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SUPRASEGMENTALS IN SHILLUK NOMINAL MORPHOPHONOLOGY

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Contents

Abbreviations and special characters

↓	downstep
σ	syllable
μ	mora
→	"becomes" is synchronic rule
*	ungrammatical form
.	in glosses: one-to-many correspondences (The Leipzig glossing rule 4)
\	in glosses: morphophonological change (The Leipzig glossing rule 4D)
ATR	advanced tongue root
CL	compensatory lengthening
DEM1	demonstrative 1 (next to the speaker)
DVN	deverbal noun
F0	fundamental frequency
FUG	centrifugal
INST	instrumental
INTR	intransitive verb
PAST	past tense
POSS.1,2,3SG	1st, 2nd,3rd person singular possessive
PL	plural
SG	singular
2SG	2 person singular
T	tone
(T)	optional tonal element
L	Low tone
M	Mid tone
H	High tone
V	short vowel
VV	long vowel
VVV	overlong vowel
(V)	stem-internally: vowel duration varies; suffix vowel: optionally realised

1. Introduction

1.1 Language Background

Shilluk is a Nilo-Saharan language of Sudan. The complete affiliation according to Ethnologue (Gordon 2005) is Nilo-Saharan, Eastern Sudanic, Nilotic, Western, Luo, Northern. The homeland of Shilluk is the Upper Nile Province and the west bank of the Nile along the Sobat River (see Figure 1). There are communities of Shilluk speakers elsewhere in Sudan, in particular in Khartoum, and abroad.

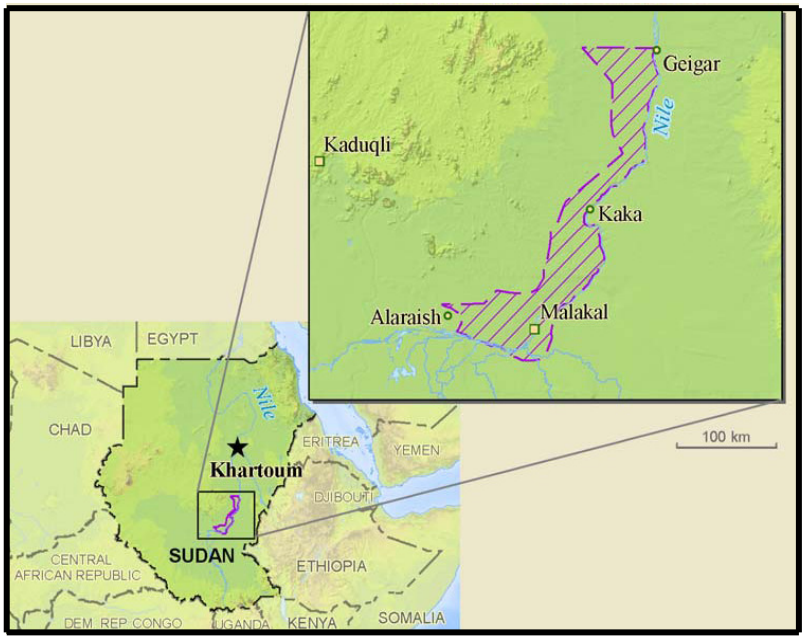


Figure 1. *A map of Sudan showing the location of the Shilluk homeland and a map of the Shilluk territory. From* ***Joshua Project*** *online.*

According to Ethnologue (Gordon 2005) there are 175,000 speakers of Shilluk (1982 SIL). Yet another source - *Joshua project* in their expanded PDF profile of Shilluk estimates the number of speakers at 750,000 (1993 census). However, the 750,000 census figure is likely to be a gross underestimation because 1993 census only provided the numbers of the adult men to the exclusion of women and children. The reason for this is that census figures served as a means for the government to keep track of the taxable population hence the numbers collected were those of men above the maturation age – *cøng* in Shilluk – which is reached at approximately 14-15 years of age. The census number is considered to be even under-representative of the adult male population, since Shilluk families used to send some of their male members into hiding prior to the arrival of the census officials. The Southern Sudanese Government

has now abolished taxation in Southern Sudan and people are encouraged to enter the Southern Government register in order to be able to vote in the upcoming elections in 2011. We might, thus, expect to get some more accurate figures for many of the peoples of Southern Sudan after 2011.

Shilluk is of a particular interest because of its rich suprasegmental system; its way of expressing morphology by alternations of the phonological material on monosyllabic roots; and the numerous markings of the distinction between singular and plural nouns. Previous work on Shilluk includes Gilley's investigations into phonology (1992) and into singular-plural formations (2000) as well as Storch (2005)'s overview of Shilluk noun morphology. These investigations provide good insights into the Shilluk sound system and into patterns of singular-plural formations. However, a number of important issues pertaining to the suprasegmental system of the language have not been fully explored by these authors. Preliminary investigations into the Shilluk verb system by Remijsen (2008) have shown that the suprasegmental system of Shilluk is much richer than that presented by Gilley and Storch. Therefore, my main objective here is to present an analysis of aspects of Shilluk suprasegmental system. To this end I investigate nominal paradigms. In this dissertation my aim is to extend the analysis of morphophonology of nouns in Shilluk presented in Gilley (*ibid.*) and Storch (*ibid.*) by examining suprasegmental phenomena: vowel length and tone.

In the rest of this section I will give an overview of previous as well as ongoing research into the phonological system, phonotactics and morphology of Shilluk nouns and I will discuss the findings of other investigations in the light of my data. This section will also serve as an introduction to the terminology that I will use throughout this dissertation. The rest of the dissertation will be structured as follows: in section 2 I will present the information about my Shilluk language consultant, outline the methodologies used in eliciting and processing the data and discuss the challenges of transcribing Shilluk and the strategies I used to overcome these challenges; in section 3 I will give an overview of the data, discuss the most common patterns of vowel length alternations in nominal paradigms and give a descriptive analysis of the process of compensatory lengthening; finally in section 4 I will deal with tone in Shilluk nominal paradigms.

1.2 Phonology and Phonotactics

Shilluk vowels fall into two sets according to the feature *advanced tongue root* [+/- ATR]. [+ATR] vowels have a somewhat breathy quality. The [+/-ATR] vowels come in three levels of height. Gilley (1992) distinguishes between short and long vowels which leads her to postulate twenty vowel phonemes. Analysis conducted by Remijsen (2008) has shown that there is a three-way phonemic length distinction in Shilluk, which means that the language has thirty vowel phonemes. A three-way vowel length distinction is a rare phenomenon but it is also attested in another Western Nilotic language – Dinka (Andersen [1990, 2002], Remijsen and Gilley [2008] and Remijsen and Mayang [to appear]). For the speakers of languages that do not make use of a three-way vowel length distinction determining vowel length in Shilluk presents a great challenge. From my experience with the language, by merely relying on ears alone I can tell that some vowels are short and some are long. For example, singular and plural forms for 'grass' have identical onset and coda consonants and both seem to have a short vowel, thus I transcribe them as [lum]. In addition, there is another form in the same paradigm where the vowel is noticeably longer, thus [luum]. However, instrumental measurements of waveforms and spectrograms reveal that the vowels which were perceived as short can be further divided into short and very short based on the duration of these sounds. It becomes clear that in the plural form for 'grass' the vowel is shorter than that in the singular form (1a-b) below. The vowel that I hear as long, then, is the third level of vowel length (1c). Thus we get a near-minimal (notwithstanding tonal differences) set for three-way vowel length distinction in a single paradigm.

(1)

a.	lùm	b.	lúum	c.	lúuum̀
	grass\PL		grass\SG		grass\SG\DEM1
	grasses		*grass*		*this grass (next to speaker)*

Approximate durations of Shilluk vowels are: 40 to 120ms –short vowels, 120ms to 200ms – long vowels, and 200ms onwards –overlong vowels. The Shilluk vowel inventory is presented in Table 1 below. Short (V), long (VV) and overlong (VVV) vowels are written as single, double and triple symbols, respectively. There

are no diphthongs in Shilluk as sequences of non-identical vowels cannot occur in the same syllable.

Table 1. *Vowel inventory*

Grade	−ATR					+ATR				
Short V	ɪ	ɛ	a	ɔ	ʊ	i	e	ʌ	o	u
Long VV	ɪɪ	ɛɛ	aa	ɔɔ	ʊʊ	ii	ee	ʌʌ	oo	uu
Overlong VVV	ɪɪɪ	ɛɛɛ	aaa	ɔɔɔ	ʊʊʊ	iii	eee	ʌʌʌ	ooo	uuu

Shilluk has 19 consonant phonemes listed in Table 2. Voiced and voiceless obstruents and nasals come in five places of articulation. There are no fricative phonemes in Shilluk. Fricatives that occur in borrowings from Arabic and English, e.g. /f/ and /s/ are not included in the table. Obstruents are often realised as affricates. This is especially true with alveolar and palatal obstruents.

Table 2. *Consonant inventory*

	Bilabial	Dental	Alveolar	Palatal	Velar
Plosives voiceless	p	t̪	t	c	k
Plosives voiced	b	d̪	d	ɟ	g
Nasals	m	n̪	n	ɲ	ŋ
Lateral			l		
Vibrant			r		
Approximants	(w)			j	(w)

In Shilluk, as in many other Western Nilotic languages, roots are largely monosyllabic. Inflection is often stem-internal in that it is expressed by alternations in phonological material of the root. The segmental template of a stem-syllable in content words is presented in (2).

(2) C (j/w) V (V) (V) C

We can see from (2) that syllables are closed. In my data, which can be found on Nilotic Prosody website, I only have one native content word with the open syllable in the plural form: [cūu] 'bones'. Storch (2005:290-1) hypothesises that this form is a remnant of an older system, thus I treat it as an exception instead of expanding the syllable template in (2). Shilluk does not allow non-identical consonantal clusters with the exception of the consonant plus glide clusters that are restricted to the onset position.

Shilluk tone system has not been previously explored in detail in the literature. I will postpone the discussion of tone in Shilluk until section 4 where I will give an overview of previous research on tone and will present my own findings.

1.3 Nominal Morphophonology

In Shilluk as well as in many other Nilo-Saharan languages the nominal system is complicated by the "tripartite division between singulative, plural, and replacive marking on nouns" (Dimmendaal 2000:214). This means that in a given singular-plural pair the form(s) marked for number can be singular, plural or both; and the unmarked or morphologically opaque form, if present, can be either singular or plural. The pattern where both singular and plural forms in the given pair are marked for number is known as *replacement pattern*. Gilley (2000) examines the numerous patterns of singular-plural formation in Shilluk and proposes the organisation of nouns into groups based on the presence or absence of the number marking features which she describes as suffixation and infixation. The latter term refers to the stem-internal number marking such as tone shift, consonant alternation, change in ATR value of the vowel, vowel lengthening/shortening, and the placement of stress. On the basis of her classification, Gilley refers to the morphologically opaque forms as *Singular* and

Collective and to the morphologically marked forms as *Singulative* and *Plural*. I will not be using these terms here for the reason that my analysis differs from that of Gilley's with respect to vowel length and tone – features that play a prominent role in her (2000)'s classification of forms as either marked or opaque. For my purposes, the terms *singular* and *plural* will suffice and should be understood to cover Gilley's Singular and Singulative and Collective and Plural, respectively.

According to Gilley (1992 and 2000) singular and plural suffixes harmonise with the root vowel. My data, however, does not confirm this observation. All vowel suffixes tend to be [-ATR] regardless of the ATR value of the root vowel. In Gilley (*ibid.*) and Storch (2005) all suffix vowels are transcribed as short. My data shows that vowels in different suffixes appear to be of different lengths. For example, vowels in some suffixes are realised as overlong: [dīwídīɪɪ] 'fish hook' (approx. 280ms), whilst vowels in other suffixes are realised as long: [dīwídīɪ] 'fish hooks' (approx. 170ms). Because all items in my data were elicited in phrase-final position I attribute the duration of the suffix vowels in these and other cases to phrase-final lengthening. However, because in different suffixes vowels are consistently realised as always long or always overlong I hypothesise that suffix vowels, just like stem vowels, come in different lengths. Measurements of suffix vowels in non-phrase-final contexts are required to determine the phonemic length of these vowels. For now, in order to account for phrase-final lengthening and to signal the durational differences between the suffix vowels, I tentatively transcribe them as long [dīwídīɪ] and short [dīwídī]. In singular forms suffixes can be -ɔ, -ɪ, or -ɪɪ; and in plural forms suffixes can be -ɪ or -ɔ.

Shilluk is a head-marking language which means that in complex noun phrases dependents are marked on the head noun (Payne 1997:31). Head-marking can be expressed by suffixation and by alternations of the phonological material stem-internally. In my analysis I use two types of complex forms – demonstrative and possessive. Shilluk distinguishes four degrees of distance in the system of demonstratives: next to the speaker (demonstrative 1), next to the hearer (demonstrative 2), away from both the speaker and the hearer (demonstrative 3) and far away/yonder (demonstrative 4). In my analysis I will only discuss demonstrative 1

forms to which I refer as *demonstrative* in the text and I will gloss them as DEM1. Demonstrative suffix vowel, when present, is -ɪ. I will also examine two possessive forms marked for 1st and 3rd person singular possession (i.e. my X, his/her/its X). I will omit examples of the 2nd person possessive forms from my discussion because the behaviour of these forms is identical to that of the 1st person possessive forms. I will refer to singular possessive forms as *possessive* in the text and I will gloss them as POSS.1SG and POSS.3SG. Suffix vowels in possessive forms are: -aa in 1st person singular, and -ɛ in 3rd person singular.

Some noun stems contain prefixes. Gilley (2000) lists three prefixes that occur in Shilluk nouns and explains their semantic functions. For example, dɪ- = 'is used for', a- = 'female item' and ʊ- = 'male item' (Gilley 2000:19). However, Gilley (*ibid.*) also notes that these prefixes are only remnants of a system which could have been fully productive in the past. Prefixation in Shilluk is always derivational and never inflectional.

Although the inflected stem in Shilluk can consist of a derivational prefix and a suffix, I will restrict the term *stem vowel* to the vowel that occurs in the root position, and the term *stem syllable* to the syllable that contains the stem vowel. Throughout this dissertation I will be referring to the initial consonant of the stem syllable as *C1* and to the final consonant of the stem syllable as *C2*.

Gilley (1992) postulates a phonetic distinction between lenis and fortis obstruents and sonorants that occur in C2 position in suffixed forms. Fortis obstruents and sonorants are said to be realised as geminates in slow and deliberate speech. In normal speech fortis obstruents are aspirated and fortis sonorants are realised with greater muscular tension. Lenis obstruents are said to become voiced in intervocalic position. Noske (1995), using the data from Gilley (1992) and Kohnen (1933), argues that the occurrence of fortis obstruents and sonorants in C2 position is predictable and is governed by a set of rules. My data, on the other hand, suggests that there is no such predictability in Shilluk. C2 obstruents in suffixed forms are sporadically realised as voiced or voiceless aspirated in normal speech and as voiced or voiceless geminated in deliberate and slow speech. This observation has been confirmed by Remijsen

(personal communication) who notes that Shilluk speakers not only freely alternate between voiced and voiceless obstruents in word-medial C2 position but also judge the words with voiced and voiceless word-medial C2 to be equally acceptable. Thus, in my data presented here and on Nilotic Prosody website I transcribe C2s as they were realised by my consultant – voiced or voiceless without marking a length distinction. Nasal consonants and the labiovelar glide in word-medial C2 position, on the other hand, are nearly always realised as long consonants. However, a confirmation of whether or not these consonants can be considered as geminates awaits instrumental measurements. Until then, I transcribe them as single consonants in my data.

2. Fieldwork

Data collection sessions were conducted in Edinburgh between September and December 2008. All data comes from a native speaker of Shilluk, Otto Gwado Ayoker. Otto spent 33 years in the Shilluk village of Tonga and 20 years in Khartoum. Otto is a Bible translator and a member of Shilluk Language Council. During each session that lasted approximately 1-1.5 hours (twice a week) a number of nominal paradigms were elicited and transcribed. At the end of each session all of the elicited data was recorded using a solid-state recorder (Marantz PMD660) and a headset microphone (Shure SM10). Since Otto has a working knowledge of linguistics we came up with template lists for the recording part of the sessions which detailed the order of the grammatical forms in paradigms. Otto recorded each paradigm using lists that consisted of the following information: singular, plural, singular demonstrative, plural demonstrative, singular+1st person singular possessive, plural+1st person singular possessive, singular+2nd person singular possessive, plural+2nd person singular possessive, singular+3rd person singular possessive and plural+3rd person singular possessive. When words were elicited in isolation it was difficult to determine the tone on these words. To overcome this problem words were also elicited in context: preceded by either a Low toned existential marker [dàa] (“there is X”) or by a High toned existential contrastive marker [dáa] (“but there is X [not Y]”). Tone on the markers provided a useful reference that assisted the interpretation of tone on the nouns. The downside of the method of reading from the list was that it

introduced a 'word-list intonation' – a rising F0 at the end of the words, which only occurred in possessive forms. However, the method was very useful in that it eliminated the confusion which occurred when I was trying to prompt Otto the order of the forms in the paradigms. Lists were especially useful with the paradigms where forms differed only in tone or vowel length as it was very difficult for me to grasp the differences straightaway. This method also gave me the opportunity to re-check my transcriptions as Otto was recording. In addition, items that needed clarification were re-recorded separately during the later sessions.

It was challenging to transcribe Shilluk accurately during the sessions. The reason for this is that apart for transcribing consonants (which is a relatively easy task) one has to simultaneously determine whether the vowels are [+ATR] or [-ATR], the length of the vowels and the tone(s). I found it difficult to concentrate on all of these features at the same time, so I developed a strategy of transcribing during and after each session. During the sessions I concentrated on transcribing what can be easier determined by watching the speaker than by listening to the recordings (for example, the difference between dental and alveolar obstruents), and on determining the ATR values of the vowels. Transcription of vowel length and tone was mainly done from the recorded material after the sessions. I used Praat software to measure duration of segments and to compare F0 traces.

3. Vowel length alternations in nominal paradigms

3.1 A glance at the data

The aim of this section is to give an overview of paradigmatic vowel length alternations in the stems. Because it is not the aim of my discussion to account for singular-plural formations in Shilluk (see Gilley 2000) I treat singular and plural paradigms separately by grouping them on the basis of the shape correspondences between the forms. Examples will be given to exemplify my discussion and more examples can be found on the Nilotic Prosody website. Because some stem vowels vary in duration from rendition to rendition I found it useful to signal this variation by means of including one of the vowel characters in parentheses. By the same token, suffix vowels which are optionally realised also appear in parentheses.

3.1.1 Singular Paradigms

As a rule, an obstruent C2 in singular forms becomes a homorganic nasal in demonstrative forms and in some possessive forms. When C2 in the singular form is a non-obstruent it does not change in the demonstrative form. Singular paradigms can be divided into four main groups based on the paradigmatic behaviour of stem vowels and presence or absence of vowel suffixes in singular and demonstrative forms.

Group Singular 1 (S1)

Words that belong to this group are distinguished by the absence of suffixes in singular and demonstrative forms. Stem vowels in demonstrative and possessive forms are longer than in the corresponding singular forms. Within this group we can distinguish two subgroups. Words in the subgroup S1a (below) have long stem vowels in the singular forms, and overlong vowels in demonstrative and possessive forms. Words in S1b have consonant + glide onsets, and short vowels in singular forms. The length of the vowels in some of the demonstrative and possessive forms varies from long to overlong in different renditions.

S1a

SG	DEM1	POSS.1SG	POSS.3SG	
lʊ̀ʊ̰t	lʊ̀ʊʊn̰	lʊ̀ʊʊ̰tāa	lʊ̀ʊʊd̰ɛ̀	‘scraping stick’
lɛ̀ɛk	lɛ̀ɛɛŋ	lɛ̀ɛɛgāa	lɛ̀ɛɛgɛ̀	‘pestle’

S1b

SG	DEM1	POSS.1SG	POSS.3SG	
ɟ́ĵɛ̂p	ɟjɛ́ɛm̀	ɟjɛ́ɛ̂bāa	ɟjɛ́ɛ̂bɛ̄	‘pocket’ (Arabic)
gẃɔ̂k	gwɔ́ɔ(ɔ)ŋ̀	gwɔ́ɔ̂(ɔ)gāa	gwɔ́ɔ̂(ɔ)gɛ̄	‘dog’

Group Singular 2 (S2)

The main reason for grouping these words together is that all of them exhibit either weakening or loss of the singular suffix vowel –ɔ, which, when pronounced, often has a schwa-like quality. All singular forms in this group have overlong vowels. Within this group we can distinguish two subgroups. Words in S2a (below) have long stem vowels in the demonstrative and possessive forms. In S2b stem vowels in the demonstrative and possessive forms are either short or vary in length from V to VV.

S2a

SG	DEM1	POSS.1SG	POSS.3SG	
lèeeɟ(ɔ̀)	lèeɲì	lèecāa	lèecɛ̀	‘tooth’
bɔ̀ɔɔɖ̈(ɔ̀)	bɔ̀ɔn̈ì	bɔ̀ɔɖ̈āa	bɔ̀ɔɖ̈ɛ̀	‘blacksmith’

S2b

SG	DEM1	POSS.1SG	POSS.3SG	
ʊ̀làaal(ɔ̀)	ʊ̀làlì	ʊ̀làlāa	ʊ̀làlɛ̀	‘red cow’
álwɛ̄ɛɛt(ɔ̄)	álwɛ̄(ɛ)nì	álwɛ̄(ɛ)nāa	álwɛ̄(ɛ)nɛ̄	‘crab’
pwɔ̌ɔɖ̈(ɔ̄)	pwɔ̀n̈ì	pwɔ̀ṯāa	pwɔ̀ṯɛ̀	‘field’

Group Singular 3 (S3)

The length of stem vowels in the words within this group remains constant in all forms within a given paradigm. Within this group we can distinguish three subgroups. Words in S3a have short stem vowels and unsuffixed singular and demonstrative forms. Words in S3b have short stem vowels and suffixed singular and demonstrative forms. Words in S3c have long stem vowels and suffixed singular and demonstrative forms.

S3a

SG	DEM1	POSS.1SG	POSS.3SG	
jíṯ	jíṋ	jíṯāa	jíṯɛ̄	‘ear’
tík	tíŋ̀	tígāa	tíkɛ̄	‘chin’

S3b

SG	DEM1	POSS.1SG	POSS.3SG	
mùɟɔ̀	mùɲì	mùɟāa	mùɟɛ̀	‘island’
ādɗ̄ìgɔ̀	ādíŋ̀ì	ādɗ̄ìŋ̀āa	ādɗ̄ìŋ̀ɛ̀	‘purple cow’

S3c

SG	DEM1	POSS.1SG	POSS.3SG	
bóojɔ̀	bóojì	bóojāa	bóojɛ̀	‘paint’ (from Arabic)
cáâjì	cáajì	cáâjāa	cáâjɛ̀	‘tea’ (from Arabic)

Group Singular 4 (S4)

All words in this group belong to the class of the so-called *instrumental nouns*. Instrumental nouns are derived from verbs and denote instruments of different kinds (e.g. machete, canoe paddle, fishhook, etc.). If C2 is an obstruent in the singular form it always becomes a nasal in the demonstrative and possessive forms. If words have a glide in C2 position this glide is always /w/. In singular forms stem vowels are most often overlong (S4a-b) or short (S4c). Short vowels in singular instrumental forms are always [+high] and overlong vowels are [-high]. When the stem vowel is short in the singular form it is also short in the corresponding demonstrative and possessive forms (S4c). When the stem vowel is overlong in the singular form (S4a-b) vowels in the corresponding demonstrative and possessive forms can be either long (S4a) or short (S4b). Thus, it is not possible to predict the length of the stem vowels in demonstrative and possessive forms when the corresponding singular forms have overlong vowels. Interestingly, the length of the stem vowels in demonstrative and possessive forms within the singular paradigms can be predicted by considering the corresponding plural forms. In plural forms stem vowels are either short (S4b-c) or long (S4a). If the plural has a short stem vowel, the vowel in the corresponding singular demonstrative and possessive forms is also short (S4b-c). If the plural has a long stem vowel the corresponding singular demonstrative and possessive forms also have a long stem vowel (S4a).

S4a

SG	DEM1	POSS.1SG	POSS.3SG	
néeenīɪ	néenì	néenāa	néenɛ̄	‘looking glass’ (mirror)
góooɟīɪ	góoɲì	góoɲāa	góoɲɛ̄	‘machete’ (from Arabic)

cf. plural forms

néenī	góocī
looking.glass\PL	machete\PL
looking glasses (mirrors)	*machetes (from Arabic)*

S4b

SG	DEM1	POSS.1SG	POSS.3SG	
rʌ́ʌʌŋīɪ	rʌ́ŋì	rʌ́ŋāa	rʌ́ŋɛ̄	‘mirror’
dīkʌ́ʌʌgīɪ	dīkʌ́ŋì	dīkʌ́ŋāa	dīkʌ́ŋɛ̄	‘stick for planting’

cf. plural forms

rʌ́ŋī	dīkʌ́gī
mirror\PL	stick.for.planting\PL
mirrors	*sticks for planting*

S4c

SG	DEM1	POSS.1SG	POSS.3SG	
dīwídīɪ	dīwínì	dīwínāa	dīwínɛ̄	'fish hook'
dījúɟīɪ	dījúɲì	dījúɲāa	dījúɲɛ̄	'file'

cf. plural forms

dīwídī	dījúɟī
fish.hook\PL	file\PL
fish hooks	*files*

3.1.2 Plural Paradigms

In plural paradigms there is no C2 alternation in demonstrative and possessive forms (cf. singular paradigms). Plural paradigms can be divided into two main groups based on the behaviour of stem-internal vowels, and presence/absence of suffixes in plural forms.

Group Plural 1(P1)

Words that fall into this group have either suffix-less plural forms (4a) or have a plural suffix –ɔ which is optionally realised (4b).

(4)

	PL	DEM1	POSS.1SG	POSS.3SG	
a.	pìn	pìnì	pìnáa	pìnɛ̄	'cheeks'
	ŋēet	ŋēetì	ŋēetáa	ŋēetɛ́	'ribs'
b.	gwɔ́ɔ̂(ɔ)k(ɔ̀)	gwɔ́kì	gwɔ́káa	gwɔ́kɛ́	'dogs'

Within this group we can distinguish three subgroups. Words in P1a and P1b (below) have short and long stem vowels, respectively, throughout the paradigms. In P1c stem vowels in demonstrative and possessive forms are short and stem vowels in plural forms are either long or vary in length from VV to VVV.

P1a

PL	DEM1	POSS.1SG	POSS.3SG	
ɗ̪ɟêk	djékɪ̀	djékáa	djékɛ́	‘goats’
pìn	pìnɪ̀	pìnáa	pìnɛ̄	‘cheeks’

P1b

PL	DEM1	POSS.1SG	POSS.3SG	
ŋēet	ŋēetɪ̀	ŋēetáa	ŋēetɛ́	‘ribs’
máan	máanɪ̀	máanáa	máanɛ́	‘women’

P1c

PL	DEM1	POSS.1SG	POSS.3SG	
ájàaac	ájàcɪ̀	ájàcáa	ájàcɛ̄	‘pregnant women’
ɟjɛ́ɛ̄ɛp	ɟjɛ́pɪ̀	ɟjɛ́páa	ɟjɛ́pɛ́	‘pockets’
twóo(o)ŋ̀(ɔ̀)	twóŋɪ̀	twóŋáa	twóŋɛ́	‘insects’
ɟwôo(o)k	ɟwôkɪ̀	ɟwôkáa	ɟwôkɛ̄	‘Shilluk Gods’ (pagan gods/deities)

Group Plural 2 (P2)

Words that fall into this group have –ɪ suffix in the plural forms and either short or long vowels throughout the paradigms. This group is significant in another way – all plural instrumental nouns fall into this group. Within this group we can distinguish two subgroups. Words in P2a have short vowels and words P2b have long vowels.

P2a

PL	DEM1	POSS.1SG	POSS.3SG	
pùgɪ̀	pùkɪ̀	pùkáa	pùgɛ̄	‘tortoise’
ápwótī	ápwótɪ̀	ápwótáa	ápwótɛ́	‘gourds’

P2b

PL	DEM1	POSS.1SG	POSS.3SG	
péenī	péenɪ̀	péenáa	péenɛ́	‘animal skin’
góocī	góocɪ̀	góocáa	góocɛ́	‘machetes’ (from Arabic)

3.1.3 Summary of findings

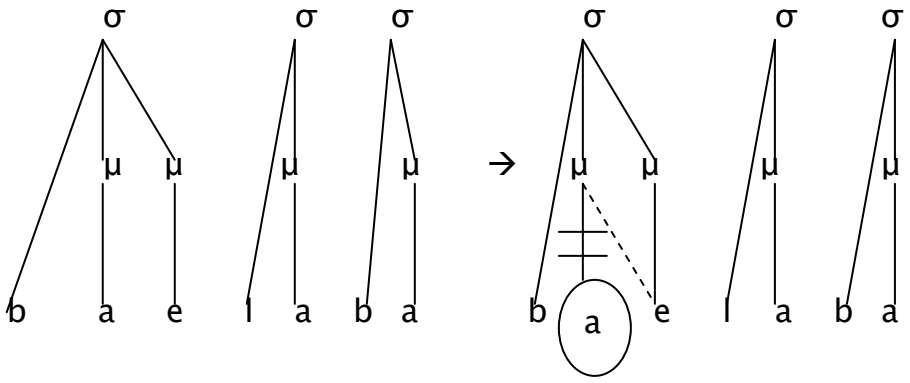
The above overview shows that with respect to vowel length alternations in paradigms a distinction should be made between singular/plural and demonstrative/possessive forms. Within demonstrative and possessive forms there is no vowel length alternation. Singular and plural forms can have longer stem vowels than the corresponding demonstrative and possessive forms. In most such cases demonstrative and possessive forms have short or long vowels and the corresponding singular/plural forms have overlong vowels. In singular paradigms stem vowels in demonstrative and possessive forms can be longer than in the corresponding singular forms. In such cases singular forms have short or long stem vowels and demonstrative and possessive forms have long or overlong vowels. In addition, there are paradigms where vowel length remains constant in all forms. Vowel length alternations seem to be connected to weakening and loss of suffix vowels. The alternations occur in paradigms where either the singular/plural forms are losing/have lost their suffixation, or where the demonstrative forms are suffix-less. In the next section I will be exploring in detail the link between weakening/loss of vowel suffixes and vowel length alternations in the paradigms.

3.2 Compensatory lengthening

Compensatory lengthening (CL) is a phonological process whereby a vowel is lengthened usually due to a loss of a following segment. In some languages, for example Luganda (Katamba 1989:171-2), CL occurs when the preceding vowel is deleted. In moraic theory (Hayes 1989) the length of a given segment is determined by the number of morae with which it is associated. Under this theory CL in Luganda can be explained by associating the following vowel with the mora of a deleted segment (5). CL can also occur as a result of the loss of a vowel in the following syllable (Trask 1996:81). In Shilluk this latter type of CL is widespread due to the weakening and loss of some suffix vowels. Examples of CL in Shilluk are given in (6).

(5) CL in Luganda (from Katamba 1989:171-2)

/ba+e+lab+a/ [be:laba] 'they see themselves'



(6)	SG	DEM1	
a.	lèeeɟ(ɔ̀)	lèeɲì	'tooth'
	jwɔ̀ɔɔn̪(ɔ̀)	jwɔ̀n̪ì	'armpit'
	ŋèeet	ŋèenì	'rib'
b.	lʊ̀ʊt̪	lʊ̀ʊʊn̪	'scraping stick'
	nāam	nāaam̀	'water area'
	PL	DEM1	
c.	lɛ̀ɛɛp	lɛ̀ɛpì	'tongues'
	ɟáâ(a)k(ɔ̀)	ɟáakì	'chiefs'

By comparing different forms within the same paradigm we can see that vowel lengthening can occur in singular (6a), singular demonstrative (6b) and in plural (6c) forms. Some singular and plural forms are optionally realised with or without the weak suffix vowel (6a, 6c), but even in the cases where the suffix vowel is realised the stem vowel is lengthened. Because of this I hypothesise that the loss of suffixation in singular and plural forms is an ongoing process. By contrast, singular demonstrative forms like that in (6b) are never realised with a suffix vowel. Thus, I hypothesise that the suffix loss in singular demonstrative forms is an earlier development. A confirmation to this hypothesis comes from the observation that the suffix-less singular demonstrative forms are the ones with the suffix-less singular forms (6b). Since most of the singular forms now appear to be suffix-less due to the

loss of suffix vowels in the words such as in (6a) we would expect that the singular demonstrative forms in these paradigms would also lose their suffix vowels. The fact that this does not happen suggests that the suffix vowel in singular demonstrative forms was only deleted if the corresponding singular forms were unsuffixed before the process of vowel deletion in singular and plural suffixes begun to operate. Another piece of evidence which confirms my hypothesis comes from the examples in (7).

(7)	SG	DEM1	
a.	djɛ̀l	djɛ̀ɛl	'goat'
	ɟjɛ̂p	ɟjɛ́ɛm̀	'pocket'
b.	jɪ̰t	jɪ́n̰	'ear'
	tík	tíŋ̀	'chin'

We can see that in all of the above examples the suffix vowel is deleted in singular demonstrative forms. However, whereas the loss of the suffix vowel in (7a) is accompanied by CL of the stem vowel, CL does not occur in the examples in (7b) (cf. the corresponding singular forms). Because of the words like that in (7b) we can say that CL does not apply if the stem vowel is short. However, stem vowels are also short in the singular forms of words in (7a), but CL does apply in the demonstrative forms. In order to solve this puzzle let us consider cognates of [djɛ̀l] 'goat' in other closely related languages (data for Anywa, Päri and Luwo from Storch [2005]):

(8)	goat\SG	'goat'
Shilluk	djɛ̀l	
Anywa	dɪ̀ɛ̀l	
Päri	dɪ̀ɛ̀l	
Luwo	dɪ́ɛ́l	

We can see that Anywa, Päri and Luwo have diphthongs (Storch 2005:68) where Shilluk has a glide + vowel sequence. There is a phonotactic constraint in Shilluk prohibiting sequences of non-identical vowels from occurring in the same syllable, but this could in itself be a recent development. The evidence that modern glide+vowel sequences in Shilluk were once diphthongs comes from three

observations. First, sequences of non-identical consonants are not allowed in Shilluk except for consonant+glide sequences. Second, no heavy onsets are allowed in Shilluk except for consonant+glide onsets. These observations suggest that consonant+glide clusters resulted out of necessity, in order to avoid the occurrence of non-identical vowels in the same syllable. Finally, in some singular-plural pairs of nouns there is a glide in the onset of singular forms whereas the corresponding plural forms lack this glide (9). In such pairs the vowel in the plural form is always longer than the vowel in the corresponding singular form by exactly one prosodic position. Singular forms in (9) are morphologically opaque and the plural forms are morphologically pluralized as is evident from the presence of the suffixes in these forms. This suggests that in these cases the process of pluralization also involved monophthongisation of the stem vowel whereby the first element of the diphthong (a [+high] vowel) was deleted and the second element became associated with its mora (cf. Luganda example in (5) above).

(9)	SG	PL	
	kwɔ̀ŋ	kɔ́ɔŋī	'culture(s)'
	pjēn	péenī	'animal skin(s)'

If glides in heavy onsets were [+syllabic] in Shilluk at the time of suffix loss in demonstrative forms, words in (7a, above) had diphthongs, i.e. long vowels, and therefore were not excluded from the application of CL. I conclude that the deletion of the suffix vowels and CL in singular demonstrative forms is a much earlier process than the loss of the suffix vowels and CL in singular and plural forms. Moreover, since there is no indication that any of the singular demonstrative forms are currently undergoing this change (i.e. no evidence of alternation between suffixed and unsuffixed forms) we can assume that this change has been completed.

I now turn to the description of CL in singular and plural forms (10). I take the length of the stem vowels in forms in not affected by CL (here demonstrative and possessive forms) to be the underlying length of the vowels in singular/plural forms that exhibit CL. Loss of the suffix vowel and CL take place in the forms which have: long stem vowels (10a); short stem vowels with heavy onsets (10b); and some forms with light onsets and short vowels (10c). Interestingly, many words with short vowels do not

exhibit CL (10d). Remijsen (personal communication) notes that whereas some short stem vowels in Shilluk transitive verbs are short throughout the paradigm, others lengthen in some forms (see examples in (11), courtesy of Bert Remijsen).

(10)	SG/PL	DEM1	POSS.1SG	POSS.3SG	
a.	pìiin(ɔ)	pìinɪ̀	pìināa	pìinɛ̀	‘cheek’
	lèeek	lèekɪ̀	lèegáa	lèegɛ̄	‘pestles’
b.	jwɔ̀ɔɔd̪(ɔ̀)	jwɔ̀n̪ɪ̀	jwɔ̀t̪āa	jwɔ̀t̪ɛ̀	‘armpit’
	ɟjɛ́ɛ̄ɛp	ɟjɛ́pɪ̀	ɟjɛ́páa	ɟjɛ́pɛ́	‘pockets’
c.	ʊ̀tʌʌʌŋ	ʊ̀tʌŋɪ̀	ʊ̀tʌŋāa	ʊ̀tʌŋɛ̀	‘black cow’
	ʊ́gìiik	ʊ́gìkɪ̀	ʊ́gìkáa	ʊ́gìkɛ̄	‘buffalos’
d.	mùɟɔ̀	mùɲɪ̀	mùɟāa	mùɟɛ̀	‘island’

(11)	Past	Past 2nd SG	Present	
a.	á-ŋ̊ɔ̂l	á-ŋɔ̀l	ʊ̀-ŋɔ̀l(ɔ̀)	‘cut’ (v.)
b.	á-ć̊âm	á-càaam	ʊ̀-càaam(ɔ̀)	‘eat’ (v.)

As noted previously, I make inferences about whether or not there is a CL in a given singular or plural form by comparing vowel length in this form with the length of the vowels in the rest of the forms within the paradigm. The assumption here is that the length of stem vowels in forms not affected by CL should be taken as the underlying length. This assumption is grounded in the fact that notwithstanding predictable cases of CL, vowel length in singular/plural and the corresponding demonstrative and possessive forms does not alternate (cf. groups P2, P1a-b, S3, etc.). This assumption, however, presents a problem if we consider the paradigms given in (10a-c). Whereas in (10a) CL is entirely logical (from VV to VVV), CL from V to VVV in (10b-c) is somewhat an unexpected development. Remijsen (personal communication) notes that short and long stem-internal vowels in certain verb forms in Shilluk become overlong in some inflected forms (see (11b) above). Thus, lengthening of both short and long stem vowels gives rise to overlong vowels. I, however, found one singular form

(given in (12), below) where the short vowel lengthens by just one prosodic position – from V to VV. An interesting point to note, though, is that the word in question has a heavy onset. There is another word with a heavy onset that exhibits an irregular behaviour of the stem vowel in the singular form, namely the instrumental noun [ápwóodīɪ] 'gourd' (13). This form should have had an overlong stem vowel, since as I have said earlier all [-high] vowels in singular instrumental forms are overlong (cf. 3.1 Group Singular 4). Perhaps, the length of the vowel in (13) can be accounted for if we assume that the vowel in this word was a diphthong at an earlier stage, and therefore was an overlong vowel (perhaps [uoo]). Some other words with heavy onsets exhibit a variation in vowel length where vowels can be realised as either long or overlong (14), and yet other words (10b above) do not show this variation.

(12)	SG	DEM1	POSS.1SG	POSS.3SG	
	pwǒɔḍ̪(ɔ̄)	pwɔ̀ṇ̪ì	pwɔ̀ṭ̪āa	pwɔ̀ṭ̪ɛ̀	'field'
(13)	SG	DEM1	POSS.1SG	POSS.3SG	
	ápwóodīɪ	ápwónì	ápwónāa	apwónɛ̄	'gourd'
(14)	SG	DEM1	POSS.1SG	POSS.3SG	
	ɟwɔ̄k	ɟwɔ̄ɔ(ɔ)ŋ̀	ɟwɔ̄ɔ(ɔ)gāa	ɟwɔ̄ɔ(ɔ)gɛ̄	'Shilluk God' (pagan god/deity)

It is clear that the words with heavy onsets exhibit an irregular behaviour with respect to vowel length alternations. Overall, it appears that lengthening of short stem vowels renders them overlong. In order to explain this phenomenon we could invoke the process of analogy: words with short stem vowels lengthen by two prosodic positions by analogy with the words with long stem vowels that become overlong due to CL. Another way to analyse this phenomenon is to assume that vowels in singular/plural forms in (10b-c) were long prior to CL and not short as in the corresponding demonstrative and possessive forms. That is, we must assume that singular forms in (10b-c) had long (VV) stem-internal vowels which became overlong due to CL. This analysis, then predicts that CL does not apply to the short stem-internal vowels (10d). The attraction of this hypothesis lies in the fact that it can explain why there is vowel lengthening in some singular forms (10b-c) and not in others (10d). We can then draw a parallel with the process of CL observed with singular demonstrative forms where

CL only occurred in words that had long stem vowels. However, this means that the vowel in [pwɔ̆ɔd̪(ɔ̄)] 'field' (12 above) should be analysed as a diphthong because otherwise the stem vowel is short (cf. [pwɔ̀n̪ɪ̀] 'this field (next to the speaker)') and thus CL should not have applied. Assuming that 'glides' are still [+syllabic] and therefore are really [u] or [ʊ] and [i] or [ɪ] would mean that there are also forms like *[tuōooŋ] 'insect' which under this interpretation are tetra-moraic. This is clearly not the case because there is no evidence to support the existence of tetra-moraic syllables in Shilluk as there are no syllables that contain tetra-moraic monophthongs.

The above discussion shows that in the case of a language like Shilluk for which there are no historical records, the possibilities of explaining how a form got from A to B are multiple (as it is in the case of CL in singular and plural forms). I have shown that some apparent irregularities can be explained by considering cognates from related languages and by assuming a relative chronology of the developments (e.g. for example CL in [djɛ̀ɛl] 'this goat (next to the speaker)' vs. [jíɲ̀] 'this ear (next to the speaker)'). I have argued that in the case of the demonstrative forms CL was a regular process by which long stem vowels lengthened by one prosodic position to compensate for the loss of the suffix vowel. By contrast, CL in singular and plural forms is irregular in that it lengthens vowels by two prosodic positions in some words (10b-c), by one prosodic position in other words (10a, 12), and in some cases it does not apply at all (10d). I conclude this discussion by saying that the change in the demonstrative forms was an earlier process which has been completed and that the change in singular/plural forms is an ongoing process.

4. Tone

4.1 Background information

Shilluk has a complicated tone system which has not been previously explored in detail in the literature. Gilley (1992 and 2000) postulates three distinctive pitch levels – High, Mid and Low the combinations of which produce three falling contours (HL, HM and ML) and three rising contours (MH, LM and LH) all of which can occur on short vowels. Gilley also gives some examples of tone patterns that differentiate

semantic classes but notes that such patterns should be viewed as a separate system from the classification of singular-plural pairs she gives in her 2000 paper. Although Gilley does not explicitly state how many tonemes there are in Shilluk, on the basis of her description (summarised above) the number is nine. The analysis of (mainly) verbal paradigms in Shilluk by Remijsen (2008) led him to postulate seven tonemes. He distinguishes between High, Low, Mid, High Fall, Fall, Late Fall and Rise. Table 3, below, courtesy of Bert Remijsen, presents a minimal set for the seven Shilluk tonemes.

Table 3. *Shilluk tonemes – minimal set as presented in Remijsen (2008)*

High (cv́c)	High Fall (cv̂c)	Fall (cv̂c)	Low (cv̀c)	Late Fall (cv́̀c)	Mid (cv̄c)	Rise (cv̌c)
ŋɔ́l cut\DVN	**ŋɔ̂l** cut\PAST	**ŋɔ̂l** cut\INTR	**ŋɔ̀l** cut\2SG	**ŋɔ́̀l** cut\FUG	**ŋɔ̄l** cut\INST	**ŋɔ̌l** cut\FUG.2SG

Remijsen (2008)'s analysis differs from that of Gilley (1992 & 2000)'s in many respects. First, Gilley postulates three rises (MH, LM and LH), whereas Remijsen postulates only one (Rise). Second, according to Gilley there are three falling contours (HL, HM and ML), whereas Remijsen postulates two (High Fall [HL] and Fall [ML]). Finally, Remijsen gives an example of a contour tone that is not accounted for in Gilley – Late Fall. The characteristic that distinguishes Late Fall from other falls (High Fall and Fall) is the late alignment of the fall. Consider Figures 2 and 3. Figure 2 (left panel) exemplifies late alignment - the fall only starts at the end of the vowel / beginning of C2. By contrast, Figure 3 (right panel) exemplifies early alignment – the fall (High Fall) starts at the onset of the vowel (marked by vertical line). This difference in alignment of the falls led Remijsen to distinguish between High Fall and Late Fall. Remijsen (*ibid.*), notes that the Late Fall and Rise are morphological tonemes. He attributes their occurrence in Shilluk to lost suffixation and notes that the tonemes do not appear on long stem vowels since he considers this level of vowel length to be lexical but not morphological.

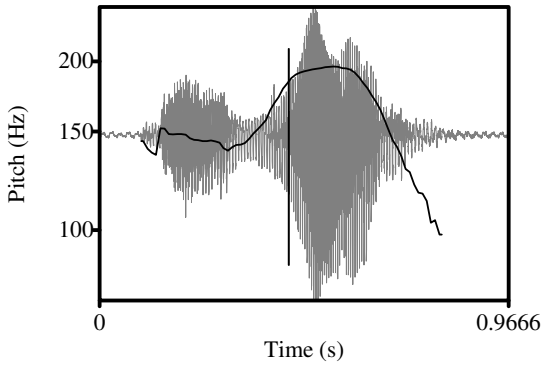


Figure 2

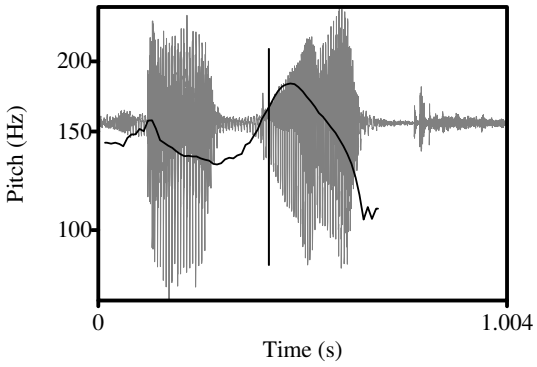


Figure 3

Figure 2. *Late alignment of fall in [dàa gwɔ́ɔ(ɔ)ŋ̀] 'this dog (next to the speaker)'. The vertical line marks the onset of glide+vowel sequence.*
Figure 3. *Early alignment of fall in [dàa gwɔ́ɔ̂(ɔ)k(ɔ̀)] 'dogs'. The vertical line marks the onset of glide+vowel sequence.*

In addition to tone Gilley (1992, 2000 and 2003) distinguishes stressed words from unstressed words. Under her interpretation, stress is a distinctive feature at the syllable level which makes the whole unit to sound more prominent. Remijsen (personal communication), attributes what has been thought of as stress by Gilley to vowel length (V vs VV) and/or presence of a High Fall contour. My data supports Remijsen's analysis in this respect, and, thus I will not be discussing stress any further.

In this section I will examine the tonal patterns that occur in the nominal paradigms in Shilluk. I will show that my data confirms the analysis proposed by Remijsen in that there is a Late Fall pattern, in that there is only one rising contour in Shilluk, and in that Rise and Late Fall are morphological tonemes. However, in my data both tonemes do appear on VV stems as in the nominal paradigms this level of vowel length can be morphological (cf. section 3.2 above). I will extend Remijsen's analysis of Late Fall in showing that there are two distinct Late Fall patterns found within the nominal paradigms that differ in the level from which the fall takes place – High and Mid. I will analyse the Late Fall from High (henceforth High Late Fall) and the Late Fall from Mid (henceforth Mid Late Fall) as distinct tonemes. I will confirm Gilley's insight about the presence of a High Mid contour in Shilluk, which I will argue, is another morphological toneme that occurs in Shilluk nouns. In addition, I will show

that lexical High Fall is restricted to the forms within the singular paradigms, and the morphological High Fall occurs in plural forms.

In my analysis I assume that the tone bearing unit in Shilluk is a mora. This assumption is motivated by the fact that stem syllables with contour tones on short vowels (see Table 3 above) are always closed syllables. In moraic theory (Hayes 1989) coda consonant can be associated with a mora, and thus words like that in Table 3 can be viewed as bi-moraic. This means that in a syllable with a short vowel contours (which are composed of sequences of level tones) have two morae to associate with. This assumption will also tie in nicely with my previous discussion on CL where vowel length is viewed in terms of prosodic positions or morae.

I use Remijsen's system of diacritics to mark tone in my data (see Table 3 above). In order to depict the nature of the late alignment High Late Fall is marked by placing (high ́) on the first vowel and (low ̀) on C2 (i.e. cv́vv̀c) and Mid Late Fall is marked by placing (mid ̄) on the first vowel and (low ̀) on C2 (i.e. cv̄vv̀c). In addition, the following combination of diacritics will be used to represent High Mid contour: cv́v̄vc. These conventions of marking tone will be used with short, long and overlong vowels when applicable. With long and overlong vowels I am only placing one tonal diacritic on the first vowel character. Finally, for typographic reasons High Fall (v́v̂) on short vowels is marked by placing one of the diacritics on the preceding consonant letter, for example [ɟj̀ềp] 'pocket'.

The rest of this section will proceed as follows: I will first describe tone in suffixes – this will allow us to understand the behaviour of morphological contours. I will then give a description of the behaviour of tones in singular and plural paradigms and postulate an analysis for some of the phenomena that we will encounter. Throughout the chapter I will use diagrams exemplifying F0 traces to support my discussion.

4.2 Tone in suffixes

In this section I will first examine tone in demonstrative suffixes, secondly in singular and plural suffixes and finally in possessive suffixes.

4.2.1 Tone in demonstrative suffixes

Singular and plural demonstrative suffixes are always Low toned (15a). In the cases where singular demonstrative forms have lost their suffix vowels (15b) Low tone of the suffix gets attached to the right edge of the stem creating a falling contour (see discussion in 4.3.2.2 below).

(15) a.

jwɔ̀n̪ɪ̀	jwɔ̄t̪ɪ̀
armpit\SG\DEM1	armpit\PL\DEM1
This armpit (next to the speaker)	*These armpits (next to the speaker)*

b.

lúuum̀	ɲāaaŋ̀
grass\SG\DEM1	crocodile\PL\DEM1
This grass (next to the speaker)	*These crocodiles (next to the speaker)*

4.2.2 Tone in singular and plural suffixes

In many singular and plural forms suffix vowels are either only weakly realised or deleted. Tone associated with those suffixes attaches to the right edge of stems creating contours (16). Interestingly, regardless of whether the suffix vowel is present or absent in a given form, the tone on the stem vowel is a contour. Thus, the tone from the suffix gets attached to the stem prior to the complete deletion of the syllabic element of that suffix (cf. CL process). Exceptions to the above generalisation are the forms where suffix vowels are preserved, namely, many of the singular forms that have short stem vowels (17a) and most of the plural forms with -ɪ suffix (17b). The variety of contours in singular and plural forms shows that suffix vowels could be High (16a), Mid (16b) or Low (16c) toned.

(16)

a.		b.		c.	
rěeeɟ(ɔ́)		kɛ́ɛ̄ɛw		álwɛ́ɛ̂(ɛ)t(ɔ̀)	
fish\SG		border\PL		crab\PL	
fish		*borders*		*crabs*	

(17)

a.		b.	
mùnɔ̀		kʌ́ʌlī	
neck\SG		family\PL	
neck		*families/fences*	

Instrumental nouns are easily distinguished by their tonal pattern. My data shows that instrumental root syllables are High toned and singular and plural suffixes are always Mid toned. Gilley (2000) and Storch (2005), however, analyse suffixes in singular and plural instrumental nouns as Low toned. Let us compare Figures 4 and 5. Figure 4 shows F0 trajectory in the singular instrumental form and Figure 5 shows F0 trajectory in the corresponding singular demonstrative form where the suffix is Low toned. We can see that F0 goes all the way to the bottom of the speaker's pitch range in Figure 5. By contrast, falling F0 at the start of C2 never reaches the lower part of the speaker's pitch range in Figure 4. Instead, it remains at the Mid level for the duration of the suffix vowel. Thus, I conclude that the singular instrumental suffix is Mid toned.

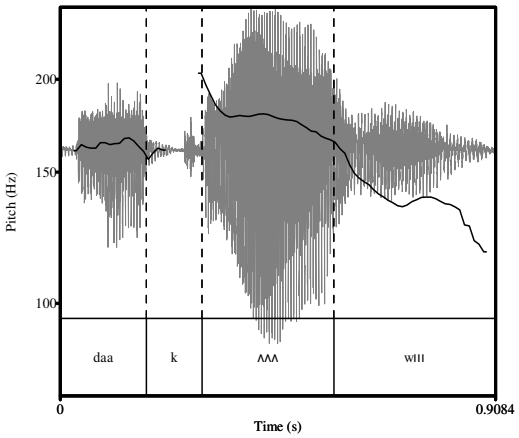


Figure 4

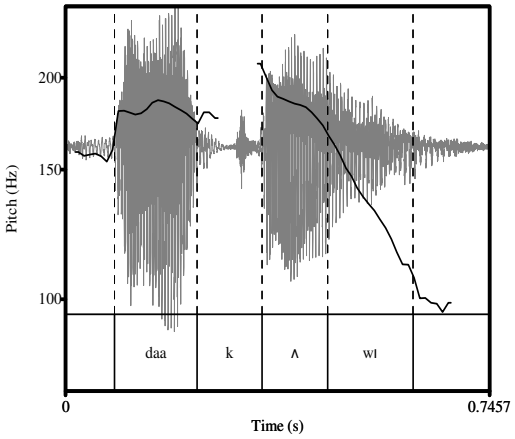


Figure 5

Figure 4*. F0 trajectory in [dáa kʌʌwīɪ] 'but there is a canoe stick' – suffix vowel is Mid toned.*

Figure 5*. F0 trajectory in [dáa kʌ́wì] 'but there is this canoe stick (next to the speaker)' – suffix vowel is Low toned.*

4.2.3 Tone in possessive suffixes

With plural forms possessive suffixes are High toned and with singular forms possessive suffixes are Mid toned. Tone in the 3rd person possessive suffixes appears to be lowered when the preceding syllable is either Low toned or has a contour with the Low second element. Figures 6 and 7, below, show F0 trajectories in the 1st and 3rd person possessive suffixes in plural and singular forms for 'scraping stick'. The onset of the suffix vowel is marked by a vertical line. The F0 has a falling trajectory in the case of the 3rd person possessive suffixes (dashed lines in both

Figures) with a Mid target in the 3rd person possessive in plural (Figure 6) and a Low target in the 3rd person possessive in singular (Figure 7). It is unclear why lowering (or automatic downstep) only occurs in 3rd person possessive suffix and not also in 1st (or 2nd) person possessive suffixes (cf. solid line F0 trajectories in Figures 6-7 and examples in (18), below), but it is worth to note that the 3rd person possessive forms often exhibit other intriguing behaviour. For example, the suffix vowel can be realised as schwa and I have even come across one form in which the suffix was not realised altogether (19a). In (19a) suffix deletion is accompanied by CL of the stem vowel (cf. [19b]).

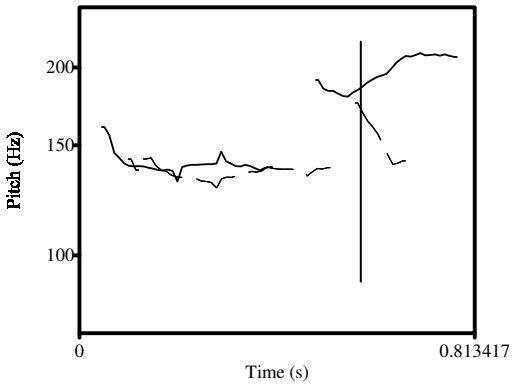


Figure 6

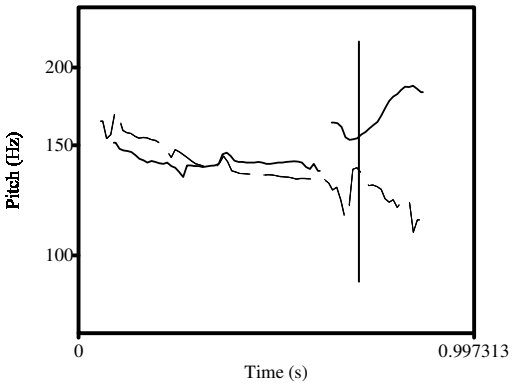


Figure 7

Figure 6. *F0 trajectories in [dàa lʊ̀ʊʊ̰t̪āa] 'there is my scraping stick' – solid line and [dàa lʊ̀ʊʊd̰ɛ̀] 'there is his/her scraping stick' – dashed line. The vertical line marks the onset of the suffix vowels. In 1st person possessive form the tone on the suffix is Mid and it is lowered in 3rd person possessive form.*

Figure 7. *F0 trajectories in [dàa lɔ̰̀t̪áa] 'there are my scraping sticks' – solid line and [dàa lɔ̰̀t̪ɛ̄] 'there are his/her scraping sticks' – dashed line. The vertical line marks the onset of the suffix vowels. In 1st person possessive form the tone on the suffix is High and it is lowered in 3rd person possessive form.*

(18)

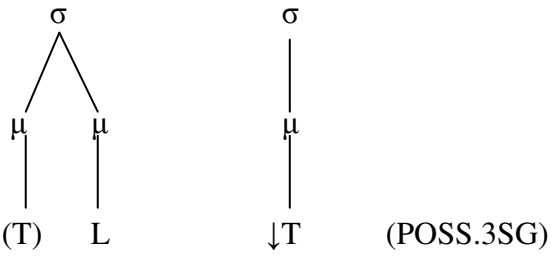
ʊ̀làlɛ̀	vs.	ʊ̀làlāa	
red.cow\SG\POSS.3SG		red.cow\SG\POSS.1SG	
his/her red cow		*my red cow*	
ʊ̀tʌ̀ŋɛ̀	vs.	ʊ̀tʌ̀ŋāa	
black.cow\SG\POSS.3SG		black.cow\SG\POSS.1SG	
his/her black cow		*my black cow*	
tèelɛ̄	vs.	tèeláa	
elbow\PL\POSS.3SG		elbow\PL\POSS.1SG	
his/her elbows		*my elbows*	

bʌ̀ʌtɛ̄	vs.	bʌ̀ʌtáa	
arm\PL\POSS.3SG		arm\PL\POSS.1SG	
his/her arms		*my arms*	

(19)	a.	ápwôoc	b.	ápwôcáa
		rabbit\PL\POSS.3SG		rabbit\PL\POSS.1SG
		his/her rabbit		*my rabbit*

In order to account for the lowering of pitch in 3rd person possessive suffixes I postulate the rule of automatic downstep (20) which states that tone in 3rd person possessive suffixes is lowered when the tone in the preceding syllable is either a level Low or a contour with the Low second element. This rule applied to both High and Mid tone in 3 possessive suffixes.

(20) *Automatic downstep in 3rd person singular possessive suffixes*



4.3 Paradigmatic study of tone in Shilluk nouns

In this section I will investigate the behaviour of tone on stem vowels in singular and plural paradigms. The paradigmatic approach to studying tone in Shilluk nouns is the key to understanding how morphological contours are formed, what their distribution is and what combinations of level tones produce different/same contours. In what follows I will first give a description of the distribution of level tones, and will then proceed to examine lexical and morphological contour tones.

4.3.1 Level tones

Level tones in singular/plural forms usually do not change in the demonstrative and possessive forms (21), except for the suffix-less singular demonstrative forms where a

tone shift takes place (22). Tone shift in singular demonstrative forms will be discussed in section 4.3.2.2 below.

(21)	PL/SG	DEM1	POSS.3SG	
	mùɟɔ̀	mùɲì	mùɟɛ̀	‘island’
	rɪ́c	rɪ́cì	rɪ́cɛ́	‘fish’ (more than one)
	jwɔ̄ⱡ	jwɔ̄ⱡì	jwɔ̄ⱡɛ́	‘armpits’

(22)	SG	DEM1	POSS.3SG	
	lúum	lúuum̀	lúuumɛ̄	‘grass’
	nāam	nāaam̀	nāaamɛ̄	‘water area’

Low tone is found in stems with short (23a), long (23b) and overlong (23c) vowels. When a Low toned syllable is word-final (and in my data phrase-final), Low tone is realised as a falling tone (cf. Figure 5 above).

(23) a
lɔ̀ⱡ
scraping.stick\PL
scraping sticks

pìnáa
cheek\PL\POSS.1SG
my cheeks

b
lʊ̀ʊⱡ
scraping.stick\SG
scraping stick

pìināa
cheek\SG\POSS.1SG
my cheek

c
lʊ̀ʊʊⱡāa
scraping.stick\PL\POSS.1SG
my scraping stick

High tone is found in stems with short (24a), long (24b) and overlong (24c) vowels. High occurs with overlong vowels only on non-final syllables.

(24) a.
rɪ́c
fish\PL
fish

rɪ́cáa
fish\PL\POSS.1SG
my fish (more than one)

b.
lɛ́ɛp
tongue\SG
tongue

ālāawāa
candy\SG\POSS.1SG
my candy (from Arabic)

c. lɛ́ɛɛbāa
tongue\SG\POSS.1SG
my tongue

Mid tone is found in suffixed and unsuffixed stems with short (25a), long (25b) and overlong (25c) vowels.

(25) a. lɛ̄k lɛ̄káa
tooth\PL tooth\PL\POSS.1SG
teeth *my teeth*

b. ŋēet ŋēetáa
rib\PL rib\PL\POSS.1SG
ribs *my ribs*

c. lwɛ̄ɛɛt(ɔ̄) ànāaabāa
finger\SG twig\SG\POSS.1SG
finger *my twig*

4.3.2 Contour tones

There are two types of contour tones in Shilluk: lexical and morphological. By *lexical contours* I understand the underlying tone pattern of a given root syllable. The underlying contours, just like the level tones, tend to appear in most of the forms within a given paradigm with the exception of some singular demonstrative forms where a tone shift takes place. *Morphological contours* occur in forms where inflection is signalled by means of stem-internal operations (e.g. CL and the association of tone with the right edge of the stem). Morphological contours occur even in those singular/plural forms where the suffix vowels are still optionally realised (cf. CL process). We will see that in general lexical and morphological contours are distinct tone patterns with the exception of High Fall which can be both lexical and morphological.

4.3.2.1 Lexical contours

High Fall

Lexical High Fall is found in stems with short (26a), long (26b) and overlong (26c) vowels, but only in singular paradigms. With some singular forms (26c) there is a question of whether High Fall should be considered as lexical or morphological, since

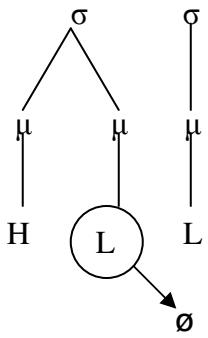
the (weak) suffixes in these forms are Low toned. Thus, we might expect that in these forms the Low of the suffix has attached to the right edge of the High toned root syllable. The same, however, cannot be said about the High Falls in singular forms in (26a-b) which are suffix-less. Words in (26b-c) are Arabic and English loans. It has to be noted that in most of the borrowed words all syllables except the last are Low toned. The last syllable is usually High toned in plural forms and in singular forms there is usually a High Fall. Thus, words like that in (26c) most likely were assigned a lexical High Fall when they entered the language. A confirmation that High Fall is lexical in all words in (26) comes from the observation that High Fall is preserved in the corresponding possessive forms. I, thus conclude that High Fall can be the underlying tone of the nouns in singular paradigms.

(26)	SG	DEM1	POSS.3SG	
a.	ɟjɛ̂p	ɟjɛ́ɛm̀	ɟjɛ́ɛ̂bɛ̄	‘pocket’ (from Arabic)
	gẃɔ̂k	gwɔ́ɔ(ɔ)ŋ̀	gwɔ́ɔ̂(ɔ)gɛ̄	‘dog’
b.	tɛ̀lɛ̀fóô̩n	tɛ̀lɛ̀fóoò̩n	tɛ̀lɛ̀fóô̩onɛ̀	‘telephone’ (borrowed word)
	mʊ́ʊ̂s	mʊ́ʊʊǹ	mʊ́ʊ̂ʊdɛ̀	‘banana’ (from Arabic)
c.	kɛ́ɛ̂ɛm(ɔ̀)	kɛ́ɛmɪ̀	kɛ́ɛ̂mɛ̀	‘tent’ (from Arabic)
	sɪ̀ɟʌ́ʌ̂ʌr(ɔ̀)	sɪ̀ɟʌ́ʌrɪ̀	sɪ̀ɟʌ́ʌ̂rɛ̀	‘cigarette’ (from Arabic)

In all paradigms in (26) there is a tone shift in singular demonstrative forms whereby the High Fall becomes either level High (26c) or Late Fall (26a-b). I account for the tone shift in demonstrative forms in (26) by postulating a process of Low Absorption (27) whereby the Low second element of the contour gets ‘absorbed’ into the right-adjacent Low of the demonstrative. Tone in (27) is associated with morae and each mora is linked to a syllable node. I assume that in the cases where demonstrative forms are suffix-less (26a-b) the rule of Parasitic Delinking (28) deletes the syllable node of the demonstrative suffix, but not the mora (hence CL) and not the tone associated with that mora. In (26a-b) demonstrative Low tone gets attached to the right edge of the stem creating a Late Fall pattern (to be discussed in 4.3.2.2 below).

Low Absorption only operates in demonstrative forms as is evident from the fact that it does not take place in singular forms with Low toned suffixes (26c).

(27) *Low Absorption in singular demonstrative 1 (next to speaker) forms*

a. 

(where the second L is the tone of the DEM1 suffix)

(28) *Parasitic delinking* (Hayes 1989:268)
Syllable structure is deleted when the syllable contains no overt nuclear segment.

Fall

Fall occurs in stems with short, long and overlong vowels. Fall is found in both singular (29a) and plural (29b) paradigms.

(29)

a.	SG	DEM1	POSS.3SG	
	ḍâap	ḍâaam	ḍâaabɛ̀	‘gold’ (from Arabic)
	lwɔ̂ɔɔg(ɔ̀)	lwɔ̂ŋì	lwɔ̂gɛ̀	‘washing’
	búlûk	búlûŋ	búlûgɛ̀	‘brigade’ (from Arabic)
	úgɔ̂ṭ	úgɔ̂ṇ	úgɔ̂ṭɛ̀	‘cloth’

b.	PL	DEM1	POSS.3SG	
	ápwôcì	ápwôɟì	ápwôoc	‘rabbits’
	áɟwôkì	áɟwôkì	áɟwôkɛ̄	‘benevolent magicians’

In paradigms with lexical Fall there appears to be no tone shift in demonstrative forms. Consider Figure 8 which shows F0 trajectories in singular forms [lwɔ́ɔ̂ɔg(ɔ̀)] ‘bath’ – solid line and [lwɔ̂ɔɔg(ɔ̀)] ‘washing’ – dashed line and Figure 9 which shows

F0 trajectories in demonstrative forms [lwɔ́ŋ̀ì] 'this bath (next to the speaker)' – solid line and [lwɔ̂ŋ̀ì] 'this washing (next to the speaker)'- dashed line. In singular forms (Figure 8) the fall is aligned early – about half-way through the glide+vowel sequence which is marked by vertical lines. In Figure 9 the tone on the stem vowel is High in [lwɔ́ŋ̀ì] due to Low Absorption. By contrast, in [lwɔ̂ŋ̀ì] F0 has a falling trajectory just as it is in the corresponding singular form (Figure 8). The fall in [lwɔ̂ŋ̀ì] (Figure 9) starts higher than in the singular form in Figure 8 because in the recordings I used to create these figures the singular forms were uttered in isolation, whereas the demonstrative forms were preceded by a High toned existential contrastive marker [dáa]. The preceding High always has an effect of raising the level from which the fall of the Fall contour starts. I conclude that Low Absorption only applies when the contour has a High first element and not when it has a non-high first element.

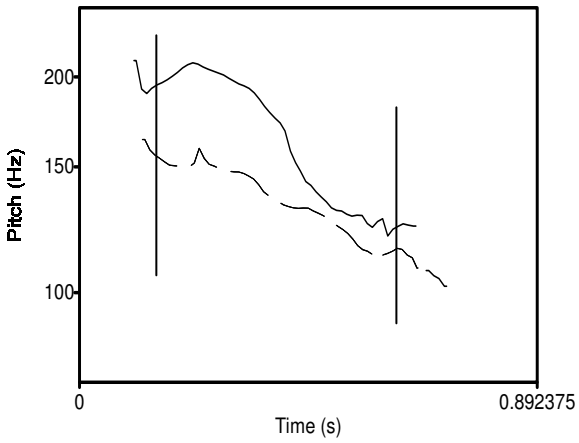


Figure 8

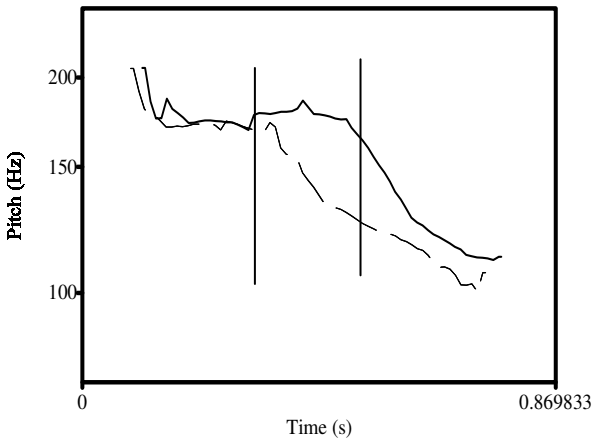


Figure 9

Figure 8. *F0 trajectories of High Fall in [lwɔ́ɔ̂ɔg(ɔ̀)] 'bath' – solid line; and Fall in [lwɔ̂ɔɔg(ɔ̀)] 'washing' – dashed line. Both words were elicited in isolation. First vertical line marks the onset of the glide and the second line marks the end of the vowel*

Figure 9. *F0 trajectories of High in [dáa lwɔ́ŋ̀ì] 'but there is this bath (next to the speaker)' – solid line; and Fall in [dáa lwɔ̂ŋ̀ì] 'but there is this washing (next to the speaker)' – dashed line. First vertical line marks the onset of the glide and the second line marks the end of the vowel.*

4.3.2.2 Morphological contours

In this section I will examine four patterns of morphological contours that occur in Shilluk nouns: Rise, High Mid, Late Fall and High Fall.

Rise

Rise occurs in stems with overlong and long vowels. We can see from (30) that both singular (30a-d) and plural (30e-g) forms can have a rising tone which occurs as a result of weakening or loss of vowel suffixes. In the examples (30a-c) and (30e-g) the first element of the contour is Low as is evident from the corresponding demonstrative and possessive forms. It is not possible to reconstruct tone of the plural suffixes in (30e-g) since suffix vowels are never realised in these forms. In singular forms in (30a-d) suffix vowels are optionally realised making it possible to see what sequences of level tones produce the Rise pattern. Interestingly, combinations of Low + High (30a and 30c), Low + Mid (30b) and Mid + High (30d) produce the identical Rise pattern as can be observed in the Figure 10, below, which shows three overlapping F0 trajectories. This pattern of collapsing level tones of different heights when they combine in the order – lower first element, higher second element – is only attested in the case of Rise. The combinations of High+Low and Mid+Low result in different falling contours (e.g. High Fall and Low Fall, respectively). The fact that none of the borrowed words seem to get assigned the rising tone strongly suggests that Rise only arises out of necessity – when the deletion of morphology results in the association of a higher tone with a root syllable with a lower lexical tone.

(30)	SG/PL	DEM1	POSS.3SG	
a.	rĕeeɟ(ɔ́)	rèeɲì	rèecɛ̀	‘fish’
b.	pwǒɔḏ(ɔ̄)	pwɔ̀n̪ì	pwɔ̀t̪ɛ̀	‘field’
c.	cǒɔɔg(ɔ́)	cɔ̀ɔŋì	cɔ̀ɔŋɛ̀	‘bone’
d.	àɟwǒɔɔk(ɔ́)	àɟwɔ̄ŋì	àɟwɔ̄ŋɛ̄	‘benevolent magician’
e.	ḏaăap	ḏàapì	ḏàapɛ̄	‘many items made of gold’ (from Arabic)
f.	ʊ̀laă(a)l	ʊ̀làlì	ʊ̀làlɛ̄	‘red cows’
g.	ʊ̀tʌǎ(ʌ)ŋ	ʊ̀tʌ̀ŋì	ʊ̀tʌ̀ŋɛ̄	‘black cows’

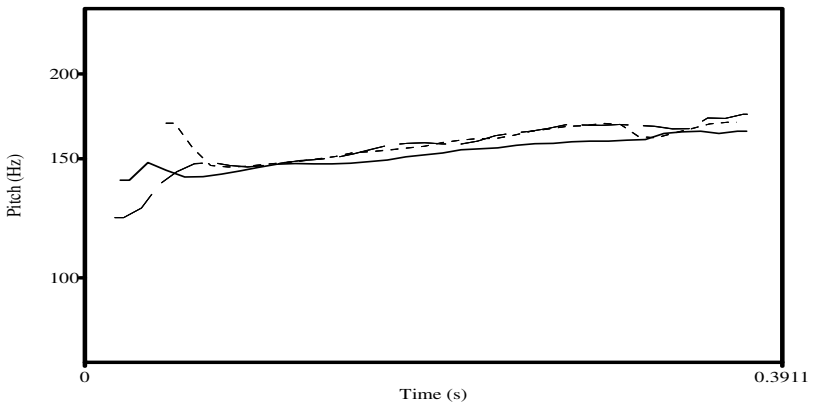


Figure 10. *F0 trajectories of Rise on the stem vowels in [rěeeɟ(ɔ́)] 'fish' – solid line, [pwǔɔɖ̈(ɔ̄)] 'field' – dotted line, and [àɟwǔɔɔk(ɔ)] 'benevolent magician' – dashed line.*

High Mid

High Mid contour is found mainly in unsuffixed forms with either long or overlong vowels (31a), but it is also found in one 3rd possessive form (31b) where the contour seems to result due to the association of the tone from the suffix with the root syllable (cf. other intriguing behaviour of 3rd person possessive forms in 4.2.3, above).

(31)

a.	ɟáāak	ɟjɛ́ɛ̄ɛp	sɪ̀ɟʌ́ʌ̄(ʌ)r(ī)
	chief\SG	pocket\PL	cigarette\PL
	chief	*pockets*	*cigarettes (from Arabic)*

b. dīdéēedɛ̄
stick.holder\SG\POSS.3SG
his/her stick holder

Figure 11 shows F0 trajectory for [ɟjɛ́ɛ̄ɛp] 'pocket'. We can see that at the onset of voicing (marked by vertical line) F0 is high and it falls half-way through the vowel but does not reach the lower part of the speaker's pitch range. Instead, F0 becomes level within the range of Mid tone for this speaker and it remains at this level for the last half of the duration of the vowel.

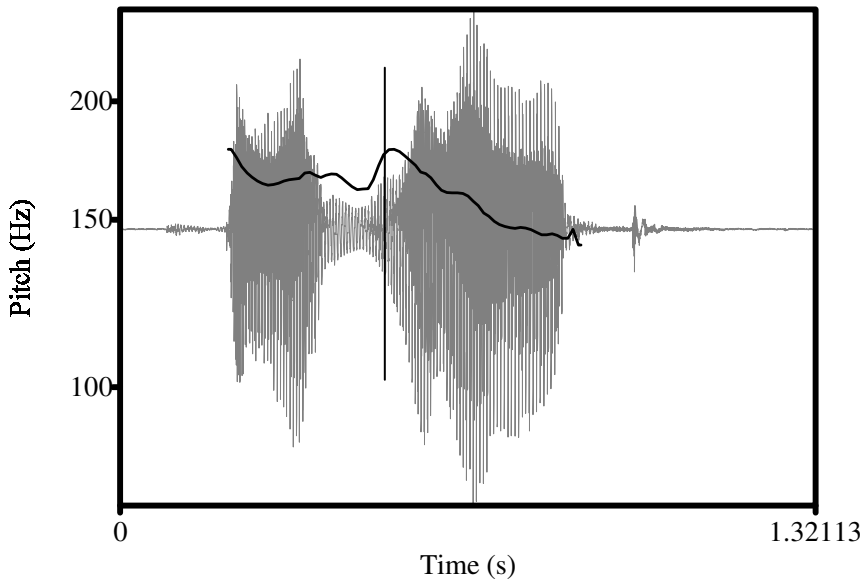


Figure 11. *F0 trajectory in [dáa ɟjɛ́ɛ̃ɛp] 'but there is a pocket'. The onset of the glide+vowel sequence is marked by vertical line. The tone on the noun is High Mid.*

Late Falls

The Late Fall pattern mainly occurs in suffix-less singular demonstrative forms (32a), but also in singular (32b) and plural (32c) forms. The peculiarity of this contour lies in the alignment of the fall which starts at the end of the vowel or at the onset of the sonorant C2.

(31)

a.	SG	DEM1	
	ɟjə̂p	ɟjɛɛm̀	'pocket'
	tík	tíŋ	'chin'
	ɲāaŋ	ɲāaaŋ̀	'crocodile'
b.	SG	DEM1	
	āláaaẁ(ɔ)	āláawɪ	'candy' (from Arabic)
	màdíɪ̀l	màdíɪɪl	'handkerchief' (from Arabic)
c.	PL	DEM1	
	twóo(o)ŋ̀(ɔ)	twóŋɪ	'insects'

Figure 12, below, shows F0 trajectories in three singular demonstrative forms: [kwɔ̀ɔɔŋ] 'this culture (next to the speaker)', [ɟwɔ̄ɔ(ɔ)ɲ̀] 'this Shilluk God (next to the speaker)' and [gwɔ́ɔ(ɔ)ɲ̀] 'this dog (next to the speaker)'. The vertical line marks the onset of C2s. We can see that in all three cases the fall starts at the end of the vowel / onset of C2 – a distinctive Late Fall pattern, but that these falls start from different levels. In [gwɔ́ɔ(ɔ)ɲ̀] (dashed line) the fall starts from High, in [ɟwɔ̄ɔ(ɔ)ɲ̀] (dotted line) from Mid and in [kwɔ̀ɔɔŋ] (solid line) from Low. Note that these words differ only with respect to place of articulation and voicing of the initial consonants. Interestingly, depressor consonants (i.e. voiced consonants which have an effect of lowering F0 on the following vowel/sonorant [Yip 2002:33-34]) occur in the onsets of the words where the fall starts from High and Mid and not in the onset of the word where the fall is from Low.

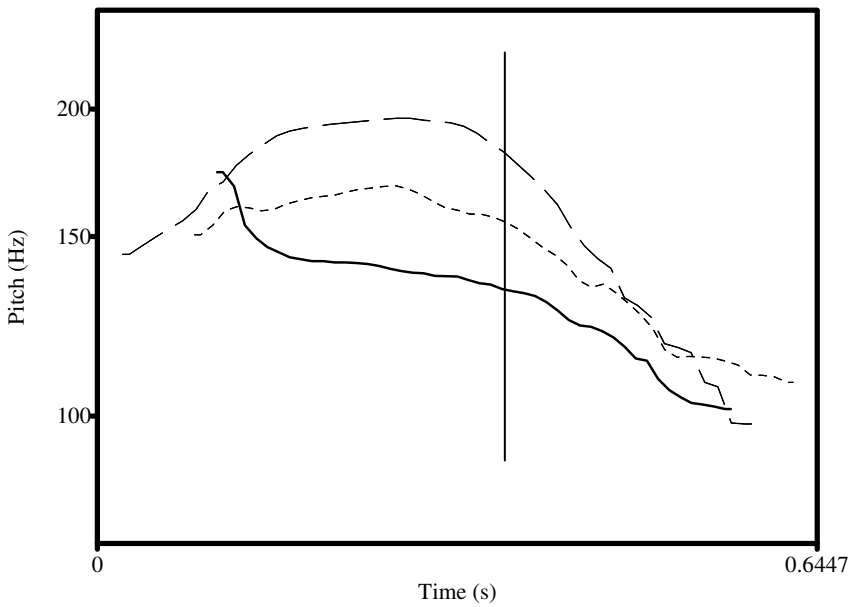


Figure 12. *F0 trajectories for the duration of the overlong vowels plus coda consonants in [kwɔ̀ɔɔŋ] 'this culture (next to the speaker)' – solid line; [ɟwɔ̄ɔ(ɔ)ɲ̀] 'this Shilluk God (next to the speaker)' – dotted line; and [gwɔ́ɔ(ɔ)ɲ̀] 'this dog (next to the speaker)' – dashed line.*

In the light of the presented evidence I propose that a distinction should be made between High Late Fall (as in [gwɔ́ɔ(ɔ)ɲ̀]) and Mid Late Fall (as in [ɟwɔ̄ɔ(ɔ)ɲ̀]) tonemes. As for the Late Fall pattern in [kwɔ̀ɔɔŋ], I do not consider it to be a distinct toneme, since as I have noted in 4.3.1, Low tone is always realised as a falling tone

phrase-finally. The summary of the occurrences of High Late Fall and Mid Late Fall in noun stems is given below.

High Late Fall is found with short, long and overlong vowels in stem syllables in word-final position. In most cases this toneme is found in singular demonstrative forms (37a) but it is also found in singular and plural forms with long (37b) and overlong (37c) vowels.

(37)

a.	SG	DEM1	
	tík	tíŋ̀	‘chin’
	ɟ́ĵɛ̂p	ɟjɛ́ɛm̀	‘pocket’
	lúum	lúuum̀	‘grass’

b.	SG	DEM1	
	màdíɪ̀l	màdíɪɪ̀l	‘handkerchief’ (from Arabic)

d.	PL	DEM1	
	twóo(o)ŋ̀(ɔ̀)	twóŋ̀ɪ	‘insects’

	SG	DEM1	
	āláaaẁ(ɔ̀)	āláawɪ	‘candy’ (from Arabic)

Mid Late Fall is found in singular demonstrative forms with long (38a) or overlong (38b) vowels. I do not have examples of this toneme is syllables with short vowels, but this could be due to the fact that I did not collected the appropriate examples.

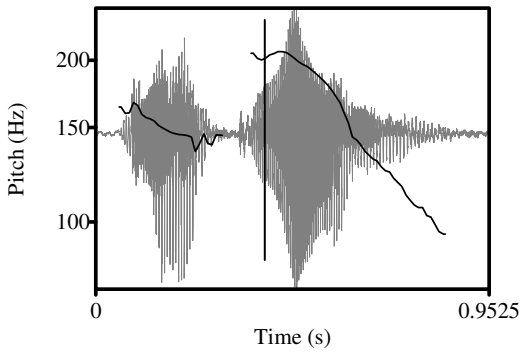
(38)	SG	DEM1	
a.	pjēn	pjēeǹ	‘animal skin’
b.	ɲāaŋ	ɲāaaŋ̀	‘crocodile’

High Fall as a Morphological Contour

Morphological High Fall occurs in some plural forms (39). The confirmation that we are dealing with a morphological contour in (39) comes from the fact that it does not survive in demonstrative and possessive forms (cf. lexical contours). Earlier I have given an example of the Late Fall pattern in the plural form for 'insects', repeated in (40) below. Figure 13 shows F0 trajectory in [twóo(o)ŋ̀(ɔ̀)] 'insects' and Figure 14 shows F0 trajectory in [gwɔ́ɔ̂(ɔ)k(ɔ̀)] 'dogs'. We can see that in Figure 13 the fall is aligned at the end of the vowel and in Figure 14 the fall starts at the onset of voicing. Both contours in these forms arise due to the weakening of the suffix vowel. So, why do we get different contour patterns in plural forms in (39) and (40)? The crucial difference between the plural form in (40) and those in (39) lies in the fact that in the former case C2 is a sonorant consonant, whereas all plural forms in (39) have voiceless obstruent C2s. Because pitch cannot be maintained during the production of the voiceless obstruents the fall in the words in (39) gets aligned early, thus creating a High Fall pattern.

(39)	PL	DEM1	POSS.3SG	
	ɟáâ(a)k(ɔ̀)	ɟáakɪ̀	ɟáakɛ́	'chiefs'
	lwɛ́ɛ̂(ɛ)t(ɔ̀)	lwɛ́(ɛ)tɪ̀	lwɛ́(ɛ)tɛ́	'fingers'
	álwɛ́ɛ̂(ɛ)t(ɔ̀)	álwɛ́(ɛ)tɪ̀	álwɛ́(ɛ)tɛ́	'crabs'
	gwɔ́ɔ̂(ɔ)k(ɔ̀)	gwɔ́kɪ̀	gwɔ́kɛ́	'dogs'

(40) twóo(o)ŋ̀(ɔ̀)
insect\PL
insects



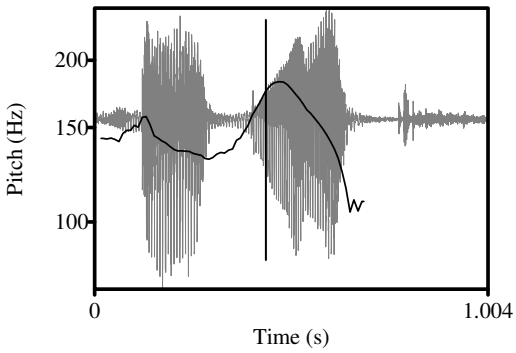


Figure 13 ***Figure 14***

Figure 13. *F0 trajectory of High Late Fall in [dàa twóo(o)ŋ̀(ɔ̀)] 'insects'. The onset of the glide+vowel sequence is marked by vertical line.*
Figure 14. *F0 trajectory of High Fall in [dàa gwɔ́ɔ̂(ɔ)k(ɔ̀)] 'dogs'. The onset of the glide+vowel sequence is marked by vertical line.*

Whereas the loss of the suffix is responsible for the occurrence of a High Fall toneme in the plural forms in (39), the same cannot be said about the plural form [ɗjêk] 'goats' (41) as there is no evidence to suggest that this form was once suffixed (cf. cognates from the related languages in (8) above). It must be noted that demonstrative and possessive forms in (41) have a level High tone on the stem vowels. I have noted earlier (see 4.3.2.1) that lexical High Fall occurs in possessive forms. By contrast, morphological High Fall in plural forms in (39) does not appear in possessive forms where the lexical High tone occurs instead. Thus, judging by the fact that High Fall does not occur in demonstrative and possessive forms in (41), I conclude that the High Fall in the plural form is also morphological.

(41)	PL	DEM1	POSS.3SG	
	ɗjêk	djékɪ̀	djékɛ́	'goats'

4.4 Summary of findings

In this chapter I have examined tonal patterns in Shilluk nouns. I have presented evidence for two processes that operate in morphologically complex forms: Low Absorption and Automatic Downstep. On the basis of the above analysis I postulate that there are nine tonemes in Shilluk: Low, Mid, High, High Fall, Fall, High Late Fall, Mid Late Fall, High Mid and Rise, all of which occur in nominal paradigms.

High Late Fall, Mid Late Fall, High Mid and Rise are purely morphological contours and High Fall can be both lexical and morphological. My analysis shows that with Shilluk contours we must consider two factors: which level tones are combined to form a contour and the alignment of the falls. I have found three falling contours where the fall is aligned early – High Fall (HL), Fall (ML) and High Mid (HM). According to Yip (2002:29), systems where these three falling contours are distinct tonemes are rare. In addition, I claim that there are two other falling contours with late alignment of the fall, which means that there are five falling tonemes in Shilluk. Because systems with five falling contours are not common, experimental verifications are required to support my analysis.

5. CONCLUSION

Shilluk has a rich suprasegmental system. In this dissertation I have investigated how the language makes use of suprasegmentals to form morphologically complex words. I have shown that due to the weakening and loss of suffixes in Shilluk nouns inflection is often expressed stem-internally by means of vowel length alternations and tone shift. These morphophonological processes occur in singular, in plural and in some singular demonstrative forms. In addition, nouns marked for 3rd person singular possessive in some cases also exhibit loss of suffixation, CL and association of the tone from the suffix with the root syllable.

I have discussed two processes of compensatory lengthening in Shilluk – in singular demonstrative forms and in singular and plural forms. I have argued that the former process operated at the time when Shilluk had diphthongs and singular suffixes were not yet deleted. CL applied to long stem vowels lengthening them by one prosodic position. I have said that CL in singular/plural forms is an ongoing process which lengthens stem vowels by one or two prosodic positions and in some cases it does not apply at all. CL in Shilluk is of theoretical interest and is currently under study.

I have postulated that there are nine tonemes in Shilluk – five lexical (Low, Mid, High, Fall and High Fall) and five morphological (Rise, High Mid, High Late Fall, Mid Late Fall and High Fall) with High Fall occurring as both. I have shown that

Shilluk contours can be distinguished on the basis of two factors – which level tones are combined to form a contour, and the alignment of the falls. Combinations of higher level tones with lower level tones give rise to five contours: Fall, High Fall, High Mid, High Late Fall and Mid Late Fall. By contrast, combinations of lower level tones with higher level tones give rise to one contour: Rise. Early alignment of falls gives rise to Fall, High Fall and High Mid contours, and late alignment of falls gives rise to High Late Fall and Mid Late Fall contours. I have also postulated two processes that operate in morphologically complex forms: Low Absorption and Automatic Downstep. The proposed analysis shows that the tonal system of Shilluk is typologically unusual. Therefore, experimental verifications are required to support some of my observations. For example, perception experiments will show whether the speakers perceive the difference between High Fall, Late Fall and High Mid; and between High Late Fall and Mid Late Fall.

Word count: 9,786

REFERENCES

Andersen, Torben (1990). Vowel length in Western Nilotic languages. *Acta Linguistica Hafniensia* 22, 5-26.

Andersen, Torben (2002). Case inflection and nominal head marking in Dinka. *Journal of African Languages and Linguistics* 23, 1-30.

Boersma, Paul and David Weenink (2005). *Praat: doing phonetics by computer* (the latest version 5.0.45) [Computer program]. Available from: http://www.praat.org/ [downloaded 07/01/09].

Dimmendaal, Gerrit J. (2000). Number marting and noun categorisation in Nilo-Saharan languages. *Anthropological Linguistics* 42(2), 214-261.

Gilley, Leoma (1992). *An autosegmental approach to Shilluk phonology*. A Publication of The Summer Institute of Linguistics and The University of Texas at Arlington.

Gilley, Leoma (2000). Singulars and plurals in Shilluk a search for order. *Occasional Papers in the Study of Sudanese Languages* 8, 1-21.

Gilley, Leoma (2003). The feature of stress in Nilotic. In Rose-Juliet Anyanwu (ed.): Stress and Tone – the African experience. *Frankfurter Afrikanistische Blätter* 15, 99-119. Cologne: Rüdiger Köppe Verlag.

Gordon, R.G. (ed.) (2005). Ethnologue*: Languages of the World, 15th edition*. Dallas (Texas): SIL International. [Online version: http://www.ethnologue.com]
Ethnologue report for Shilluk: http://www.ethnologue.com/show_language.asp?code=shk
[last accessed 27/02/09].

Hayes, Bruce (1989). Compensatory lengthening in moraic phonology. *Linguistic Inquiry* 20, 253-306.

Joshua project: http://www.joshuaproject.net/peopctry.php [last accessed 27/02/09].

Katamba, Francis (1989). *An introduction to phonology*. London: Longman.

Kohnen, B. (1933). *Shilluk grammar*. Verona: Missioni Africane.

Nilotic Prosody website: http://www.ling.ed.ac.uk/~bert/nilotic_output.html

Noske, Manuela (1995). Consonant gemination in Shilluk. In Robert Nicolaï & Franz Rottland (eds.) *Cinquième Colloque de Linguistique Nilo-Saharienne / Fifth Nilo-Saharan Linguistics Colloquium. Nice, 24-29 août 1992*, 217-243. Cologne: Rüdiger Köppe Verlag.

Payne, Thomas E. (1997). *Describing morphosyntax: A guide for field linguists*. Cambridge: Cambridge University Press.

Remijsen, Bert (2008). Suprasegmental distinctions and their phonetic realisations in Shilluk - preliminary findings. Paper presented at the P-workshop, University of Edinburgh.

Remijsen, Bert and Leoma G. Gilley (2008). Why are three-level length systems rare? Insights from Dinka (Luanyiang dialect). *Journal of Phonetics* 36(2), 318-344.

Remijsen, Bert and Caguor Adong Manyang (to appear). 'Luanyjang Dinka - Illustration of the IPA'. *Journal of the International Phonetic Association,* 39(1), 113-124.

Storch, Anne (2005). *The noun morphology of Western Nilotic. Nilo-Saharan Linguistic Analyses and Documentation,* 21. Cologne: Rüdiger Köppe Verlag.

The Leipzig Glossing Rules: Conventions for interlinear morpheme-by-morpheme glosses (2008). Available from: http://www.eva.mpg.de/lingua/resources/glossing-rules.php [last accessed 13/03/09].

Trask, R. L. (1996). *A dictionary of phonetics and phonology*. London: Routledge.

Yip, Moira (2002). *Tone*. Cambridge: Cambridge University Press.