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Morphophonological interactions in Shilluk
An investigation into the tone system and suffixation patterns
in the Gar dialect

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Abstract

West Nilotic languages are known to have rich suprasegmental systems, and Shilluk offers a case in point. Previous studies on the Lwak dialect postulate nine tonemes in the tone inventory of Shilluk, which are *High*, *Mid*, *Low*, *High Fall*, *Low Fall*, *High Fall to Mid*, *Late Fall*, *High Rise*, and *Low Rise* (Remijsen & Ayoker 2019; Remijsen et al. 2019). In contrast to the southern dialect of Lwak, the northern dialect of Gar is relatively understudied. This gap in the literature motivated an investigation into the tone system of Gar. Based on the data collected from a native Gar speaker, this study postulates that the Gar tonal inventory has the same nine tonemes as that of Lwak. However, there is dialectal variation in the distribution of tone specifications. These differences can be explained by the loss of suffix hypothesis (Remijsen & Ayoker 2019), which motivated the subsequent investigation into the patterns of suffixation in Gar. This study shows that Gar has lost the suffixes *-i/-ɔ* in areas of the grammar where Lwak shows *-i/-ɔ* suffixation. Based on this between-dialect comparison and following Andersen's (1990) diachronic analysis of ternary vowel length contrast and suffix loss in West Nilotic languages, this study postulates that Lwak reflects an earlier, conservative stage of the diachronic development of Shilluk, whereas Gar reflects a later, advanced stage. The suffix investigation further shows that in Gar, suffix loss only involves the loss of the segmental material. The tonal material of the suffix is preserved and interacts compositionally with the tonal specification of the stem syllable. This compositional interaction analysis provides an explanation for the dialectal variation between Lwak and Gar with respect to the distribution of certain tone specifications. It also offers insight into why Shilluk has a more complex tone system than its neighbouring West Nilotic languages.

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Abbreviations

| | | | |
|-------|------------------------------|--------|--------------------------------------|
| APPL | Applicative voice | L | Low tone |
| ANTIP | Antipassive | LF | Low Fall tone |
| CS | Construct State | LR | Low Rise tone |
| DEM | Demonstrative | M | Mid tone |
| EXSP | Existential predicate marker | NOM | Nominalization |
| F | Focus marker | NP | Noun Phrase |
| FUG | Centrifugal derivation | OV | Object voice |
| H | High tone | P | Plural |
| HF | High Fall tone | PRT | Pertensive |
| HFM | High Fall to Mid tone | PRT(P) | Pertensive with a plural possessor |
| HR | High Rise tone | PRT(S) | Pertensive with a singular possessor |
| IMP | Imperative | S | Singular |

Table of Contents

| | | |
|---|---|-------|
| 1 | Introduction and background | 5-6 |
| | 1.1 Introduction | 5 |
| | 1.2 Language background | 5-6 |
| | 1.3 Objective and motivation | 6 |
| 2 | Linguistic characteristics of Shilluk | 7-11 |
| | 2.1 Shilluk phonology | 7-9 |
| | 2.2 Shilluk morphology | 9-11 |
| 3 | Methods | 12-15 |
| | 3.1 Virtual fieldwork with a language consultant | 12 |
| | 3.2 General elicitation methods | 12 |
| | 3.3 Methodological framework | 12-14 |
| | 3.4 Transcription and acoustic data | 14-15 |
| 4 | The tone system of Gar | 15-32 |
| | 4.1 Introduction and scope of exploration | 15 |
| | 4.2 The Gar tone inventory | 16-27 |
| | 4.3 Discussion: dialect comparison | 27-32 |
| | 4.4 Summary | 32 |
| 5 | Patterns of suffixation in Gar nouns and adjectives | 32-52 |
| | 5.1 Introduction and scope of exploration | 32-33 |
| | 5.2 The loss of -ɪ and -ɔ̃ | 33-41 |
| | 5.3 The preservation of -ɪɪ and -ɔ̃ɔ̃ | 41-44 |
| 6 | Conclusion | 44-45 |
| 7 | Bibliography | 46-47 |
| 8 | Appendices | 48-49 |

1 Introduction and background

1.1 Introduction

Shilluk has a rich suprasegmental system, which is typical of West Nilotic languages. Previous studies on the Lwak dialect postulate nine tonemes in the Shilluk tone system (Remijsen & Ayoker 2019; Remijsen et al. 2019). On the other hand, the tone systems of the northern dialects of Mwomo and Gar are undescribed. Concerning this literature gap, this study firstly investigates the tone system of Gar based on the lexical class of nouns. The second topic of investigation is suffixation patterns in Gar. The suffixation analysis presented in this study builds on Remijsen and Ayoker's (2019) loss of suffix hypothesis, which was postulated based on an exceptional suffixation pattern identified in Lwak nouns. This suffixation analysis also draws connections with Andersen's (1990) analysis of suffix loss and the ternary vowel length system in West Nilotic languages. These two existing arguments will be explained in Section 2 after the general linguistic characteristics of Shilluk are introduced. By comparing the patterns of suffixation between Gar and Lwak, this study shows the morphophonological interactions between tone and the lost suffixes, and their diachronic implications.

1.2 Language background

Shilluk is the first language of the Shilluk people, who live in the north-eastern part of South Sudan (Ayoker & Kur 2016). The self-referent term of the language is /ḍó cól(ɔ)/, which is *dhøg cøllø* in Shilluk orthography (Remijsen et al. 2011). As one of the 59 indigenous languages spoken in South Sudan, Shilluk is spoken by 574,000 people as of 2017 (Eberhard et al. 2021). The Shilluk speech community extends from Renk (north) to Tonga (west) to Doleib Hill (southeast) (Gilley 1988). Fig.1 shows the area in South Sudan where Shilluk is spoken. Shilluk belongs to the West Nilotic group of the Nilo-Saharan language phylum, one of the four major phyla in the classification of African languages. The other three phyla are Niger-Congo, Afroasiatic, and Khoisan (Childs 2003; Dimmendaal 2000; Riailand 2009).

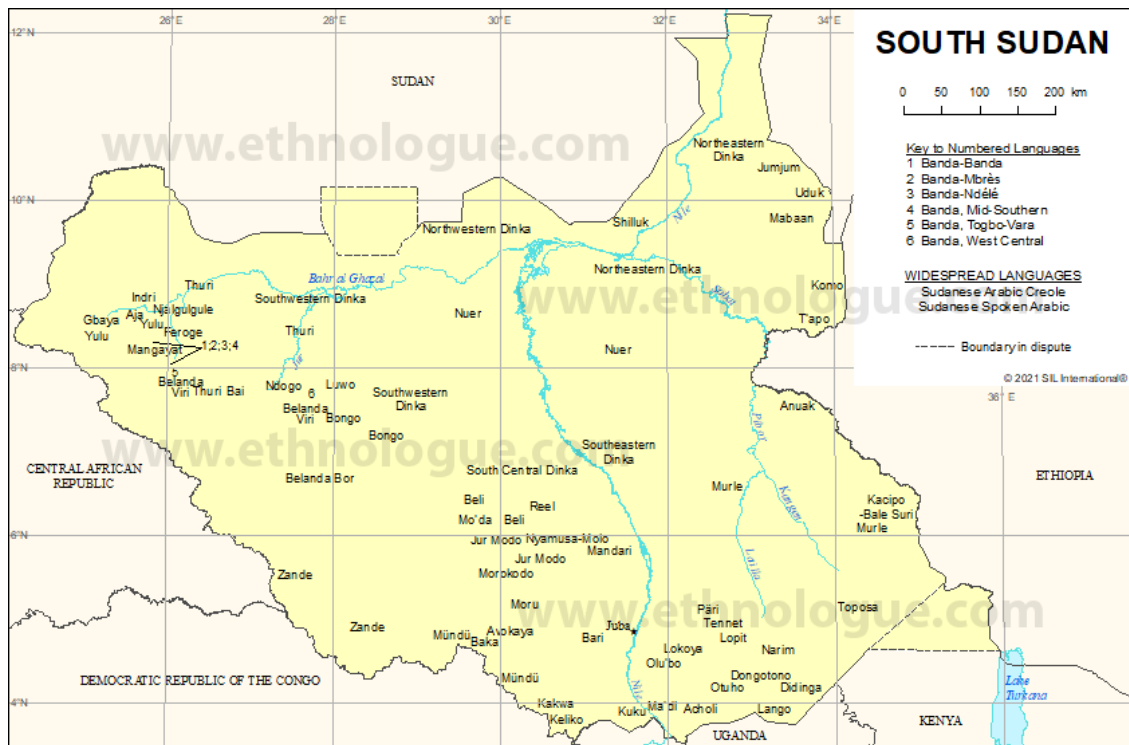


Figure 1 A map of languages in South Sudan (Eberhard et al. 2021).
'Shilluk' is labelled in the north-eastern part of the South Sudan territory.

Shilluk has been the subject of linguistic documentation since the early 1900's (Westermann 1912; Kohlen 1933). In the current scholarship, there are studies on Shilluk phonetics and phonology, morphology and syntax (Gilley 1988; Remijsen et al. 2011; Remijsen et al. 2015; Remijsen & Ayoker 2019). However, dialectal variation remains an understudied aspect. The Shilluk people distinguish three dialects: Lwak, Gar, and Mwomo. Lwak is the southern dialect spoken around the Doleib Hill area. Gar and Mwomo are spoken in the northern region, and Mwomo is the northernmost dialect (Gilley 1988). To the best of my knowledge, all existing studies, e.g. Remijsen and Ayoker (2014, 2019), are based on the Lwak dialect. In contrast, little is known about Gar and Mwomo.

1.3 Objective and motivation

In light of the lack of studies on Gar, this study aims to present a descriptive analysis of the Gar tone system and suffix system, based on an examination of nouns. The descriptive analyses will be followed by dialect comparison with Lwak, which provides insight into the morphophonological interactions in Gar and sheds light on the diachronic development of Shilluk. By investigating the morphophonology of an understudied dialect, this study seeks to contribute to the scholarship on dialectal variation in Shilluk.

2 Linguistic characteristics of Shilluk

2.1 Shilluk phonology

2.1.1 The syllable structure of Shilluk nouns

Most Shilluk nouns have a monosyllabic stem with the typical phonotactic structure of $C(C_{j/w})V(V)(V)C$, as in /mâal/ ‘sky’ and /cwλλj/ ‘soup’ (Remijsen & Ayoker 2019). There are a few exceptional cases of native stems in Lwak that do not follow this phonotactic structure, e.g. /ɔt/ ‘house’ (VVC) and /jii/ ‘people’ (CVV). The vowel length of a morpheme can be short (V), long (VV), or overlong (VVV). This will be explained in Section 2.1.2. Most of the nouns investigated in this study have the typical phonotactic structure.

A monosyllabic stem can be affixed with a suffix or a prefix. Five prefixes are found in nouns (a- ʊ- di- ni- nāa-), among which a- and ʊ- are the most commonly found in the lexicon and have the highest functional load (Remijsen & Ayoker 2019:7-9). For example, some nouns with à- are derived from transitive verbs, and some nouns with á- are derived from ordinal numbers. Although the same morphophonological inflectional processes apply to prefixed and prefix-less nouns, in order to maintain a systematic design, most nouns explored in this study are prefix-less nouns. For this reason, this section will not explain prefixation patterns in detail.¹ The pattern of suffixation in nouns will be explained in Section 2.2.2.

2.1.2 Consonants and vowels

Consonants

The consonant inventory of Shilluk is typical of West Nilotic languages. Shilluk has 19 contrastive consonantal phonemes (Remijsen et al. 2011). These include 15 voiceless plosives, voiced plosives and nasals, which are found for each of the following five places of articulation: labial, dental, alveolar, palatal and velar. The remaining four phonemes are /r l w j/.

| | Labial | Dental | Alveolar | Palatal | Velar |
|-------------|--------|--------|----------|---------|-------|
| Plosive | p b | t̪ d̪ | t d | c ɟ | k g |
| Nasal | m | n̪ | n | ɲ | ŋ |
| Trill | | | r | | |
| Lateral | | | l | | |
| Approximant | w | | | j | |

Figure 2 The consonant inventory of Shilluk (Remijsen et al. 2011:3).

Vowels

¹ Interested readers may consult Chapter 1.3 of Remijsen and Ayoker’s (2019) description.

The vowel inventory of Shilluk consists of ten phonemes, which can be organized as five vowel qualities crossed orthogonally with the binary feature [+/- *Advanced Tongue Root*] (ATR) (Remijsen et al. 2011). In comparison to their [-ATR] counterpart (/i ɛ a ɔ u/), the [+ATR] vowels (/i ɛ ʌ o u/) are “more closed” and “somewhat breathier” (Remijsen et al. 2011:116). ATR alternation can distinguish between unrelated lexical items, and it is one of the exponents in morphological inflection and derivation.

Shilluk vowels have a three-level length contrast, which is also reported for Dinka, a closely related West Nilotic language (Remijsen & Gilley 2008). Ternary vowel length contrast is a typologically rare phenomenon. Andersen’s (1990) comparative study of West Nilotic languages shows that diachronically, the original binary vowel length contrast developed into a ternary contrast, as a result of the compensatory lengthening triggered by suffix loss. Hence, the overlong vowel length diachronically originated from lost suffixes. Pāri and Dinka have a two-level and three-level vowel length contrast respectively. For example, ‘home’ is /pàaj-ó/ in Pāri and /bàaaj/ in Dinka (Andersen 1990:17). This pair of cognates indicates that -ó is lost in Dinka but preserved in Pāri, and the vowel is overlong in the Dinka form. On the basis that Pāri has retained the original binary vowel length contrast and more suffixal morphology than Dinka, Andersen (1990) argues that Pāri is relatively conservative among West Nilotic languages. Following Andersen’s comparative analysis, Remijsen et al. (2015:25) suggest that since both stem-internal morphology and suffixes are widespread in Shilluk, Shilluk represents an intermediate stage with respect to the loss of suffix-based morphology in West Nilotic languages. Andersen’s (1990) analysis informs the suffix exploration section of this study (§5).

Like ATR, vowel length is a phonological property that distinguishes between unrelated lexical items and plays a role in inflectional and derivational morphology. This is exemplified by the minimal set (1a-c) from Remijsen et al. (2019:108). In their quantitative study of ternary vowel length contrast, Remijsen et al. (2019) established that the mean vowel duration for short, long, and overlong vowels are 68ms, 111ms, and 150ms respectively. This quantitative study is based on data from Lwak and Gar speakers, which suggests the ternary vowel length contrast is attested in both dialects. The data collected in this study corroborate this analysis.

- (1) a. lám
pray.NOM

- ‘praying’
- b. láam
prayer
‘a prayer’
- c. láaam
pray.NOM.PERT.PL
‘a prayer’

2.1.3 Tone

West Nilotic languages are known to have rich suprasegmental systems, and the Shilluk tone system offers a case in point. According to recent studies (Remijsen & Ayoker 2019; Remijsen et al. 2019), there are nine distinct tone categories in Shilluk: *Low, Mid, High, Low Rise, High Rise, Low Fall, High Fall, High Fall to Mid, Late Fall*. These tone categories are contrastive lexical and morphological tone specifications on monosyllabic stems. Minimal sets from Remijsen et al. (2019:97) are provided in Appendix A.

The phonemic contrast between High Fall and Late Fall is especially remarkable. They illustrate the cross-linguistically rare phenomenon of contrastive alignment in contour tones, which is also reported for Dinka (Remijsen 2013). Tonal alignment involves “the timing of fundamental frequency (F0) patterns relative to the sequence of speech segments” (Remijsen & Ayoker 2014:435). In a pair of falling tones with contrastive tonal alignment, the point at which the F0 begins to fall is expected to set in earlier in the early-aligned fall than in the late-aligned counterpart. In the case of Shilluk, High Fall is an early-aligned High Fall that contrasts with Late Fall, which is a late-aligned High Fall. In Remijsen and Ayoker’s (2014:450) quantitative investigation of contrastive tonal alignment in Shilluk, the mean values for tonal alignment of the high turning point, which is the time difference between the vowel onset of the target syllable and its F0 peak, are 13ms and 77ms for High Fall and Late Fall respectively.

2.2 Shilluk morphology

2.2.1 The inflectional paradigm of Shilluk nouns

The inflectional paradigm of Shilluk nouns expresses four functions: (i) pertensive with singular possessor; (ii) pertensive with plural possessor; (iii) construct state; (iv) proximal demonstrative (Remijsen & Ayoker 2019). The paradigm involves various

dog.P:PRT people

‘the people’s dogs’

(Remijsen & Ayoker 2019:13)

The construct state inflection is found on the head noun of an NP when it is modified by a constituent, unless the modifier is (i) a possessor, (ii) marked by the relativizer *mé/mó*, or (iii) a cardinal numeral. For example, when a head noun is followed immediately by an adjective, it is inflected for construct state (4).

(4) **gwóooŋ** dwóowŋ

dog.S:CS big

‘a big dog’

(Remijsen & Ayoker 2019:14)

The proximal demonstrative form is used when proximal demonstrative is the only modifier in an NP, as in (5a). However, when demonstrative is not the only modification on the noun, instead of inflection, the demonstrative function is expressed by a morpheme, which is *èn* for singular head noun (5b) and *èk* for plural head noun.

(5) a **gwóooŋ^h**

dog.S:DEM

‘this dog’

b. **gwóooŋ** à têek èn

dog.S:CS REL strong DEM.S

‘this strong dog’

(Remijsen & Ayoker 2019:15)

2.2.2 Shilluk nouns: number marking

For a given Shilluk singular noun, its plural form is not predictable from the morphophonological form of the singular noun itself, and vice versa (Remijsen & Ayoker 2019). Instead, various morphophonological exponents are used to mark grammatical number in Shilluk nouns, including tone alternation, suffixation, vowel quality and length alternation. In some nouns, number marking is expressed by a single morphophonological marker, e.g. tone alternation: ‘war’ /lɪŋ/ - ‘wars’ /lɪŋ/. In other nouns, multiple exponents are used in combination, e.g. tone alternation and suffixation: ‘ancestor’ /kwâaaj-ð/ - ‘ancestors’ /kwâaaj/ (Xu 2017; as cited in Remijsen & Ayoker 2019:70). Therefore, in Shilluk nouns, whereas the morphological marking of pertensive, construct state, and proximal demonstrative is largely regular and productive, the marking of number is not. For this reason, this study does not

interpret the morphological relationship between the singular and plural form of a given noun as inflectional.

3 Methods

3.1 Virtual fieldwork with a language consultant

This study adopts a virtual fieldwork methodology. Between October 2020 and April 2021, twenty 1.5hr-long controlled elicitation sessions were carried out with a native Gar speaker using an online video conferencing platform. For every session, the consultant receives an honorarium. This study received research ethics approval from the School of Philosophy, Psychology and Language Sciences, University of Edinburgh. Written consent was obtained from the language consultant prior to the first session.

3.2 General elicitation methods

Elicitation was conducted in English, and pictures were occasionally used as a visual prompt. Elicitation stimuli were prepared using the Shilluk lexicography created by Remijsen et al. (2018), which is based on the Lwak dialect. For example, in the initial stage of tonal exploration, I prepared an elicitation list consisting of 4-6 tokens for each of the nine tonemes in Lwak, which were identified from the lexicography. During elicitation sessions, I transcribed the utterances based on my own hearing, without reference to the existing transcription of the Lwak corresponding form. This is to minimize bias and to avoid making assumptions that the forms should be phonologically related in Lwak and Gar.

3.3 Methodological framework

The methodology adopted in this study, especially in the tonal exploration, is informed by previous studies on fieldwork methodology. As advocated by Yu (2014), the elicitation process for exploring an understudied tone system should be conducted with an experimental state of mind. Yu (2014) describes the following experimental procedure for tonal exploration. Firstly, classify words into word classes according to their morphological and phonological structure, then generate several substitution frames for each class, with pragmatic and prosodic factors taken into consideration. This informed the choice of substitution frames used in this study, which are listed in (7) and will be discussed later. After eliciting the items in a given class, sort them into tentative, unlabelled tonal categories based on the pitch contour. Then, evaluate the various proposals of hypothesized tone groupings for each word class and determine what converging or diverging evidence they provide

concerning specific proposed tonemes. This ultimately builds toward a single coherent toneme inventory hypothesis based on all words elicited. Pike (1948; as cited in Yu 2014) emphasizes the importance of reducing variability. By asking the question of “How do you say ___?” and prompting the consultant to insert target forms into predetermined frames, the speaker would produce controlled utterances. This ensures a mechanical approach with minimal variables.

For the tonal exploration, following the approach of Yu (2014) and Pike (1948, as cited in Yu 2014), I designed the first set of elicitation stimuli based on the lexical, morphological and phonological specifications in (6). The motivation for restricting target words to maximally sonorant consonantal structure in the first stage of elicitation is to ease the transcription process. In contrast to sonorants, plosive consonants are likely to produce F0 perturbation effects, which reduces the ability of acoustic software to accurately trace the F0 (Xu 2019).

- (6) a. Lexical: noun, native to Shilluk;
 b. Morphological: underived, uninflected (base form);
 c. Phonological: monosyllabic, suffixless, closed syllable, sonorant onset, sonorant coda.

Whereas the elicitation stimuli for each session varied according to the research focus of the session, the same elicitation frames were used in all sessions. For each target token, the speaker was asked to produce it in the three frames in (7) and repeat each frame twice. There are two key motivations for using these frames. Firstly, in (7b) and (7c), the target token is in utterance-final position. This ensures its phonetic realization is maximally salient because of final lengthening. This also avoids interference on the F0 trace from having a following tone target. Secondly, it is difficult to determine the tone of a word produced in isolation because there are no contextual tonal benchmarks, as in (7a). In contrast, (7b) and (7c) provide the phonological environment of a preceding Low and High tone target respectively. They act as a tuning fork that provide reference F0 values of the speaker’s Low and High tone range, thereby increasing the accuracy of tone transcription (Remijsen & Ayoker 2019).

- (7) a. *Citation form*
 kīt
 mountain.S
 ‘a mountain’

- b. *Existential predicate*
 dâa kīt
 EXSP mountain.S
 ‘There is a mountain.’
- c. ‘*The name of _____.*’
 níŋí kīt
 name.S:PRT(S) mountain.S
 ‘The name of a mountain.’

Since most elicitation stimuli are NPs, the selected frames in (7) therefore satisfies Yu’s (2014) pragmatic consideration regarding substitution frames, as mentioned above. After eliciting the first list of words according to the specifications in (6), I proposed a preliminary hypothesis of contrastive tonemes. To verify the hypothesis, I expanded the elicitation stimuli to other sets of specifications, including loanwords (lexical), suffixed nouns (phonological), non-sonorant onset and coda (phonological) and demonstrative inflection (morphological). Finally, I posited a nine-toneme inventory based on the elicited forms from various word classes.

3.4 Transcription and acoustic data

3.4.1 Transcription during the session

During elicitation sessions, I transcribed the speaker’s productions by ear. In situations where I was uncertain of the tone specification of a word, I re-elicited the prototypical form of the competing toneme candidates. Prototypical forms are words representative of a particular toneme according to previous elicitation. They were used as a reference point for comparison. Hearing the target form and the toneme candidates consecutively allows immediate comparison of the pitch contours, thereby confirming which of the tone candidates the target form is most similar to. Another frequently encountered problem is suppletive nouns that do not have contrasting morphological forms for singular and plural. To determine the grammatical number of these nouns for glossing purposes, I elicited the noun with an attributive adjective that has a distinct plural form in agreement with the noun. The grammatical number of the noun was determined by whether the base (singular) or plural form of the adjective is used.

3.4.2 Acoustic data and transcription check

The sessions were recorded using a solid-state recorder and headset-mounted directional microphone. This was assisted by a linguist in the field. After each session, the recordings were chopped into individual sound files for each production using the acoustic analysis software, Praat (Boersma & Weenink 2018). Individual sound files were named according to a predetermined metadata coding system.³ Then, a second round of transcription check was carried out. This involved crosschecking the raw ear-based transcription with acoustic evidence from the recordings in Praat, including the spectrogram, waveform, and F0 trace. This combination of qualitative and quantitative data increases the reliability of transcription.⁴ Finally, the transcribed Gar forms were compared with the Lwak forms for dialectal variation analyses. The Lwak forms are reference data from the aforementioned Shilluk lexicography (Remijnsen et al. 2018).

3.4.3 Tone transcription conventions

This study adopts the tone transcription practice used in recent Shilluk studies, which is based on the IPA system of transcribing a diacritic over the vowel. The diacritics for the nine proposed tonemes are as follows: *High* *c̣vc*, *Mid* *c̣v̄c*, *Low* *c̣v̀c*, *High Fall* *c̣v̄c̄*, *Low Fall* *c̣v̀c̄*, *High-Fall-to-Mid* *c̣v̄c̄̄*, *Late Fall*, *c̣v̀c̄̄*, *High Rise* *c̣v̄c̄̄̄*, *Low Rise* *c̣v̀c̄̄̄*. The diacritic is marked on the first vowel regardless of vowel length (*c̣vc/c̣v̄vc/c̣v̀vvc*), except for High-Fall-to-Mid and Late Fall. For these two tonemes, the final tone target is marked on the final phoneme.

4 The tone system of Gar

4.1 Introduction and scope of exploration

³ The purpose of using a metadata encoding system is to facilitate efficient retrieval of sound files during transcription check and subsequent quantitative analysis on Praat (Boersma & Weenink 2018). Beyond the current project, it can also ease data archiving and depositing processes. The metadata encoded in the file name makes the content of each sound file self-evident for those who wish to use the data in future research. The metadata coding system is exemplified in Appendix B.

⁴ Beside increasing transcription reliability, another motivation for collecting recorded acoustic data is to increase the accountability of this study. As discussed by Himmelmann (2006), in language documentation, especially for understudied languages, accountability is important in fieldwork. By collecting acoustic data that can be shared with the wider academic and public community, it makes it possible for others to evaluate the quality of the transcription and the relevant analyses. This also increases transparency of the work produced. Upon completion of this research project, I plan to make the recordings accessible by depositing them on *Edinburgh DataShare*.

This chapter presents an analysis of the Gar tone system based on primary data collected in this study. The focus of this analysis is the Gar tone inventory, a basic parameter of tone systems. The tone inventory analysis (§4.2) will be followed by a discussion on dialectal variation between Gar and Lwak (§4.3).

4.2 The Gar tone inventory

Based on the data of 196 nouns (107 singular, 89 plural), this study found that there are nine tonemes in Gar, and they are identical to those identified for Lwak. In the following analysis, a set of illustrative examples will be provided for each toneme, followed by a description of its distribution in nouns. The analysis also includes displays of the spectrogram and raw F0 trace of an example utterance for each toneme. For accountability, sound files of the example utterances are also embedded.⁵ These sound files were manually segmented and annotated on Praat (Boersma & Weenink 2018). They show the acoustic evidence on which a given phonological tone is analysed. Unless otherwise specified, the examples provided are the base (uninflected) form of underived, native nouns. In the tables presented in this section, *none* indicates there is no example of the specified tone and vowel length configuration in the data collected.

4.2.1 Three level tones: *High, Mid, Low*

Generally, all three level tones are found in singular and plural native, underived nouns, though there are two exceptions to this generalization. In the data of this study, there is no High-toned native noun stem with an overlong vowel. This configuration is only found in the stem of derived suffixed instrumental nouns, e.g. /rʌʌʌt-ɪ/ ‘radios’. Mid tone is also not found in singular nouns with an overlong vowel.

High (H)

Fig.3-4 provide acoustic evidence for the H tone specification of ‘blessing’. The utterance with a preceding H target shows a relatively flat F0 trace throughout (Fig.3).

Table 2 Examples of singular and plural uninflected nouns with a High tone specification on the stem, crossed orthogonally with vowel length.

| High |
|------|
|------|

⁵ The embedded sound files can be played on Adobe Acrobat. To play a sound file, click on the Play button below the relevant figure. To play it again, right-click on the Play button and select ‘Disable Content’.

| Vowel length | Singular | | Plural | |
|--------------|----------|----------|---------|---------------|
| V | bún | ‘coffee’ | ńń | ‘eyes’ |
| | líń | ‘war’ | ţń | ‘eggs’ |
| VV | láam | ‘prayer’ | ráań | ‘desert’ (pl) |
| | gwéeṭ-ĩ | ‘pen’ | lálak | ‘dreams’ |
| VVV | láaaw-ĩ | ‘paddle’ | rálak-ĩ | ‘radios’ |

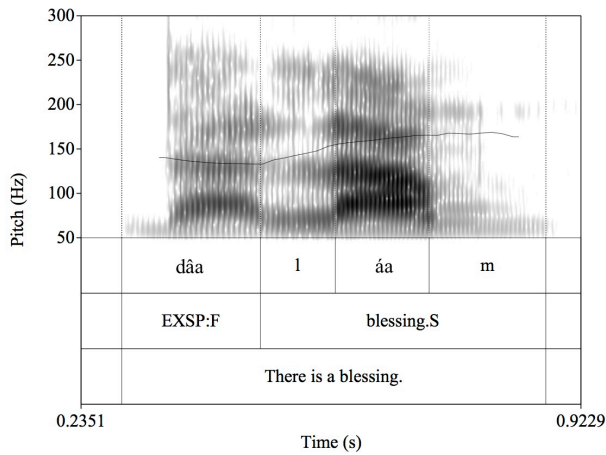


Figure 3 The spectrogram and raw F0 trace of 'There is a blessing.'

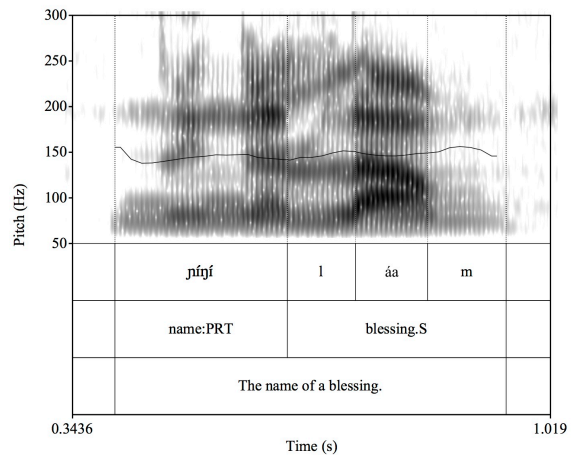


Figure 4 The spectrogram and raw F0 trace of 'The name of a blessing.'

Mid (M)

Fig.5 shows a very small F0 increase between the end of the preceding L target /dâa/ and the vowel onset of the target syllable /l̩eɛl/. Fig.6 shows a decline in F0 between the preceding H target (end of /ńńí/) and the vowel onset of the target syllable.

Table 3 Examples of singular and plural uninflected nouns with a Mid tone specification, crossed orthogonally with vowel length.

| Mid | | | | |
|--------------|----------|------------|--------|---------------|
| Vowel length | Singular | | Plural | |
| V | wāń | ‘eye’ | wĩń | ‘metal wires’ |
| | kwāń | ‘porridge’ | wūń | ‘years’ |
| VV | twōol | ‘snake’ | l̩eɛl | ‘pebbles’ |
| | jāaṭ | ‘tree’ | ńjēen | ‘money’ |
| VVV | none | | cūuu | ‘bones’ |

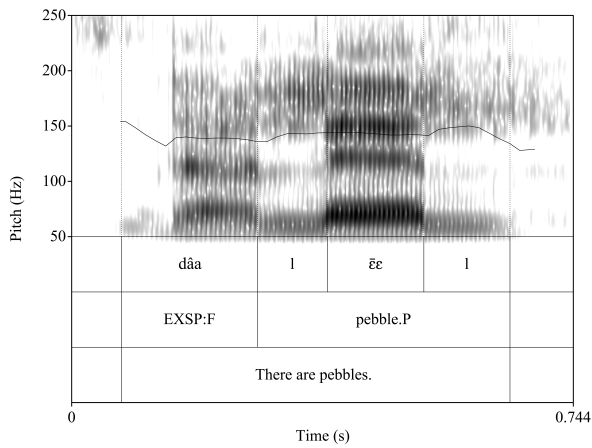


Figure 5 The spectrogram and raw F0 trace of 'There are pebbles.'

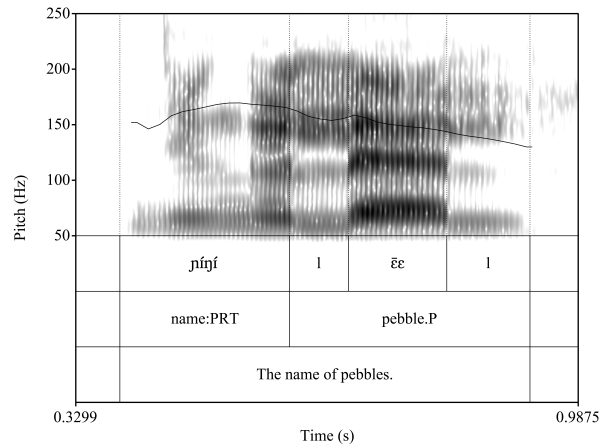


Figure 6 The spectrogram and raw F0 trace of 'The name of pebbles.'

Low (L)

Table 4 Examples of singular and plural uninflected nouns with a Low tone specification, crossed orthogonally with vowel length.

| Low | | | | |
|--------------|----------|--------------|--------------|------------|
| Vowel length | Singular | | Plural | |
| V | tòm | 'instrument' | ɲim | 'sesame' |
| | tík | 'door' | | |
| VV | wùun | 'year' | cwɔɔj | 'soup' |
| | jèen | 'carrot' | càak | 'milk' |
| VVV | miiin | 'heart' | kɔɔɔp (loan) | 'cups' |
| | lèeɛl | 'pebble' | mjèeer | 'villages' |

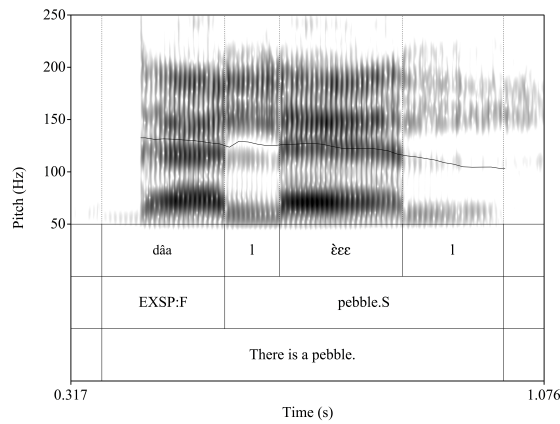


Figure 7 The spectrogram and raw F0 trace of 'There is a pebble'.

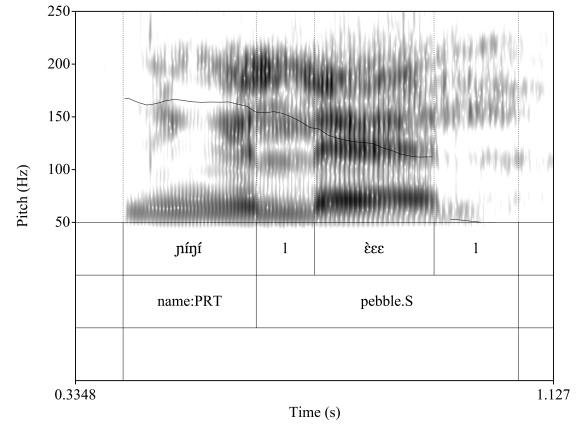


Figure 8 The spectrogram and raw F0 trace of 'The name of a pebble'.

4.2.2 Four falling tones: *High Fall, Low Fall, High Fall to Mid, Late Fall*

High Fall (HF)

The distribution of HF is restricted. Based on the data of this study, in singular nouns, HF is only found in loanwords. In contrast, this study found several plural native uninflected nouns specified with HF.

Table 5 Examples of singular and plural uninflected nouns with a High Fall tone specification, crossed orthogonally with vowel length.

| High Fall | | | | |
|--------------|-----------|---------------------|--------|-----------------|
| Vowel length | Singular | | Plural | |
| V | jǰĕp | 'pocket' (loan) | wĭŋ | 'birds' |
| | cĕt | 'pepper' (loan) | rĕt | 'radios' (loan) |
| VV | (à)lĕmúun | 'lemon' (loan) | none | |
| | múut | 'banana' (loan) | | |
| VVV | jáaam | 'university' (loan) | tjĕeel | 'elbows' |
| | kúuur | 'ball' (loan) | kjĕeel | 'stars' |

Low Fall (LF)

The distribution of LF is unrestricted. It is attested in both singular and plural nouns for all vowel lengths.

Fig.9-12 provide acoustic evidence for analysing HF and LF as contrastive tonemes. Firstly, with a preceding L target, between the end of /dâa/ and the vowel onset of the target word, F0 increases more when the target word is specified with HF (Fig.9) than with LF (Fig.11). In

the preceding H target context, F0 increases from the preceding H-toned morpheme /ɲíŋ/ to the vowel onset of the HF target word ‘stars’ (Fig.10). This contrasts with the F0 trace of the LF example (Fig.12), which remains level between the end of /ɲíŋ/ and the vowel onset of the target word ‘singer’. Furthermore, in the preceding H context, the F0 change over the rhyme is 74Hz for ‘stars’ (HF; Fig.10) and 54Hz for ‘singer’ (LF; Fig.12). This suggests the size of F0 change is larger in HF than LF. The F0 trace in these figures suggests that compositionally, LF falls from M to L, whereas HF falls from H to L.

Table 6 Examples of singular and plural uninflected nouns with a Low Fall tone specification, crossed orthogonally by vowel length.

| Low Fall | | | | |
|--------------|----------|---------------|--------|--------------|
| Vowel length | Singular | | Plural | |
| V | lúm | ‘grass’ | líŋ | ‘wars’ |
| | mún | ‘neck’ | lúm | ‘grass’ (pl) |
| VV | múnŋ | ‘deaf person’ | ḱʌŋ | ‘hats’ |
| | nâam | ‘river’ | kʌŋ | ‘trumpets’ |
| VVV | léem | ‘jaw’ | wʌŋḱ | ‘heads’ |
| | lôoŋ | ‘singer’ | | |

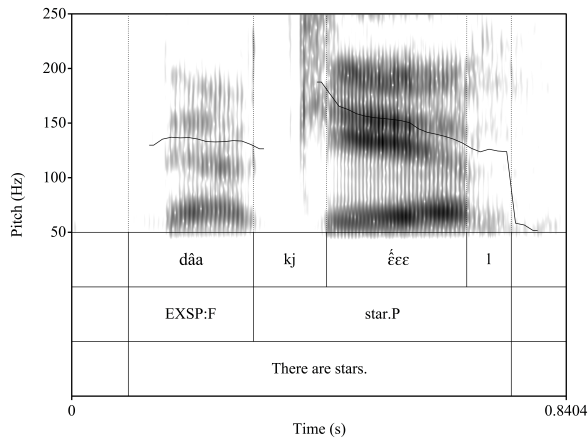


Figure 9 The spectrogram and raw F0 trace of 'There are stars.'

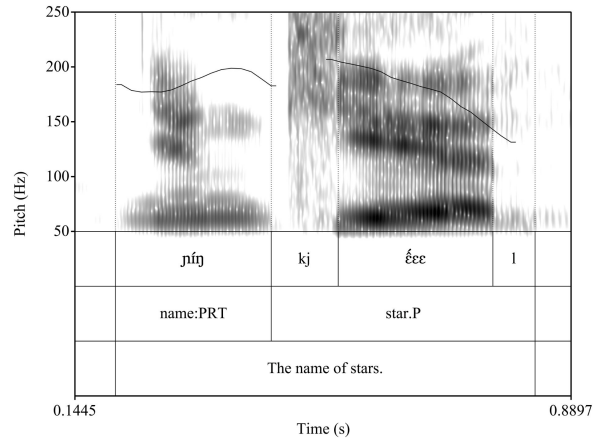


Figure 10 The spectrogram and raw F0 trace of 'The name of stars.'

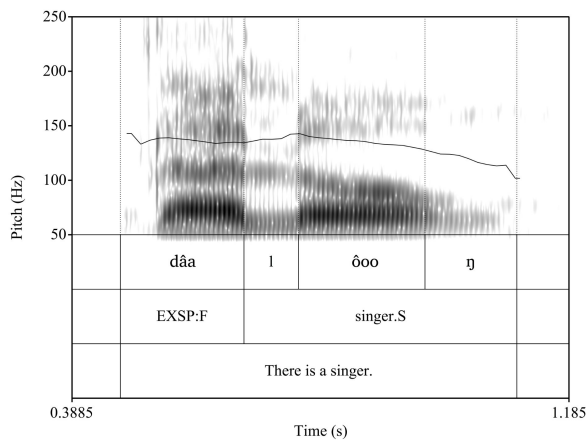


Figure 11 The spectrogram and raw F0 trace of 'There is a singer.'

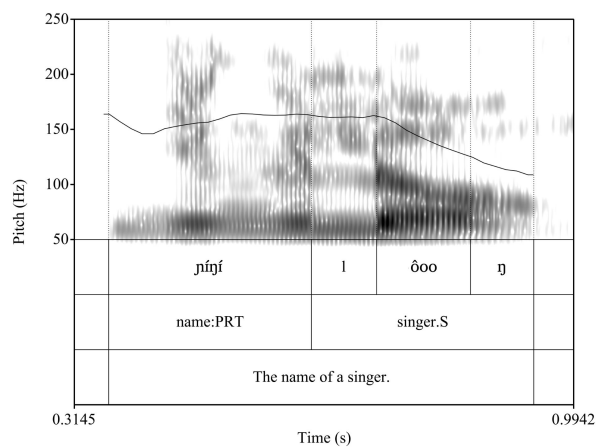


Figure 12 The spectrogram and raw F0 trace of 'The name of a singer.'

High Fall to Mid (HFM)

Among uninflected nouns, HFM is restricted to plural nouns. This study found only two singular uninflected nouns specified with HFM: 'star' /kjééé̄/ and 'cloud' /póóó̄/. These exceptions may be attributed to the semantics of number marking. In Nilo-Saharan languages, nouns that naturally appear in large quantities tend to be morphologically unmarked in the plural (Dimmendaal 2000). This means the singular form of these nouns should be interpreted as morphologically marked forms (Remijsen et al. 2015).

HFM contrasts with HF with respect to the size of F0 change. For the HFM target 'jaws', in the preceding H tone context (Fig.14), the F0 change from the beginning to the end of the rhyme is 36Hz, which is approximately half the size of the F0 change over the rhyme of the HF target syllable in Fig.10 (74Hz). The smaller size of F0 change in HFM suggests that, in terms of the sequence of level tone targets, in HFM, F0 only falls from H to M, whereas in HF, it falls from H to L. Thus, HFM (H-M) and LF (M-L) contrast with respect to their level

tone target composition.

Table 7 Examples of singular and plural uninflected nouns with a High Fall to Mid tone specification, crossed orthogonally with vowel length.

| High Fall to Mid | | | |
|------------------|-----------------------------------|---------|--|
| Vowel length | Singular | | Plural |
| V | none | | m ^é l̄ ‘droughts’ |
| | none | | n ^á m̄ ‘rivers’ |
| VV | none | | léem̄ ‘jaws’ |
| VVV | p ^ó w̄l̄ | ‘cloud’ | k ^í l̄ ‘crutches’ |
| | p ^ó w̄l̄ | ‘cloud’ | ṭ ^ó w̄l̄ ‘snakes’ |
| | kj ^é é ^é l̄ | ‘star’ | k ^é é ^é l̄ ‘borders’ |

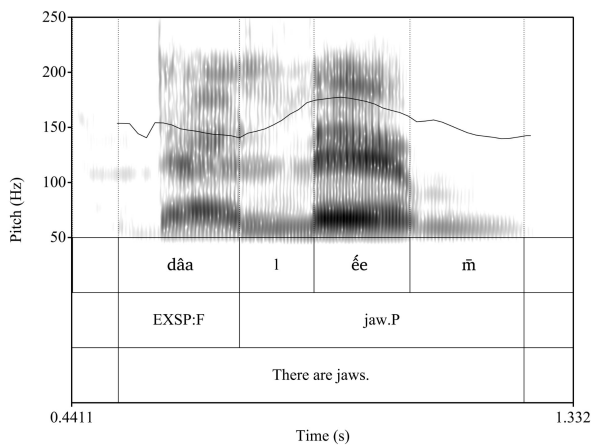


Figure 13 The spectrogram and raw F0 trace of ‘There are jaws.’

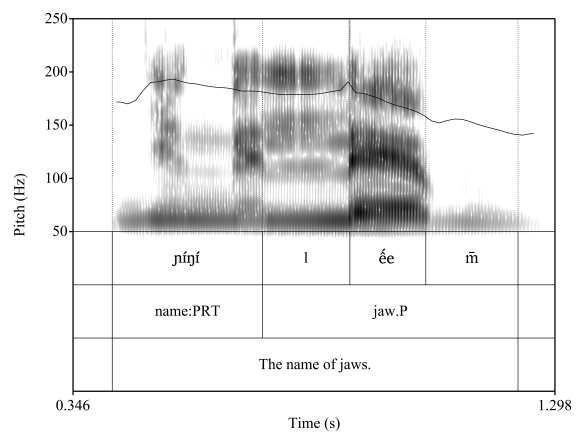


Figure 14 The spectrogram and raw F0 trace of ‘The name of jaws.’

Late Fall

This study shows that there is a tonal alignment contrast between Late-aligned HF (Late Fall) and early-aligned HF (HF) in Gar. Firstly, Late Fall is very rare among the uninflected nouns elicited in this study, the only three identified instances of which are ‘clouds’ /p^ów̄l̄/, ‘countries’ /p^ów̄l̄/ and ‘person’ /ḍáaañ̄/. (8a/b) shows minimal contrast between Late Fall and HFM, and (9a/b) shows contrast between Late Fall and LF.

- (8) a. p^ów̄l̄
cloud.P
‘clouds’

- (9) b. p[́]óó̄l̄
cloud.S
'a cloud'
- a. p[́]óó̀t̄
country.P
'countries'
- b. p[́]ôó̀t̄
country.S
'a country'

On the other hand, Late Fall is regularly found in the demonstrative inflectional paradigm of singular nouns. According to Remijsen and Ayoker (2019), the demonstrative inflection for singular suffixless nouns involves the addition of a L morphological tone to the stem. This results in a late-aligned HF contour in the demonstrative inflection for noun stems that have an initial H target in the base form. Data from the current study aligns with this description. The demonstrative forms in Table 8 show that Late Fall is found in all vowel lengths.

Table 8 Examples of singular nouns that have a Late Fall tone specification in the demonstrative inflection.

| | 'cup' | 'radio' | 'river' |
|---------------|-------|----------|---------|
| Base | káɸ | ráλλt-ɸi | nâam |
| Demonstrative | káɸ̀ | ráλλ̀ | náaaɸ̀ |

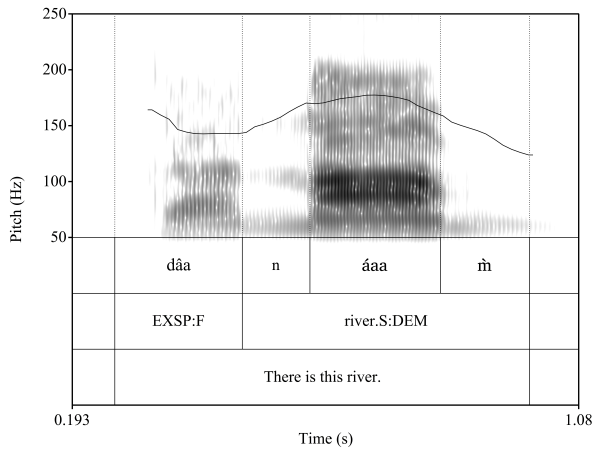


Figure 15 The spectrogram and raw F0 trace of 'There is this river.'

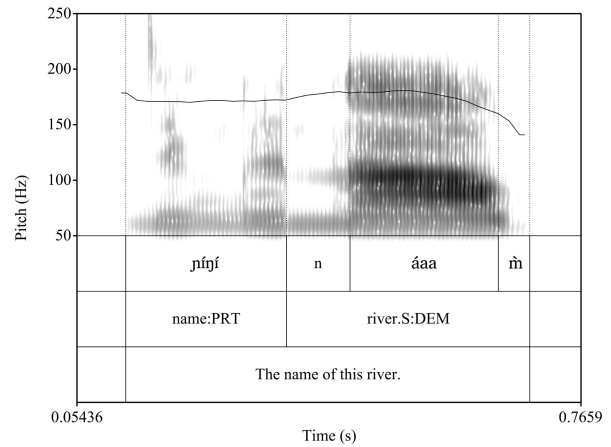


Figure 16 The spectrogram and raw F0 trace of 'The name of this river.'

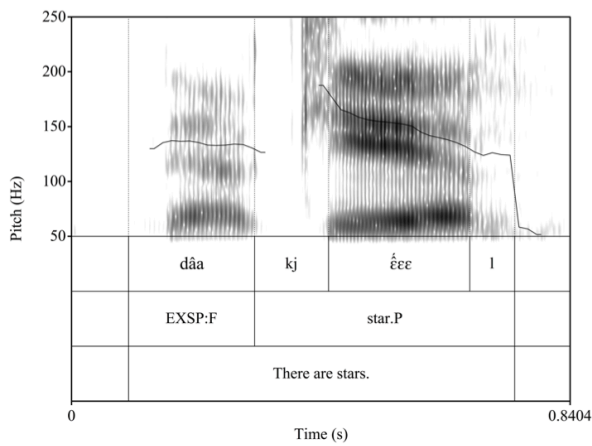


Figure 9 The spectrogram and raw F0 trace of 'There are stars.'

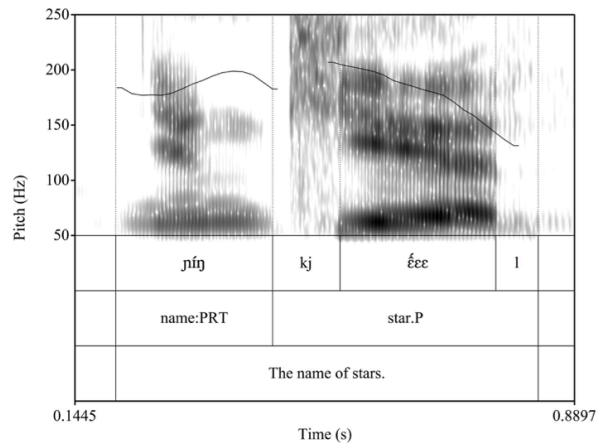


Figure 10 The spectrogram and raw F0 trace of 'The name of stars.'

In Fig.15-16, the F0 trace in the target noun starts to fall only after the first half of the vowel. This contrasts with the HF examples (Fig.9-10; repeated above), in which F0 begins to fall at a time-point close to the vowel onset. The comparison between Fig.15-16 and Fig.9-10 shows tonal alignment contrast between Late Fall and HF.

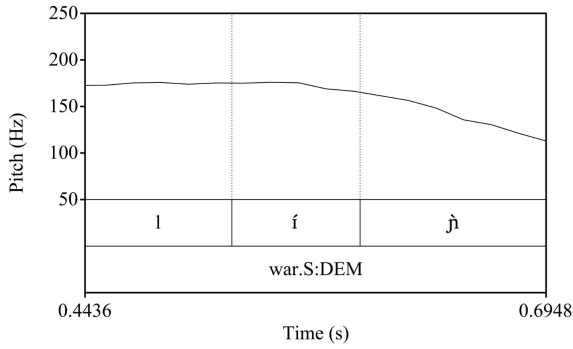


Figure 17 The raw F0 trace of the demonstrative form of ‘war’ from the utterance /ɲíɲí líɲ/ ‘The name of this war’.

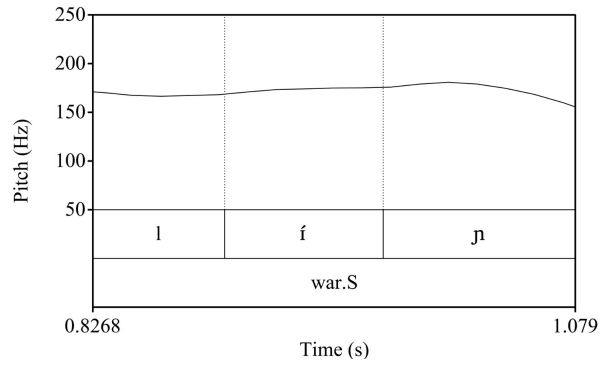


Figure 18 The raw F0 trace of the base form of ‘war’ from the utterance /ɲíɲí líɲ/ ‘The name of a war’.

The inflectional morphology of ‘war’ provides a minimal pair contrasting between Late Fall (demonstrative) and H (base). Fig.17-18 show differences in their F0 trace; both segmented nouns are extracted from a preceding H target frame. In the demonstrative form /líɲ/ (Fig.17), F0 begins to fall approximately half-way into the vowel, from 175.8Hz (0.547s) to 112.0Hz at the end of the coda (0.694s); the size of F0 change is 63.8Hz, which is comparable to that of the HF example in Fig.9 (74Hz). This contrasts with the base form /líɲ/ (Fig.18), in which the F0 trace is relatively flat; the small drop at the end of the coda can be attributed to final lowering.

In the data of this study, beyond nouns, Late Fall is also found in some adjectives, as shown in Table 9. These are all the base form of adjectives that mark number, in agreement with the noun that they are modifying. As opposed to the plural form, the base form is used when the head noun is grammatically singular, as in (11). Table 9 shows that for these base form adjectives, the tone specification and vowel length of the Gar form are different from the Lwak counterpart.

- (11) a. dâa mùn-ì cjeéek
 EXSP:F neck.S:CS short
 ‘There is a short neck.’

Table 9 Base form adjectives that have a Late Fall tone specification.

| Gar | Lwak |
|-----|------|
|-----|------|

| | | |
|----------|---------|-------|
| ‘long’ | bállàr | bàlar |
| ‘short’ | cjéeeèk | cjêk |
| ‘small’ | ǰíuǰ | ǰíu |
| ‘bad’ | ráaaè | râac |
| ‘narrow’ | póuuò | pôut |
| ‘wide’ | láaaè | lâac |

4.2.3 Two rising tones: *High Rise, Low Rise*

Both rising tones are generally restricted to singular nouns; they are rarely found in plural nouns. The two exceptions found in this study are ‘singers’ /lǝooŋ/ and ‘onions’ /bátǰaaal/, the latter of which is a disyllabic loanword from Arabic.

High Rise (HR)

Table 10 Examples of singular and plural uninflected nouns with a High Rise tone specification, crossed orthogonally with vowel length.

| High Rise | | | |
|--------------|----------|-----------------|--------|
| Vowel length | Singular | | Plural |
| V | wǰŋ | ‘bird’ | none |
| | lǰŋ | ‘hippo harpoon’ | |
| VV | ɲáll | ‘python’ | none |
| | ó-pǰuun | ‘bread’ | |
| VVV | bjǰéèl | ‘sorghum’ | none |
| | lǰaaŋ | ‘nabak tree’ | |

Low Rise (LR)

Table 11 Examples of singular and plural uninflected nouns with a Low Rise tone specification, crossed orthogonally with vowel length.

| Low Rise | | | |
|--------------|----------|-----------------|--------|
| Vowel length | Singular | | Plural |
| V | bǰǰ | ‘fishing spear’ | none |
| | pǰk | ‘pot’ | |

| | | | |
|-----|-------|-----------|-------------------|
| VV | tũuk | ‘storm’ | none |
| | kĩil | ‘crutch’ | |
| VVV | lěεεw | ‘lizard’ | lõooŋ ‘singers’ |
| | bõooŋ | ‘pelican’ | báṭṭaaal ‘onions’ |

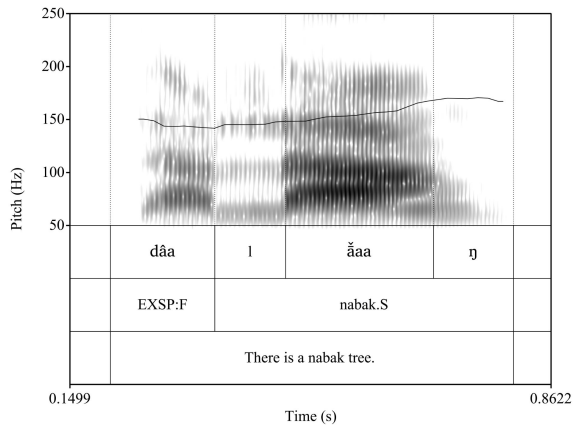


Figure 19 The spectrogram and raw F0 trace of ‘There is a nabak tree.’

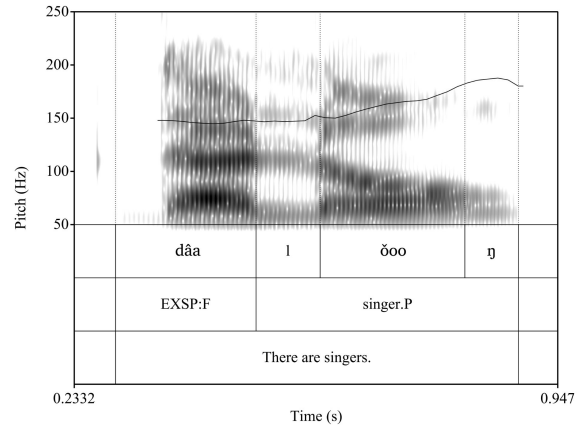


Figure 20 The spectrogram and raw F0 trace of ‘There are singers.’

Fig.19-20 illustrate the contrast between HR and LR. The F0 excursion in the rhyme of ‘nabak tree’ (HR) is 19.2Hz (Fig.19), whereas that of ‘singers’ (LR) is 36.0Hz (Fig.20). Since LR involves a larger F0 excursion than HR, this study posits that the tone target sequence of HR is M-H, and that of LR is L-H. This aligns with Remijsen & Ayoker’s (2019) compositional interpretation of Lwak HR (M-H) and LR (L-H).

4.3 Discussion: dialect comparison

4.3.1 Identical tone categories

From the perspective of tone categories, the Gar tone inventory is identical to that of Lwak (§2.1.3). The same nine tonemes are found in these two dialects: H, M, L, HF, LF, HFM, Late Fall, HR, LR. This suggests Gar and Lwak do not diverge in the area of tone system. Considering the factor of geographical proximity, the Mwomo dialect, which is spoken further up north, may demonstrate greater variation in the tone system with the southern dialect of Lwak, than Gar does. On the other hand, from the perspective of the distribution of tone specifications, there are several points of variation found between Gar and Lwak, which will be discussed in Section 4.3.3.

4.3.2 A quick detour: overlong vowels in suffixless singular uninflected nouns

Before discussing dialectal variation in the distribution of tone specifications, this subsection will address an observation made during the tonal exploration that is not directly related to tones but may shed light on the tonal observations to follow.

The examples provided throughout Section 4.2 reveal the general pattern that in Gar, the vowel length of suffixless singular uninflected nouns can be either short, long or overlong. Of the 107 singular suffixless native uninflected nouns elicited in this study, 27 (25%) have an overlong vowel.

Vowel length is one of the exponents in the inflectional paradigm. In Lwak, the vowel length of suffixless singular noun stems is expected to alternate according to one of the three patterns: Fixed short (**V~V**), Short with Grade (**V~VVV**), and Long (**VV~VVV**); the first (boldfaced) and second length are realized on the base and inflected forms respectively (Remijsen & Ayoker 2019). Accordingly, it is expected that the vowel length of a suffixless singular noun is either short or long in the base form. The notable proportion (25%) of Gar nouns found with an overlong vowel in the base form therefore seems to contradict with this analysis of vowel length alternation. However, Remijsen and Ayoker (2019) identified an exceptional pattern in Lwak singular nouns that draws parallel to the observation under discussion: 23 singular nouns in Lwak have a suffixless base form but suffixed inflectional forms. Of these 23 nouns, 18 of them have an overlong vowel in the suffixless base form (Remijsen & Ayoker 2019:47). Remijsen and Ayoker consider these to be exceptions because there are no regular suffixless nouns with an overlong vowel in the base form. Considering nouns that have a suffixless base form but suffixed inflectional forms, Remijsen and Ayoker (2019:47-48) proposed the following analysis: these nouns used to have a suffix in their base form, displaying the regular inflectional paradigm of suffixed singular nouns, however this suffix was subsequently lost. This hypothesis from Remijsen and Ayoker (2019) will be referred to as the *loss of suffix* hypothesis in this study.

Remijsen and Ayoker's (2019) hypothesis can be applied here to explain why suffixless singular nouns with an overlong vowel are common in Gar, but irregular in Lwak. Consider the seven L-toned singular suffixless nouns with an overlong vowel in Gar, and their

corresponding Lwak forms (Table 12). For all examples in Table 12, except for ‘lion’, the Lwak corresponding form has the suffix -ò. This systematic pattern of correspondence between Gar (CṼVVC) and Lwak (CṼVVC-ò) can be interpreted as supporting evidence for Remijsen and Ayoker’s (2019) loss of suffix hypothesis. From a comparative perspective, the examples in Table 12 suggest that Gar has lost the suffix -ò in singular nouns, which is still a regularly produced suffix in Lwak singular nouns. The correspondence between the suffixless overlong vowel form in Gar and the suffixed form in Lwak aligns with Andersen’s (1990) analysis that diachronically, the overlong vowel length in West Nilotic languages originated from lost suffixes.

Table 12 Examples of uninflected nouns with an overlong vowel in Gar and their corresponding forms in Lwak.

| | Gar | Lwak |
|---------------|------------|-------------|
| ‘chicken’ | gǰèeen | gǰèeen-ò |
| ‘tooth’ | lèèec | lèèec-ò |
| ‘pebble’ | lèèel | lèèel-ò |
| ‘heart’ | mìiin | mìiin-ò |
| ‘metal wire’ | wìiṅ | wìiṅ-ò |
| ‘bronze bell’ | mλλλλ | mλλλλ-ò |
| ‘lion’ | ḡùuur | ḡùuur |

4.3.3 The distributional characteristics of certain tone specifications

Returning to the discussion of tones, this section will address restrictions on the distribution of HFM, HR and HF in Gar, and how they differ from Lwak. As will be shown, the loss of suffix analysis offers an explanation for some of these observations.

HFM: restricted to plural nouns

In Gar, HFM is a toneme restricted to plural nouns (§4.2.2). Similarly, in Lwak, among suffixless stems, HFM is only found in plural nouns, and never in singular nouns (Remijsen & Ayoker 2019). Based on Xu’s (2017, as cited in Remijsen & Ayoker 2019) study of Shilluk number marking, Remijsen and Ayoker (2019) postulate that the plural-exclusive HFM tone specification in suffixless noun stems is a subregularity among the generally unpredictable number marking patterns in Shilluk. Evidence from Gar supports the claim that the HFM tone specification is morphologically marked for plural nouns.

Furthermore, there is an additional observation concerning the distribution of HFM in Gar that diverges from Lwak, and corroborates the above claim concerning HFM restriction. For some of the HFM plural nouns in Gar, their Lwak corresponding forms are identical except for the tone specification, as shown in Table 13.

Table 13 Examples of base form nouns with HFM tone specification in Gar and their corresponding forms in Lwak.

| | Gar | Lwak |
|----------------------|------------|-------------|
| ‘types of meat’ | ríḡ | ríḡ |
| ‘bronze bells’ | máḡ | māḡ |
| ‘deaf people’ | míḡ | mìḡ |
| ‘varieties of grass’ | lúḡ | lùḡ |

Firstly, these examples suggest that HFM has been generalized as a plural-marking tone specification. Secondly, from the perspective of dialect comparison, these examples suggest Gar uses HFM as a morphological tone to mark plurality more extensively than Lwak. Of the 89 plural nouns elicited in this study, 33 of them (37%) are specified with HFM in the base form. Among the various morphophonological markers of number, HFM is used to mark plural potentially at a higher frequency in Gar than in Lwak. Subsequently, the HFM specification is generalized as a tone for plural nouns to a greater extent in Gar than Lwak.

A possible explanation for the greater extent of this generalization in Gar relates to the loss of suffix hypothesis. Suffixation is one of the ways in which numbers are marked in nouns (§2.2.2). According to the assumption that Gar has undergone suffix loss in the base form of nouns, there is therefore one less morphophonological exponent available to mark number. Subsequently, greater functional weight is put on the remaining number marking methods, which include tone marking. Examples supporting this hypothesis are (i) ‘crutches’: Gar /kíḡ/ - Lwak /kiil-i/; (ii) ‘jaws’: Gar /léḡ/ - Lwak /lêem-i/. In both nouns, the Lwak form is suffixed, whereas the Gar form is suffixless and has a HFM specification. In the Lwak form, the sequence of tone targets in the stem and the suffix (L-L; LF-L) cannot interact in any way that would yield a HFM specification on the stem. Therefore, the HFM specification in the Gar form is arguably best explained by the analysis that HFM has become increasingly generalized as a plural number marker, which is the consequence of losing suffixation as a

means of number marking. To examine this hypothesis, it will be worthwhile to conduct a systematic investigation into number marking patterns in Gar, as a Gar counterpart to Xu's (2017) study.

HR in uninflected nouns

In Lwak, there are only two nouns specified with HR in the base form: 'morning' /mwǒɔɔl/ and 'wildcat' /ɲǎaaw/ (Remijsen & Ayoker 2019:41). However, in Gar, more cases of HR uninflected nouns are found. Table 14 shows a systematic pattern of correspondence between the Gar HR forms and their Lwak counterpart: the Lwak form has the H-toned suffix -ó. This suggests that the reason there are more uninflected nouns specified with HR in Gar than in Lwak is related to the loss of suffix phenomenon. This analysis will be pursued in Section 5.2 with a full exploration of suffixation in uninflected nouns.

Table 14 Examples of uninflected nouns with a HR tone specification in Gar and their corresponding forms in Lwak.

| | Gar | Lwak |
|--------------|------------|-------------|
| 'blood' | rǐm | rêm-ó |
| 'bird' | wǐɲ | wîɲ-ó |
| 'python' | ɲǎɔɔl | ɲâɔɔl-ó |
| 'sorghum' | bjǐɛɛl | bjêeel-ó |
| 'song' | wǒoor | wôr-ó |
| 'nabak tree' | lǎaaɲ | lâaaɲ-ó |

HF in singular nouns: restricted to loanwords

The distribution of HF is relatively restricted. Singular and plural nouns differ in the type of nouns that carry the HF specification. In plural nouns, HF is found in a number of native Shilluk nouns, e.g. /wǐɲ/ 'birds' and /tjêeel/ 'elbows'. On the other hand, in singular nouns, HF is only found in loanwords, e.g. /ɲǐǐp/ 'pocket' and /ɲáaam/ 'university', which are both borrowed from Arabic (Table 5, repeated below). This suggests that among native nouns, HF is lexically restricted to plural nouns, whereas for non-native nouns, this restriction does not hold.

Table 5 Examples of singular and plural bare nouns with a High Fall tonal specification, crossed orthogonally with vowel length.

| High Fall | | | | |
|--------------|-----------|---------------------|--------|-----------------|
| Vowel length | Singular | | Plural | |
| V | jjép | ‘pocket’ (loan) | wíjɲ | ‘birds’ |
| | cét | ‘pepper’ (loan) | rÁt | ‘radios’ (loan) |
| VV | (à)lémúun | ‘lemon’ (loan) | none | |
| | múut | ‘banana’ (loan) | | |
| VVV | jáaam | ‘university’ (loan) | tjéeel | ‘elbows’ |
| | kúuur | ‘ball’ (loan) | kjéεel | ‘stars’ |

The rarity of HF specification in native, suffixless singular uninflected nouns is also identified in Lwak (Remijsen & Ayoker 2019:35). According to Remijsen and Ayoker (2019), the fact that HF is a common tonal specification in loanwords reflects phonological adaptation of lexical items borrowed from a non-tonal source language, usually Arabic or English, to Shilluk. The accentual prominence of the word in the non-tonal source language is alternatively realized in Shilluk in the form of a falling contour that starts from a high pitch, and thus becomes a lexical item with a HF tone specification. This study of Gar corroborates this analysis.

4.4 Summary

Based on the analysis of primary data, this section has established that the Gar tone system consists of nine contrastive tone categories: *High*, *Mid*, *Low*, *High Fall*, *Low Fall*, *High Fall to Mid*, *Late Fall*, *Low Rise* and *High Rise*. While the tone categories of the Gar dialect are identical to that of the Lwak dialect, there are various points of variation in the distribution of certain tones (§4.3.3). The points of tonal variation provide compelling evidence for the analysis that Gar has undergone suffix loss in the base form of nouns, which is based on the loss of suffix hypothesis previously postulated for Lwak (Remijsen & Ayoker 2019). In light of this analysis, a further investigation is conducted to explore dialectal variation in suffixation (§5).

5 Patterns of suffixation in Gar nouns and adjectives

5.1 Introduction and scope of exploration

Following the loss of suffix hypothesis (Remijsen & Ayoker 2019) explored in Section 4.3, this chapter will examine several areas of the grammar in which Lwak shows regular suffixation. This chapter is organized by the segmental content of suffixes, specifically their phonological vowel length. Section 5.2 examines -ɔ/-ɪ and Section 5.3 examines -ɔɔ/-ɪɪ. To facilitate a clear dialect comparison, each section will begin with a description of the relevant suffix in Lwak based on previous studies, followed by an analysis of the Gar data collected in this study.

The following analysis assumes that, diachronically, the Lwak dialect reflects an earlier stage of the language in which suffixation in the base form of nouns is common, whereas Gar reflects a diachronically more advanced stage that has lost some suffixes. This assumption is based on Andersen's (1990) analysis of West Nilotic vowel length system and suffix loss, as introduced in Section 2.1.2. While Andersen (1990) shows Dinka and Pāri, two West Nilotic languages, demonstrate a contrast between suffix loss and the lack thereof, this study shows that the same contrast can be seen in Gar and Lwak, two dialects of the same language.

5.2 The loss of -ɔ and -ɪ

5.2.1 The consistent absence of -ɔ and -ɪ in the base form of Gar nouns

In Lwak monosyllabic nouns, some are suffixed, while others are not. According to Remijsen and Ayoker (2019:19), in their dataset of over 900 singular nouns, the ratio of suffixless to suffixed nouns is approximately 6:4. In suffixed singular nouns, the vowel quality of the suffix is -ɔ in the base form and -ɪ in inflected forms. As for suffixed plural nouns, the base form suffix is invariably -ɪ. In the inflectional forms, all plural nouns are suffixed with -ɪ regardless of whether the base form is suffixed or not. The tone of this suffix is predictable based on the tone of the stem syllable, rather than lexically specified (Remijsen & Ayoker 2019).

To investigate whether suffix loss in Gar uninflected nouns is consistent or sporadic, I elicited the base form of 65 underived nouns (41 singular, 24 plural) that are suffixed in Lwak. Of these nouns, 62 (95%) are suffixless in Gar; only 3 have a suffixed form. In all examples shown in Table 15, the vowel length of the stem syllable in Gar is identical to that in Lwak despite the loss of suffix. The high proportion (95%) of relevant nouns having undergone suffix loss in Gar is drastically different from the 6:4 ratio between suffixless and

suffixed singular nouns in Lwak (Remijsen & Ayoker 2019:19). This provides strong evidence that Gar has undergone suffix loss in the base form of nouns.

Table 15 Examples of singular and plural uninflected nouns that show suffixation contrast between Gar (suffixless) and Lwak (suffixed).

| | | Gar | Lwak |
|-----------------|--------------|------------|-------------|
| Singular | ‘hand’ | cìŋ | cìŋ-ò |
| | ‘bird’ | wǎŋ | wǎŋ-ó |
| | ‘neck’ | mûn | mûn-ò |
| | ‘pebble’ | lèɛɛl | lèɛɛl-ò |
| | ‘cloud’ | póɔɔ̄ | póɔɔ̄-ò |
| | ‘sorghum’ | bjěɛɛl | bjěɛɛl-ó |
| Plural | ‘drums’ | bùl̄ | bùl-i |
| | ‘crocodiles’ | náŋ̄ | náŋ̄-ī |
| | ‘trumpets’ | káŋ̄ | káŋ̄-i |
| | ‘horses’ | kjééj̄ | kjééj̄-ī |
| | ‘rivers’ | náŋ̄ | náŋ̄-ī |

Now, let us consider the 3 nouns that have a suffixed form in Gar (Table 16). The suffix of these nouns is not consistently realized in all iterations. This means that the absence of suffix in these three nouns is sporadic. The speaker commented that the suffixed and suffixless forms have the same meaning. The optionality of the suffix in these nouns can be interpreted as real-time evidence of Gar nouns undergoing suffix loss.

Table 16 Three base form nouns showing sporadic suffixation in Gar.

| | Gar (suffixed) | Gar (suffixless) | Lwak |
|----------------|-----------------------|-------------------------|-------------|
| ‘fish’ (sg) | rēɛɛc-ó | rěɛɛc | rēɛɛc-ó |
| ‘type of meat’ | rīŋ-ó | rǐŋ | rīŋ-ó |
| ‘cheek’ | pīiin-ò | pīiin | pīiin-ò |

Interestingly, the suffix/suffixless variants of ‘fish’ and ‘type of meat’ have the same tone pattern alternation. In the Gar suffixed form, the stem is specified with M and the suffix is specified with H; in the Gar suffixless form, the stem is specified with HR. Recall that HR is compositionally M-H, and LF is M-L (§4.2.2; §4.2.3). Comparing the Gar and Lwak forms of these two nouns, we can postulate that the loss of a H-toned suffix in Gar only involves

deleting the segmental material; its tonal material is preserved. This is represented in Fig.21. Note that this autosegmental approach assumes that the tone bearing unit is a syllable instead of a mora (Remijsen & Ayoker 2014). In Fig.21 (b), the H tone originally associated with the suffix morpheme is now delinked after suffix loss, and preserved in the tonal tier. Subsequently, it associates to the right edge of the stem syllable, resulting in the tone melody of HR (M-H). This provides evidence for compositional interaction between the tonal material from the lost suffix and the stem syllable. This compositional analysis of tones mirrors Remijsen and Ayoker’s (2019:47-48) compositional analysis of Lwak nouns that have a floating quantity as a result of suffix loss.

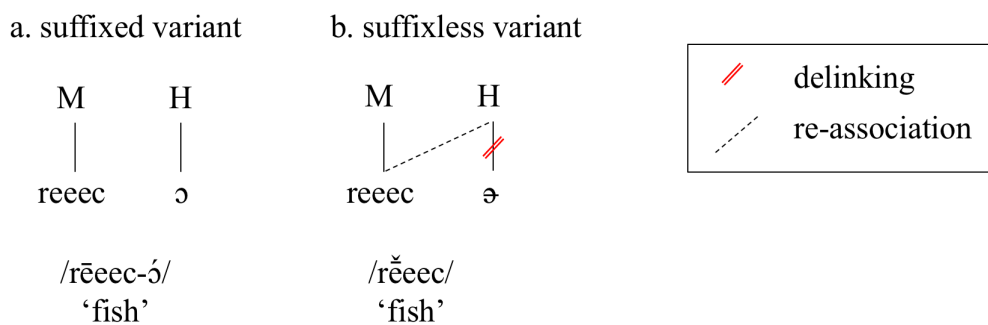


Figure 21 The tone association processes involved in the (a) suffixed and (b) suffixless variants of the base form of 'fish' in Gar.

Following this analysis, I examined Gar singular uninflected nouns whose Lwak corresponding form has a H-toned -ó suffix. In the Lwak corresponding form of these nouns, the tone specification on the stem is L, LF or LR. Among the 15 relevant nouns, they show a systematic pattern of tone alternation. All, except for one (tjāaaŋ/ 'stalk'), are specified with LR or HR in the Gar suffixless form, as exemplified in Table 17. This supports the above analysis that the H target of the suffix, whose segmental material is lost in Gar, gets associated to the right edge of the stem syllable, thus resulting in a surface rising contour.

Table 17 Examples of Lwak base form nouns that have a H-toned suffix and their corresponding forms in Gar. The tone specification of the stem and the suffix, if any, is stated in parentheses.

| | Gar | Lwak |
|-------------|-------------|----------------|
| 'egg shell' | pǎllat (HR) | pλλat-ó (L-H) |
| 'blood' | rěm (HR) | rê m-ó (LF-H) |
| 'bone' | cǒǒk (LR) | cǒook-ó (LR-H) |

This analysis can also explain why there are more cases of HR among uninflected nouns in

Gar than in Lwak (§4.3). Recall the cases of HR base form nouns in Gar and their Lwak counterpart (Table 14; repeated below).

Table 14 Examples of bare nouns with a HR tone specification in Gar and their corresponding forms in Lwak.

| | Gar | Lwak |
|--------------|--------|----------|
| ‘blood’ | rěm | rêṁ-ó |
| ‘bird’ | wǎŋ | wâŋ-ó |
| ‘python’ | ɲǎǎǎl | ɲâǎǎl-ó |
| ‘sorghum’ | bjěěel | bjêeel-ó |
| ‘song’ | wóoor | wôr-ó |
| ‘nabak tree’ | lǎaaŋ | lâaaŋ-ó |

The fact that all Gar HR uninflected nouns in Table 14 have a suffixed corresponding form in Lwak is likely not a mere coincidence. Crucially, in the Lwak forms, the tone pattern on the stem and the suffix is consistently LF-H. Following the loss of suffix hypothesis, a compelling explanation for why these nouns are specified with HR in Gar is that the loss of a H-toned suffix results in a delinked H target preserved in the tonal tier. The following process is represented in Fig.22. Based on the compositional interpretation of LF (M-L), we can posit that in order for the preserved H target to dock, the final tone target (L) of the LF specification in the stem syllable has to be delinked. Then, H associates to the right of the remaining M target in the LF configuration (M-L). This results in a M-H tone target sequence, which is realized as HR. The proposed tone association process, which follow suffix loss, explains why there are more HR uninflected nouns in Gar than in Lwak.

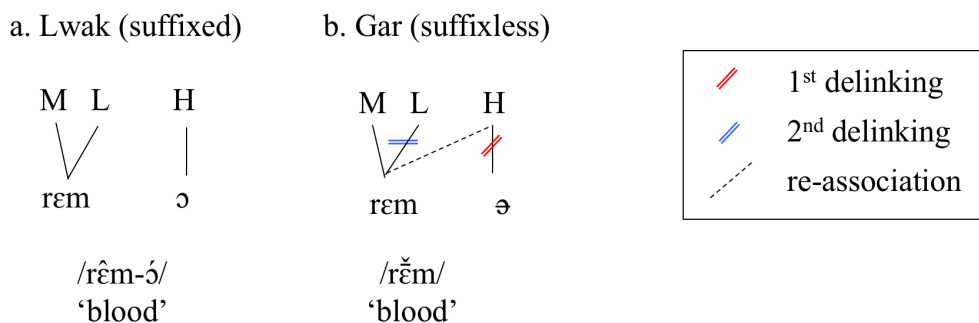


Figure 22 The tone association processes involved in the base form of ‘blood’ in (a) Lwak and (b) Gar.

The loss of suffix analysis can also explain the rarity of LR and HR specification on plural uninflected nouns (§4.2.3). In Lwak suffixed singular nouns, the tone specification of the suffix in the base form can be L, M or H (-ò/-ṁ/-ó). In contrast, in Lwak suffixed plural nouns,

the tone specification of the suffix in the base form is either L or M (-ì/-ī) (Remijsen & Ayoker 2019:20,58). According to the above analysis of HR in Gar suffixless uninflected nouns, the HR specification is yielded when the phonological environment offers a H tone target that was delinked from the lost suffix morpheme. Since there is no H-toned suffix in the base form of Lwak plural nouns, in the case where a suffix is lost in the base form in Gar, the tone of the suffix that gets preserved can only be L or M, and never H. Therefore, there is no opportunity for a rising tone contour to surface in plural nouns that have undergone suffix loss.

On a broader scale, the compositional interaction between the tonal material preserved from the lost suffix and the tone specification of the stem syllable offers an explanation for why the number of tonemes in Shilluk is greater than that of other West Nilotic languages, such as Nuer and Dinka, which only have three and four tonemes respectively (Monich 2020; Remijsen & Ladd 2008). It is precisely the loss of suffix that has provided the relevant phonological environment in Shilluk for more distinct tone targets to be associated to a given stem syllable, namely a preserved tone target that was originally associated to the suffix morpheme. Synchronically, Gar nouns have undergone suffix loss to a greater extent than Lwak. Thus, certain tonemes involving a sequence of multiple tone targets, such as HR, are found in monosyllabic uninflected nouns more regularly in Gar than in Lwak.

5.2.2 The sporadic absence of -ɪ in the Gar pertensive forms

Remijsen and Ayoker (2019) describe suffixation patterns in the Lwak pertensive inflectional paradigm. When a suffixed singular noun is inflected for *pertensive (pl)* (pertensive with a plural possessor), the tone specification of the suffix is invariably H (-í). In contrast, when inflected for *pertensive (sg)* (pertensive with a singular possessor), the suffix is either M-toned (-ī), when preceded by a M or HFM stem, or L-toned (-ì), when preceded by a L or LF stem. Singular nouns that are suffixless in the base form generally remain suffixless in the inflected forms. As for plural nouns, they are invariably suffixed in the inflectional paradigm. Unlike singular nouns, in plural nouns, the inflectional suffix for pertensive is invariably H (-í). Considering the suffixation patterns in Lwak pertensive forms, it is worthwhile to investigate how the suffixation exponent of pertensive inflection is expressed in Gar, if at all. The fundamental question is whether the suffixal pertensive inflection seen in Lwak is also used in Gar. If the pertensive inflectional suffix morpheme is lost in Gar, what happens to its

tonal material? To answer these questions, I will describe the pattern of suffixation, or the lack thereof, in the Gar pertensive inflectional paradigm for singular and plural nouns.

Sporadic realization of the pertensive inflectional suffix

Overall, the pertensive forms elicited in this study show sporadic realization of the inflectional suffix in Gar. Firstly, plural nouns show a sporadic pattern of suffix loss. There is variation in the absence of suffix across iterations, which is indicated by the parentheses in (11) and the (a/b) variants in (12).

- (11) líŋ(-í) ʝiɪ
 hippoharpoon.P:PRT people
 ‘People’s hippo harpoons’
- (12) a. líŋ-í ʝiɪ
 war.P:PRT people
 ‘People’s wars’
- b. líŋ ʝiɪ
 war.P:PRT people
 ‘People’s wars’

In singular nouns, in both pertensive (sg) and pertensive (pl), the absence of suffix is sporadic across nouns and across iterations of the same noun. Examples of suffixless and suffixed inflectional forms are shown in (13-14) and (15-16) for pertensive (sg) and pertensive (pl) respectively.

- (13) cɪŋ ɡjèeen
 hand.S:PRT(S) chicken.S
 ‘The chicken’s hand’
- (14) lìŋ-ì twóɔŋ
 hippoharpoon.S:PRT(S) Twong
 ‘Twong’s hippo harpoon’
- (15) gwóok ʝiɪ
 dog.S:PRT(P) people
 ‘People’s dog’

- (16) náaam-í j̄i
 river.S:PRT(P) people
 ‘People’s river’

The absence of suffix in the pertensive (sg) form of singular nouns is expected. This is because Gar nouns are mostly suffixless in the base form (§5.2.1), and according to the Lwak inflectional paradigm, only singular nouns that are suffixed in the base form would have a suffixed pertensive form.

Recall the substitution frame (7c) (§3.3; repeated below). In (7c), /j̄i/ is the pertensive (sg) form of /j̄i/ ‘name’ because it is the possessum of the singular noun ‘mountain’. If the target word is a plural noun, ‘name’ will be inflected for pertensive (pl) instead.

7. c. ‘The name of ____.’
 j̄i k̄t
 name.S:PRT(S) mountain.S
 ‘The name of a mountain.’

In this study, 474 utterances were elicited in the frame ‘the name of ____’; each iteration of a noun is counted as an individual utterance. In 265 of these utterances (55.9%), the target noun, which is the possessor, is singular; in the 209 remaining utterances (44.1%), the target noun is plural. The number of suffixed and suffixless pertensive (sg/pl) form used in these utterances was calculated and shown in Table 18. Of all pertensive (sg) forms produced, 40.75% of them are suffixless. This is higher than the percentage of pertensive (pl) forms that are suffixless (25.84%). These quantitative results suggest that in singular nouns, the absence of suffix is more consistent and less sporadic in pertensive (sg) than pertensive (pl).

Table 18 The percentage and number (n) of pertensive (sg) and pertensive (pl) forms that are suffixed and suffixless in ‘The name of ____’ frame.

| | Suffixed (n) | Suffixless (n) | Total |
|-----------------|--------------|----------------|------------|
| Pertensive (sg) | 59.25% (157) | 40.75% (108) | 100% (265) |
| Pertensive (pl) | 74.16% (155) | 25.84% (54) | 100% (209) |

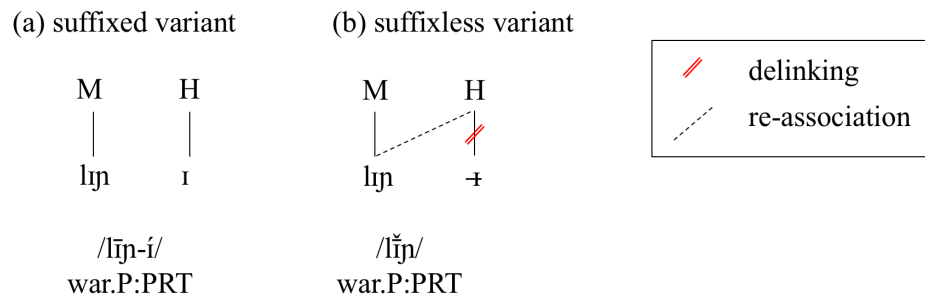


Figure 23 The tone association processes involved in the (a) suffixed and (b) suffixless variant of the pertensive form of 'wars' in Gar.

The data of pertensive inflection support the analysis that suffix loss involves only the loss of its segmental material. In contrast, the tonal material is preserved and interacts with the stem syllable as part of the morphological expression.

5.2.3 Summary

The analysis presented in Section 5.2 shows that -ɪ/-ɔ have undergone suffix loss in Gar nouns. This results in compositional interactions between the tone target originally associated to the suffix morpheme and the tone specification of the stem syllable. This may explain why the Shilluk tone system consists of more tonemes than other West Nilotic languages. In Shilluk, the loss of suffix leads to tone target interactions, which in turn results in the surfacing of contour tones. Further to Andersen's (1990) analysis that suffix loss is the diachronic origin of the ternary vowel length contrast in West Nilotic languages, this study postulates that suffix loss is also the diachronic origin of a complex tone system, provided that the tonal material of the suffix is preserved and interacts with the tone specification of the stem compositionally. This section has also shown that an autosegmental analysis (Fig.21-23) can capture the separate workings of segmental and tonal material in the event of suffix loss.

5.3 The preservation of -ɪɪ and -ɔɔ

This section investigates two other suffixes: -ɪɪ/-ɔɔ. The motivation for exploring -ɪɪ/-ɔɔ is that, segmentally, their vowel length is long, whereas the vowel length of the suffixes in native, underived nouns (-ɪ/-ɔ) is short. Therefore, it is worth investigating whether the long vowel suffixes (-ɪɪ/-ɔɔ) have also been lost. The following analysis examines singular instrumental nouns, contingent adjectives and plural adjectives, where -ɪɪ or -ɔɔ is expected to be present according to previous studies.

5.3.1 -ī in derived singular instrumental nouns

Shilluk instrument nouns are derived from transitive verbs (Remijsen & Ayoker 2019). For example, in Lwak, /góooc-ī/ ‘machete (sg)’ is derived from /gòɔɔc/ ‘hit’ (Remijsen et al. 2018). This is a regular process of derivational morphology that involves -ī suffixation, H specification on the stem and other stem-internal changes (Remijsen et al. 2015:22-23).

Nine instrumental nouns were elicited in this study, which are exemplified in Table 19. In singular instrumental nouns, the suffix in CV(VV)C-ī is preserved in Gar. As for their plural counterpart, they are all suffixless with a HFM specification, except for ‘radios’ (HF). The absence of suffix in plural forms contrasts with the suffixed Lwak form, which provides further evidence of the loss of suffix -ī in uninflected nouns (§5.2.1). The only exception to this pattern of formal alternation between plural and singular is ‘ladder’. This descriptive analysis shows that unlike -i/-ɔ, suffix -ī in singular instrumental nouns is preserved in Gar. This suggests -ī is a suffix morpheme distinct from -i.

Table 19 The plural and singular form of instrumental nouns in Gar and their Lwak corresponding forms. Note: ‘n/a’ indicates there is no entry for the relevant word in the reference lexicography (Remijsen et al. 2018).

| | Instrument nouns | | | |
|-----------|------------------|--------|----------|--------|
| | Gar | | Lwak | |
| | Singular | Plural | Singular | Plural |
| ‘machete’ | góooc-ī | góoḱ | góooc-ī | n/a |
| ‘pen’ | gwéet-ī | gwéḱ | n/a | n/a |
| ‘mirror’ | ráaaŋ-ī | ráaḱ | ráaaŋ-ī | ráaḱ-ī |
| ‘ladder’ | jiḱ | jiḱ-ī | jiḱ-ī | jiḱ-ì |
| ‘paddle’ | láaaw-ī | láw | láaaw-ī | láw-ī |
| ‘radio’ | ráaaḱ-ī | ráḱ | ráaaḱ-ī | ráḱ-ī |

5.3.2 -î in the plural form of adjectives

As mentioned in Section 4.2, a small set of adjectives in Shilluk have two morphologically distinct forms based on the number of the noun that it modifies. According to Kohnen (1933, as cited in Remijsen & Ayoker 2019), in the northern part of the Shilluk-speaking area, the plural form of these adjectives consists of a H-toned stem and the suffix -î (CV(C)-î). This

phonotactic structure is different from the Lwak forms (Table 20). Since Gar is a northern dialect, its plural adjectives are expected to have this phonotactic structure.

Results of this study show that all plural forms of the relevant adjectives have the structure of CV́C-íi (Table 20). This generally confirms Kohnen’s (1933, as cited in Remijsen & Ayoker 2019) description, except this study found that the tone specification of the suffix is HF rather than LF. Due to inability to access the original source, it is unclear whether Kohnen (1933) distinguishes between HF and LF. It is possible that the two falling contours are undistinguished in this early work. In short, similar to the analysis of instrumental nouns, the preservation of suffix -íi in Gar plural adjectives suggests that -ii is a suffix morpheme distinct from -i.

Table 20 The Gar and Lwak corresponding forms of adjectives that have a morphologically distinct plural form.

| | Adjectives | | | |
|----------|------------|-------------|-------------|-------------|
| | Base form | | Plural form | |
| | Gar | Lwak | Gar | Lwak |
| ‘big’ | dwóóŋ | dwóóŋ | dwóŋ-íi | dóŋ-ò |
| ‘small’ | úiiṅ | úiiṅ | úŋ-íi | úŋ-ò |
| ‘long’ | báλλɪ | báλλɪ | báɪ-íi | báɪ-ò |
| ‘short’ | cjééék | cjék | cjék-íi | cék-ò |
| ‘wide’ | láaaç | láac | líç-íi | láç-ò |
| ‘bad’ | ráaaç | râac | ríç-íi | ríç-ò |
| ‘narrow’ | póuut | pôut | póŋ-íi | pòt-ò |

5.3.3 -óó in the contingent form of adjectives

In Lwak adjectives, beside plural forms, suffixation also appears in some contingent forms. This is described by Remijsen and Ayoker (2020). Most adjectives in Lwak have a contingent form that is morphologically distinct from the base form. The base form is used when the referent property is permanent, complete, or objective, whereas the contingent form is used when it is temporal, incomplete, or subjective. The contingent form is formed either by a suprasegmental pattern or an affixal pattern, the latter of which involves the suffixation of -óó. Therefore, the affixal pattern of contingent form is relevant to this study.

In this study, 7 adjectives that have a contingent form belonging to the affixal class in Lwak were elicited. Results show Gar has two distinct forms for these adjectives. Morphologically, the affixed form generally corresponds to the contingent form described in Lwak (Table 21).⁶ This suggests that the suffix -ɔɔ is preserved in the affixal contingent form of Gar adjectives.

Table 21 The base and contingent form of seven adjectives in Gar.

| Gar adjectives | | |
|----------------|--------|-------------|
| | Base | Contingent |
| ‘cold’ | lìp | ù-lìp-ɔɔ |
| ‘hot’ | léɛɛɛ̀ | léɛɛɛ̀-ɔɔ |
| ‘sour’ | wâac | ù-wâaac-ɔɔ |
| ‘lightweight’ | jóoot̀ | ù-jóoot̀-ɔɔ |
| ‘smelling bad’ | pêɛɛ̀ | ù-pêɛɛ̀-ɔɔ |
| ‘green’ | màr | ù-màr-ɔɔ |
| ‘tasty’ | mè̀ | ù-mè̀-ɔɔ |

5.3.4 Summary and discussion

Section 5.3 has shown that in Gar, the -ɪ suffix is regularly found in instrumental nouns (-ɪ̄) and the plural form of adjectives (-ɪ̄), while -ɔɔ is found in the affixal contingent form of adjectives. The preservation of -ɪ̄/-ɔɔ in Gar contrasts with the loss of -ɪ/-ɔ. This motivates the postulation that the suffixal morphemes -ɪ̄/-ɔɔ are distinct from -ɪ/-ɔ. A possible explanation for the preservation of -ɪ̄/-ɔɔ relates to phonological vowel length. In her study of nominal morphology in Lwak, Reid (2009:29) notes that suffix -ɪ/-ɔ in nouns are sometimes weakly realized. Since -ɪ̄/-ɔɔ are long vowel suffixes with greater duration, it has more phonological weight. Therefore, from the perspective of language acquisition, -ɪ̄/-ɔɔ are

⁶ From a semantic perspective, Gar does not seem to use the contingent form in the same way as Lwak. Specifically, the semantic contrast between the base and contingent form appears to be diluted in Gar. For example, with ‘fire is hot, ice is cold’ it is expected that the consultant would produce the base form of ‘hot’ and ‘cold’, since hotness and coldness are intrinsic, objective and permanent properties of fire and ice respectively. However, the consultant used both the base and contingent forms in different iterations and expressed that they can be used interchangeably. However, it is worth noting that the controlled elicitation method of this study might have affected the naturalness of the semantic and pragmatic context. In light of this semantic observation, it will be worthwhile to conduct further studies on the contingent form of adjectives with larger sample size and spontaneous speech, in order to determine the semantic function of the base/contingent contrast in Gar adjectives.

more likely to be saliently produced and perceived than -ɪ/-ɔ. Consequently, -ɪɪ/-ɔɔ are more resistant to suffix loss.

6 Conclusion

Based on the acoustic data collected from a native Gar speaker, Section 4 presents a descriptive analysis of the Gar tone inventory and postulates nine contrastive tonemes in Gar: *High, Mid, Low, High Fall, Low Fall, High Fall to Mid, Late Fall, High Rise* and *Low Rise*. This analysis is based on an examination of Gar nouns. Although the tonal inventory of Gar is identical to that of Lwak, there are several points of dialectal variation in the distribution of tone specifications in nouns. The discussion of these observations shows compelling evidence for which Gar has undergone suffix loss (§4.3). This is in line with Remijsen and Ayoker's (2019) *loss of suffix* hypothesis and motivated the subsequent investigation into suffixation patterns in Gar. Section 5 shows that while long vowel suffixes (-ɪɪ/-ɔɔ) are preserved in Gar (§5.3), short vowel suffixes (-ɪ/-ɔ) are either consistently or sporadically lost in Gar nouns (§5.2). In particular, in the suffix loss phenomenon, only the segmental material is deleted. The tonal material is preserved and interacts compositionally with the tone specification of the stem. The compositional interaction of tone targets offers an explanation for the distributional differences of certain tone specifications between Gar and Lwak. It also provides an explanation for why Shilluk has a more complex tone system than its neighbouring West Nilotic languages in terms of the number of tonemes. Ultimately, the analyses and discussions presented in this study show that in Shilluk, morphology and phonology are intricately intertwined, as suffix loss has implications on the tonal phonology of the language.

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8 Appendices

Appendix A. *Two minimal sets of the 9 tonemes in Lwak*

(1) is a minimal set of eight of the nine tone categories, showing that they are contrastive lexical and morphological tonal specifications on monosyllabic stems. (2) is a minimal pair of Low Rise and High Rise. The examples in (1) and (2) are from Remijsen et al. (2019:97).

- (1) a. *Low*
 á-kòl
 PAST-disturb.2SG
- b. *Mid*
 á-kōl
 PAST-disturb.APPL
- c. *High*
 á-kól
 PAST-take out.APPL.2SG
- d. *Low Fall*
 á-kôl
 PAST-take out.2SG
- e. *High Fall*
 á-kól
 PAST.disturb.OV
- f. *High Fall to Mid*
 á-kól̄
 PAST-take out.APPL.
- g. *Late Fall*
 á-kól̀
 PAST-take out.FUG
- h. *High Rise*
 á-kǒl
 PAST-disturb.APPL.2SG
- (2) a. *Low Rise*
 pǎ́ǎ́ǎ́ǎ́
 twist rope using hands.ANTIP.IMP
- b. *High Rise*
 pǎ́ǎ́ǎ́ǎ́

fall.IMP

Appendix B. *Coding metadata in file names*

For the audio recording of each utterance, the file name consists of seven slots, which are separated by an underscore. From left to right, the seven slots denote the following information: dialect name, speaker number, lexical class of the target form (*N* for Noun), English translation of the target form, grammatical number (*SG, PL*), frame (*CITATION, EXISTPred, NameOf*), and repetition number. For example, the file name of the utterance ‘there are birds’ is *Gar_01_N_bird_PL_EXISTPred_1*.