vowel in the high-low area when one looks at the front vowel space. If one compares the distribution of short non-ATR, short ATR, long non-ATR and long ATR vowels, one sees that each is a balanced 5-vowel system. This is shown in (X).

(3) Controlling for length and ATR, we get a very balanced 5-vowel system.

	short		long	
non-ATR	i	o	i:	o:
	ɛ	ɔ	æ:	ɔ:
	a		a:	
ATR	ị	ụ	ị:	ụ:
	ɛ̣	ɔ̣	ɛ̣:	ɔ̣:
	ə̣		ạ:	

Given the different formant structure of phonologically related vowels in different length and ATR contexts, we can clearly see that phonetics and phonology are not 1:1 - e.g. what is transcribed by Gilley as [o] (note there is no [u]) corresponds to [ụ]. If we abstract away from the phonetic realization just a little, we get the following contrastive vowel inventory for Shilluk.

(4) Contrastive vowel inventory

	Front		Central	Back/round
High	i(:)	ị(:)		u(:) ụ(:)
Mid	e(:)	ɛ̣(:)		o(:) ɔ̣(:)
Low			a(:) ạ(:)	

Note that the height allophony seen in some of the ATR/non-ATR vowel pairs is in some sense both phonetic and phonological allophony. It is phonetic in that the phonological height features are taken to be identical despite significant phonetic height differences. However, it is phonological in that the phonetic height difference actually provides a cue that the segments are phonologically different. However, the phonological difference is one of place, not height. Because phonetic realization and phonological identity are not always 1:1, I will make use of the following transcription conventions: []=phonetic form, // = surface phonology, /// = underlying phonology.

(5) shows contrasts between long and short ATR and non-ATR vowels. Morpheme boundaries are indicated in the phonological transcription, but not the phonetic transcription.

(5) Examples of vowels

a. [bi]	/bi/	to come	[bḭ]	/bḭ/	termite
b. [ki:]	/ki:/	Nile River	[kḭ:]	/kḭ:/	falcon
c. [dot]	/dʊt/	tumble bugs	[dḭt]	/dḭt/	loin cloth
d. [do:r]	/du:r/	heat rash	[bḭ:r]	/bḭ:r/	hole
e. [jɛp]	/iep/	to open	[jɛp]	/iep/	tail
f. [jæ:jɔ]	/ie:i-o/	hair	[jɛ::jɔ]	/ie:i-ɔ/	rat
g. [dɔŋɔ]	/dɔŋ-o/	Juba person	[dḭɔŋɔ]	/dḭɔŋ-ɔ/	basket
h. [gɔ:l]	/go:l /	Wild Dog	[gḭ:l]	/gḭ:l/	fireplace in barn
i. [lwak]	/luak/	barn	[lwɛk]	/luak/	pride
j. [ga:gɔ]	/ga:g-o/	button	[gḭ:gḭ]	/gḭ:g-ɔ/	to mock

Moving on to consonants, there are several interesting observations to make. First, several of the phonetic forms given in (1) are in free variation according to Gilley (1992), while others occur only in very particular environments. The alveolar and palatal affricates and fricatives occur as “alternative pronunciations” for the palatal stops, while the labio-dental fricatives vary with the bilabial stops.

(6)

a. [pḭk]~[fḭk]	/pḭk/	soft-shelled turtle
b. [bḭk]~[vḭk]	/bḭk/	to dig
c. [cak]~[tʰak]~[tʰɛak]~[ʃak]~[ɕak]	/cak/	to start
d. [jak] ~[dʒak]~[dʒak]	/jak/	to rule

The long consonants appear only intervocalically and only in “deliberate” speech. In “normal” and “rapid” speech, the long stops surface with aspiration and the long sonorants surface as “tense”.

(7)

a. [ʔal:a]~[ʔal'a]	/ʔal:-a/	to cook
b. [ciŋ:ɛ]~[ciŋ'ɛ]	/ciŋ:-e/	his hands
c. [agɐ:k:i]~[agɐ:kʰi]	/a-gak:-i/	raven-plur.
d. [okɔ:t:i]~[okɔ:tʰi]	/u-kɔt:-i/	his hands

Keeping this in mind, we can collapse part of the consonant chart, as in (8).

(8) Phonetic consonant inventory showing phonetic variation

bilabial		dental		alveolar		palatal			velar	
voi	lng	voi	lng	voi	lng	voi	lng		voi	lng
p~f	b~v	p:~pʰ	t̪ d̪	t̪:~t̪ʰ	t d	t:~tʰ	c~tʃ~cɕ~ʃ~ɕ	ɟ~dʒ~ɟʒ~ʒ	k	g
	m	m:~mʰ	ɲ	ɲ:~ɲʰ	n	n:~nʰ		ɲ	ŋ	ŋ:~ŋʰ
					l	l:~lʰ				
					r	r:~rʰ				
	w	w:~wʰ					j	j:~jʰ		

Of the remaining consonants, there are positional neutralizations. Voiced obstruents always devoice in coda positions, both word-finally and word-medially. Because of the syllable structure restrictions of the language, medial devoicing is seen only in those cases where voiced stops become long.

(9)

- a. [lwæ:do] /lue:d-o/ finger
 b. [lwet] /luet/ finger-plur.
 c. [apɔ::di] /a-pɔ:di/ calabash
 d. [apot:i]~[apot^hi] /a-put:-i/ calabash-plur.

Finally, there is a consonant place restriction within roots. All non-palatal coronal stops must match in place - all dental or all alveolar. This suggests that these segments are similar to one another in a way that excludes the other coronals.

(10)

- a. [aɖɹ̥:t] /a-ɖɹ̥t/ stinger-sing. versus [ɖɹ̥:t] /ɖɹ̥t/ loin cloth-sing.
 b. [ti̥:n] /ti̥ n/ small versus [ti̥:n] /ti̥ n/ today-sing.

If we take consonant length to be a suprasegmental, not a segmental property (e.g. moraic theory), and glides to be non-nuclear vowels, then the contrastive consonants of Shilluk are given in (11). Note that we have gone from a phonetic inventory of 60 or more consonants to only 17 featurally distinct phonological consonants.

(11) Initial onset consonant inventory showing phonetic variation

bilabial		dental		alveolar		palatal				velar	
p~f	b~v	t̪	ɖ̪	t	d	c~tʃ~c̥~ɟ̥	ɟ̥~dʒ~ɟ̥~ʒ̥			k	g
	m		ɳ̪		n		ɲ̪				ŋ
					l						
					r						

These segments are demonstrated in onsets in (12).

(12)

- a. [pɹ̥:k]~[fɹ̥:k] /pɹ̥k/ soft-shelled turtle
 b. [bɹ̥:k]~[vɹ̥:k] /bɹ̥k/ to dig
 c. [t̪ɔl] /t̪ɔl/ rope
 d. [ɖ̪ɔk] /ɖ̪ɔk/ mouth
 e. [t̪ɔŋ] /t̪ɔŋ/ spear
 f. [ɖ̪ɔk] /ɖ̪ɔk/ pot
 g. [cɔk]~[tʃɔk]~[c̥ɔk]~[ɟ̥ɔk]~[ɟ̥ɔk] /cɔk/ to start
 h. [ɟ̥ɔk]~[dʒɔk]~[ɟ̥ɔk] /ɟ̥ɔk/ to rule
 i. [kɔk] /kɔk/ to split
 j. [gɔk] /gɔk/ bracelet
 k. [mɔk] /mɔk/ to catch
 l. [aɳ̪ɹ̥:t] /a-ɳ̪ɹ̥t/ type of fish

m. [t̪i·n̪]	/t̪in̪/	small
n. [an̪p̪]	/a-n̪ap̪/	branch of tree
o. [t̪i·n̪]	/t̪in̪/	today
p. [ɲan̪]	/ɲan̪/	crocodile
q. [ɲan̪]	/ɲan̪/	person
r. [lɛk]	/lɛk/	pestle
s. [rɛk]	/rɛk/	necklace

Syllable Structure

Syllable structure in this language is quite restricted. No clusters are allowed, except onsets beginning with a consonant followed by a glide. Most syllables are heavy (contain a long vowel and/or coda), but the following shapes are all attested: V, CV, VC, CVC, CVVC, CGVVC, (VVC?). In addition, most consonants can appear as geminates intervocalically. The exceptions are the voiced stops, which devoice. The rest of the geminates are phonetically realized as short aspirated stops or short “tense” sonorants in casual/fast speech.

The most interesting thing about syllable structure from our perspective in this paper is that onsets may only be C, G or CG, excluding *[rw] and *[wj], and C-[j] onsets may only be followed by /e(:), ɛ(:), a(:), ʌ(:)/. Examples of the glide clusters are given in (13) through (15). (13) shows Cj, (14) shows Cw, (15) shows combinations of Cw with a variety of vowel qualities.

(13)

a. [pjɛ·w]~[fjɛ·w]	/piɛu/	heart
b. [bjɛl]~[vjɛl]	/biɛl/	millet
c. [t̪jɛw]	/t̪ieu/	also
d. [d̪jɛ·ŋ]	/d̪iaŋ/	cow
e. [ot̪jɛ·m]	/u-tiɛm/	dragonfly
f. [djɛl]	/diɛl/	goat
g. [ɕjɛ·ŋ]~[t̪j̥jɛ·ŋ]~[t̪ɕj̥ɛ·ŋ]~[ʃj̥ɛ·ŋ]~[ɕj̥ɛ·ŋ]	/ciaŋ/	sun
h. [t̪j̥ɛ·k]~[d̪ɕj̥ɛ·k]~[d̪ʒj̥ɛ·k]	/ɕiɛk/	2nd milling
i. [kj̥ɛ·ɲ]	/kiɛɲ/	horse
j. [gj̥ɛ·k]	/giɛk/	Nile lechwe
k. [amj̥ɛ·l]	/a-miɛl/	stubborn
l. [ɲja:jɔ]	/ɲia:i-o/	fish trapped by flooding
m. [ɲjɛl]	/ɲiɛl/	to trundle
n. [lj̥ɛ·c]~[lj̥ɛ·t̪ʃ]~[lj̥ɛ·t̪ɕ]~[lj̥ɛ·ʃ]~[lj̥ɛ·ɕ]	/liɛc/	elephant
o. [orjal]	/u-riɛl/	mongoose

(14)

a. [pwɔ̌::dɔ̌]~[fwɔ̌::dɔ̌]	/puɔ̌:d-ɔ̌/	field
b. [bwɔ̌:lɔ̌]~[vwɔ̌:lɔ̌]	/buɔ̌l-ɔ̌/	corn cob
c. [tɔ̌:l]	/tuɔ̌l/	snake
d. [dɔ̌wɔ̌t]	/duɔ̌t/	to rise
e. [otwɛl]	/u-tuel/	type of fish
f. [dwɔ̌r]	/duɔ̌r/	kudu, antelope
g. [cwɔ̌:k]~[tɔ̌wɔ̌:k]~[tɔ̌wɔ̌:k]~[ɬwɔ̌:k]~[ɕwɔ̌:k]	/cuɔ̌k/	type of fish
h. [ɬwɔ̌k]~[dɜ̌wɔ̌k]~[dɜ̌wɔ̌k]	/ɬuɔ̌k/	sickness
i. [kwɛj]	/kuei/	grandfather
j. [gwɔ̌k]	/guɔ̌k/	work
k. [mwɔ̌l]	/muɔ̌l/	morning
l. [onwa:ŋɔ̌]	/u-nua:ŋ-o/	black ants
m. [ɲwɛlɔ̌]	/ɲuel-o/	earthworm
n. [ɲwɛc]~[ɲwɛtɕ]~[ɲwɛtɕ]~[ɲwɛɕ]~[ɲwɛɕ]	/ɲuec/	Nile monitor
o. [lwak]	/luak/	barn

(15)

a. [acwik]~[atɕwik]~[atɕwik]~[aɬwik]~[aɕwik]	/a-cuik/	hip joint
b. [gwɛm]	/guem/	cheating
c. [cwa:gɔ̌]~[tɕwa:gɔ̌]~[tɕwa:gɔ̌]~[ɬwa:gɔ̌]~[ɕwa:gɔ̌]	/cua:g-o/	support
d. [cwɔ̌:gɔ̌]~[tɕwɔ̌:gɔ̌]~[tɕwɔ̌:gɔ̌]~[ɬwɔ̌:gɔ̌]~[ɕwɔ̌:gɔ̌]	/cuɔ̌:g-ɔ̌/	pretense
e. [cwɔ̌r]~[tɕwɔ̌r]~[tɕwɔ̌r]~[ɬwɔ̌r]~[ɕwɔ̌r]	/cuur/	blind person
f. [obwɔ̌:ɲɔ̌]~[ovwɔ̌:ɲɔ̌]	/u-buɲɲ-ɔ̌/	foreigner

Tone

On monosyllables, there are eight possible surface tones - three level and five “contour”. There seems to be no correlation between tone and either segmental type or vowel length. Both level and contour tones appear on syllables closed by all segment types and with long and short vowels. According to Gilley, these tones remain constraint throughout an utterance (i.e. there is no down drift or down step or up step). In a somewhat controversial move, I will assume, like Gilley, that level high and level low tones are sequences of identical tones. However, unlike Gilley, I will assume that mid tone is a complete lack of tone. Thus, any “contour” involving a mid tone is a sequence of two tone-bearing units, one of which is toneless (Morén and Zsiga, 2006). This will be justified later in the paper.

(16) a. level high	[kɔ̌:r]	/kɔ̌r/	wealthy
b. level mid	[kɔ̌:c]	/kɔ̌c/	hunger
c. level low	[kɔ̌:p]	/kɔ̌p/	raid
d. high-null	[bɔ̌::c]	/bɔ̌:c/	outer layers of plant
e. high-low	[bɔ̌:ɲ]	/bɔ̌ɲ/	servant
f. null-high	[bɔ̌'t]	/bɔ̌'t/	arm
g. null-low	[bwɔ̌:c]	/buɔ̌:c/	barren person
h. low-high	[bɔ̌ɕ:c]	/biɕ:c/	cow with horns straight out

Note that there is only one tone combination that does not appear in monosyllables on the surface. At present, the absence of low-null is something of a mystery, but I will return to this below.

(17)

	H	0	L
H	✓	✓	✓
0	✓	✓	✓
L	✓	-	✓

In disyllabic words with prefixes, the prefixes only carry simple tones and there are restrictions on combinations of tone sequences. When the root has a sequence of two identical tones, most combinations are allowed. If we look at only unsuffixed forms, the only restriction is that the prefix can only be null if the root is low. In comparing monosyllabic and prefixed words, it also seems somewhat odd that null-tone sequences allowed on monosyllables (i.e. null-high and null-low) are prohibited in these disyllabic forms. However, prefix-root-suffix combinations do allow these, as well as high+high-null on prefix-roots. This leaves only the null+null combination as a completely illicit on prefix-root combinations.

(18)

- | | | | |
|-------------------|----------|----------|----------------------|
| a. high+high-high | [álám] | /á-lám / | dragnet-sing. |
| b. high+null | [átwēl] | /á-tuel/ | stem of plant-sing. |
| c. high+low-low | [ágàk] | /á-gàk/ | raven-sing. |
| d. high+high-low | [ábîp] | /á-bîp/ | measles-plur. |
| e. high+low-high | [ámǎl] | /á-mǎl/ | camel-plur. (rare) |
| | | | |
| f. null+low-low | [ādwək] | /a-duək/ | gum tree-plur. |
| | | | |
| g. low+high-high | [àḍúṭ] | /à-ḍúṭ/ | stinger of bee-sing. |
| h. low+null | [àbōj] | /à-boi/ | rotten fish |
| i. low+low-low | [àdwəṭl] | /à-duṭl/ | grain |
| j. low+high-low | [àbôn] | /à-bôn/ | measles-plur. |
| k. low+low-high | [əṭjǎk] | /əṭ-iǎk/ | sleeping cover-sing. |

(19)

		Root								
		HH	0	LL	H0	HL	0H	0L	LH	L0
Prefix	H	✓	✓	✓	✓	✓			✓	---
	0	✓		✓						---
	L	✓	✓	✓		✓			✓	---

The situation with suffixed forms is something of a mess, with a range of combinations that seem to defy a direct interpretation. In (20) and (21), “2” indicates a root-suffix sequence and “3” indicates a prefix-root-suffix sequence. We will see below that some of the forms that look like they have singular or plural suffixes actually do not. This will help to resolve the complex tone distribution. The tone combinations in (20) and (21) without parentheses are predicted in the analysis below. Those in parentheses are analyzed as lexically specified.

(20)

		Singular suffix		
		H	0	L
Root	HH	(✓ 2)		(✓ 2)
	0	(✓ 3)	✓ 2	
	LL	(✓ 2,3)		✓ 2,3
	H0	(✓ 3)	✓ 2,3	
	HL	(✓ 3)		✓ 3
	0H			
	0L			✓ 2
	LH			
	L0	---	---	---

(21)

		Plural suffix		
		H	0	L
Root	HH		✓ 2	
	0			
	LL			✓ 2
	H0		✓ 3	(✓ 3)
	HL			✓ 2
	0H			
	0L			
	LH			
	L0	---	---	---

Voicing in Shilluk - data from Gilley (1992)

One of the most talked about bits of Luo phonology has to do with voicing alternations in plural formation (Alderete 2001, Trommer 2006). On the one hand, Alderete cites data and suggests that voice switches polarity from singular to plural, and from this he argues the need for transderivational antifaithfulness constraints in OT. In contrast, Trommer points to flaws in Alderete’s analysis, the largest being empirical coverage since there are “well-documented data” that Alderete does not cite and cannot account for. To account for all of the data, Trommer proposes the need for a 3-way voicing contrast using a binary feature [+ voice] combined with feature underspecification and a constraint against intervocalic voicing across a morpheme boundary. Bye (2006) has shown that a more careful look at the data of DhoLuo reveals a complex interaction between phonology and morphology that shows no evidence of either exchange rules (contra Alderete) or a binary voice feature (contra Trommer).

The questions are: 1) What is the distribution of voicing in Shilluk Luo? 2) Does it have the same pattern as in DhoLuo? 3) How might one account for the distribution of voicing in Shilluk if one assumes a feature theory with only privative features?

Not surprisingly, the data for Shilluk are actually even more complicated than the descriptions that Trommer and Bye present for DhoLuo. There are intricate relationships between vowel length, consonant length, voicing, aspiration, “tensing”, tone and morphology. In what follows, I will attempt to untangle these variables and provide a detailed description (if not analysis) of the facts. With any luck, the description/analysis provided here will integrate well with the DhoLuo facts/analysis.

Nominal Morphology

Since the controversy about DhoLuo voicing revolves around the plural formation, it is important to begin with a detailed description of nominal morphology. Nouns are composed of (usually) monosyllabic roots of the shape CV(:)C(:), to which a variety of prefixes and suffixes can attach. The prefix system is limited but semantically complex. There seem to be only /a-, o-, di-, ni-, ja-, ʔa-, ba-/ , which correspond very loosely to a range of semantic properties. According to Gilley, they may have once been part of a gender system, but seem to act as derivational formatives today (change the meaning of one word into another with only loose connection to semantic gender). Examples are:

(22) Personal names

	<u>Male</u>	<u>Female</u>
a.	[oɬɔw] /u-ɬou/	[ɲaɬɔw] /ɲa-ɬou/
b.	[awɯl] /a-uɯl/	[apar] /a-par/

(23) Cattle names

	<u>Male</u>	<u>Female</u>	<u>Child</u>	
a.	[objɛ·c] /u-biɛc/	[abjɛ·c] /a-biɛc/	[ɲibjɛ·c] /ɲi-biɛc/	extra long horns
b.	[didɯ·k] /di-dɯk/	[adɯ·k] /a-dɯk/	[ɲidɯ·k] /ɲi-dɯk/	dark gray
c.	[dila:l] /di-la:l/	[ola:lɔ] /u-la:l-o/	[ɲila:lɔ] /ɲi-la:l-o/	red
d.	[ditɕ·ŋ] /di-taŋ/	[ota::ŋɔ] /u-ta:ŋ-o/	[ɲita::ŋɔ] /ɲi-ta:ŋ-o/	black
e.	[ɲibɔŋ] /ɲi-boŋ/	[obɔw] /u-bou/	[ɲibɔw] /ɲi-bou/	white

(24) Derived nouns²

a.	[bɯ·l]	/bɯl/	to mend	[a-bɯ·l]	/a-bɯl/	a patch
b.	[lwe:dɔ]	/lue:d-o/	finger	[a-lwe:dɔ]	/a-lue:d-o/	crab
c.	[gwɔk]	/guok/	dog	[o-gwɔk]	/u-guok/	jackal

² Interesting derived compounds: /a-dE:l-iuok/ - butterfly (something with God skin), /a-Nok-rou/ - chameleon (something that vomits itself)

d. [naŋ]	/naŋ/	crocodile	[naŋaŋ]	/na-naŋ/	lizard type
e. [pin]	/pin/	wasp	[ta-pin]	/ta-pin/	hornet
f. [jwan]	/iuan/	to hurry	[bajwan]	/ba-iuan/	*hurry-name
g. [kɔmɔ]	/kom-o/	behind	[di-kɔmɔ]	/di-komo/	back-body part

The suffix system is also quite limited (/o, -i, -a, -e, -uan, -uon, -uun, -gen, -gon, -ani/), but there are also many complications. For our purposes, we will concentrate on the number system. Warning: the number system of Luo is long acknowledged to be complicated. The following is an excerpt from Kohnen (1933: 19), “A general rule for the formation of plurals in Shilluk cannot be given. Practically one has to learn the plural of nouns from the dictionary.” Gilley (1992), among others, concludes that the singular and plural forms both need to be stored underlyingly.

That said, let's look at the basics. The usual description is that nouns fall into at least three classes (ignoring suppletion). Some are “default” singular and do not take a singular suffix, but do take a plural suffix. Some are “default” plural and do not take a plural suffix, but do take a singular suffix. Some are “default” neutral and take both a singular and plural suffix. This can be depicted as in (25), with relevant data in (26).

(25)	<u>Singular</u>	<u>Plural</u>
	marked -o	marked -i
	marked -o	unmarked
	unmarked	marked -i

(26)	<u>Singular</u>	<u>Plural</u>	<u>Gloss</u>
	[acɯ·ŋɔ̣] /a-cɯŋ-ɔ̣ _{sing} /	[acɯ·ŋɔ̣·i] /a-cɯŋ:-i _{plur} /	type of termite
	[wa:rɔ̣] /ua:r-ɔ̣ _{sing} /	[war] /uar _{plur} /	shoe
	[naŋ] /naŋ _{sing} /	[nɐ·ŋɔ̣·i] /naŋ:-i _{plur} /	crocodile

This is a simplistic view that does not cover a large number of noun shapes found in the language. Not only can number be indicated in this purely concatenative way, but it can also be indicated by a combination of other factors. As we will see, there are at least 17 descriptive classes of nouns that make use of different strategies for indicating singular or plural. After I present those descriptive classes, I will use the regularities and irregularities seen in the data to propose a morpho-phonological analysis.

Unaffixed nouns without suppletion

Some nouns differ only in tone.

(27)

Class1	sing	plural	sing	plural	gloss
	kul	kul	LL	LH	pig
	kii	kii	HL	LH	plant with edible roots
	go:l	go:l	0H	0L	wild dog

Some nouns differ only in vowel length.

(28)

Class2	sing	plural	sing	plural	gloss
	giɛk	giɛ:k	LL	LL	Nile lechwe
	baŋ	ba:ŋ	HL	HL	servant
	guok	guo:k	HL	HL	dog
	kuer	kue:r	HH	HH	small lizard
	gok	go:k	LL	LL	white skin bracelet

Some nouns differ in tone and vowel length.

(29)

Class3	sing	plural	sing	plural	gloss
	diɬaŋ	diɬa:ŋ	H.HH	L.HL	black bull
	iɛp	iɛ:p	HH	0L	tail
	gur	gu:r	HL	0L	Nile perch
	kel	ke:l	HH	LL	cheetah
	mok	mo:k	LL	0L	type of fish

Some nouns differ in tone, vowel length and ATR.

(30)

Class4	sing	plural	sing	plural	gloss
	guok	guo:k	0	0L	work
	bat	ba:t	0H	0L	arm
	bak	ba:k	HH	0L	garden
	iuok	iuo:k	0	0L	god

Note that unaffixed forms with a vowel length difference always have long vowels in the plural. This could be that vowel lengthening sometimes indicates the plural, or it could be that the singular is sometimes indicated by consonant moraicity (“lengthening”). The latter would force vowel shortening.

Suffixed nouns without suppletion

In the following discussion, any singular form ending in /-o/, /-ọ/, /-i/ or /-ị/ will be interpreted as having a suffix. This will be revised later.

Some nouns differ only in the presence of a singular suffix.

(31)

Class5	sing	plural	sing	plural	gloss
	ade:ro	ade:r	L.L.L.L	L.LL	donkey

Some nouns differ in the presence of a singular suffix and tone differences. Note that the vowel can be long or short in both singular and plural.

(32)

Class6	sing	plural	sing	plural	gloss
	belo	bel	0L.L	0	taste
	ḍoŋo	ḍoŋ	LL.L	0	Juba person
	curo	cur	HH.L	0L	eel-like catfish
	ḍoŋo	ḍoŋ	0L.L	HH	basket
	ciŋo	ciŋ	LL.L	HH	hand
	ge:lo	ge:l	HH.L	HL	riverbank
	ba:ṇo	ba:ṇ	H0.0	HL	grasshopper

Some nouns differ in the presence of a singular suffix and tone and vowel length differences. Note the syllable-final devoicing.

(33)

Class7	sing	plural	sing	plural	gloss
	ua:ro	uar	LL.L	HL	shoe
	bie:ro	bier	LL.L	0	root
	lue:do	luet	H0.0	HL	finger
	alue:do	aluet	H.H0.0	H.HL	crab

Some nouns differ in the presence of a singular suffix and tone, vowel length and ATR differences.

(34)

Class8	sing	plural	sing	plural	gloss
	bịe:ḷo	biel	LL.H	HH	millet

Note that forms with singular suffixes and a vowel length difference always have long vowels in the singular. This could be that vowel lengthening sometimes indicates the singular, or it could be that the plural is sometimes indicated by consonant moraicity (“lengthening”). The latter would force vowel shortening. **This is the opposite of that in**

unsuffixed forms. Singular suffix ATR value seems completely dependent on the quality of the preceding vowel - harmony.

Some nouns differ in the presence of a plural suffix and tone and consonant length differences.

(35)

Class9	sing	plural	sing	plural	gloss
	akoŋ	akoŋ:i	H.LL	H.H0.L	gazelle
	pam	pam:i	LL	HH.0	table

Some nouns differ in the presence of a plural suffix and tone, consonant length and ATR differences.

(36)

Class10	sing	plural	sing	plural	gloss
	naŋ	naŋ:i	HL	HH.0	crocodile
	kaŋ	kaŋ:i	HH	HL.L	trumpet
	kieŋ	kieŋ:i	0	HH.0	horse

Some nouns differ in the presence of a singular suffix, a plural suffix and tone and consonant length differences.

(37)

Class11	sing	plural	sing	plural	gloss
	acujɔ	acuj:i	H.LL.L	H.HL.L	type of termite

Note that forms with plural suffixes always have a consonant length difference, where the plural has a geminate consonant. This could be that consonant lengthening sometimes indicates the plural, or it could be that the forms that take just a plural suffix always end in a moraic consonant. When unsuffixed, this would not show any additional length, but would if followed by a vowel. Thus, it could be phonologically conditioned allomorphy. Note that the relationship between root and plural suffix ATR value is not as straightforward as in the case of the singular suffix. Class 9 suggests that ATR harmony is root-controlled, but class 10 suggests that it is suffix-controlled.

Unsuffixed nouns with suppletion

Some nouns without suffixes in either the singular or plural show non-trivial differences in consonants and/or vowels, which can co-occur with a range of tone, length and ATR alternations.

(38)

Class12	sing	plural	sing	plural	gloss	Csup	Vsup	ATR	RTR	short	length	tone
	duai	duat			moon/month	✓						?
	pal	pət	0	HL	spoon	✓		✓				✓
	diel	diək	LL	HL	goat	✓		✓				✓
	cuj	coj	HH	0L	knee		✓		✓			✓
	ka:l	kə:t	HL	0L	cattle camp	✓		✓				✓
	luol	lüt	HL	0	gourd	✓	✓	✓				✓
	uic	uət	0	HL	head	✓	✓	✓				✓
	iu:	iɛ:t			road	✓	✓	✓				?
	lu:t	lot	LL	0L	club		✓			✓		✓
	mei	mɛ:k			mother	✓		✓			✓	?
	cuot	cɔ:t	HL	LL	cow w/o horns		✓				✓	✓
	cuur	cɔ:r	ml	LL	blind people		✓	✓			✓	✓
	uii	ue:k			father	✓	✓				✓	?

Note that forms with vowel length differences **usually** have long in the plural. This is just like the non-suppletion cases.

Suffixed nouns with suppletion

Some nouns with only singular suffixes show non-trivial differences in consonants and/or vowels, which can co-occur with a range of tone, length and ATR alternations.

(39)

Class13	sing	plural	sing	plural	gloss	Csup	Vsup	ATR	RTR	short	tone
	le:io	lek	LL.L	0	tooth	✓				✓	✓
	cɔ:gɔ	cɔu	LL.H	0	bone	✓	✓			✓	✓
	rɛ:iɔ	ric	LL.H	HH	fish	✓	✓		✓	✓	✓
	ubuoro	ubuɾ	H.HL.L	HH.0	type of grass		✓	✓			✓

Note that forms with vowel length differences have long in the singular. This is just like the non-suppletion cases.

Some nouns with only plural suffixes show non-trivial differences in consonants and/or vowels, which can co-occur with a range of tone, length and ATR alternations.

(40)

Class14	sing	plural	sing	plural	gloss	Csup	Vsup	ATR	RTR	length	short	gem	tone
	u-guok	u-go:k-i	h.m	h.hl.l	jackal		✓			✓			✓
	ŋu:	ŋur:i	LL	HH.0	lion	✓					✓	✓	✓
	beɬ	biɬ:i			fish spear		✓					✓	?
	ukuor	ukor:i	HH.0	H.HL.L	serval		✓	✓				✓	✓
	pier	pɛr:i	LL	HL.L	lower back		✓	✓				✓	✓
	piɛn	pen:i	0	HH.0	sleeping skin		✓		✓			✓	✓
	tuɔl	tuɫ:i	0	HH.0	snake		✓		✓			✓	✓
	gin	iam:i	LL	HH.0	thing	✓	✓	✓				✓	✓
	gol	kəl:i	HH	HH.0	household	✓	✓	✓				✓	

Note that forms with plural suffixes have a consonant length difference, and the long consonant is in the plural. This is just like the non-suppletion cases.

Some nouns with both singular and plural suffixes show non-trivial differences in consonants and/or vowels, which can co-occur with a range of tone, length, ATR and **voicing** alternations.

(41)

Class15	sing	plural	sing	plural	gloss	Csup	Vsup	ATR	devoi	short	gem	tone
	ukoɖo	ukɔti	L.LL.L	H.HL.L	hedgehog		✓	✓	✓			✓
	bu:ɖo	bɔti	LL.L	HL.L	craftsman		✓	✓	✓			✓
	apuo:io	apuɔc:i	H.LL.L	H.HL.L	rabbit	✓		✓		✓	✓	✓

Note that forms with both a singular and a plural suffix seem to have a voicing alternation. The data for non-suppletion is limited, so I do not know if this can be said there as well. However, note that the forms with voicing differences do not have a geminate in the plural. This is unlike the non-suppletion cases.

Some nouns seem to take an irregular singular suffix that looks like a plural suffix, but no plural suffix. These show non-trivial differences in vowels, and can have tone and ATR alternations.

(42)

Class16	sing	plural	sing	plural	gloss	Vsup	RTR	tone
	aɬiui	aɬeu	H.HH.0	L.LL	small container	✓	✓	✓

Some nouns seem to take an irregular singular suffix that looks like a plural suffix, and a similar plural suffix. These show non-trivial differences in vowels, and can have tone, length, ATR and **voicing** alternations.

(43)

Class17	sing	plural	sing	plural	gloss	Vsup	RTR	devoi	short	gem	tone
	apɔːɖi	aput:i	H.H0.0	H.H0.0	calabash	✓	✓	✓	✓	✓	

The irregular singulars ending in [-i] suggest that perhaps these are not suffixes, but a part of the root. This would be the one exception to the generalization that roots in this language end in a consonant (i.e. CV(:)C(:)).

Stop-nasal alternations

Before moving on to an interpretation of the nominal morpho-phonology of Shilluk, one final morpho-phonological alternation should be mentioned. Specifically, there are morphologically motivated alternations between stops and nasals, where the addition of the *-áni* referential determiner causes a preceding stop of singular nouns to surface as a homorganic nasal. Similarly, the *-e* possessive causes a preceding stop of derived singulars (those ending in what looks like a singular suffix) to also surface as a homorganic nasal. This suggests that there is a minimal featural difference between the stops and the nasals and that this alternation is intricately connected to the morphology. Gilley claims that these alternations are only between voiced stops and nasals, but we see in (47) that voiceless stops also participate in morphological nasalization.

(44) Plural forms of underived and derived singular roots ending in voiced stops - only syllable-final devoicing

- | | | | |
|---|--------------|-------------------|------------|
| a. [gwɔːk] | /guɔːk/ | dog-plur. | -devoicing |
| b. [gwɔːk:ani]~[gwɔːk ^h ani] | /guɔk:-ani/ | this dog-plur. | -devoicing |
| c. [gwɔːk:ɛ]~[gwɔːk ^h ɛ] | /guɔk:-e/ | dog-plur.poss. | -devoicing |
| d. [lwet] | /luet/ | finger-plur. | -devoicing |
| e. [lwet:ani]~[lwet ^h ani] | /luet:-ani / | this finger-plur. | -devoicing |
| f. [lwet:ɛ]~[lwet ^h ɛ] | /luet:-e / | finger-plur.poss. | -devoicing |

(45) Singular forms of underived singular roots ending in voiced stops - devoicing, nasalization or no change depending on the context

- | | | | |
|---------------|-------------|----------------|---------------|
| a. [gwɔːk] | /guɔk/ | dog-sing. | -devoicing |
| b. [gwɔːɲani] | /guɔːɲ-ani/ | this dog-sing. | -nasalization |
| c. [gwɔːgɛ] | /guɔːg-e/ | dog-sing.poss. | -no change |

(46) Singular forms of derived singular roots ending in voiced stops- nasalization or no change depending on the context

- | | | | |
|--------------------------|-------------|-------------------|---------------|
| a. [lwæ:do] | /lue:d-o/ | finger-sing. | -no change |
| b. [lwɛn:ani]~[lwɛn'ani] | /luen:-ani/ | this finger-sing. | -nasalization |
| c. [lwɛn:ɛ]~[lwɛn'ɛ] | /luen:-e/ | finger-sing.poss. | -nasalization |

(47) Singular forms of underived singular roots ending in voiceless consonant - no change and nasalization depending on the context

- | | | | |
|-----------------|----------------|------------------------|-------------------|
| a. [acwəṭː] | /a-cuəṭ/ | guinea fowl-sing. | -no change |
| b. [acwəṭːnani] | /a-cuəṭːnani / | this guinea fowl-sing. | -nasalization |
| c. [acwəṭːtɛ] | /a-cuəṭːt-e / | guinea fowl-sing.poss. | -no change |

(48) Singular forms of derived singular roots ending in nasal consonant - no change

- | | | |
|------------------------|------------|-----------------|
| a. [pi:nɔ] | /pi:n-o/ | wasp-sing. |
| b. [pin:ani]~[pin'ani] | /pin:-ani/ | this wasp-sing. |
| c. [pin:ɛ]~[pin'ɛ] | /pin:-e/ | wasp-sing.poss. |

Given these patterns, I propose the following morphological analysis. There are two classes of nouns here. Given just these forms, I will call those with underlyingly long vowels and short final consonants the default class³ (to be justified below) and those with underlyingly short vowels and long final consonants class A. The morphemes that attach to these nouns as suffixes are either general (apply to both classes) or class-specific.

- | | | |
|------|----------------------|------------------------|
| (49) | <u>Default nouns</u> | <u>Class A nouns</u> |
| | //guɔːg// | //luedː// _A |
| | //acuəṭː// | //pinː// _A |

- | | | |
|------|-------------------------------|--------------------------------|
| (50) | <u>Singular</u> | |
| | //geminate// _{sing.} | //long, o// _{sing. A} |

- | | |
|------|----------------------------|
| (51) | <u>Plural</u> |
| | Unmarked for these classes |

- | | |
|------|-------------------------------|
| (52) | <u>Referential determiner</u> |
| | //stop, ani// _{ref.} |

- | | |
|------|---------------------------------------|
| (53) | <u>Plural referential determiner</u> |
| | //geminate, ani// _{ref. pl.} |

- | | | |
|------|------------------------|--------------------------------|
| (54) | <u>Possessive</u> | |
| | //e// _{poss.} | //stop, e// _{poss. A} |

- | | |
|------|--------------------------------------|
| (55) | <u>Plural possessive</u> |
| | //geminate, e// _{poss. pl.} |

How to actually get the vowel lengthening and consonant lengthening to work out is still a mystery to me. Keep in mind that this is just a preliminary descriptive analysis and perhaps needs to be revised significantly to get it to work using real phonological technology. I will not worry about that here. Another controversial move being made here is the claim that the feature that conditions nasalization is a “stop” feature. Foreshadowing the featural analysis to be given below, I claim that plain “stops” are mannerless and just have place features, the

³ Things are more complicated than this since there are other irregularities involved in what I call the default class that lead to the conclusion that not all of these are “default”. However, I do not have the time (or data) available at the moment to do a full morphological investigation.

voiced “stops” have just place and a voice feature, and “nasals” have place and a stop feature (i.e. C-manner[closed]).

As we see in (56) through (59), combining these morphemes gets the correct result.

(56)

a. //guɔ:g// + //geminate// _{sing.}	-->	/guɔk:/ _{sing.}	dog-sing.
b. //guɔ:g//	-->	/guɔ:k/	dog-plur.
c. //guɔ:g// + //stop, ani// _{ref.}	-->	/guɔ:ɲani/ _{ref.}	this dog-sing.
d. //guɔ:g// + //geminate, ani// _{ref. pl.}	-->	/guɔk:ani/ _{ref. pl.}	this dog-plur.
e. //guɔ:g// + //e// _{poss.}	-->	/guɔ:ge/ _{poss.}	dog-sing.poss.
f. //guɔ:g// + //geminate, e// _{poss. pl.}	-->	/guɔk:e/ _{poss. pl.}	dog-plur.poss.

(57)

a. //a-cua:t// + //geminate// _{sing.}	-->	/acuɑt:/ _{sing.}	guinea fowl -sing.
b. //a-cua:t//	-->	?/acuɑ:t/	guinea fowl -plur.
c. //a-cua:t// + //stop, ani// _{ref.}	-->	/acuɑ:ɲani/ _{ref.}	this guinea fowl -sing.
d. //a-cua:t// + //geminate, ani// _{ref. pl.}	-->	/acuɑt:ani/ _{ref. pl.}	this guinea fowl -plur.
e. //a-cua:t// + //e// _{poss.}	-->	/acuɑ:te/ _{poss.}	guinea fowl-sing.poss.
f. //a-cua:t// + //geminate, e// _{poss. pl.}	-->	?/acuɑt:e/ _{poss. pl.}	guinea fowl -plur.poss.

(58)

a. //lued:// _A + //long, o// _{sing.}	-->	/lue:do/ _{A sing.}	finger -sing.
b. //lued:// _A	-->	/luet:// _A	finger -plur.
c. //lued:// _A + //stop, ani// _{ref.}	-->	/luen:ani/ _{A ref.}	this finger -sing.
d. //lued:// _A + //geminate, ani// _{ref. pl.}	-->	/luet:ani/ _{A ref. pl.}	this finger -plur.
e. //lued:// _A + //stop, e// _{poss. B}	-->	/luen:e/ _{A poss.}	finger -sing.poss.
f. //lued:// _A + //geminate, e// _{poss. pl.}	-->	/luet:e/ _{A poss. pl.}	finger -plur.poss.

(59)

a. //pin:// _A + //long, o// _{sing.}	-->	/pi:no/ _{A sing.}	wasp -sing.
b. //pin:// _A	-->	?/pin:// _A	wasp -plur.
c. //pin:// _A + //stop, ani// _{ref.}	-->	/pin:ani/ _{A ref.}	this wasp -sing.
d. //pin:// _A + //geminate, ani// _{ref. pl.}	-->	?/pin:ani/ _{A ref. pl.}	this wasp -plur.
e. //pin:// _A + //stop, e// _{poss. B}	-->	/pin:e/ _{A poss.}	wasp -sing.poss.
f. //pin:// _A + //geminate, e// _{poss. pl.}	-->	?/pin:e/ _{A poss. pl.}	wasp -plur.poss.

Once we have these morphemes, we can then try to apply them to other types of nouns.

Gilley points out that some nouns have vowels that undergo length alternations within the singular paradigm. Some of these were shown in (56) through (59). However, other nouns have consistently short vowel or consistently long vowels. Since I am defining class A as the special case of nouns ending in geminate consonants, it should not be surprising to not find class A nouns with consistently long vowels.

(60) Consistently short vowel

- | | | |
|--------------|-----------|-------------------|
| a. [abon] | /abun:/ | pastor-sing. |
| b. ??? | | |
| c. [abonani] | /abunani/ | this pastor-sing. |
| d. [abone] | /abune/ | pastor-sing.poss. |

(61) Consistently long vowel

- | | | |
|------------------|----------------|---------------------|
| a. [go:l] *[gɔl] | /go:l/ */gɔl:/ | wild dog-sing. |
| b. [go:l] | /go:l/ | wild dog-plur. |
| c. [go:lani] | /go:lani/ | this wild dog-sing. |
| d. [go:lɛ] | /go:le/ | wild dog-sing.poss. |

(62) Consistently long vowel

- | | | |
|---------------|------------|--------------------|
| a. [ade:rɔ] | /ade:ro/ | donkey -sing. |
| b. [ade:r] | /ade:r/ | donkey -plur. |
| c. [ade:rani] | /ade:rani/ | this donkey -sing. |
| d. [ade:rɛ] | /ade:re/ | donkey -sing.poss. |

(63) Consistently short vowel - class A

- | | | |
|------------------------|-----------------|-------------------|
| a. [ɖɔ·ŋɔ·] *[ɖɔ::ŋɔ·] | /ɖɔŋɔ/ */ɖɔ:ŋɔ/ | basket-sing. |
| b. [ɖɔ·ŋ] | /ɖɔŋ:/ | basket-plur. |
| c. [ɖɔ·ŋ:ani] | /ɖɔŋ:ani/ | this basket-sing. |
| d. [ɖɔ·ŋ:ɛ] | /ɖɔŋ:ɛ/ | basket-sing.poss. |

What is odd about these is that morpheme concatenation should always lengthen some vowels and shorten others depending on the noun class and paradigm cell. To account for this exceptional behavior, we could propose more noun classes and more suffix allomorphy, or we could claim that the exceptional singular forms are lexically stored as root allomorphs. I choose the latter. One important thing to note here is that morphological “nasalization” (phonological stopping) does not apply to liquids due to feature incompatibility. When morphemes containing the stop feature are concatenated to a liquid-final root, the stop feature deletes.⁴

(64) Default class nouns

//abun//
 //go:l//_{sing.} //go:l//
 //ade:ro//_{sing.} //ade:r//

Class A nouns

//ɖɔŋɔ//_{A sing.} //ɖɔŋ:/_A

(65) Consistently short vowel

- | | | |
|---|--------------------------------|--------------------|
| a. //abun// + //geminate// _{sing.} | --> /abun:/ _{sing.} | pastor-sing. |
| b. //abun// | --> /abun/ | pastor -plur. |
| c. //abun// + //stop, ani// _{ref.} | --> /abunani// _{ref.} | this pastor -sing. |
| d. //abun// + //ɛ// _{poss.} | --> /abune// _{poss.} | pastor -sing.poss. |

⁴ As we will see later, this is simplified slightly here. The only consonant that is incompatible with the stop feature is the flap.

(66) Consistently long vowel

- | | | |
|---|-------------------------------|----------------------|
| a. //go:l// _{sing.} | --> /go:l/ _{sing.} | wild dog -sing. |
| b. //go:l// | --> /go:l/ | wild dog -plur. |
| c. //go:l// + //stop, ani// _{ref.} | --> /go:lani/ _{ref.} | this wild dog -sing. |
| d. //go:l// + //e// _{poss.} | --> /go:le/ _{poss.} | wild dog -sing.poss. |

(67) Consistently long vowel

- | | | |
|--|--------------------------------|--------------------|
| a. //ade:ro// _{sing.} | --> /ade:ro/ _{sing.} | donkey -sing. |
| b. //ade:r// | --> /ade:r/ | donkey -plur. |
| c. //ade:r// + //stop, ani// _{ref.} | --> /ade:rani/ _{ref.} | this donkey -sing. |
| d. //ade:r// + //stop, e// _{poss.} | --> /ade:re/ _{poss.} | donkey -sing.poss. |

(68) Consistently short vowel - class A

- | | | |
|---|---------------------------------|--------------------|
| a. //ḍoŋo// _{A sing.} | --> /ḍoŋo/ _{A sing.} | basket -sing. |
| b. //ḍoŋ:// _A | --> /ḍoŋ:/ _A | basket -plur. |
| c. //ḍoŋ:// _A + //stop, ani// _{ref.} | --> /ḍoŋ:ani/ _{A ref.} | this basket -sing. |
| d. //ḍoŋ:// _A + //stop, e// _{poss. A} | --> /ḍoŋ:e/ _{A poss.} | basket -sing.poss. |

Interpreting nominal number morphology

With the preceding as an introduction, we can now move onto a more detailed discussion of the noun number morphology. If one looks closely at the nominal number paradigm, a variety of irregularities seem to only be explained by lexical allomorphy. These include: unexpected consonant alternations, unexpected vowel alternations, and/or unexpected tonal alternations. If we assume that forms with unpredictable characteristics are lexically specified, then we arrive at a view of nominal morphology where a range of regularities emerges. Including at least one more class of nouns. I will call this class B, and it is characterized by taking an -i plural suffix. Unfortunately, I have not had time (or data) enough to completely untangle the morphological system along the lines suggested in the previous section. I leave that for future research. However, the following regularities are suggested by the data.

- The singular and plural suffixes harmonize with the preceding ATR vowel.
- The productive singular suffix is accompanied by vowel lengthening.
- The productive plural suffix is accompanied by consonant gemination.
- The default tone on both singular and plural suffixes is mid (no tone).
- Root //H// spreads leftward from a root to the prefix, but not within the root.
- Root //L// spreads rightward (recall *LM within the root or across a root-suffix boundary).
- Root //H// does not spread rightward.
- Root //L// does not spread leftward.

Summary

As we have seen, nouns can be described on the surface as using a wide range of strategies to indicate a difference between singular and plural - suffixation, tone, length, ATR, laryngeal specification and combinations of these. However, these data can be analyzed as falling into approximately three morpho-phonological classes - each of which may make use of lexical allomorphy. As suggested above, there are ways of analyzing at least some of the nouns as having regular morphology. This contradicts the claims of Kohnen (1933) and Gilley (1992)

that all singular and plural forms need to be stored underlyingly and are not derivable. With regard to the issue of voicing in Shilluk, there is no evidence of the kind of patterns claimed by Alderete and Trommer for DhoLuo. Shilluk seems to have a simple voicing contrast that is neutralized in syllable-final position. The only cases where a voicing alternation is not directly attributable to syllable position are those with exceptionally “devoiced” plural forms that are analyzed here as involving lexical allomorphy and underlyingly non-voiced consonants.

Segmental Analysis⁵

Given the above facts about the segments of Shilluk and their realizations in particular environments, we have to ask what their phonological features are and how one might explain the alternations seen. Let us begin with vowels.

Prefixes and a selection of suffixes never surface with the ATR feature. However, other suffixes (e.g. singular and plural) always agree with the ATR value of the preceding vowel.

(69)

a. [apar]	/a-par/	personal name
b. [abɔ̣ːl]	/a-bɔ̣ːl/	a patch
c. [ola:lɔ̣]	/u-la:l-o/	red cow name
d. [otɔ̣ːɲɔ̣]	/u-tɔ̣ːɲ-ɔ̣/	black cow name
e. [nila:lɔ̣]	/ni-la:l-o/	red calf name
f. [nitɔ̣ːɲɔ̣]	/ni-tɔ̣ːɲ-ɔ̣/	black calf name

Root vowels can have the ATR feature or not depending on the lexical item and the morpheme class (recall that ATR is sometimes associated with the marked member of singular-plural noun pairs). Root vowels seem to sometimes be the target of morphological ATR but not the target of harmony triggered by a suffix.

Using the PSM, we might interpret the facts in the following ways:

- Since the ATR feature involves the tongue dorsum and participates in harmony alternations, let us hypothesize that it is V-place[dor].
- Since there is a restriction that [j] in a cluster can only appear before /e, eː, ɛ, ɛː, a, aː, ɔ̣, ɔ̣ː/ let us assume that these vowels form a natural class of V-manner[open].
- If the [j] and [i] are the same phonological segment found in different syllable positions, and if [j] causes a preceding alveolar nasal (in a cluster) to become palatal, then let us assign this segment V-place[cor].
- Since [w] participates in sonority-based restrictions but [j] does not (recall *[rw], *[wj], but [rj], [jw]), let us give [w] V-manner[closed].

⁵ From this point forward, I will not transcribe the allophonic alternations among labials and palatals.

Thus, the feature specifications for the individual Shilluk vowels are given in (70).

(70)

			V-place			V-manner	
			lab	cor	dor	closed	open
//o//	/o/	[ɔ] [ɔ:]	✓				
//i//	/i/	[i] [i:] [j]		✓			
//ĩ//	/ĩ/	[ĩ] [ĩ:]			✓		
//ɔ̣//	/ɔ̣/	[ɔ̣] [ɔ̣:]	✓		✓		
//u//	/u/	[o] [o:] [w]				✓	
//ụ//	/ụ/	[ụ] [ụ:]			✓	✓	
//a//	/a/	[a] [a:]					✓
//e//	/e/	[ɛ] [æ:]		✓			✓
//ạ//	/ạ/	[ɸ̣] [ạ:]			✓		✓
//ẹ//	/ẹ/	[ɛ̣] [ɛ̣:]		✓	✓		✓

With these features, the two glides are actually phonologically quite different from one another. The only non-nuclear vocalic features allowed in the language are V-manner[closed] and V-place[cor]. Recall that the different glide feature specifications are justified by their different distributions in clusters - [w] is more phonologically sonorous than [j].

There are several interesting things to note about the consonant inventory that lead us to a particular PSM analysis.

- The plain stops, voiced stops and nasals are exactly parallel in place specification.
- The plain and voiced palatal non-nasals show significant allophonic (i.e. phonetic) variation in the amount of oral constriction there is. This suggests that they do not have a manner feature.
- The same can be said for the labial non-nasals.
- There are no phonetic fricatives in this language, but there are phonetic continuants.
- There is a morphological process turning “stops” into nasals. This suggests that they are featurally similar.
- There is a root-internal restriction on non-palatal coronal stops. This suggests that dental and alveolars have a feature that the palatals do not.
- The rhotic is the only consonant that cannot be followed by [w]. This suggests that it is phonologically more sonorous than the other consonants, including the lateral.

These observations combined with the restrictions imposed by the PSM, can be interpreted as follows:

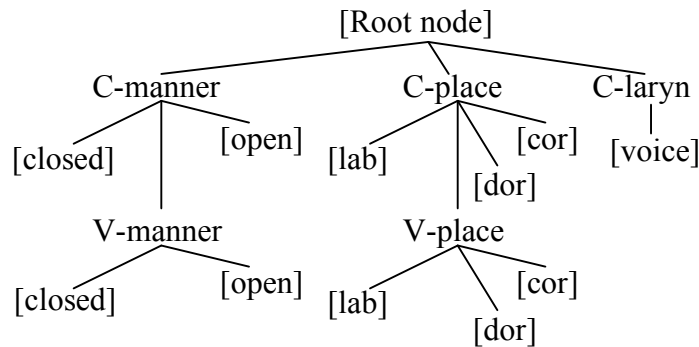
- The plain “stops” only have place. They are composed of combinations of C-place[lab], C-place[cor], C-place[dor] and V-place[cor].
- The voiced “stops” are identical to the plain, but have an additional C-laryn[voice] feature.
- The “nasals” are identical to the mannerless segments, but have an additional C-manner[closed] feature. The lowering of the velum that accompanies these segments

is a phonetic enhancement strategy to ensure that they are phonetically distinct from the mannerless segments.

- Using C-manner[closed] for nasals implies a segment consisting of just this feature. The only segments left are the lateral and the rhotic. Since we know that the rhotic must be more sonorous than the lateral, let us give them C-manner[open] and C-manner[closed], respectively. This is consistent with their phonetic properties since the later has a stop gesture while the rhotic does not.

Ignoring tone, the fully-specified PSM structure needed for this language is given in (71), and the complete segment chart for Shilluk is given in (72).

(71)



(72)

			C-place			V-place			C-manner		V-manner		C-laryn
UR	SR	PF	lab	cor	dor	lab	cor	dor	closed	open	closed	open	voice
//p//	/p/	[p]~[f] - [p:] [p ^h]	✓										
//t//	/t/	[t] - [t:] [t ^h]		✓									
//k//	/k/	[k] - [k:] [k ^h]			✓								
//t//	/t/	[t] - [t:] [t ^h]		✓			✓						
//c//	/c/	[c]~[tʃ]~[cɕ]~[ʃ]~[ɕ]- [c:]~[tʃ:]~[cɕ:] [c ^h]~[tʃ ^h]~[cɕ ^h]			✓		✓						
//b//	/b/	[b]~[v]	✓										✓
//d//	/d/	[d]		✓									✓
//g//	/g/	[g]			✓								✓
//d//	/d/	[d]		✓			✓						✓
//ʒ//	/ʒ/	[ʒ]~[dʒ]~[ʒʒ]~[ʒ]			✓		✓						✓
//m//	/m/	[m] - [m:] [m']	✓						✓				
//ŋ//	/ŋ/	[ŋ] - [ŋ:] [ŋ']		✓					✓				
//ŋ//	/ŋ/	[ŋ] - [ŋ:] [ŋ']			✓				✓				
//n//	/n/	[n] - [n:] [n']		✓			✓		✓				
//ɲ//	/ɲ/	[ɲ] - [ɲ:] [ɲ']			✓		✓		✓				
//l//	/l/	[l] - [l:] [l']							✓				
//r//	/r/	[r] - [r]								✓			
//o//	/o/	[ɔ] - [ɔ:]				✓							
//i//	/i/	[i] [j] - [i:] [j:] [j']					✓						
//i//	/i/	[i] - [i:]						✓					
//ɔ//	/ɔ/	[ɔ] - [ɔ:]				✓		✓					
//u//	/u/	[o] [w] - [o:] [w:] [w']									✓		
//u//	/u/	[u] - [u:]						✓			✓		
//a//	/a/	[a] - [a:]										✓	
//e//	/e/	[ɛ] - [æ:]					✓					✓	
//a//	/a/	[ɐ] - [a:]						✓				✓	
//e//	/e/	[ɛ] - [ɛ:]					✓	✓				✓	

One interesting thing about the consonant system is that it falls under what Christian might term a “symmetrical inventory” in that the non-liquids have symmetrical place specifications and there are no gaps. Note that nothing special needs to be said about capturing this system. The only somewhat unexpected feature specifications are the claim that the lateral is only C-manner[closed] and the flap is only C-manner[open]. Given that laterals do have phonetic stop gesture, there is nothing obviously contradictory in this. The only things that worry me slightly are 1) the fact that there is only one segment in the language that is C-manner[open] and 2) the characterization of what can be in a given syllable position might be a little tricky. However, we need to capture the fact that the only C+glide clusters not allowed in the language are *[rw] and *[wj]. By claiming that the labial glide has V-manner[closed] but the palatal glide does not, we capture the glide-glide facts. V-manner[closed] must be adjacent to the nucleus. By positing C-manner[open] for the flap, we might claim that C-manner[open]+V-manner[closed] is too near in sonority to be a good cluster.

Syllable-final devoicing is straightforwardly accounted for by using a constraint against C-laryngeal[voice] in coda position. This must be a true coda condition constraint and not the

result of a constraint ranking in which onset faithfulness is higher ranked than markedness against the voice feature ranked higher than general faithfulness to the voice feature. The reason for this is that geminate voiced consonants are also prohibited. If geminates are associated with an onset position, then onset faithfulness should protect them from neutralization if the voicing facts of this language were strictly a matter of positional faithfulness effects. However, geminates devoice in this language, thus forcing the conclusion that there is a coda condition.

The only other process to be accounted for is morphological “nasalization”. Recall that the *-ani* and *-e* morphemes condition phonetic nasalization of mannerless consonants under certain morphological conditions. I proposed above that those morphemes conditioning this “nasalization” contain a floating C-manner[stop] feature. Note that morphemes introducing floating stop features may be a common occurrence in Luo languages. Patrik proposed something similar for DhoLuo.

Full autosegmental analysis of harmony, voicing neutralization, vowel lengthening, consonant gemination and stopping to come!

OT analysis of harmony, voicing neutralization, vowel lengthening, consonant gemination and stopping to come!