SUPRASEGMENTALS IN SHILLUK NOMINAL MORPHOPHONOLOGY

by Tatiana Reid

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Acknowledgements

I would like to thank my Shilluk language consultant Otto Gwado Ayoker for sharing with me his knowledge about the Shilluk language and people, for his dedication to the project and for his patience in dealing with my inability to hear distinctions that are so salient to his ear.

My deepest gratitude goes to my supervisor Dr. Bert Remijsen, whose work on Western Nilotic languages has inspired my research, for giving me the opportunity to work on Shilluk, and for providing detailed feedback and untiring support.
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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 – cōng 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. lúuwm |
| 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**

<table>
<thead>
<tr>
<th>Grade</th>
<th>−ATR</th>
<th>+ATR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short V</td>
<td>ɪ ɛ a ʊ i</td>
<td>ɪ e ʌ o u</td>
</tr>
<tr>
<td>Long VV</td>
<td>ɪɪ ɛɛ a a a ʊʊ o o u u</td>
<td></td>
</tr>
<tr>
<td>Overlong VVV</td>
<td>ɪɪɪ ɛɛɛ a a a a ʊʊʊ o o o u u u u</td>
<td></td>
</tr>
</tbody>
</table>

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**

<table>
<thead>
<tr>
<th></th>
<th>Bilabial</th>
<th>Dental</th>
<th>Alveolar</th>
<th>Palatal</th>
<th>Velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plosives voiceless</td>
<td>p</td>
<td>t</td>
<td>t</td>
<td>c</td>
<td>k</td>
</tr>
<tr>
<td>Plosives voiced</td>
<td>b</td>
<td>d</td>
<td>d</td>
<td>ɹ</td>
<td>g</td>
</tr>
<tr>
<td>Nasals</td>
<td>m</td>
<td>ɳ</td>
<td>n</td>
<td>ɳ</td>
<td>ɳ</td>
</tr>
<tr>
<td>Lateral</td>
<td></td>
<td></td>
<td>l</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibrant</td>
<td></td>
<td></td>
<td>r</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approximants</td>
<td>(w)</td>
<td></td>
<td>j</td>
<td></td>
<td>(w)</td>
</tr>
</tbody>
</table>
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: [dɪwɪdɪtɪ] ‘fish hook’ (approx. 280ms), whilst vowels in other suffixes are realised as long: [dɪwɪdɪ] ‘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 [dɪwɪdɪ] and short [dɪwɪdɪ]. In singular forms suffixes can be -ɔ, -ɪ, or -ɪː; 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 \( -\iota \). I will also examine two possessive forms marked for 1\(^{st}\) and 3\(^{rd}\) person singular possession (i.e. my X, his/her/its X). I will omit examples of the 2\(^{nd}\) person possessive forms from my discussion because the behaviour of these forms is identical to that of the 1\(^{st}\) 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: \(-\text{aa}\) in 1\(^{st}\) person singular, and \(-\epsilon\) in 3\(^{rd}\) person singular.

Some noun stems contain prefixes. Gilley (2000) lists three prefixes that occur in Shilluk nouns and explains their semantic functions. For example, \( d\text{-} \) = ‘is used for’, \( a\text{-} \) = ‘female item’ and \( \text{ʊ-} \) = ‘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 [dáa] (“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 from 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**

<table>
<thead>
<tr>
<th>SG</th>
<th>DEM1</th>
<th>POSS.1SG</th>
<th>POSS.3SG</th>
<th>Transliteration</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>lùuṭ</td>
<td>lùuṇ</td>
<td>lùuṭāa</td>
<td>lùuṇḍē</td>
<td>ʟùuṇ</td>
<td>‘scraping stick’</td>
</tr>
<tr>
<td>lèek</td>
<td>lèeṇ</td>
<td>lèeɡāa</td>
<td>lèeɡè</td>
<td>l̥̂eɡ</td>
<td>‘pestle’</td>
</tr>
</tbody>
</table>

**S1b**

<table>
<thead>
<tr>
<th>SG</th>
<th>DEM1</th>
<th>POSS.1SG</th>
<th>POSS.3SG</th>
<th>Transliteration</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>ĵ̥ēp</td>
<td>ĵ̥eṛ̃</td>
<td>ĵ̥eēbāa</td>
<td>ĵ̥eēbè</td>
<td>ĵ̥eēbè</td>
<td>‘pocket’ (Arabic)</td>
</tr>
<tr>
<td>gwɔ̃k</td>
<td>gwɔ́ɔ(ɔ)̥̂</td>
<td>gwɔ́ɔ(ɔ)gāa</td>
<td>gwɔ́ɔ(ɔ)gè</td>
<td>gwɔ́ɔ(ɔ)gè</td>
<td>‘dog’</td>
</tr>
</tbody>
</table>

*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.
### 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

<table>
<thead>
<tr>
<th>SG</th>
<th>DEM1</th>
<th>POSS.1SG</th>
<th>POSS.3SG</th>
</tr>
</thead>
<tbody>
<tr>
<td>jít</td>
<td>jín</td>
<td>jítāa</td>
<td>jítē</td>
</tr>
<tr>
<td>tík</td>
<td>tíŋ</td>
<td>tígāa</td>
<td>tíkē</td>
</tr>
</tbody>
</table>

#### S3b

<table>
<thead>
<tr>
<th>SG</th>
<th>DEM1</th>
<th>POSS.1SG</th>
<th>POSS.3SG</th>
</tr>
</thead>
<tbody>
<tr>
<td>mùţɔ</td>
<td>mùŋ̂</td>
<td>mùţ̣a</td>
<td>mùţ̣e</td>
</tr>
<tr>
<td>ādīgɔ</td>
<td>āḍiŋ̂</td>
<td>āḍiŋ̣a</td>
<td>āḍiŋ̣e</td>
</tr>
</tbody>
</table>

#### S3c

<table>
<thead>
<tr>
<th>SG</th>
<th>DEM1</th>
<th>POSS.1SG</th>
<th>POSS.3SG</th>
</tr>
</thead>
<tbody>
<tr>
<td>bóojɔ</td>
<td>bóoj̣</td>
<td>bóoj̣a</td>
<td>bóoj̣e</td>
</tr>
<tr>
<td>cáaj̣i</td>
<td>cáaj̣i</td>
<td>cáaj̣a</td>
<td>cáaj̣e</td>
</tr>
</tbody>
</table>
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**

<table>
<thead>
<tr>
<th>SG</th>
<th>DEM1</th>
<th>POSS.1SG</th>
<th>POSS.3SG</th>
</tr>
</thead>
<tbody>
<tr>
<td>néeeni</td>
<td>néenni</td>
<td>néenaa</td>
<td>néennë</td>
</tr>
<tr>
<td>góooji</td>
<td>góonnì</td>
<td>góoonaa</td>
<td>góonë</td>
</tr>
</tbody>
</table>

‘looking glass’ (mirror)

‘machete’ (from Arabic)

cf. plural forms

| néenì    | góocì      |
looking.glass\PL | machete\PL |
looking glasses (mirrors) | machetes (from Arabic) |

**S4b**

<table>
<thead>
<tr>
<th>SG</th>
<th>DEM1</th>
<th>POSS.1SG</th>
<th>POSS.3SG</th>
</tr>
</thead>
<tbody>
<tr>
<td>rânni</td>
<td>râni</td>
<td>rânnæa</td>
<td>rânnë</td>
</tr>
<tr>
<td>dîkánqi</td>
<td>dîkánì</td>
<td>dîkánæa</td>
<td>dîkánë</td>
</tr>
</tbody>
</table>

‘mirror’

‘stick for planting’
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 – which is optionally realised (4b).

(4)  

<table>
<thead>
<tr>
<th></th>
<th>PL</th>
<th>DEM1</th>
<th>POSS.1SG</th>
<th>POSS.3SG</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>pin</td>
<td>pin̂</td>
<td>pin̄a</td>
<td>pin̂́</td>
</tr>
<tr>
<td></td>
<td>ṅēet</td>
<td>ṅēet̂</td>
<td>ṅēet̄a</td>
<td>ṅēet̂́</td>
</tr>
<tr>
<td>b.</td>
<td>gwọ̀ọ̀(ọ́)kọ̀</td>
<td>gwọ́k̀</td>
<td>gwọ́k̄a</td>
<td>gwọ́k̂́</td>
</tr>
</tbody>
</table>

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**

<table>
<thead>
<tr>
<th>PL</th>
<th>DEM1</th>
<th>POSS.1SG</th>
<th>POSS.3SG</th>
</tr>
</thead>
<tbody>
<tr>
<td>djék</td>
<td>djékì</td>
<td>djékáa</td>
<td>djéké</td>
</tr>
<tr>
<td>pin</td>
<td>pinì</td>
<td>pináa</td>
<td>pinè</td>
</tr>
</tbody>
</table>

**P1b**

<table>
<thead>
<tr>
<th>PL</th>
<th>DEM1</th>
<th>POSS.1SG</th>
<th>POSS.3SG</th>
</tr>
</thead>
<tbody>
<tr>
<td>ñēet</td>
<td>ñēetì</td>
<td>ñēetáa</td>
<td>ñēeté</td>
</tr>
<tr>
<td>máan</td>
<td>máanì</td>
<td>máanáa</td>
<td>máanè</td>
</tr>
</tbody>
</table>

**P1c**

<table>
<thead>
<tr>
<th>PL</th>
<th>DEM1</th>
<th>POSS.1SG</th>
<th>POSS.3SG</th>
</tr>
</thead>
<tbody>
<tr>
<td>ájàaac</td>
<td>ájàcì</td>
<td>ájàcáa</td>
<td>ájàcè</td>
</tr>
<tr>
<td>jjéɛep</td>
<td>jjépì</td>
<td>jjépáa</td>
<td>jjépè</td>
</tr>
<tr>
<td>twóo(o)ŋ</td>
<td>twóŋì</td>
<td>twóŋáa</td>
<td>twóŋè</td>
</tr>
<tr>
<td>jwôo(o)k</td>
<td>jwôkì</td>
<td>jwôkáa</td>
<td>jwôkè</td>
</tr>
</tbody>
</table>

**Group Plural 2 (P2)**

Words that fall into this group have -r 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**

<table>
<thead>
<tr>
<th>PL</th>
<th>DEM1</th>
<th>POSS.1SG</th>
<th>POSS.3SG</th>
</tr>
</thead>
<tbody>
<tr>
<td>pùgì</td>
<td>pùkì</td>
<td>pùkáa</td>
<td>pùgè</td>
</tr>
<tr>
<td>ápwótì</td>
<td>ápwótì</td>
<td>ápwótáa</td>
<td>ápwótè</td>
</tr>
</tbody>
</table>

**P2b**

<table>
<thead>
<tr>
<th>PL</th>
<th>DEM1</th>
<th>POSS.1SG</th>
<th>POSS.3SG</th>
</tr>
</thead>
<tbody>
<tr>
<td>péenì</td>
<td>péenì</td>
<td>péenáa</td>
<td>péenè</td>
</tr>
<tr>
<td>góocì</td>
<td>góocì</td>
<td>góocáa</td>
<td>góocè</td>
</tr>
</tbody>
</table>
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).
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. djɛl  djɛɛl  ‘goat’
   jjɛp  jjɛɛmpl  ‘pocket’

b. jɪt  jɪn  ‘ear’
   tík  tíŋ  ‘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 [djɛl] ‘goat’ in other closely related languages (data for Anywa, Pări and Luwo from Storch [2005]):

(8) goat\SG  ‘goat’

<table>
<thead>
<tr>
<th>Language</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shilluk</td>
<td>djɛl</td>
</tr>
<tr>
<td>Anywa</td>
<td>dɨɛl</td>
</tr>
<tr>
<td>Pări</td>
<td>dɨɛl</td>
</tr>
<tr>
<td>Luwo</td>
<td>dɨɛl</td>
</tr>
</tbody>
</table>

We can see that Anywa, Pări 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

kwòŋ  kóŋĩ ‘culture(s)’
pjën  péenĩ ‘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) piinì piināa piinē ‘cheek’
lèeek lèekì lèegāa lèegē ‘pestles’
b. jwòccqd(ɔ) jwòñì jwòtāa jwòtē ‘armpit’
jjēêep jjēpì jjēpāa jjēpē ‘pockets’
c. ʊtɔaŋa ʊtɔñì ʊtɔnāa ʊtɔñē ‘black cow’
   ùgiìik ùgikì ùgikāa ùgikē ‘buffalos’
d. mùjò múñì mújāa mújē ‘island’

(11) Past Past 2nd SG Present
a. á-ŋał á-ŋ̩l ū-ŋ̩l(ɔ) ‘cut’ (v.)
b. á-çám á-çàaam ū-çàaam(ɔ) ‘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 [ápwóodí] ‘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.

\[
\begin{array}{lllll}
12 & SG & DEM1 & POSS.1SG & POSS.3SG \\
& pwóç(ɔ) & pwóñ & pwóñáa & pwóñé & ‘field’
\end{array}
\]

\[
\begin{array}{lllll}
13 & SG & DEM1 & POSS.1SG & POSS.3SG \\
& ápwóodí & ápwón & ápwónáa & apwóné & ‘gourd’
\end{array}
\]

\[
\begin{array}{lllll}
14 & SG & DEM1 & POSS.1SG & POSS.3SG \\
& jwók & jwóh(ɔ)ŋ & jwóh(ɔ)gáa & jwóh(ɔ)gẽ & ‘Shilluk God’
\end{array}
\]

(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 [pwɔŋɔt] ‘field’ (12 above) should be analysed as a diphthong because otherwise the stem vowel is short (cf. [pwɔŋi] ‘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 [ɨ] would mean that there are also forms like *[tuŋoŋ] ‘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 [djɛl] ‘this goat (next to the speaker)’ vs. [jiŋ] ‘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)

<table>
<thead>
<tr>
<th>High</th>
<th>High Fall</th>
<th>Fall</th>
<th>Low</th>
<th>Late Fall</th>
<th>Mid</th>
<th>Rise</th>
</tr>
</thead>
<tbody>
<tr>
<td>(cvç)</td>
<td>(ćvç)</td>
<td>(cvç)</td>
<td>(cvç)</td>
<td>(cvç)</td>
<td>(cvç)</td>
<td>(cvç)</td>
</tr>
</tbody>
</table>

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.
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. cvvć) and Mid Late Fall is marked by placing (mid ) on the first vowel and (low ) on C2 (i.e. cvvće ). In addition, the following combination of diacritics will be used to represent High Mid contour: cvvč. 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 (v) on short vowels is marked by placing one of the diacritics on the preceding consonant letter, for example [j̄j̄ēp] ‘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. jwọ́tì
   armpit\SG\DEM1
   This armpit (next to the speaker)

  jwọ́tì
  armpit\PL\DEM1
  These armpits (next to the speaker)

   b. lúuʊ̊m
   grass\SG\DEM1
   This grass (next to the speaker)

  nāaaah̚
  crocodile\PL\DEM1
  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 -i 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. rēeēj(ó̯)
   fish\SG
   fish

  kēēŵ̪w̪
  border\PL
  borders

  ālwēē(ε̈)t(ó̯)
  crab\PL
  crabs

(17) a. mūnò
   neck\SG
   neck

  kālah̚
  family\PL
  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.

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 6.** F0 trajectories in [dàa lʊ/gravenospʊʊt/bridgesubnospāa] ‘there is my scraping stick’ – solid line and [dàa lʊ/gravenospʊʊd/bridgesubnospϵ/gravenosp] ‘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

**Figure 7.** F0 trajectories in [dàa l/cturn/gravenospt/bridgesubnospāa] ‘there are my scraping sticks’ – solid line and [dàa l/cturn/gravenospt/bridgesubnospϵ/macronnosp] ‘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)  
\[
\begin{align*}
\text{ʊ/gravenosplàlϵ/gravenosp} & \quad \text{vs.} \quad \text{ʊ/gravenosplàlāa} \\
\text{red.cow\SG\POSS.3SG} & \quad \text{red.cow\SG\POSS.1SG} \\
\text{his/her red cow} & \quad \text{my red cow}
\end{align*}
\]

\[
\begin{align*}
\text{ʊ/gravenospt/vturn/gravenospŋϵ/gravenosp} & \quad \text{vs.} \quad \text{ʊ/gravenospt/vturn/gravenospŋāa} \\
\text{black.cow\SG\POSS.3SG} & \quad \text{black.cow\SG\POSS.1SG} \\
\text{his/her black cow} & \quad \text{my black cow}
\end{align*}
\]

\[
\begin{align*}
\text{tèelϵ/macronnosp} & \quad \text{vs.} \quad \text{tèeláa} \\
\text{elbow\PL\POSS.3SG} & \quad \text{elbow\PL\POSS.1SG} \\
\text{his/her elbows} & \quad \text{my elbows}
\end{align*}
\]
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
tense 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
mūjò mūŋi mūŋê ‘island’
ríc ríci rícé ‘fish’ (more than one)
jwōst jwōtī jwōtê ‘armpits’

(22) SG DEM1 POSS.3SG
lúum lúuum lúuumê ‘grass’
nāam nāaam nāaamê ‘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 lūt pīnāa
scraping.stick\PL cheek\PL\POSS.1SG
scraping sticks my cheeks

b lūuŋ pīnāa
scraping.stick\SG cheek\SG\POSS.1SG
scraping stick my cheek

c lūuŋtāa
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. ríc rícáa
fish\PL fish\PL\POSS.1SG
fish my fish (more than one)

b. léēp ālāawāa
tongue\SG candy\SG\POSS.1SG
tongue my candy (from Arabic)
Mid tone is found in suffixed and unsuffixed stems with short (25a), long (25b) and overlong (25c) vowels.

(25) a. lēk̪ lēk̪áa
tooth\PL tooth\PL\POSS.1SG
teeth my teeth

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

c. lwēt̪(ɔ) 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. jỳʾep jỳʾemī jỳʾebē 'pocket' (from Arabic)
gwǭk gwǭc(ǭ)ŋ gwǭc(ǭ)gē 'dog'
b. tělěfōōn tělěfōōonē tělěfōōonē 'telephone' (borrowed word)
mùūs mùūuŋ mùūudē 'banana’ (from Arabic)
c. kěʾem(ǭ) kěʾemī kěʾemē 'tent’ (from Arabic)
sīṯjāʾāl(ǭ) sīṯjāʾārī sīṯjāʾārē '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)  \textit{Low Absorption in singular demonstrative 1 (next to speaker) forms}

\begin{center}
\begin{tikzpicture}
  \node[above right] (a) at (0,0) {$\sigma$};
  \node[below right] (b) at (0,-1) {$\sigma$};
  \node[below] (c) at (0,-2) {\text{H}};
  \node[below] (d) at (0,-3) {\text{L}};
  \node[below] (e) at (0,-4) {\text{L}};
  \node[below] (f) at (0,-5) {$\emptyset$};
  \draw (a) -- (b);
  \draw (a) -- (c);
  \draw (b) -- (d);
  \draw (d) -- (e);
  \draw (e) -- (f);
\end{tikzpicture}
\end{center}

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

(28) \textit{Parasitic delinking} (Hayes 1989:268)

Syllable structure is deleted when the syllable contains no overt nuclear segment.

\textbf{Fall}

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

(29)

\begin{enumerate}
\item[29a.] SG  \quad DEM1  \quad POSS.3SG
\begin{itemize}
\item dâ\text{â}ap \quad dâ\text{â}aam \quad dâ\text{â}a\text{b}ê \quad ‘gold’ (from Arabic)
\item lw\text{ô}\text{ô}\text{ô}g(\text{ô}) \quad lw\text{ô}\text{ê} \quad lw\text{ô}gê \quad ‘washing’
\item bû\text{lû}k \quad bû\text{lû}nä \quad bûlûgê \quad ‘brigade’ (from Arabic)
\item ù\text{gô}t \quad ù\text{gô}nä \quad ùgôtê \quad ‘cloth’
\end{itemize}
\end{enumerate}

\begin{enumerate}
\item[29b.] PL  \quad DEM1  \quad POSS.3SG
\begin{itemize}
\item ápwôcë \quad ápwôjë \quad ápwôoc \quad ‘rabbits’
\item á\text{jwô}kë \quad á\text{jwô}kë \quad ájwôkê \quad ‘benevolent magicians’
\end{itemize}
\end{enumerate}

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 \{lw\text{ô}\text{ô}\text{ô}g(\text{ô})\} ‘bath’ – solid line and \{lw\text{ô}\text{ô}\text{ô}g(\text{ô})\} ‘washing’ – dashed line and Figure 9 which shows
F0 trajectories in demonstrative forms [lw̃ŋ] ‘this bath (next to the speaker)’ – solid line and [lw̃ŋ] ‘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 [lw̃ŋ] due to Low Absorption. By contrast, in [lw̃ŋ] F0 has a falling trajectory just as it is in the corresponding singular form (Figure 8). The fall in [lw̃ŋ] (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 8.** F0 trajectories of High Fall in [lw̃ɔŋ(ɔ)] ‘bath’ – solid line; and Fall in [lw̃ɔŋ(ɔ)] ‘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

**Figure 9.** F0 trajectories of High in [dáa lw̃ŋ] ‘but there is this bath (next to the speaker)’ – solid line; and Fall in [dáa lw̃ŋ] ‘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. rĕeēj(š) rĕeŋi rĕecē ‘fish’
b. pwœcbd(š) pwœnî pwœntê ‘field’
c. çœcç(š) çœnî çœntê ‘bone’
d. ãjwœcck(š) ãjwœnî ãjwœntê ‘benevolent magician’
e. ḏaãapi ḏaãpi ḏaãpê ‘many items made of gold’ (from Arabic)
f. ťlaã(a)l ťlãlî ťlãlê ‘red cows’
g. ţtaã(λ)ŋ ţtaŋi ţtaŋê ‘black cows’
Figure 10. F0 trajectories of Rise on the stem vowels in [r̥e̞j] ‘fish’ – solid line, [p̥w̥d̥j] ‘field’ – dotted line, and [əjw̥j] ‘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. ɟáːak  j̥j̣e̞j̣ep  ɹj̣j̣e̞j̣ep(ɹ)  
   chief\SG  pocket\PL  cigarette\PL  cigarette\PL (from Arabic)
   chief  pockets  cigarettes (from Arabic)

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

Figure 11 shows F0 trajectory for [j̥j̣e̞j̣ep] ‘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 jjé̂ê ep] ‘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  
jjēp jjé̂ê m̄ ‘pocket’  
tīk tīŋ ‘chin’  
ɲāaŋ ɲaaŋ ‘crocodile’

b. SG DEM1  
ālāaw(ɔ) ālāwī ‘candy’ (from Arabic)  
mādīfīl mādīrīl ‘handkerchief’ (from Arabic)

c. PL DEM1  
twōo(ɔ)ŋɔ̃ twōŋǐ ‘insects’
Figure 12, below, shows F0 trajectories in three singular demonstrative forms: 
[kwɔɔɔɔn] ‘this culture (next to the speaker)’, [jwɔɔɔɔŋ] ‘this Shilluk God (next to the
speaker)’ and [gwɔɔɔɔŋ] ‘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 [gwɔɔɔɔŋ] (dashed line) the fall starts from High, in [jwɔɔɔɔŋ] (dotted line)
from Mid and in [kwɔɔɔɔŋ] (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.

In the light of the presented evidence I propose that a distinction should be made
between High Late Fall (as in [gwɔɔɔɔŋ]) and Mid Late Fall (as in [jwɔɔɔɔŋ])
tonemes. As for the Late Fall pattern in [kwɔɔɔɔŋ], 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 tíŋ/gravenosp 'chin'
   jjép jjeemù 'pocket'
   lúum luumù 'grass'

b. SG DEM1
   màdíirl màdíirìl 'handkerchief’ (from Arabic)

d. PL DEM1
   twóo(o)ŋ twōŋì 'insects'

SG DEM1
   āláaaaw(ɔ̃) āláawì '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 pjēeŋ ‘animal skin’

b. jnāanŋ jnāaaŋ ‘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 [twóó(o)ŋ(ɔ)] ‘insects’ and Figure 14 shows F0 trajectory in [gwóɔɔ(ɔ)k(ɔ)] ‘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
      jáâ(a)k(ɔ) jáâkí jáâké  ‘chiefs’
      lwé(ε)t(ɔ) lwé(ε)tí lwé(ε)té  ‘fingers’
      álwe(ε)t(ɔ) álwe(ε)tí álwe(ε)té  ‘crabs’
      gwóɔɔ(ɔ)k(ɔ) gwóɔkí gwóɔké  ‘dogs’

(40) twóó(o)ŋ(ɔ)
insect\PL             
insects
Figure 13. F0 trajectory of High Late Fall in [dàa twóð(ʊ)ð] ‘insects’. The onset of the glide+vowel sequence is marked by vertical line.

Figure 14. F0 trajectory of High Fall in [dàa gwɔð(ʊ)k(ʊ)] ‘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 [djék] ‘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
djék  djékɛ djékɛ  ‘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.
REFERENCES


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


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


