THE STATUS AND FUNCTION OF TONE IN TIRA

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DECLARATION

This dissertation is my original work and has not been presented for a degree in any other university.

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Kathie Watters

This dissertation has been submitted for examination with the approval of the following university supervisors:

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DEDICATION

To Fajak, Cici and the Tira People
TABLE OF CONTENTS

Title Page .............................................. iv
Declaration ........................................... iv
Dedication ............................................ iv
Table of Contents .................................... iv
Key to Symbols and Abbreviations .................. vii
Acknowledgments ...................................... viii
Abstract ............................................. ix

CHAPTER 1  INTRODUCTION TO THE RESEARCH .......... 1

1.1 Background to the Problem ....................... 1
1.2 Problem Statement ................................ 2
1.3 Objectives ....................................... 3
1.4 Hypotheses ...................................... 3
1.5 Scope and Limitations ............................ 4
1.6 Justification for the Study ....................... 6
1.7 Conceptual Framework ............................ 7
1.8 Methodology ..................................... 9
1.9 Literature Review ................................ 10
   1.9.1 Tonal Typology ............................... 10
      1.9.1.1 Definition of Terms for Suprasegmentals 11
      1.9.1.2 Definition of a Stress-Accent Language 12
      1.9.1.3 Definition of a Tone Language .......... 13
      1.9.1.4 Features that Characterize Tone Languages 14
1.9.2 Tira and Related Languages .................. 14
   1.9.2.1 Tira .................................... 14
   1.9.2.2 The Heiban Group ....................... 18
   1.9.2.3 Kordofanian ............................ 19
1.9.3 Tonal Systems in Niger-Congo Languages .... 19

CHAPTER 2  OVERVIEW OF THE SEGMENTAL PHONEMES .... 21

2.0 Why Re-examine Tira Segments? .................. 21
2.1 Consonants ..................................... 22
   2.1.1 Inventory .................................. 22
   2.1.2 Non-continuants ........................... 23
      2.1.2.1 Contrasts .............................. 23
      2.1.2.2 Allophonic Processes ................ 26
   2.1.3 Neutralization of the Velar Plosive Contrast 27
2.1.3 Continuants ........................................... 29
  2.1.3.1 Contrasts ....................................... 29
  2.1.3.2 Allophonic Processes ......................... 33
  2.1.4 Syllabic Consonants ............................. 34
2.2 Vowels .................................................. 35
  2.2.1 Inventory .......................................... 35
  2.2.2 Contrasts ......................................... 37
  2.2.3 Phonetic Realization ............................ 38
  2.2.4 Allophonic Processes ......................... 40
  2.2.5 Vowel Length .................................. 43
2.3 Tira Phonotactics and Tone ............................ 45
  2.3.1 Morpheme Structure .............................. 47
    2.3.1.1 Nouns ....................................... 47
    2.3.1.2 Verbs ....................................... 51
  2.3.2 Syllable and Word Structure .................... 55
    2.3.2.1 Syllable Structure ........................ 55
    2.3.2.2 Word Structure ............................ 56
    2.3.2.3 Vowel Sequence Interpretation ............ 57
2.3.3 Morphophonemic Changes
  that Affect Tone Association ....................... 59
  2.3.3.1 Stem Vowel Deletion ......................... 60
  2.3.3.2 Prefix Vowel Deletion ...................... 62
  2.3.3.3 Segments that Change
    their Tone-Bearing Status .......................... 65
  2.3.3.4 Consonant Cluster Formation ............... 67
2.4 Summary ............................................... 70

CHAPTER 3 THE STATUS OF TONE .................................. 72
3.0 Introduction .......................................... 72
3.1 Tonal Inventory ....................................... 72
  3.1.1 Surface Tone Contrasts ......................... 73
  3.1.2 Allotones ....................................... 78
    3.1.2.1 Downdrift .................................. 78
    3.1.2.2 Downglide .................................. 79
    3.1.2.3 Downstep ................................... 80
    3.1.2.4 Depressor Consonants ..................... 82
3.2 Tira Tone in Relation to Length and Loudness .... 85
  3.2.1 Tone and Length ................................ 85
  3.2.2 Tone and Loudness ............................. 87
3.3 Summary ............................................... 88

CHAPTER 4 THE FUNCTION OF TONE .............................. 89
4.0 Introduction .......................................... 89
4.1 The Tonal Tier ...................................... 90
  4.1.1 The Well-formedness Condition
    and Association Conventions ..................... 90
4.1.2 Tonal Melodies and The Obligatory Contour Principle .......... 93
4.1.3 Strategies for the Initial Tonal Association .................. 94
4.1.4 Syllabification and Tone Association ......................... 97
4.2 Nominal Tone ............................................. 97
4.2.1 The Function of Tone in Tira Nouns ......................... 98
4.2.2 Noun Composition .......................................... 99
4.2.3 Noun Melody Association .................................. 100
  4.2.3.1 Low and High Tone Melody Association .................. 101
  4.2.3.2 HL and LH Melody Association ......................... 102
  4.2.3.3 LHL Melody Association ............................... 103
4.2.4 Starred Melodies and the Initial Association Rule .......... 104
  4.2.4.1 Apparent Violations of the OCP ....................... 104
  4.2.4.2 Possible Explanation for OCP Violations ............... 106
  4.2.4.3 A Proposed Solution for Apparent OCP Violations ...... 107
4.2.5 Suffixixed Nouns .......................................... 111
4.2.6 Vowel Deletion and Contour Tones .......................... 112
4.2.7 Syllabic Consonant Formation and Tone Association ........ 114
4.3 Verbal Tone ................................................ 116
  4.3.1 The Function of Tone in Verbs ............................ 116
  4.3.2 Verb Composition ......................................... 117
  4.3.3 Verb Tone Association ..................................... 119
    4.3.3.1 Imperatives ........................................ 119
    4.3.3.2 Boundary Types With No Morphophonemic Changes ...... 122
    4.3.3.3 Boundary Types that Change Vowels to Consonants .... 123
    4.3.3.4 Boundary Types that Trigger Vowel Deletion .......... 127
    4.3.3.5 Boundary Types that Change Consonants to Syllabics.. 129
  4.3.4 Verb Melodies ............................................ 130
4.4 Summary ................................................... 131

CHAPTER 5 SUMMARY AND CONCLUSION ............................... 132
  5.1 Summary .................................................. 132
  5.2 Conclusions ............................................... 137
  5.3 Reccommendations for Further Study .......................... 138

BIBLIOGRAPHY ................................................. 139
KEY TO SYMBOLS AND ABBREVIATIONS

|= +RTR, high, front vowel | u = +RTR, high, back vowel |
|x = voiceless dental plosive | d = voiced dental plosive |
r = retroflexed lateral flap |
|c = alveolar flap |
|t = alveolar trill |
|l = syllabic lateral |

- high tone |
~ low tone |
^ falling tone |
\ rising tone |
\' downstepped high |
^' 'depressed' high |

[ ] encloses a phonetic transcription |
// encloses a phonemic transcription |
{} encloses a morpheme |
** marks an ungrammatical form |
~ freely varies with |
--> 'is rewritten as...' or 'becomes...'
. syllable boundary |
+ morpheme boundary |
# word boundary |

C consonant |
V vowel |

IN inclusive |
EX exclusive |
SG singular |
DU dual |
PL plural |
NCP noun class prefix |
SUF suffix |
ASP aspect marker |
IMP imperative |

WFC Well-formedness Condition |
AC Association Conventions |
TBU tone-bearing unit |
OCP Obligatory Contour Principle |
IAR Initial Association Rule
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Dr. Yokwe gave me my first formal introduction to Autosegmental Phonology as my phonology instructor by presenting his work on Bari. He has helped me in presentation of segmental analysis. He has has been particularly helpful in application of autosegmental theory to the special problems of Tira tone analysis.

I would also like to acknowledge the help of my husband, Dr. John Watters. He has helped me throughout the research by discussing my proposed analyses, suggesting alternatives and critiquing the text.

While acknowledging the excellent help of these individuals, I take full responsibility for any inaccuracies in the data or analysis.

For me, this has been a fascinating adventure in one of the great wonders of God's creation, human language. My desire is that this work will help the Tira people design a practical and adequate orthography. May they someday delight in the ability to read and write in the language God gave to them.
ABSTRACT

This study attempts to demonstrate that Tira, a Kordofanian language of Sudan, is tonal. It describes lexical and grammatical functions of Tira tone as well as processes of tone association. It is a case study based on one speaker of the El Akdar dialect.

Theoretical concepts from traditional and generative phonology as presented by Hyman (1975) were used as a model for description of tone-bearing segments, non-tone-bearing segments and surface tones. Autosegmental theory as presented by Goldsmith (1990) was used as a model to analyze and describe underlying tone, tone association and its representation.

Chapter one gives historical background to the problem, states the problem and objectives for the research. A fairly detailed review of literature on aspects of tonal typology and evaluation of earlier works on Tira is included.

Chapter two re-examines the phonemes proposed by an earlier researcher, identifying tone-bearing segments. It further discusses Tira morpheme structure in terms of segmental and tonal phonemes, syllable structure and word structure. It describes segmental morphophonemic changes
that are triggered by the concatenation of morphemes and syllabification of words.

Chapter three demonstrates the four surface tones of Tira and their allotones. It also suggests what the relationships between tone, length and loudness are. Finally, it shows that Tira demonstrates characteristics typical of tone languages and meets the definition given for a tone language.

Chapter four shows that Tira tone functions lexically in nouns and grammatically in verbs. Using the principles of autosegmental analysis it demonstrates that Tira has only two underlying tones, high and low, from which the surface tones are derived. It shows that tone spreading, contour tone formation and tone shifting found in Tira are all explained with universal principles of tonal association plus parameters and rules specific to Tira. It also demonstrates that syllabification and tonal association are interdependent in Tira.

Chapter five gives a general summary and the conclusions drawn from the research. It also suggests some areas for further study.
CHAPTER 1 INTRODUCTION TO THE RESEARCH

1.1 BACKGROUND TO THE PROBLEM

Tira is a Niger-Congo (Greenberg's Niger-Kordofanian) language spoken in the Nuba Mountains of Sudan. It is part of the Kordofanian sub-family and more specifically the Heiban Group (Williamson 1989:21, Schadeberg 1989:69). Over the last eighty years, various researchers have collected and published some Tira vocabulary as part of wider surveys of the Nuba Mountain languages. They include Seligman 1910, Meinhof 1916, MacDiarmid 1931, Stevenson 1956 and 1964 and Schadeberg 1981. Basically, these works contain phonetically transcribed data that focus on lexical, grammatical and classification issues. None claim to have analyzed the segmental phonemes of Tira and only three make brief reference to suprasegmental phenomena.

There is, however, an unpublished grammar of Tira by Stevenson which contains an analysis of the segmental phonemes and has some brief notes on tone and stress. In his grammar, Stevenson makes the claim that 'Tira is not a tone language' but that 'stress is more important' (1942:14). However, as we will see later in reviewing his work, this claim is not very convincingly supported.

Schadeberg's work on Tira was part of a survey on Kordofanian languages. Schadeberg recorded high, low and
falling pitch on his data but did not attempt to analyze the
tonal system (1981:86,132). Although he did not analyze
tone, Schadeberg assumed that on further investigation Tira
would prove to be a tone language. He based this assumption
on the prevalence of tone languages in the Niger-Congo
family (personal communication).

Schadeberg's assumptions about the status of tone in
Tira are supported by other linguists. Williamson notes
that since the majority of present day Niger-Congo languages
are tonal, Proto Niger-Congo is also believed to have been
tonal (1989:26). Welmers says than any sub-Saharan language
should be assumed tonal unless proven otherwise (1973:78).

The main hypothesis of this study is that Tira is a
tone language. In an effort to test the researchability of
the proposed program, some preliminary investigation was
conducted. Impressions were gained that reinforced various
hypotheses arising out of review of the literature. Also
similarities were noted between the pitch patterns heard in
Tira and the tonal patterns of Ejagham, another Niger-Congo
tonal language with which I am familiar. These factors
together led me to the problem statement, objectives and
hypotheses which follow.

1.2 PROBLEM STATEMENT

The problem in this study has been to investigate the
pitch patterns of Tira in order to determine if pitch is a
lexically distinctive and contrastive phonological unit that enters into the composition of at least some morphemes. Having found it to be so, a further problem has been to investigate how tone functions lexically and grammatically.

1.3 OBJECTIVES

The solution to the problem above was found by achieving the following objectives.

1) Determine what the contrastive pitches are, and thereby determine the tones.

2) Determine the allotones of the above tones.

3) Suggest how loudness and length interact with tone.

4) Identify the tone-bearing units by re-examining Stevenson's 1942 analysis of segmental phonemes.

5) Determine the effect of vowel deletion on tone.

6) Determine if tone functions to signal both lexical and grammatical meaning.

7) Determine, in part, the system by which tones are assigned to tone-bearing units in their domain.

8) Identify a set of criteria for tone languages and demonstrate that Tira meets the criteria.

1.4 HYPOTHESES

The main hypothesis of this study is that Tira is a tone language in which tone functions both lexically and grammatically. Below are supporting hypotheses which relate to each of the objectives.
1) There are two underlying tones in Tira, high and low. Under certain circumstances, these may be assigned to one tone-bearing unit thus producing rising and falling contour tones.

2) Allotones are present which are due to the influence of certain segments and other tones.

3) Intensity and length will interact with tone in ways typical of a tone language rather than a stress-accent language.

4) Tira will have 8 vowels and at least two syllabic consonants that are additional tone-bearing units.

5) The domain of tone is the word. Vowel loss will lead to the appearance of complex consonant clusters and the formation of contour tones. It will also lead to syllabification of consonants or addition of an epenthetic transition vowel.

6) Tone signals both lexical and grammatical meaning.

7) Tone assignment will be better understood through autosegmental analysis.

8) Tira will meet the criteria identified for a tone language.

1.5 SCOPE AND LIMITATIONS

The scope of this tonal study has been an analysis of tonal and segmental phonemes of Tira at word level. The inventory of both tonal and segmental phonemes has been established. A beginning analysis of the system which governs the distribution of tones at word level has been done. For tonal phonemes this was accomplished by the application of autosegmental analysis to questions of tone assignment. Systems which govern the alternation of vowels in the word were not addressed. The study was restricted to simple nouns and verbs.
In some regards the study has had limitations that were not foreseen. The research program called for a re-examination of Stevenson's analysis of Tira segmental phonemes. It was assumed that Stevenson's work could be relied upon heavily as the basic segmental analysis seemed sound. Indeed, this has been the case in many regards. However, a number of differences arose between Stevenson's analysis and that presented here, thus requiring a more in-depth study of segments than was originally anticipated. In addition, the degree of importance of syllable and morpheme structure and morphophonemic changes to the process of tone assignment was not anticipated. These were areas Stevenson and Schadeberg had only touched on.

As a result of extra research time being spent in these areas, the study of verb tone has not been as extensive as had been planned. The verb analysis was based on a complete conjugation of the 'definite' aspect for each root type, 25 partial conjugations and a few isolated forms in other aspects. It is recognized that further study could modify this analysis. Nevertheless, what is presented was done with significant enough depth and breadth so that it is felt to be soundly supported.

In the description of segmental phonology, distinctive features are used in rule writing, but no formal attempt was made to present the distinctive feature system of Tira.
Finally, this study has attempted to show that Tira is a tone language based on the criteria given. There is increasing awareness of late that the dividing line between tonal and accentual systems cannot always be easily drawn (Williamson 1989:26). It is felt that Tira however, has fallen fairly clearly into the tone language end of the spectrum. As this study has focused on pitch and tone, the discussion of how length and loudness interact with tone is only suggestive. No attempt has been made to determine if an accentual system is also operating in Tira overlaid on the tonal system.

1.6 JUSTIFICATION FOR THE STUDY

It appears that there is no current work done on any suprasegmentals in Kordofanian languages other than that presented in Schadeberg's survey. Although he was able to reconstruct Proto-Heiban segments, he did not have adequate data on the tonal systems to do a tonal reconstruction (Schadeberg 1981:132).

Schadeberg notes that although Greenberg's association of Kordofanian with the rest of Niger-Congo has never been challenged, many authors prefer to leave Kordofanian unclassified due to the inadequacy of information available on its languages (1981:6). Any current study of the tonal system of a Kordofanian language, would contribute to the knowledge needed by linguists to reconstruct
proto-Kordofanian tone and give added evidence to support the genetic relationship of Kordofanian to the rest of Niger-Congo.

This study has already been of practical help to the Tira speaking community. It has given them facts about the lexical and grammatical load carried by tone on which to base their decision concerning if and how to write tone in their orthography. The data collected will contribute to a future Tira dictionary.

1.7 CONCEPTUAL FRAMEWORK

There are two basic aspects to this research, description and analysis. Description will answer the question, "What are the tones and tone bearing units of Tira?" Analysis will answer the question, "How do the tones relate to these tone-bearing units?"

To begin with, the principles of contrast, complementation and distribution, inherited from structuralism, were drawn on to re-test Stevenson's analysis and identify the segments and surface tones. Generative phonological theory, as presented by Hyman (1975), was then used to describe the segmental allophonic processes. Doing so in terms of distinctive features captures generalizations about these processes that apply to entire classes of phonemes and help propose phonologically plausible explanations for the processes observed. Hyman's
presentation is particularly helpful because it has numerous illustrations of these processes using African language data and a very clear presentation of features which typify tone languages.

Then, autosegmental analysis of the units thus described will answer the question, "How do the tones relate to these tone-bearing units?" It may also attempt to explain why they relate in the way they do. Autosegmental phonology, as presented by Goldsmith (1990) in Autosegmental and Metrical Phonology, is the best tool we have to show how tonal phonemes are associated to tone bearing-units of the words they are part of. In 'classical' generative phonology, phonological units were viewed as a linear arrangement of segments and boundaries with no hierarchical ordering to them. Autosegmental phonology proposes to split this string of complex segments into multiple layers or 'tiers' of phonological units. For this study, we will deal primarily with the segmental and tonal tiers. The Well-formedness Condition and Association Conventions both universal, plus language specific parameters and rules, will govern how these tiers relate. For Tira, two parameters and four language specific rules are needed.

In Tira vowels undergo reduction and deletion. When deletion occurs, the tone that was once associated with the vowels remains behind. Autosegmental tonology helps us see that segments and tones operate autonomously. It
illustrates how in Tira changes in the segmental tier necessitate 'delinking' of tones from deleted or lost vowels and reassociation to other tone bearing units, thus producing contour tones and syllabic consonants. Goldsmith's book is a very recent and comprehensive presentation of the theory and includes illustrations from some Niger-Congo languages.

Finally, in order to give a tonal typology for Tira, the definition of and features for identifying a tone language is described. The definitions and features are drawn from Pike (1948), Welmers (1973) and Hyman (1975). These are detailed in 1.9.1.

1.8 METHODOLOGY

This research has been carried out by means of a case study of the speech of Mr. Fajak Avejani, a speaker of the El Akdar dialect. He spoke this language exclusively until about the age of 13 when he began to acquire first Arabic and then English. He continued, however, to use Tira regularly in addition to the other two languages until his recent arrival in Kenya. Both his father and mother, who raised him up to age 13, are speakers of El Akdar dialect. It is therefore believed that he is an adequate speaker of this dialect of Tira.

Data collection was carried out by means of linguistic interview using procedures developed primarily by
structuralists and described in Pike's Phonemics (1947) and Tone Languages (1948). A corpus of approximately 400 nouns and verbs and some 50 phrases were collected. A modified version of the International Phonetic Alphabet was used for transcription. Review of earlier works on Tira served as a basis for choosing initial words and phrases that needed re-eliciting. This sample was investigated to see how tone functions in lexical contrasts on nouns and some areas of verbal morphology which included aspect, person, number and direction. These are contexts where the literature indicates tone functions in other Niger-Congo languages.

Description and analysis of the data collected is presented using a generative type notation to state segmental allophonic rules. Autosegmental notation is used to present tonal phenomena in those contexts where it is particularly revealing. The application of suprasegmental typological criteria requires no special notation.

1.9 LITERATURE REVIEW

1.9.1 Tonal Typology

As Williamson noted, the dividing line between tonal and accentual systems can not always be easily drawn. It would perhaps be more accurate to place languages on a cline between tonal at one end and accentual at the other. Nevertheless, we can draw from the literature certain definitions and features useful in classifying languages as
either tonal or accentual. The hypothesis of this study is that Tira, judged by these criteria, is tonal. We will start with definitions of the terms to be used.

1.9.1.1 Definition of Terms for Suprasegmentals

The features most commonly identified as suprasegmentals are tone, duration and stress. For any given language, a suprasegmental feature that is linguistically significant will have a domain or sphere of operation (Hyman 1975:186-87, Kenstowicz & Kisseberth 1979:271 ff). For example, in certain languages an individual tone or tone sequence may be realized over the vowels of an entire word regardless of its length. Thus, the domain of tone would be the word. We will see that Tira is such a language.

The terms 'tone', 'duration' and 'stress' indicate that these features have been analyzed and determined to be linguistically significant. For each of these features there is also a phonetic realization which is independent of the question of linguistic significance. The phonetic feature that reflects tone is pitch, measured by vibrations of the vocal chords. This is an absolute measurement of pitch. Pitch may also be measured in relative terms, that is a pitch may be higher or lower than surrounding pitches. Duration is reflected by the relative length of a segment and stress by loudness, measured in decibels.
The phonetic features pitch, length and loudness are present in all utterances in any language (Hyman 1975:203, Kenstowicz & Kisseberth 19:19, 264). Analysis must determine what governs the distribution of each feature, showing which features are predictable based on their environments and which are not. If the distribution of a feature such as pitch cannot be predicted, then we identify that feature as linguistically significant. In the case of pitch, we call it tone. This study will demonstrate that tone is a significant suprasegmental feature in Tira. Although it is hypothesized that length and loudness in Tira are predictable based on the phonological environment, this study has not focused on those features and no definitive claims are being made about their phonological status.

1.9.1.2 Definition of a Stress-Accent Language

A stress-accent (or stress) language is a language that uses a combination of the phonetic features pitch, length and loudness to give prominence to one syllable per word (Hyman 1977:38,40).

For some time there has been confusion over the term 'stress' due to the practice of using this term in two different ways. As stated earlier, when used in reference to phonetic features, it reflects loudness. However, more frequently, the term is used in reference to its linguistic function. In this usage, 'stress' refers to a combination
of the phonetic features pitch, length and loudness. These features come together to 'accent' one syllable per word, marking it as more prominent than all others. For a long time, it was believed that loudness was the primary phonetic feature of linguistic stress. However, it is now known that pitch (usually high pitch) and length, in that order, are far more important than loudness in identifying linguistic stress (Hyman 1975:203-07, Hyman 1977:40, Kenstowicz & Kisseberth 1979:19). It follows from this definition that it would be exceptional for a stress-accent language to have any words with either all high or all low pitches.

1.9.1.3 Definition of a Tone Language

A tone language, on the other hand, uses pitch as the primary phonetic feature reflecting tone (Hyman 1975:213). Pike says that "A tone language may be defined as a language having lexically significant, contrastive, but relative pitch on each syllable" (1948:3).

Welmers, however, thought that Pike's insistence on 'one contrastive pitch on each syllable' was too strong. He noted that in a given tonal language, pitches may contrast on some syllables, therefore qualifying as tones, but other syllables are 'toneless'. Still other morphemes may be composed only of tone. He therefore proposed a modification that says, "A tone language is a language in which both pitch phonemes and segmental phonemes enter into the
composition of at least some morphemes" (1973:79-80).
Welmers' definition of a tone language will be adopted for this study.

1.9.1.4 Features that Characterize Tone Languages

Below is a summary of features that characterize tone languages. It is compiled from Hyman (1977:38-54) and Welmers (1973:77 ff).

1) In a tone language, tones contrast in identical phonological environments but in stress-accent languages, stress alters the environment.

2) Tone can be influenced by adjacent consonants but stress assignment is never influenced by segments.

3) Tone languages can allow more than one high tone per word but stress-accent languages limit high pitch to the one stressed syllable in the word.

4) Tone languages may have words ending on high tone but in stress-accent languages word final stress will have falling pitch.

5) In tone languages both tone and duration may be linguistically significant but in stress-accent languages length is almost always dependent on stress.

6) In tone languages, tone is a phoneme that contributes to the composition of morphemes but in stress-accent languages stress is a feature that contributes to the composition of whole words.

1.9.2 Tira and Related Languages

1.9.2.1 Tira

Since the 1900's there have been a number of general works on Kordofanian languages which have included data on Tira. In 1910, Seligman published a short word list of the
Kanderma dialect of Tira. On re-eliciting words she marked for 'stress', they showed no regular correlation with high pitch. The consonant clusters she records offer support to the analysis of cluster formation presented in this research.

In 1916 Meinhof followed up on Seligman's work. His identified 'prefixed group' of Nuba Mountain languages included most of present-day Kordofanian. Their distinction was possession of 'Bantu-like' noun-class and concord systems (Hellison:1920-287-90). This later was Greenberg's major reason for associating Kordofanian with Niger-Congo. This gives us support for assuming that Tira tone may be similar to systems in other Niger-Congo languages.

In 1931 the MacDiarmids surveyed Nuba. They recorded eight vowel qualities which closely match Stevenson's vowel inventory as well as that in this study. No variations in pitch, length or loudness were noted. The consonant clusters recorded match the analysis of cluster formation presented in this study.

The only in depth work done on Tira is an unpublished manuscript by Stevenson (1942) called 'The Tira Language'. Here, Stevenson claims that "Tira is not a tone language in the fullest sense of the term ... Inherent tone plays little part in distinguishing words, ... but dynamic accent or stress is more important." He sights minimal pairs that
differ only in the placement of 'stress' as seen in (1) below.

(1) Stevenson  l'aro 'chicken'  lar'o 'they said'
      Watters  lârù 'hen'  lârù 'they said'

When re-elicited, the majority of syllables marked for 'stress' were found to have high or falling pitch. Those unmarked for 'stress' had low pitch. There was no contrast noted in length or loudness. It may be that Stevenson mistakenly interpreted the high or falling pitch heard on these syllables as one of the phonetic features marking linguistic stress rather than the primary phonetic reflection of phonemic high tone. His statement that tone plays 'little part' in distinguishing words, implies that it does play some part. This contradicts a claim by Welmers in which he says that no African tone language has been reliably demonstrated to also have phonemic stress (1973:113).

Stevenson goes on to propose a rule predicting the placement of stress that he claims applies in 'a great number of cases', though he admits that it was impossible to form a precise rule (1942:14). In any case, a rule of stress placement would make stress a predictable feature and not phonemic as he implies. Thus, even Stevenson's examples, given to demonstrate the significance or 'stress' over 'tone', lead to the opposite conclusion. They tell us
that tone is the 'lexically significant and contrastive' feature in Tira and not stress. Segmental issues raised by his data or analysis will be discussed in Chapter 2.

Schadeberg's volume on the Heiban Group (1981) includes a section on Tira. Here we find a list of 100 Tira (Tiro) words marked for pitch and length. He says that Tira, "tones have been described as high, low or falling... (but) no analysis has been attempted for the tonal system."

(1981:86 &132). Schadeberg uses 'tone' here to refer to pitch. Though he did not analyze 'tone', he assumes that further investigation will show Tira is tonal. This assumption is based on the prevalence of tonal languages in the Niger-Congo family. He knows of no current studies on tone in Kordofanian languages that could either confirm or deny this assumption (personal communication).

Schadeberg records both long and short vowels. Examination of his data shows that high or low pitch may occur on both short and long vowels but falling pitch only on short. This would suggest that length may also be phonemic. This points out the need for more in depth study of vowels. It also supports the argument that Tira is tonal according to feature five which tells us that tone languages may have contrastive pitch and length while stress-accent languages almost never do.
1.9.2.2 The Heiban Group

Stevenson's 1956 article on 'Nuba' languages included analysis of the Heiban Group (his Koalib-Moro) in part based on data from Tira. Stevenson says that for the group as a whole "dynamic accent (stress), accompanied by high or low tone, plays a greater role than syllable pitch... In most languages a few lexical tone doublets are to be found" (1957:27). He gave examples from a neighboring language to Tira of word pairs that are identical segmentally but show high tone in contrast with low as seen in (2) below.

(2) from Laro 'yórè 'ashes' 'yórè 'fences'

Since in these examples stress remains on the same syllable while the tone changes, it seems clear that tone is the relevant phonological feature here signaling the difference in meaning and not stress. As noted earlier, Welmers claimed that it has not been reliably demonstrated that a tonal language may also have phonemic stress.

According to Schadeberg, Moro is the language most closely related to Tira. He also notes (1989:68) that Black and Black's work is the most complete existing description of any Kordofanian language.

Black notes (1971:14) that "stress presents a problem because it fluctuates freely in many words." He attempts a rough rule for 'stress' placement but notes that "while this
is not a tone language there is in a number of instances contrast..." He follows with some minimal pairs. Quite the opposite of his conclusion, his discussion suggests that tone is the phonologically significant feature and not stress.

1.9.2.3 Kordofanian

Schadeberg's overview of Kordofanian in a volume on Niger-Congo languages, gives a good summary of the early scholarship and classification issues. The discussion of consonants suggests some reasons for the differences between the analysis of consonants in this research and Stevenson's analysis. Conspicuous by its absence was any discussion of either vowels or tone (1989:67-80). I believe this reflects the relative lack of definitive studies in these two areas.

1.9.3 Tonal Systems in Other Niger-Congo Languages

There are no current studies on suprasegmentals in Kordofanian languages. The best help that can be hoped for is a review of some of the literature describing tonal systems of Niger-Congo languages.

Included in Hyman (1976) Studies in Bantu Tonology are articles describing various tonal phenomenon in specific Bantu languages that are also common to other Niger-Congo languages. Some of these touch on issues relevant to Tira. Particularly helpful are Hyman on the relationship of tone
and accent in Haya and Trithart on the effect of depressor consonants on tone in Chichewa.

Clements and Goldsmith's (1984) Autosegmental Studies in Bantu Tone begins with a helpful history of some approaches to description of tone in Bantu. They point out that two analytically difficult features of Bantu, mobility of tone and the spreading of tone onto inherently tone-less morphemes, are solved by applying autosegmental analysis to these problems. Also helpful in this volume is Laughren on the problems of depressor consonants, downstep and tone classes in Zulu. Then, Clements discusses the phenomenon of tone shift in Kikuyu. These are all phenomena that appear to be present in Tira.

In conclusion, this study will attempt to demonstrate that Tira is a tone language. On the one hand, it will refute Stevenson's claim that 'tone plays little part in distinguishing words'. On the other, it will confirm the assumption of Schadeberg, Williamson and Welmers that Tira will prove to be tonal. Once the status of tone has been established, its function in the lexicon and grammar can be demonstrated.
CHAPTER 2  OVERVIEW OF THE SEGMENTAL PHONEMES

2.0 WHY RE-EXAMINE TIRA SEGMENTS?

In order to identify the tonal phonemes in Tira, it is important to first identify the segmental phonemes, especially those that function as tone-bearing units. Tone-bearing units are those segments in a given language that are designated to bear or be associated with the tonal phonemes. In Tira, these include both vowels and consonants. An inventory of the 32 vowel and consonant phonemes is presented followed by illustration of contrasts and allophonic variants.

Following the segments, there is a discussion of Tira phonotactics. In Tira certain tonal phenomena are dependent on the morphophonemic changes that occur when a string of morphemes is syllabified to form a word. Thus an understanding of morpheme, syllable and word structure are necessary for tone analysis. Vowel deletion and resultant consonant cluster formation also affect tonal phenomena. Neither Stevenson, or Schadeberg, have addressed these issues to any great extent. It is for these reasons that the re-testing was done and this overview is presented.

Both Stevenson's and Schadeberg's work have served as a guide to re-testing Tira segments. Issues raised by their work that are relevant to this study will be noted in the
sections that follow. Unless otherwise stated, all data presented and conclusions drawn about the phonology of Tira in this study will be based on data which I have either re-elicited or newly elicited. A key to symbols and abbreviations is included on page 3 of this study.

2.1. CONSONANTS

2.1.1 Inventory

There are 24 consonant phonemes which are presented in (3) below. The consonants in parentheses occur infreqently. Under certain conditions, some liquids and nasals may become syllabic and function as tone-bearing units.

(3) Consonant Phonemes

<table>
<thead>
<tr>
<th>Non-Continuants</th>
<th>Labials</th>
<th>Dentals</th>
<th>Alveolars</th>
<th>Palatals</th>
<th>Velars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plosives</td>
<td>p</td>
<td>t</td>
<td>t</td>
<td>c</td>
<td>(k)</td>
</tr>
<tr>
<td>Retroflexed</td>
<td>b</td>
<td>d</td>
<td>d</td>
<td>j</td>
<td>g</td>
</tr>
<tr>
<td>Flap</td>
<td>r</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fricatives</td>
<td>(f)</td>
<td>(s)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquids</td>
<td>v</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flap</td>
<td></td>
<td>r</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trill</td>
<td></td>
<td>r</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral</td>
<td></td>
<td>l</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasals</td>
<td>m</td>
<td>n</td>
<td>n</td>
<td>n</td>
<td></td>
</tr>
<tr>
<td>Semi-vowels</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
<td>y</td>
</tr>
</tbody>
</table>
This consonant inventory differs from Stevenson who identified 22 consonant phonemes. However, his inventory included /tr/, /dr/ as affricates and a retro-flexed sibilant /ʂ/. It excluded /f/, /θ/, /r/ and /k/. He did not identify any consonants which could become syllabics. Stevenson considered the phonemes /c/ and /ʃ/ to be true palatal plosives rather than the alveopalatal affricates [tʃ] and [dʒ] (1942:7-11). Schadeberg also transcribed them as palatals. I have chosen to follow Stevenson and Schadeberg, but it should be noted that these sounds function as coronals.

Schadeberg noted some phonetically long obstruents and also reconstructed a series for Proto-Heiban (1981:116). However, no long consonants were found by Stevenson nor have any been noted in this research.

2.1.2 Non-continuants

2.1.2.1 Contrasts

The consonants divide into two classes, non-continuants and continuants, based on their distribution. Non-continuants occur word initially and medially but never finally whereas continuants occur also word finally. All plosives show a voicing contrast while the retroflexed flap has no voiceless counterpart. Non-continuant contrasts (excluding velars) are illustrated in (4) below. The 'c/t' signifies 'cause to'.
(4) Non-Continuant Word Initial Contrasts

<table>
<thead>
<tr>
<th>Labials</th>
<th>Dentals</th>
<th>Alveolars</th>
<th>Palatals</th>
</tr>
</thead>
<tbody>
<tr>
<td>pÊ 'c/t beat'</td>
<td>tÊ 'c/t drink'</td>
<td>tÊ 'shake!'</td>
<td>cô 'insult'</td>
</tr>
<tr>
<td>bÊ 'hurry!'</td>
<td>dÊ 'c/t be fat'</td>
<td>dÊ 'c/t sit'</td>
<td>jô 'particle'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rÊ 'thorns'</td>
<td></td>
</tr>
</tbody>
</table>

By looking down the columns in (4) above, we see clear evidence of the voicing contrast for each class of non-continuants in the initial position. By looking across the rows, evidence for the contrast between either voiced or voiceless plosives at the various points of articulation can be seen.

In (5) below, this same procedure can be followed for non-continuant contrasts in the intervocalic position. Non-continuants do not occur in the final position.

(5) Non-Continuant Intervocalic Contrasts

<table>
<thead>
<tr>
<th>Labials</th>
<th>Dentals</th>
<th>Alveolars</th>
<th>Palatals</th>
</tr>
</thead>
<tbody>
<tr>
<td>ðàpàri 'stick'</td>
<td>ðàjô 'to drink'</td>
<td>tútô 'cough!'</td>
<td>cícô 'name'</td>
</tr>
<tr>
<td>ðàbà 'star'</td>
<td>ðúôô 'breathe'</td>
<td>ôúôô 'to burn'</td>
<td>lîjî 'people'</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ôúôô 'to loosten'</td>
<td></td>
</tr>
</tbody>
</table>

Velar Plosive Contrast: The contrast between the phonemes /k/ and /g/ is very restricted. The phoneme /k/ has only occurred in a small set of terms for family members. These are all words with reduplicated syllables as seen in (6) below.
(6)  kákà [kákà] 'grandmother'  
gálì [γálì] 'first daughter'  
kúkù [kúkù] 'first son'  
lúgò [lúγò] 'dress'  

In (6) above we see the /k/ and /g/ contrasted initially in the first set and medially in the second set. Although these environments are not identical, there is no plausible explanation in the environments for them to be treated as allophones. Stevenson also noted this contrast in certain verbal forms (1942:145) as seen in (7) below. The labialization of the velars is allophonic.

(7)  ikwòdhè 'I pierce'  igwòdhè 'I sow'  

Although there is contrast between /k/ and /g/ initially and medially, we will see in 2.1.2.3 that there may also be neutralization of this contrast word initially.

The Retroflexed Flap: The retroflexed flap /ɾ/ is a heavily laterialized sound which occurs word initial and medial but not final. Due to its distribution, it is classified as a non-continuant even though it bears phonetic similarity to the two 'r-like' continuant sounds, the alveolar flap /ɾ/ and the trill /ɾ/.
2.1.2.2 Allophonic Processes

There are two allophonic processes attested for the non-continuants. First, there is an optional spirantization occurring for the voiced non-coronals as shown in (8) below.

(8) Spirantization Rule

\[
\begin{array}{c}
\text{C} \\
\text{[-cont]} \\
\text{[-cor]} \\
\text{[+voice]} \\
\end{array} ~ \sim \begin{array}{c}
\text{[+cont]} \\
\end{array} / V \rightarrow V \\
\text{Examples:} \\
\text{[yàbà ~ yàbà] 'stars'} \\
\text{[lúyò ~ lúgò] 'dress'}
\]

We see here that the optional spirantization of voiced non-coronals is such that /b/ and /g/ may be realized as the fricatives [θ] and [γ] intervocally. This spirantization does not occur for the voiced coronal plosives /d/ and /d/. If it did, the contrast between them and their corresponding voiced fricatives /θ/ and /ɾ/ would be neutralized.

The second allophonic process that occurs with non-continuants is a labialization of velars. This is seen in (9) below.

(9) Velar Labialization Rule

\[
\begin{array}{c}
\text{C} \\
\text{[+cons]} \\
\text{[-cor]} \\
\text{[-ant]} \\
\text{[-round]} \\
\end{array} \rightarrow \begin{array}{c}
\text{[+round]} \\
\end{array} / V \rightarrow \begin{array}{c}
\text{[+back]} \\
\text{[+round]} \\
\text{[-high]} \\
\end{array} \\
\text{Examples:} \\
\text{[k'wóóò] 'pierce'} \\
\text{[dóy'wóóò] 'to sow'}
\]
We see here that there is a labialization of velar plosives such that /k/ and /g/ may be realized as [kʰ] and [ɣʰ] preceding the back low rounded vowel /ɔ/. It is interesting to note that this same labialization may optionally occur with the velar nasal /ŋ/ as in [ŋɔŋ ~ ɳɔŋ] 'grain'. In this case we see that the process is being extended to velars all the way thru the consonant system. Stevenson (1942:12,18) noted this process also occurring with all back rounded vowels but identified it as a consonant cluster.

2.1.2.3 Neutralization of Velar Plosive Contrast

As we saw in 2.1.2.1, there is contrast between the velar plosives /k/ and /g/. However, in the word initial position, it is possible for this contrast to be neutralized. In addition to the spirantized and labialized allophones of /g/ that are described above, there are two other alternations unique to /g/ that are seen in (10) below. For clarity, the rule is stated in letter notation and the full range of allophones is given. Examples of each alternation are included.

(10) Voiced Velar Plosive Allophonic Rule

/g/ \rightarrow [k ~ ɣ] / # — V / [kʰ ~ ɣʰ] 'big farm'
[ɣ ~ g] / V — V / [iɣânǐ ° iɡânĩ] 'mine'
[ɣʰ'] / V — ɔ / [oɔ̦y³ɔɔ̦ɔ°] 'to sow'
[g] / N — / [ɔɔŋgú] 'large pot'
We see here that /g/ is realized as [k] in free variation with [ɣ] word initially but only as [ɣ] in free variation with [g] intervocalically. The form **[i volunteered] is rejected as a possible pronunciation of 'mine'. If we return to our earlier examples of contrast, we can see this illustrated again in (11) below.

(11) (a) /g/  gàli [kàli ~ ɣàli] 'first daughter'
       lúgò [lúyò ~ lúgò] **[lúkò] 'dress'
(b) /k/  kákà [kákà] **[ɣáyà] 'grandmother'
       kûkû [kûkû] **[ɣûyû] 'first son'

We see in (11a) that either the phone [k] or [ɣ] are acceptable initially for the phoneme /g/, but only [ɣ] or [g] are acceptable intervocalically. We see in (11b) above that the only acceptable forms for 'grandmother' and 'first son' have the phone [k] throughout. We conclude that any instances of the phone [k] which may not vary with [ɣ] are realizations of the phoneme /k/. Any which may vary with [ɣ] are realizations of /g/. Thus, there may be neutralization of the contrast between /k/ and /g/ whenever the phone [k] surfaces word initially.

We see in (12) below that the word initial alternation is maintained even when the phoneme occurs intervocalically across word boundaries.

(12) /ùjì gènè/ [ùjì ɣènè ~ ùjì kènè] 'any person'
It is interesting to note that Schadeberg reconstructs for Proto-Kordofanian and Proto-Heiban an intervocalic contrast between short and long plosives but no voiced/voiceless distinction. He says that allophonic intervocalic lenition of obstruents is common in Kordofanian languages. He further suggests that in languages where a voiced/voiceless contrast exists, the intervocalic voiceless plosives may have come from simplification of the long plosives. This implies that voiced lenis phones are realizations of the short voiced plosives. We have seen that to be the case in Tira for the non-coronals. We will see that the lenis coronal variants have already been phonologized into full phonemes.

There is no short/long plosive contrast in Tira. However, we see that an intervocalic voiced/voiceless contrast has already emerged for the labials, dentals, alveolars and palatales. This suggests that what we see in the discussion of velar plosives in (10), (11) and (12) above may well represent an emerging voiced/voiceless contrast in the velar plosives (1989:74-75).

2.1.3 Continuants

2.1.3.1 Contrasts

In contrast to non-continuants, the continuants occur word finally as well as initially and medially between vowels. They include fricatives, liquids, nasals and
semivowels. Intervocalic contrasts are seen in (13) below. The phonemes /f/ and /s/ are discussed separately.

(13) Intervocalic Continuant Contrasts

<table>
<thead>
<tr>
<th>Fricatives</th>
<th>Liquids</th>
<th>Nasals</th>
<th>Semi-vowels</th>
</tr>
</thead>
<tbody>
<tr>
<td>̀avì 'liver'</td>
<td>̀arì 'belly'</td>
<td>̀amò 'you took'</td>
<td>̀yù 'insides'</td>
</tr>
<tr>
<td>̀aòì 'crew'</td>
<td>̀arì 'stool'</td>
<td>̀anò 'you heard'</td>
<td>̀awù 'shelter'</td>
</tr>
<tr>
<td>̀flì 'chief'</td>
<td>̀anù 'you tilled'</td>
<td>̀nàñù 'scratch!'</td>
<td></td>
</tr>
</tbody>
</table>

By looking down the columns, we can see evidence for the contrasts between phonemes in the same class but made at different points of articulation. All points of articulation are not fully utilized in every class and the voicing distinction is lost as the continuants are all voiced.

Initial and final contrasts are illustrated in (14) below.

(14) Continuant Contrasts, Initial and Final

(a) Initial Contrasts

<table>
<thead>
<tr>
<th>Fricatives</th>
<th>Liquids</th>
<th>Nasals</th>
<th>Semi-vowels</th>
</tr>
</thead>
<tbody>
<tr>
<td>v̀ì 'be!'</td>
<td>̀racì 'pour!'</td>
<td>m̀ì 'choose me'</td>
<td>ẁò 'leave!'</td>
</tr>
<tr>
<td>̀ðì 'cut'</td>
<td>r̀ì 'stab me'</td>
<td>ǹì 'hear me'</td>
<td>ỳò 'eat!'</td>
</tr>
<tr>
<td></td>
<td>l̀ì 'we two'</td>
<td>ǹì 'till!'</td>
<td></td>
</tr>
</tbody>
</table>
(b) Final Contrasts

<table>
<thead>
<tr>
<th>Fricatives</th>
<th>Liquids</th>
<th>Nasals</th>
<th>Semi-vowels</th>
</tr>
</thead>
<tbody>
<tr>
<td>ìròv 'grass'</td>
<td>lír 'we IN PL'</td>
<td>tum 'onion'</td>
<td>ñàw 'water'</td>
</tr>
<tr>
<td>ðàd 'road'</td>
<td>lìr 'soup'</td>
<td>ñèn 'country'</td>
<td>này 'root'</td>
</tr>
<tr>
<td>ðùl 'giraffe'</td>
<td>lèn 'egg'</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ìòòñ 'son'</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The two rare fricatives /f/ and /s/ are not included in the charts above as they are exceptions as regards both distribution and voicing. There are thus far only two lexical items in which /f/ occurs. They are the personal name /fâjâk/ and /kafarana/ 'finally'. These words may be relics or perhaps borrowings. Otherwise the phone [f] is a word-final allophone of the phoneme /v/.

The voiceless alveolar sibilant /s/ has been observed in several contexts. First, it occurs in free variation with /t/ word initially in certain lexical items such as /tòfàlèfò/ 'shake!'. Second, it occurs without variation in the diminutive prefix of certain nouns such as /sàrò/ 'little goat'. Last, it occurs in lexical items such as /àsò/ 'guard'. Schadeberg (1989:75) has reconstructed an affricate /ts/ for Proto-Kordofanian and /s/ is a reflex found in neighboring Heiban group languages. Stevenson (1942:8) analyzed /s/ as a phoneme, finding it an allophone of retroflexed /t/ and in contrast with alveolar /t/, but I have found no similar data.

The relevant intervocalic contrasts for the fricatives and liquids with the voiced plosives to which they are most
phonetically similar are presented in (15) below. These contrasts are important because neither Stevenson nor Schadeberg found clear contrast between /d/ and /ð/.
Stevenson did not note the presence of the alveolar flap /ɾ/ at all. However, Schadeberg's short and long trill correspond to the /ɾ/ versus /r/ contrast of the present analysis in all lexical items we elicited in common.

(15) Contrasts for Plosives and Lenis Obstruent Counterparts

| Sòtó 'to drink' | Tútó 'cough!' |
| Súdó 'to breathe' | Súdó 'to burn' |
| Súsdó 'to tan' | Súcó 'to loosten' |
| | Súró 'to bury' |
| | Súró 'to descend' |

At this point we can follow up on the discussion of the possible emerging voiced/voiceless contrast for velar plosives. Schadeberg says that in Kordofanian languages there is commonly an allophonic intervocalic lenition of plosives that changes voiced plosives into voiced fricatives (1989:75). We saw in 2.1.2.2 lenition realized as an allophonic spirantization for non-coronals. Now we see in (15) above that this lenition has already been phonologized for the dentals and alveolars. It appears that the dental contrast may have been emerging during the 40's when Stevenson wrote and that the alveolar contrast has perhaps emerged since.
2.1.3.2 Allophonic Processes

There is one allophonic process attested for the continuants. There is an optional devoicing for voiced fricatives and non-lateral liquids occurring utterance finally as seen in (16) below.

(16) Final Devoicing Rule

\[
\begin{array}{c}
C \\
+\text{cons} \\
+\text{cont} \\
+\text{voice}
\end{array} \rightarrow \begin{array}{c}
\text{[-voice]} \\
\text{[-voice]} \\
\text{[-voice]}
\end{array} / " # \\
[\text{iɾóf}] 'k/o grass' \\
[\text{iɾɛθ}] 'palm tree' \\
[\text{lɪɾ}] 'we IN PL' \\
[\text{lɪɾ}] 'soup'
\end{array}
\]

We see here that the utterance final devoicing is such that /v, ʃ, r, r/ are realized as [f, θ, r, r], respectively when occurring utterance final. This final devoicing is most marked for the fricatives and non-lateral liquids. However, the lateral, nasals and even semivowels (which are not included in the rule) may occasionally be devoiced in this way.

This analysis of final devoicing differs from Stevenson significantly. Stevenson analyzed [θ] as an allophone of /t/ and [ð] as an allophone of /d/. Morphophonemic alternation between [d̪] and [ð] seems to have convinced him that this was the case even though he cited cases of minimal contrast between [d̪] and [ð] morpheme internally (1942:8).

I believe an analysis of contrast between /d̪/ and /ð/ with
[θ] as an utterance final allophone of /θ/ would have fit his own data better.

2.1.4 Syllabic Consonants

In Tira, the liquids /r/ and /l/ and the nasals /n/, /ŋ/ and /ɴ/, may become syllabic and fill a syllable nucleus just as vowels do. When syllabic, these consonanats are longer than their non-syllabic counterparts and, like vowels, bear contrastive tone as seen in (17) below.

(17) Syllabic Consonant Contrast

(a) ř.rà 'we IN DU stabbed'   ř.là.řó 'we DU IN hoed'
    ř.rà 'they stabbed'       ř.là.řó 'they hoed'

(b) ědēɗ 'clothes'
    ŋnà 'we EX'
    ŋgélà 'I am going'

Syllabic consonants typically fill the nucleus of a syllable that has no consonant onset or coda as in /ɬ.tà/ 'head' or /ɬ.rú/ 'ostriches'. Occasionally, however, they can also fill the nucleus of syllables that have either onset or coda as in /n.dř.dó /'knives' /nè.mř.tá/ 'horses'. In this study, when consonants become syllabic, they will always be marked for tone, their non-syllabic counterparts will not. For clarity laterals will also have a syllabic sign /ʃ/.
2.2 VOWELS

2.2.1 Inventory

There are seven fully specified vowels plus the reduced vowel schwa which are attested in the data. The seven full vowels are illustrated in (18) below. Distinctive feature labels have been used to identify the parameters.

(18) Vowels

| +High | -RTR | i    | u    |
| +RTR  |      | i̯   | u̯   |
| -High |      | e    | a    |

These seven vowels are the primary tone-bearing segments in Tira and also fill the nuclei of syllables. They share these two functions with syllabic consonants. The distinctive features for vowels are backness, rounding, height, and retracted tongue root. The graphemes, normally designated for the high central vowels, have been used to indicate the two vowels with the feature 'retracted tongue root' [+ RTR]. This feature is only applicable for the high vowels. It is discussed further in 2.2.3.

The vowels in (18) above are essentially the same vowels that Stevenson identified but with some minor differences in the allophones (1942:3-5). However, a major difference between the two analyses does exist.
Stevenson's vowel /ö/ was found in this research to be an allophone of the back unrounded vowel /a/ in most instances. In some few cases, however, it was a realization of the back retracted vowel /u/.

Schadeberg did not analyze the phonemes of Tira. However, he did reconstruct for Proto-Heiban a seven vowel system entirely parallel to that presented in (18) above. He also noted that though the correspondences for /i,ɛ,a,o,u/ are more clear, those for the 'intermediate' vowels, what corresponds to /e/ and /u/ in Tira, are less clear. This is significant since the retracted vowels are relatively infrequent (1981:116,128-31).

The reduced vowel schwa /ə/ is also a tone-bearer and fills the nuclei of syllables. It has a very restricted distribution occurring most often in the person/number prefixes of what Stevenson calls the 'definite' aspect. It most probably represents a reduced form of several different underlying full vowels. It often undergoes deletion or assimilation to other vowel qualities depending on the environment which follows it. This will be discussed further in 2.3.3.2. Further research would need to be done to determine the underlying vowels it represents. For these reasons it is not included on the vowel chart.

The schwa presented in this study, basically corresponds to Stevenson's central vowel /ə/. He also noted its restricted distribution and thought it to represent
'unaccented' forms of /i/ or /a/. Schadeberg also transcribed a few instances of a phone [ə] for Tira in noun-class or concord prefixes. However, these apparently do not figure in his reconstruction for Proto-Heiban.

2.2.2 Contrasts

In (19) below are the contrasts that establish the front and back vowel phonemes. In (19a) word initial contrasts are seen, in (19b) intervocalic contrasts and in (19c) word final contrasts.

(19) Vowel Contrasts

(a) Initial
   Front Vowels          Back Vowels
   īlī 'selling'
   ūlī 'chief'
   ēlō 'god'
   ūrī 'rat'
   ūrī 'ten'
   ərī 'river'
   ārī 'stool'

(b) Intervocalic
   Front Vowels          Back Vowels
   līdī 'pot'
   līdī 'coconut'
   lērī 'place name'
   kūrī 'forest'
   nūrī 'axe'
   kōrī 'male name'
   nālī 'first daughter DIM'

(c) Final
   Front Vowels          Back Vowels
   əfī 'hand'
   tū 'hut'
   əfī 'thorn'
   tā 'be lost!'
   əfī 'this'
   tā 'drink!'
2.2.3 Phonetic Realization

The seven vowels of Tira are realized by fourteen vowel phones. Using the cardinal vowel system as a model (Ladefoged 1982:189-203), the diagram in (20) below attempts to roughly identify the vowel phones used in Tira. The vowel phones which are members of a single phoneme are encircled.

(20) Cardinal Vowel Display of Tira Phones

(1) \( \text{ɪ, ɪ, ɪ, e, ɛ, æ, a} \)
(2) \( \text{ə, e, ɛ, æ} \)
(3) \( \text{ʌ, ʊ, o, ɒ} \)
(4) \( \text{a} \)
(5)
(6) \( \text{i, i, i, e} \)
(7) \( \text{u, u, u, o} \)
(8)

In Tira, the front vowels and the back rounded vowels and their allophones form two sets of phones that are very close to one another in their pronunciation. The two sets are \([i, ɪ, ɪ, e]\) and \([u, u, u, o]\). Stevenson also noted the closeness in pronunciation of these two sets (1942:3-5). The difficulty in describing these sets, is to choose distinctive features which accurately describe the phonetic nature of these phones and also make appropriate distinctions between the phonemes.
The phones [i] and [u] approximate the positions of cardinal vowels 1 and 8. The phones [ɪ] and [ʊ] are more lax and centralized than are [i] and [u]. The lax variants are similar to the vowel sounds in the English words 'bit' and 'foot'.

The high retracted vowel phones [ɨ] and [ʉ] lie somewhere between cardinal vowels 1 and 2 for [ɨ] and between vowels 7 and 8 for [ʉ]. Unlike the phones [ɪ] and [ʊ], they are neither lax nor centralized.

When the language assistant for this research was writing his language using the vowel graphemes 'a,e,i,o,u' which he knew from English, he most often wrote the phonemes /ɨ/ and /ʉ/ with the graphemes 'i' and 'u', respectively. This reflected his native speaker intuition which identified /ɨ/ and /ʉ/ as closer to the high vowels than to the non-high. He describes these vowels as being produced by 'closing his throat'. This description could be interpreted as tongue root retraction.

It is proposed, then, that Tira uses a tense/lax contrast to distinguish the phones [i] and [u] from [ɪ] and [ʊ]. It is also proposed that the feature marking the phones [ɨ] and [ʉ] is 'retracted tongue root' [+/-RTR]. The feature in Tira appears to be retraction from a resting point rather than advancement or lack of advancement. In addition, the feature only serves to differentiate between the two sets of high vowels.
Such a proposal has some support from an article by Trigo (1991) discussing pharynx and larynx interactions in Turkana. In the case of Turkana, there are two systems operating. One is based on raising and lowering of the larynx and the other advancing or not advancing the tongue root. In certain cases the two systems intersect, producing a limited set of vowels which are 'mixed' (1991:113-121).

The proposal for Tira bears some similarities. In Tira, a system of tenseness versus laxness produces the phones [i,e,ʌ,o,u] versus the phones [ɨ,ɛ,a,ɔ,u]. In the case of Tira these bear an allophonic relation to each other. However, another system of retracted versus non-retracted tongue root is also operating which produces the phones [ɨ,u] versus all other phones which are not retracted. The exact description of the distinctive feature that operates in each system is debatable for Tira, the point is that intersection of two independent systems produces the contrast between [i,i] and [e,ɛ] or [u,u] and [o,ɔ] on the one hand and [ɨ] and [u] on the other.

2.2.4 Allophonic Processes

There are four allophonic processes taking place with the vowels. First, there is a laxing of the high, non-retracted vowels between consonants as shown in (21) below.
(21) High Vowel Laxing Rule

\[
\begin{align*}
\begin{bmatrix} V \\
+{\text{high}} \\
-RTR \\
+{\text{tense}}
\end{bmatrix} & \rightarrow \begin{bmatrix} -{\text{tense}} \end{bmatrix} / C \rightarrow C
\end{align*}
\]

Examples:

[imbirí] 'dress'
[lícr] 'we IN DU'
[dúl] 'giraffe'
[núndú] 'elephant'

We see here that the laxing of high, non-retracted vowels /i/ and /u/ is such that they are realized as [ɪ] and [ʊ] when occurring between consonants.

Second, there is word final (probably utterance final) tensing of the non-high vowels. This is illustrated in (22) below.

(22) Non-High Vowel Tensing Rule

\[
\begin{align*}
\begin{bmatrix} V \\
-{\text{high}} \\
-{\text{tense}}
\end{bmatrix} & \rightarrow \begin{bmatrix} +{\text{tense}} \end{bmatrix} / \rightarrow \#
\end{align*}
\]

Examples:

[léné] 'number'
[rñò] 'snake'
[nánñ] 'mother'

We see here that the tensing of non-high vowels is such that /ɛ, ɔ, a/ are realized as [e, o, a], respectively, when occurring word finally.

Third, there is a raising of the back unrounded vowel /a/. This is illustrated in (23) below.

(23) Unrounded Back Vowel Raising Rule

\[
\begin{align*}
/a/ & \rightarrow \begin{bmatrix} ɪ \end{bmatrix} / \rightarrow C \\
\begin{bmatrix} V \\
+{\text{high}} \\
-RTR
\end{bmatrix} & \rightarrow \begin{bmatrix} ɔrǔ \end{bmatrix} 'shield' \\
\begin{bmatrix} ɔdfí \end{bmatrix} 'catch!'
\end{align*}
\]
We see here that this raising is such that /a/ is realized as [ɛ] when the following vowel, after an intervening consonant, is either one of the high non-retracted vowels /i/ or /u/.

The back unrounded vowel transcribed as /ö/ in Stevenson (1942:5) was found in this research either to be a realization of the phoneme /u/ or to be the [ɛ] allophone of /a/. Thus, the contrast found by Stevenson could not be established in this study. It is significant that the majority of Stevenson's examples of his vowel /ö/ would be allophones of /a/ by this raising rule.

Fourth, there is a palatalization of non-high back vowels preceding palatal consonants as seen in (24) below.

(24) Palatalization Rule

\[
\begin{array}{c|c|c}
V & \text{Examples:} \\
\begin{array}{c}
+\text{back} \\
-\text{high}
\end{array} & \begin{array}{c|c|c}
\rightarrow V^j & / & C \\
+\text{cor} & [nâjyâ] & 'beer' \\
+\text{high} & [nâjɛ] & 'give!' \\
\end{array}
\end{array}
\]

We see here that the palatalization of the non-high back vowels /a/ and /ɔ/ is such that they are realized as [ɑ^j] and [ɔ^j] preceding palatal consonant. The fact that this process occurs with /ɔ/ as in /ɔ^jnâ/ 'many' but not with /u/ as in /ûbûcû/ 'white', strengthens the argument for classifying /u/ as a high vowel. We see here that the /u/
patterns with the other high back vowel /u/ rather than with 
/ɔ/.

2.2.5 Vowel Length

Although vowels do differ phonetically in length, these
differences are presently hypothesized to be predictable in
most cases on the basis of syllable shape, the number of
tones carried by the vowel and its potential for being
reduced and deleted. This is discussed further in 3.2.1.

However, there are a few lexical items in which vowels
were transcribed as long which apparently are not
predictable on this basis. The one minimal pair observed is
seen in (25) below.

(25) [lɛnɛ] 'any'  [lɛnɛ] 'number'

Stevenson made no mention of different vowel lengths.
It is important to note, however, that Schadeberg recorded
phonetic length on almost all the vowel phones (1981:85,29).
A number of these long vowel phones appear in one form of a
given noun, either the singular or plural form, and not the
other. This fact suggests that there man be a
morphophonemic explanation relative to the boundary between
the noun prefix and noun root. An example is given in (26)
below.
(26) áníñò 'ear'  n-ááñíñò 'ears'

Other instances of his long vowels might be a matter of semi-vowel interpretation. For example, the lexical item /ùjí/ 'person' Schadeberg recorded with long vowel in [ùùjí] but Stevenson has it as /wuji/. All Schadeberg's long vowels have level tones and thus are not predictable according to the rules proposed for this analysis.

Clearly, further study of vowel length is in order. However, for this study, it will be assumed that there is no underlying length contrast. For the time being, long vowels which are not predictable based on tonal and syllabic criteria will be interpreted as vowel sequences. They are exceptions to a rule which disallows vowel sequences to occur word internal in Tira.

Having re-tested the segments and established for the present speaker what the segmental phonemes of Tira are, we may now look at how these consonants and vowels combine to form morphemes, syllables and words. We will also see that a number of morphophonemic changes occur, particularly to tone-bearing segments, when those morphemes and syllables combine to form words. These changes will be important for a proper understanding of tonal association.
2.3 TIRA PHONOTACTICS AND TONE

Phonotactics, as used here, refers to the strategies employed by a language to build morphemes from its phonemes, and then to string those morphemes together to form words. These strings of morphemes must be syllabified in such a way as to form syllables and words that are well-formed in Tira. Tira phonotactics, then, is the study of morpheme structure, syllable structure and word structure in Tira.

In Chapter 1 we defined a tone language as one which includes tonal and segmental phonemes in the composition of at least some of its morphemes. Thus far in Chapter 2 we have established the segmental phonemes in Tira. In Chapter 3 we will establish that Tira is indeed a tone language with high, low, falling and rising as surface tones. In Chapter 4 we will go on to demonstrate the function, processes and representation of tone. We will see that only high and low tone are present underlyingly.

The discussion of Tira phonotactics that follows assumes knowledge of these basic conclusions from Chapters 3 and 4. However, the process of tonal association discussed in Chapter 4 draws on an understanding of the segmental changes that occur when morphemes are joined together and syllabified to form words. This presentation on Tira phonotactics will discuss just those features; that is, morpheme structure, word structure and morphophonemic segmental change. The reader should be aware, however, that
particularly in relation to morpheme structure, certain assumptions are being made with regard to tone that are not properly addressed until Chapters 3 and 4.

Tira, like other Niger-Congo languages, is a language which in principle prefers to alternate consonants and vowels in a CVCV sequence throughout a word, associating tones with vowels. However, there are constraints in Tira which put pressure on the language to delete certain vowels. These constraints are not entirely understood at this point, but they appear to involve both historical and synchronic processes.

The deletion of certain vowels affects both segments and tone. First, in the case of segments, it creates a variety of complex consonant clusters and forces both vowels and consonants to alter their status as tone-bearers. Thus, high vowels may become semi-vowels and non-syllabic consonants may become syllabic. Second, in the case of tone, when a given vowel is deleted it leaves the tone that had been associated with it unassociated with any tone-bearing unit. Ultimately, these unassociated tones must find a tone-bearing unit to associate with at the word level.

The results for tone are threefold. First, some tones are reassigned with a suitable consonant, the consonant functioning as a syllabic nucleus. These are the syllabic consonants described in 2.1.4. Second, other tones
reassociate with a vowel already associated with a tone. In these cases, where the two tones are dissimilar, a contour tone is created. Third, in a few exceptional cases tones remain unassociated at the phrase level but exert an influence on the tones that follow them creating downstep. This is discussed in 3.1.2.3.

The following discussion of Tira phonotactics will be limited to non-compounded nouns and verbs.

2.3.1 Morpheme Structure

In a tone language, at least some morphemes will be composed of both tonal and segmental phonemes. Others may be composed of segments only and still others only of tones. In Tira, all three kinds of morphemes exist. We will look here at the morphemes composed of both segments and tones.

2.3.1.1 Nouns

Non-compound nouns in Tira are typically composed of an obligatory noun-class prefix, an obligatory root and an optional suffix as illustrated in (27) below.
(27) Morpheme Composition of Nouns

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Root</th>
<th>(Suffix)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>C</td>
<td>VC</td>
<td>VC</td>
</tr>
<tr>
<td></td>
<td>VCV</td>
<td>VCCVC</td>
</tr>
<tr>
<td></td>
<td>VCVVC</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>V</th>
<th>CV</th>
<th>CVC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CVCV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CVCCV</td>
<td></td>
</tr>
</tbody>
</table>

**Noun Prefixes:** We see above that noun class prefixes in Tira may be composed of a single consonant, a vowel or a zero segmental realization as seen in (28) below.

(28)  

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>l+ôn</td>
<td>'NCP+grain'</td>
<td></td>
</tr>
<tr>
<td>à+pći</td>
<td>'NCP+boy'</td>
<td></td>
</tr>
<tr>
<td>ø+ùrì</td>
<td>'NCP+rat'</td>
<td></td>
</tr>
</tbody>
</table>

Niger-Congo noun class prefixes are believed to have developed from a prefix of CV shape (Williamson 1989:21) which has been eroded in many sub-families. While in many Niger-Congo languages prefixes have lost the consonant, in Tira, as well as other Kordofanian languages, it is most often the vowel which has been lost. In some cases in Tira, the whole prefix has been lost as seen in (28) above. There is a zero realization of the class prefix in 'rat'. We know, however, that the prefix is there underlyingly because the noun-class concord consonant /g/, is present in on any modifiers of this noun.
It is hypothesized that the noun class prefixes in Tira are toneless. This is proposed because the majority of prefixes are either single consonants or a zero segmental realization of the prefix. Neither are tone bearing units. Since the prefix is obligatory and thus cannot be removed, there is no way to determine the portion of the tonal pattern realized over a whole noun that comes from the prefix, as opposed to that which comes from the root. It may well be that the old prefix tones have become frozen to the root melody. We will see in 4.2.4.3 that there are tonal phenomenon which may support this view.

Another problem in analysis concerns the C prefixes. Schadeberg and Stevenson both identified these prefixes as single consonants. They do appear to be such, at least on the surface. I have followed them in this research. However, there are a few cases of nouns that appear to join a Cω- prefix to a consonant-initial root. These may be the result of reduction of the initial root vowel. It is simply not yet clear. However, it forces us to ask if the underlying form of the noun prefixes should not be Cω- as is proposed in 2.3.1.2 for the verbal prefixes. The issue is important because, as we will see in 4.4.3.4, the presence of schwa in the verbal prefixes has a significant effect on the way tonal association proceeds.

Noun Roots: Tira noun roots are composed of tonal as well as segmental phonemes. In a significant percentage of
the nouns, tone is the sole means of distinguishing what are otherwise segmentally homophonous lexical roots as will be seen in 3.1.1. Noun roots may have one of five different tonal patterns, or melodies, realized on roots with one, two or three syllables as will be seen in 4.2.3. Some examples of noun roots with various shapes and tonal melodies are seen in (29) below.

(29) ə+ tô 'NCP+thorn'  
     l+ʊd 'NCP+gourd'  
     ɳ+ícóló 'NCP+squirrel'  
     æ+ŋɔnɔ 'NCP+body'  
     +iɛd 'NCP+hoe'  
     +imbiri 'NCP+headpad'

The majority of noun roots are disyllabic. Roots may begin or end in either a consonant or a vowel. This structure is consistent with Williamson's (1989:20-21) description of proto Niger-Congo roots. These roots originated typically as CVCV structures but have been greatly reduced in many branches through phonological change.

Though the majority of noun roots are vowel-initial, there is a small set of consonant-initial roots which take a single vowel for their noun class prefix. Examples are seen in (30) below.

(30) SG  æ+ŋɔnɔ 'NCP+body'  
     ɳ+ŋɔnɔ 'NCP+body'  
     ã+ðù 'NCP+breast'  
     ñ+ðù 'NCP+breast'  
     PL  ì+ŋɔnɔ 'NCP+bodies'  
     ì+ðù 'NCP+breasts'
This is a more common noun building strategy for Niger-Congo languages. Some other words in this class are 'house' and 'boy'. Perhaps these represent some of the oldest and least altered roots in Tira.

There appears to be only one restriction to the consonants or vowels that can appear in the root. The restriction is on the consonant combinations that may appear internal to noun roots. In slow speech, when all the potentially deletable vowels have surfaced, the first member of any consonant cluster internal to the root is restricted to nasals. The second member is restricted to voiced stops at the same point of articulation as the preceding nasal. Thus, there is a neutralization of the contrast between voiced and voiceless stops following nasals. This process is described further in 2.3.3.4. in relation to consonant cluster formation.

**Noun Suffixes:** The objective case suffix consists of a toneless vowel that is realized on the surface only on nouns ending in a consonant as seen in (31) below.

(31)  nēn 'country'  nēn+é 'country OBJ'
      naw 'water'  nāv+é 'water OBJ'
      lōmōn 'finger'  lōmōn+ā 'finger OBJ'
      cūlōm 'door'  cūlōm+ā 'door OBJ'

2.3.1.2 Verbs

Non-compounded verbs have an optional person/number or concord prefix, an obligatory root, optional extensional
suffixes and an obligatory aspectual suffix. This structure is illustrated in (32) below.

(32) Morpheme Composition of Verbs

<table>
<thead>
<tr>
<th>(Prefix)</th>
<th>Root</th>
<th>(Ex 1)</th>
<th>(Ex 2)</th>
<th>Aspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>CVC</td>
<td>VC</td>
<td>VC</td>
<td>V</td>
</tr>
<tr>
<td>CV</td>
<td>VC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cə</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Verb Prefixes: As seen above, verbal prefixes have one of three shapes as illustrated in (33) below. Prefixes have either high or low inherent tone.

(33) V í+p+ò 'I hit ASP'
     CV ná+p+ò 'youPL hit ASP'
     Cə kə+p+ò 'he hit ASP'

As noted earlier, Niger-Congo prefixes originated from a CV prefix that has lost its vowel in a number of Kordofanian languages (Schadeberg 1989:76). It is hypothesized here that in a number of Tira verbal prefixes, these vowels have been reduced to the vowel [ə] and thus only partially lost. The schwa, like any full vowel, bears the inherent tone of the prefixes of which it is part. About 50% of Tira verb roots are consonant-initial. In these cases the prefix is simply joined to the root and schwa is realized as seen in (34) below.
(34) kà+dù 'he cut ASP'
là+ràc+i 'we DU IN poured ASP'
là+ràc+i 'they poured ASP'

In the other half of the roots that are vowel-initial, the schwa is deleted and so does not surface. This is illustrated in 2.3.3.2.

Verb Roots: All verb roots are of the shape (C)(V)C. About 45% of the sample collected are CVC, 45% are VC and 10% are composed of a single consonant.

(35) í +c +o --> í.rò 'I put'
I put ASP

ý +dò +o --> yò.ò 'I burned'
I burn ASP

í +nàŋ +u --> í.nà.nà 'I scratched'
I scratch ASP

Thus, we see that these verb roots do not have an underlying syllable shape. They become part of syllables once the morphemes are concatenated. So, we find that any consonant may occur as the initial or final consonant of the root. The final consonant of a root is not restricted to continuants as is the coda of a normal syllable.

Tira apparently has no lexical distinction between high tone and low tone verb roots as is found in many Niger-Congo languages. Rather, it is hypothesized that all verb roots have low tone. This may be an unexpected hypothesis for a Niger-Congo language but at the present time it is what the
data seems to suggest. More support for this assertion is found in the patterns for tone association for the imperative in 4.3.3.1 and for the 'definite' aspect in 4.3.3.4.

**Verb Suffixes:** The verb root plus the aspectual suffix forms the minimal verb stem. Up to two extensional suffixes may be added to the stem between the root and the aspectual suffix. These extensional suffixes derive stems that are related semantically, sometimes rather obscurely, to the lexical root as seen in (36) below.

\[(36) \quad \text{p+oHL} \rightarrow \text{pò 'hit!'} \]
\[p+iδ+u+HL \rightarrow \text{pìδû 'fight!'} \]
\[\text{av+ac+i+HL} \rightarrow \text{ávácî 'press!'} \]
\[\text{av+aδ+ac+i+HL} \rightarrow \text{áváδácî 'squeeze!'} \]

It is interesting to note how closely the Tira verb structure resembles the Bantu verb as described by Hinnebush (1989:465-67). In (36) above, the extensional suffix \{-Vò\} possibly indicates reversive or reciprocal action, while \{-Vc\} possibly indicates causative action. The final vowels are all aspectual suffixes. The similarity of the two verbal systems shows their common ancestry with Proto Niger-Congo.

In (37) below we see the same verb in the imperative and then conjugated in the 'definite' aspect.
(37) (a) yɔ́ 'eat!'  
cɔ́ɔ́ɔ́ 'rub!'  
ɲɔ́váɔ́ 'press'  
(b) líyɔ́ 'we ate'  
lícɔ́ɔ́ 'we rubbed'  
líɲɔ́váɔ́ 'we pressed'

We see in (37) above that the tonal pattern is realized over the verbs in the same way regardless of the number of syllables. This is true for the imperative (37a) that has a high-low tonal morpheme and also for conjugated verbs (37b). In (37b) the tonal pattern stems from the high tone on the person prefix plus the low tone on the root. However, as with the imperative, the tonal pattern is realized over the entire verbal form in the same way for all the verbs, regardless of how many affixes have been added to the root. This shows us that the extensional and aspectual suffixes are all toneless.

2.3.2 Syllable and Word Structure

2.3.2.1 Syllable Structure

Non-compounded (only one root) words in Tira typically vary from one to five syllables in length. Nouns have up to three syllables and conjugated verbs up to five syllables. The basic syllable structure is (C)V(C). This produces four possible syllable types which are CVC, CV, VC and V. All consonants may occupy the syllable onset and all vowels the nucleus, but only continuants may occupy the coda. No consonant clusters are allowed in the coda or onset and no
vowel sequences may occupy a nucleus. All syllable nuclei must bear at least one tone.

Two variant syllable types Ç and CÇ, are created when consonants become syllabic and occupy the nucleus of a syllable. The syllabic consonants most often function in the same position as the V syllable type occurring word initially. However, when vowel deletion occurs word internally, they may also function as the nucleus of CV syllables.

The relative frequency of these five syllable types was measured in two samples of text. These texts were transcribed using slow speech, meaning most of the potentially deletable vowels were present. The frequencies of the types were found as follows; CV 73%, CVC 11%, Ç 9%, V 5%, VC 2% and CÇ negligible. Examples of these syllable types are seen in (38) below. A full stop (i.e. "."), internal to the transcribed Tira words indicates a syllable break.

(38) Syllable Types

CV  δu 'heart'  V  ù.òò 'worm'
CVC  ṇál 'bamboo'  Ç  ŋ.rǐ 'trees'
VC  ōn 'hedgehog'  ÇÇ  ŋ.dř.dù 'place name'

2.3.2.2 Word Structure

Multisyllabic words may have many different combinations of syllable types in their composition,
depending on the shape of the morphemes used to form the words. We have seen a number of these for nouns in (29) and for verbs in (35) and (36).

Words may begin with any syllable type but may only end in a CV or CVC syllable. No combinations of syllables are allowed that produce vowel sequences word internal. Also only combinations of syllables that produce consonant clusters where the first member of the cluster is a nasal and the second a voiced plosive at the same point of articulation are allowed. This neutralization of the contrast between the voiced plosives is only found morpheme internal in nouns. However, there is some evidence for it across morpheme boundaries in verbs. This is discussed in detail in 2.3.3.4.

2.3.2.3 Interpretation of Vowel-Vowel Sequences

Vowel-Vowel Sequences Word Internal: The condition for Tira that well-formed words have no word internal vowel-vowel sequences raises certain questions of interpretation for sequences that involve high vowels. They all involve at least one of the high, non-retracted vowels [i] or [u] as the second member of the sequence. These segments are open to interpretation as the phones [y] and [w]. Where these vowel sounds are short and occupy a non-nuclear position in the syllable, one normally occupied
by a consonant, they are interpreted as the semi-vowels /y/ and /w/ as seen in (39) below.

(39) [l-èi] /lèy/ 'eye'                     [náù] /náw/ 'mosquitoes'
     [n-ài] /này/ 'potato'                 [ŋáù] /ŋâw/ 'water'
     [uí] /űy/ 'bee'                      [áú] /áw/ 'grass shelter'

However, when they are of normal length and if interpreting them as consonants would create non-allowable vowel sequences, then they are interpreted as vowels with a corresponding semi-vowel preceding them as seen in (40) below. Stevenson interpreted the sequences in both (39) and (40) as sequences of vowels (1942:6) while Schadeberg interpreted them as vowel-consonant sequences. Interpretation is important to this study because the semi-vowels are not tone bearing units, but the vowels are.

(40) [défító] /ðí.yí.tó/ 'allowing'
     [ŋàùdè] /ŋà.wù.dè/ 'work'

Another question of interpretation arises where a sequence of vowels which includes at least one of the high non-retracted vowels /i/ or /u/ occurs across the morpheme boundary between a verb root and its aspectual suffix as seen in (41) below.

(41) [úáfi] /wáy-f/ 'wash!'           [áù] /áw-ʊ/ 'urinate!'
     [ûù] /áw-û/ 'be present!'
Applying the same criteria as that used for such sequences found in noun roots, with the added support from the fact that all other verb roots end in a consonant, the high vowels /i/ and /u/ are interpreted as vowels preceeded by a corresponding semi-vowel.

2.3.3 Morphophonemic Changes that Affect Tone Association

In Tira, the greatest amount of morphophonemic change takes place at the morpheme boundaries of prefixes and roots. The changes that occur in nouns are in the initial vowel and consonant of the noun roots. These changes are governed by the segmental nature of the prefix that is added. In only a few cases is there any effect on tonal association. The prefix appears to be toneless and all the lexical tone is on the root.

In contrast, when prefixes are added to verbs, the changes that occur are in the consonant and vowel of the prefix and are governed by the segmental nature of the verb root. They often effect the process of tonal association. Verbal prefixes have inherent high or low tone.

For nouns and verbs combined, there are five different prefix shapes and two different root onsets. This yields ten possible types of boundaries between prefixes and roots. Various morphophonemic changes occur at these boundaries. They can be summarized in four subgroups.
First, there are those boundary types where a prefix or root vowel either remains unchanged or only changes its quality. There is no effect on tone association as the vowel can still bear tone. These will not be discussed here. Second, a high vowel may become a semi-vowel and thus become unable to carry tone any longer. Third, a vowel may be deleted altogether and thus not be available to bear tone. Fourth, certain combinations of prefixes and consonant initial roots trigger vowel deletion. The prefix consonant becomes syllabic and thus the consonant is able now to bear tone. These last three types will be discussed below, focusing on the segmental changes that occur. It is these three types that will affect tonal association discussed in Chapter 4.

There is also a vowel deletion that occurs stem internally that does not appear to be motivated by morpheme boundary considerations. Loss of these vowels also effects tonal association so it too will be considered below.

2.3.3.1 Stem Vowel Deletion

There are three different circumstances in which vowels can be deleted. First, full vowels in a stem may be first reduced and then deleted. Second, full vowels or schwa in a verb prefix are deleted before a vowel initial stem. Third, the prefix schwa in a verb or the initial root vowel in a noun are deleted when the prefix consonant and the root
consonant are sufficiently similar phonetically to allow for the formation of a syllabic consonant in the prefix.

The processes that control synchronic deletion of stem vowels is not well understood. However, some observations can be made. First, deletion often occurs between plosives or nasals and the two flaps /ɾ/ and /ɾ/ as seen in (42) below. As with the labialization of velar plosives, the nasals in this context again function with plosives.

(42) ìmbr̥ə ~ ìmbər̥ə 'feather'
      ðəmr̥ə ~ ðəmrərə 'pumpkin'
      àpr̥i ~ àpər̥i 'boy'
      ìtr̥u ~ ìtûr̥u 'official'

Second, deletion may occur between any continuant and any other consonant, thus forming another consonant cluster. The first member of this derived cluster is one of the consonants that normally occurs in word final codas. These deletions occur in normal speech. Slowing down the speech causes the vowels to resurface as seen in (43) below.

(43) ànnə ~ ànìnə 'house'     ìmàròən ~ ìmàrcòən 'woman'

These reinserted vowels are not simply an echo vowel of the vowel which precedes or follows them but, as seen in (43) above, the underlying vowels may differ from the preceeding or following vowel.
2.3.3.2 Prefix Vowel Deletion

Prefix Vowel Deletion before Vowel-Initial Verb Roots:

In Tira, sequences of vowels are not allowed to surface word internal. However, when verbal prefixes are added to vowel-initial verbs, vowel sequences occur at these boundaries. Whether the prefix vowel is a full vowel or a schwa, deletion of the prefix vowel will occur as seen in (44) below.

(44)  á+ɔɔ+ɔ  -->  ɔɔɔ 'you built'
kɔ+ɔɔ+ɔ  -->  kɔɔɔ 'he built'
ɲá+ɔɔ+ɔ  -->  ɲɔɔɔ 'you PL built'

When vowel sequences occur across word boundaries, no deletion of either vowel takes place as seen in /íŋgá ölšnò əpə/ 'I should bring'.

Prefix Schwa Deletion before Consonant-Initial Verb Roots: As noted earlier, normally when CV- or Cǝ- prefixes are added to consonant-initial verb roots, there is simple concatenation and no morphophonemic changes occur. However, when the prefix consonant and initial root consonant are both made at the same point of articulation, the deletion is an option. The rule which governs this is shown in (45) below.
(45) Optional Schwa Deletion Rule

\[
\varepsilon \sim 0 / \begin{array}{c}
\begin{array}{c}
\varepsilon \text{ cor} \\
\beta \text{ ant}
\end{array}
\end{array}
\begin{array}{c}
\begin{array}{c}
\varepsilon \text{ cor} \\
\beta \text{ ant}
\end{array}
\end{array}
\end{array} + [\alpha \text{ cor}]
\]

Examples:

- kə+gəɾ+u \rightarrow k'gəɾ u \rightarrow ŋəɾu 'he broke'
- kə+nəɾ+i \rightarrow k'ɾəɾ i \rightarrow ŋəɾi 'he gave'
- lə+ɾ+i \rightarrow l'ɾ i \rightarrow ləɾi 'they shook'
- lə+ɾ+ə \rightarrow l'ɾə \rightarrow ləɾə 'we DU IN sat'
- lə+n+a \rightarrow l'nə \rightarrow ləɾə 'they heard'
- lə+ləɾ+u \rightarrow l'ɾəɾ u \rightarrow ləɾə 'we DU IN hoed'
- lə+ɾ+ə \rightarrow l'ɾə \rightarrow ləɾə 'we DU IN stabbed'

We see in (45) above that the schwa is optionally deleted between consonants made at the same point of articulation. The feature [+/-flap] is adapted here from Ladefoged (1982:261) to distinguish the two flaps /ɾ/ and /ɾ/ from the trill /r/. Apparently there are no traditional distinctive features which distinguish the two. The flaps can then be excluded from the rule since they do not participate in it. Thus far the only verbal prefixes which fit the structural description are \{kə-\} 'he', \{lə-\} 'we', and \{lə-\} 'they'. As can be seen in the examples, the schwa deletion is the first step in a two part process. If it is deleted, the Prefix Consonant Assimilation Rule, as discussed in the next section 2.3.3.3 below, will apply.

We see that there is an obligatory deletion of the schwa between two voiced dental fricatives. This is illustrated in (46) below.
Obligatory Schwa Deletion

\[ \varepsilon \rightarrow 0 / \begin{array}{c}
\text{C} \\
\text{[+dental]} \\
\text{[+cont]}
\end{array} \quad \quad + \begin{array}{c}
\text{C} \\
\text{[+dental]} \\
\text{[+cont]}
\end{array} \]

Example: \( \delta \acute{\varepsilon} + \delta \acute{\varepsilon} + a \rightarrow \delta \acute{\varepsilon} \delta \acute{\varepsilon} \ a \rightarrow \delta \acute{\varepsilon} \acute{\varepsilon} ' \text{to suck}' \)

In the rule above, the feature \([+/- \text{ dental}]\) has been adapted from Ladefoged (1982:259) to distinguish dental consonants from alveolar as there is no traditional distinctive feature which will distinguish these two points of articulation.

Initial Stem Vowel Deletion in Nouns: The initial stem vowel deletion seen in Tira nouns is similar to the schwa deletion described above. This vowel is deleted when the single prefix consonant and the first consonant of the root are both alveolars as is illustrated in the examples in (47) below.

(a) \( \text{ùrùvà} \ ' \text{bird'} \)
\( 1+\text{ùrùvà} \ ' \text{birds'} \rightarrow \text{ùtùvà} \rightarrow \text{ùtùvà} \)

(b) \( \delta + \text{úrì} \ ' \text{tree'} \)
\( 1+\text{úrì} \ ' \text{trees'} \rightarrow \text{ùtì} \rightarrow \text{ùtì} \)

In (47) we see that the vowel /u/ has been deleted between alveolars. Following this, the root in consonant in (47a) has undergone a morphophonemic change in response to the approximation of the /l/. Since that creates a consonant cluster, and consonant clusters are not allowed in
syllable onsets, the /l/ becomes syllabic. A similar process occurs for the /r/ in (47b). The consonants now become capable of bearing tone.

2.3.3.3 Segments that Change their Tone-bearing Status

Vowels to Semi-vowels: We have seen that one strategy Tira uses for avoiding vowel sequences that are formed at morpheme boundaries is to delete the first vowel. Another alternative is for a high vowel to become a semi-vowel. This avoids the vowel sequence while maintaining the morpheme segmentally.

The prefix for 1st person singular is {í-}. When added to vowel-initial roots it becomes {ý-}. Since only vowels and syllabic nasals or liquids can bear tone, the tone of the prefix is left unassociated with any tone-bearing unit when the prefix is {ý-}. An example is seen in (48) below.

(48) í+áp+o --> y´áp o --> yápò 'I brought'

Non-syllabic Consonants to Syllabic Consonants: We saw already in the discussion of schwa deletion that the second step in that morphophonemic process is the assimilation of the prefix consonant to the root consonant. Once the schwa has been deleted, a consonant cluster is formed word initially in violation of the word structure rules. Thus, the first consonant of the cluster, which is in a position
normally occupied by a vowel, now assimilates to the liquid or nasal most phonetically similar to the root consonant. This assimilation is illustrated in (49) below.

(49) Prefix Consonant Assimilation Rule

\[
\begin{bmatrix}
\chi & \text{cor} \\
\beta & \text{ant} \\
- & \text{dental}
\end{bmatrix}
\rightarrow
\begin{bmatrix}
\chi & \text{cor} \\
+ & \text{cons} \\
+ & \text{son} \\
- & \text{flap} \\
+ & \text{yll}
\end{bmatrix}
/ \# \rightarrow +
\begin{bmatrix}
\chi & \text{cor} \\
\beta & \text{ant} \\
- & \text{dental}
\end{bmatrix}
\]

Examples:

k̡ʰa+gàr+u \rightarrow p̡'gàr u \rightarrow ñgàrù 'he broke'
k̡ʰa+ñàc+i \rightarrow p̡'ñàc i \rightarrow ññàcì 'he gave'
l̡e+çi+a \rightarrow p̡'rà \rightarrow ñrà 'we DU IN stabbed'

It should be noted that the schwa deletion is optional in these cases in the first place. Thus, if it does not take place, then the assimilation to the sonorant does not take place either.

When the initial vowel of noun roots is deleted, the prefix consonant will also become syllabic. We saw in 2.3.3.2 the conditions under which the initial vowel is deleted. Following deletion of the vowel, a consonant cluster is formed word initial. This is not allowed in Tira. The first consonant is in a position normally occupied by a vowel. It is also a liquid and so may become syllabic and does so as is seen in (50) below.
(50) ḫi_che 'hoe'  
n+хиće 'hoes' --> Ṗ̄iטרה --> ́niṭə

2.3.3.4 Consonant Cluster Formation

As noted in 2.3.1, there is for noun roots a morpheme internal neutralization of the voicing contrast between plosives. This occurs following a nasal. It is illustrated in (51) below. In slow speech, when all the potentially deletable vowels have surfaced, the coda of non-final CVC syllables of multisyllabic roots is restricted to nasals. Any consonant which follows as the onset of the next syllable must be a voiced plosive at the same point of articulation as the preceding nasal.

(51) Morpheme-Internal Plosive Neutralization

አᵐᵇᵃتلك 'robber' እንዳגדל 'elephant' ብንጆጎ 'large pot'

נהג 'dress' እንወክስ 'peanuts ሜንጆጎ 'night''

The voicing and point of articulation of the plosive in such an onset is completely predictable. Although the cluster 'ɲj' has not yet been observed, it is anticipated that it will eventually be found.

This neutralization is important to the study of tone because it is hypothesized that all exceptions found to it indicate that vowel deletion has taken place. Since noun roots have inherent tone, when vowel deletion occurs, there is potentially an unassociated tone to account for. The
reverse is also true: there is no vowel loss between the consonants of underlying sequences and any attempts to insert one are rejected by the Tira speaker. For example, the form **[àmìbávì] is rejected as a pronunciation of 'robber'. Therefore, with underlying sequences, there is no vowel loss and no potentially unassociated tone to be accounted for.

We note also that the same neutralization occurs across morpheme boundaries and triggers morphophonemic alternation of prefixes in verbs and roots in nouns. The change of the morpheme {kè-} 'he' to {ŋ-} is a case in point. Stevenson also noted /oran/ 'arm' and /ndan/ 'arms'.

This neutralization leads to the emergence of a complex consonant cluster 'ndr' through a process called 'exercence' (Antilla 1972:67-68). When the noun class prefix {n-} is joined to a noun root beginning in 'Vr' the vowel is deleted as was the case in (47) and (50). When /n/ precedes /r/ a transitional /d/ is inserted in order to maintain the neutralization. This process is illustrated in (52) below.

(52) ĩrë́o 'hand' n+ĩrë́o --> ňrë́o --> p̌drë́o
    --> ñdrë́o 'hands' ñdrë́o ~ ñdë́o

We see in (52) above that the loss of the initial root vowel has led to the formation of a syllabic consonant /p/. 
Then the neutralization process has triggered, via
excriscence, the formation of the complex cluster '\text{ndr}'. We
know that it is neutralization that has triggered this
because of the an acceptable free variation that exists
between /\text{ndrɛd}/ and /\text{ndɛd}/. We also know that there is no
added vowel lost between /d/ and /r/ so we will not
anticipate any unassociated tone to be accounted for. We
will see in 4.2.7 that the formation of complex consonant
clusters by excrescence is involved in the process that
brings syllabic consonants to occupy the nucleus of CV
syllables and to bear the tone for those syllables.

We have seen the origin and nature of underlying
consonant clusters in Tira. It is hypothesized that all
other clusters are derived clusters. They are the result of
vowel deletion, either stem vowels as in 2.3.3.1 or prefix
vowels as in 2.3.3.3. Thus, the cluster 'mb' involves no
vowel loss but clusters like 'br', 'nn' 'll' and 'ndr' all
involve vowel loss. The derived clusters are allowed to
surface but always imply that there may be tones that have
become unassociated and need to be accounted for.

It should be noted that this analysis of vowel deletion
and cluster formation appears to account for all the
consonant clusters noted by both Stevenson (1942:11) and
Schadeberg (1989:85). Further support for this hypothesis
comes from early researchers on Tira, Seligman (1910) and
MacDiarmid (1931). They recorded only two types of
sequences. The first type were velar consonant and semivowel sequences which we have seen in 2.2.4 are allophonic. The second type were nasal and plosive sequences as described above. This could suggest that the process of synchronic vowel deletion is a more recent innovation. It might also be that these researchers recorded only careful speech.

2.4 SUMMARY

In this chapter we have demonstrated that there are 8 vowel and 24 consonant phonemes in Tira. We have seen evidence that demonstrates the phonemes and their allophones. We saw that certain nasals and liquids may become syllabic and fill the nucleus of a syllable. Thus, the syllabic consonants join the vowels as the phonemes in Tira that can bear tone.

Having established what the segmental phonemes in Tira are, we went on to look at the composition of Tira morphemes in terms of both their segmental and tonal phonemes, recognizing that the tonal phonemes of Tira will not be properly demonstrated until Chapter 3. Once morphemes are concatenated to form words, the strings of segments that result are organized into well-formed syllables and words. We saw the rules that determine what well-formed syllables and words are.
When morphemes are concatenated, certain sequences of consonants or vowels may result which violate the word structure rules. In an attempt to make the strings into proper Tira words, many morphophonemic changes are triggered. Some of these changes have no effect on the way tones will associate with tone-bearing units in the words. Others have a marked effect. We examined those changes that will effect tone association, concentrating on segments.
CHAPTER 3 THE STATUS OF TONE

3.0 INTRODUCTION

Our definition of a tone language from 1.9.1.3 is drawn from Pike and Welmers. It says that a tone language is a language that has significant, contrastive, but relative pitch. Further, both pitch phonemes and segmental phonemes make up at least some of its morphemes. In Chapter 2 we have re-examined the segmental phonemes of Tira. We have seen how segments are combined, along with tone, to form morphemes, syllables and words.

In Chapter 3 we want to return to the issue of establishing that pitch is a 'significant, contrastive but relative' feature in Tira. We will do this by investigating pitch patterns as they surface on syllables. We also will be looking for additional evidence that Tira displays the features noted in 1.9.1.4 that are typical of a tone language.

3.1 TONAL INVENTORY

There are two underlying tones in Tira, high and low. However, under certain circumstances these two level tones can both associate to the same tone bearing unit simultaneously, thus producing either a falling or rising
contour tone. The circumstances which produce these contour tones will be discussed in Chapter 4.

3.1.1 Surface Tone Contrasts

From the two underlying tones high and low, four contrastive surface tones are realized on single syllables. These four are high, low, falling and rising. All four are found on monosyllabic words as seen in (53) below.

(53) ṇēn 'dog'  tūm 'onion'  ṅāw 'water'  lūd 'gourd'

These surface tones can also be seen to contrast in disyllabic words on single syllables. These contrasts are illustrated in (54), (55) and (56) below.

(54) Low vs. High Tone Contrasts

(a) Ḭlā 'broken gourd'  lūrō 'testicle'
    Ḭlā 'animal fat'  lūrō 'goat dung

(b) Ḧūgō 'sand'
    Ḧūgō 'ground'
    rōvō 'leopards'
    rōmō 'sheep'

(c) nāpō 'we EX brought'
    nāpō 'you PL brought'
    lāpō 'we IN brought'
    lāpō 'they brought'

In (54a) above, high and low are shown to contrast in identical tonal and segmental environments. The tone on the first syllable remains constant and the tone on the second syllable contrasts. In (54b) the tone on the first syllable
contrasts while the tone on the following syllable remains constant.

We see here that Tira displays the first feature noted in Chapter 1 that is characteristic of a tone language. That is that tones contrast in identical phonological environments. We also see in (54a) that Tira displays the fourth feature that says that tone languages can have words ending in high level tone where stress accent languages with final stress will end in falling pitch.

Both (54a) and (54b) show lexical contrast in noun roots. That is, the difference in meaning of the two segmentally identical roots is signaled only by the change in tone. In contrast, (54c) shows contrasts of high and low tone in the person/number system of verbs. This type of contrast is typically designated 'grammatical' since it does not indicate a difference in the lexical meaning of two segmentally identical roots. Rather the root in all four cases is the same. The contrast in tone has signaled different person/number combinations. There is no lexical contrast found in Tira on verb roots. The tonal distinctions for verbs are all grammatical. Thus we can confirm the hypothesis in our study which proposes that tone signals both lexical and grammatical meaning.

We also note in (54c) that the tonal contrast is on the first syllable while the second remains constant. In Tira, the contrasts in tone on verbal forms almost always occur on
the first syllable of the verb, regardless of how many
syllables the verb has. This is illustrated in (55) below.

(55) làpō 'they brought'
lápō 'we DU IN brought'
lènånù 'they scratched'
lènånù 'we DU IN rubbed'

Here we see again that the contrast is on the first
syllable of the verb, which is the person/number prefix.
The root and its suffixes which follow all take low tone.

In (56) below, we see a contrast between high and low
where both tones on each word contrast. Here we begin to
see evidence of a contrast between two tonal patterns, that
is a low pattern versus a high pattern, each spread over a
whole word.

(56) ọ̀pà 'light weight' ọ̀bọ́ 'half'
dápá 'bringing' ọ̀bọ́ 'eight'

We observe here that Tira displays the third feature
typical of tone languages. That is, tone languages can
allow more than one high tone per word. Further, they can
allow all highs or all lows. By contrast, a stress-accent
language can not allow all high or all low pitches in a
single word. If it did so, it would leave stress virtually
unmarked on any one syllable over the others.
In (57) below, the contrast between level and contour surface tones is illustrated.

(57) Level vs. Contour Tone Contrasts

(a) lű̀̀h 'ant dew'
    lű̀h 'gourd'
    ně̀n 'dogs'
    ně̀n 'countries'

(b) lŏ̀p̀o 'we IN will beat'
    lŏ̀p̀o 'they will beat'

(c) iřë̀̀o 'palm'
    iřë̀̀o 'cloth'
    nò̀mò̀ 'food'
    kò̀kò̀ 'daughter'

(d) à̀rù̀ 'crowd'
    árù 'shield'
    ú̀tù̀r 'pig'
    ú̀tù̀r 'navel'

(e) lò̀rò 'back'
    lò̀rò 'rock'
    lì̀dì̀ 'pot'
    lú̀lì̀ 'frog'

In (57a) and (57b) we see both lexical and grammatical contrast between high and rising. No similar contrast between low and rising in identical environments has been observed. Rising tone is rare and only found on a few monosyllabic nouns as in (57a) or on certain multi-morphemic verbal forms as in (57b).

Contrast between low and falling are illustrated in (57c). Here the pattern low-low contrasts with low-falling. This is an infrequent pattern of contrast since disyllabic words with the low-falling pattern are rare. A more common contrast is shown in (57d). Here the pattern low-low is contrasted with high-falling. Contrast between high and falling where the preceeding tone remains constant is shown
in (57e). Falling tone in Tira is almost always found on the last syllable of words.

We see in the examples above that all four tones contrast with at least one of the other surface tones in an identical environment. Again, we see that Tira meets the first criteria for a tone language, all four tones contrast with at least one other in identical environments.

Tone bearing units in Tira are typically full vowels. However, the reduced vowel schwa [ə] and the syllabic consonants also bear tone as seen in (58) below.

(58) Tonal Contrasts on Schwa and Syllabic Consonsonants

(a) ล่ำะคิ 'they gave'
    ล่ำะคิ 'we IN gave'

(b) ทร่ำ 'they are young'
    ทร่ำ 'we IN are young'
    ทร่ำ 'we IN hoed'
    ทร่ำ 'we IN hoed'

(c) หน่า 'you PL'
    ตรี 'palm'
    นางา 'he broke'
    ง่า 'PARTICLE'
    หน่า 'we EX'

In (58a) above we see that schwa only carries level tones, never contour tones. Syllabic consonants /r/, /l/, /n/, /n/ and /ŋ/ complete the tone-bearing units and also carry contrastive high and low tone as seen in (58b) and (58c) above. Falling and rising tone have only been observed on full vowels.
3.1.2 Allotones

These four contrastive surface tones have various predictable phonetic realizations which are influenced by their segmental and tonal environments.

3.1.2.1 Downdrift

The first such predictable phonetic variant is an allotone of high which occurs following a low. In the illustration below (59), the absolute pitch levels are marked on the bars above the letters.

(59)

\[ \text{hlh} \quad \text{hlh} \]

*Ilaró 'they have said' \quad *Ayítì 'you have died for me'

We can see in (59) above that every high tone following a low tone is realized at a slightly lower pitch than that of the preceding high. It is completely predictable and the two different pitch levels, which are both realizations of high, never contrast. Thus we see that the term 'high tone' has a relative value and not an absolute one. Its absolute value can change as long as it is realized at a pitch that is higher than that of the low tone adjacent to it. This phenomenon is known in other Niger-Congo tone languages as downdrift (Hyman 1975:226, Welmers 1973:82-85).
We have already seen that a high tone in Tira can contrast with other tones and have lexical significance. Now we see that it is also characterized by relative pitch. Again we see that Tira meets a part of the requirements for a tone language.

3.1.2.2 Downglide

A related allophonic process occurs in Tira which is sometimes called downglide (Hyman 1975:288). This occurs when a final low tone, following another low, falls to a lower pitch than that of the low preceding it. This is illustrated in (60) below. Both Welmers (1973:88) and Hyman note that this is a phenomenon that occurs in other African tonal languages.

(60)

\[ \text{lôvè 'cornstalk'} \quad \text{àlàcì 'wool'} \]

This gradual lowering of each successive high following a low and also a final falling-low following a low, causes an intonational feature of downward drift over a whole clause or sentence. The low tones must also lower somewhat along the way in order to maintain the contrast between low and high as seen in (61) below.
Downdrift cannot go on indefinitely. At some point the speaker pauses, resets the high tone and then continues speaking. The process of gradual downdrift begins all over again. High tone resetting then becomes one phonetic marker of higher level syntactic units such as the sentence.

3.1.2.3 Downstep

While downdrift represents an automatic lowering of tones that is completely predictable and therefore not phonologically distinctive, downstep is a lowering of a high tone that is not predictable and therefore is distinctive. A downstep tone is therefore a tonal phoneme, just as high or low.

It is thought that downstep develops in a given language from the presence of downdrift. In such cases, it is proposed that there was originally an intervening low between two highs which caused the automatic lowering seen in downdrift. When the segment to which the intervening low was associated was lost historically, the low tone remained but was not associated to any segment. Even though it does not surface, it continues to demonstrate its presence by
lowering the following high. However, the once predictable lowering of the following high is no longer predictable. Thus the 'downstepped' tone becomes phonologically distinctive (Hyman 1975:227-28, Welmers 1973:85-88).

To date, a very few cases of downstep have been observed in the Tira verbal system. All involve phrase level tonal phenomena. As this study has focused on word level issues, assertions about phrase level can only be suggestive. It appears, however, that the examples sighted in (62) below most likely result from a lost low between two highs occurring at a juncture between a word or clitics and a verb. If true, this case would follow the pattern seen in other Niger-Congo languages.

(62)
(a)  
ýá pó̩dě
'yáp'óðë
'I did not bring.'
á́rú l'ópò
'aráú l'ópò'
'(Say, they will beat.'
(b)  ý +á̩p +ô +è̩ #dë
'I bring ASP COMP #not 
á́rú# lò +è̩̩ +p +ô
'say# they will beat ASP

In (62a) above we see how the downstep is realized phonetically. In (62b) we can see the underlying morphemes from which the tonal pattern arose. The interesting point to note here is that when the morphemes were originally concatenated, it was not the low that was 'floating'. That is, it was not the low but rather the high that had no
segment with which it was associated. These are Welmer's 'tone-only' morphemes that are a feature of many tone languages. The first tonal morpheme marks a verb that is taking a complement of some kind. The second marks habitual aspect. We will see in Chapter 4 that the high tone in Tira is marked, often carrying the lexical or grammatical distinction, and that the low is default. Thus the low may often be delinked to give place to a high.

It is believed that once the verbal morphology is better understood, this downstep high will prove to be predictable as underlying low-high realized on a single tone bearer. Therefore, it is not here considered a tone in its own right.

3.1.2.4 Depressor Consonants

Certain consonant types may affect tones adjacent to them in various ways. Hyman notes that it is typical of tone languages that consonants may affect tone but tone does not alter consonants (1975:228-9). By contrast, in a stress-accent system, stress has a great deal of effect on segments. In a tone language, voiced obstruents may function as depressor consonants, generally lowering or 'depressing' the tone on vowels that follow them (Hyman 1973:167-172, Kenstowicz and Kisseberth 1979:273).

In Tira, the voiced stops /b, d, g, and g/ and the voiced fricative /θ/ function in this way. High tones
occurring on vowels between two of these segments, are predictably lowered thus producing allotones of high. This contrasts with what Hyman presents as the typical behavior for depressor consonants, since the lowered tone usually only need follow the consonant.

A 'depressed' high is phonetically similar to a downstep high, but not identical to it. The pitch of another high following a 'depressed' high goes back up to the previous height as seen in (63) below.

(63) High Tone Lowering with Depressor Consonants

\[
\begin{align*}
\text{árú } & \text{árbóñá} \\
\text{árú } & \text{árdá} \\
\text{árú } & \text{ádá}
\end{align*}
\]

'Say barking!' 'Say being fat!' 'Say cutting!'

\[
\begin{align*}
\text{árú } & \text{ádifyá} \\
\text{árú } & \text{ádgará}
\end{align*}
\]

'Say sitting!' 'Say breaking!'

If this 'depressed' high were in fact a downstep high, it would have reset the pitch level for high and a following high would thus be at the same level as the downstep (Hyman 1975:227). Also, the restricted environment in which the 'depressed' high occurs, that is, between the voiced stops and the voiced dental fricative, further identifies it. Thus the lowering of the pitch in the cases of downstep high
illustrated in (63) above, cannot be due to the influence of depressor consonants since downstepped highs do not necessarily occur between voiced obstruents.

To date, this allophonic lowering of high has been observed almost entirely in the gerund form of verbs as seen in (63) above. The gerund is formed by adding a toneless prefix {sə-} to a low tone verb stem. Then the high tone morpheme indicating the gerund replaces the verb stem tone. The high tone spreads to the entire word, giving the derived gerund.

High tone on full vowels may also be depresed in this way as illustrated in (64) below.

(64)  
\[
\begin{array}{c}
\underline{\text{ářú}} \\
\underline{\text{sūdó}}
\end{array}
\]
"Say burning!"

Very few examples of full vowels being 'depessed' were found among the verbs and none were found among the nouns. The distribution of segments and tones in the prefixes and roots was such that almost no high tones occurred on a full vowel between two of the designated voiced obstruents in the lexical items collected. It spite of the limited and somewhat unique contexts in which the depressor consonants seem to operate, it appears that here again, Tira displays another feature typical of tone languages.
3.2 TIRA TONE IN RELATION TO LENGTH AND LOUDNESS

We turn now to the question of how tone in Tira relates to the other two suprasegmental features. As noted by Martinet, the features pitch, length and loudness are always present in all utterances (Hyman 1975:203). Whenever one of these features is determined to be phonologically significant, the analyst must then seek to discover what the relationship of the significant feature is to the other two? In Tira we have shown pitch to be phonologically significant and thus Tira to be a tone language. Now we must ask the question: what relationship do length and loudness have to tone?

3.2.1 Tone and Length

We know from the features indicative of tone languages that both tone and duration may be phonologically significant in the same language. We have seen that tone is a phonological feature of Tira. Now we must ask the question: is length also a phonological feature of Tira?

As we saw in 1.9.2.1, no previous researchers except Schadeberg have made reference to length on vowels in Tira. Stevenson had commented that vowel length was present in the Heiban Group languages, but apparently not phonologically significant (1956:27). Schadeberg, however, noted length on almost all the vowel phones he recorded. He recorded high, low and falling pitch on short vowels but only high and low
were recorded on long vowels. This would suggest that vowel length is not dependent on tone. Also, most of Schadeberg's recorded long vowel phones occur on what he indicates to be root vowels. This would also suggest some independent status for long vowels. Quite a few however could possibly be interpreted as coming from two different morphemes.

However, in this research there has been almost no evidence to suggest that vowel length is a phonologically significant feature in Tira. We have already seen in 2.2.5 the limited evidence that exists. By contrast, minor variations in the length of vowels have been noted that appear to depend on the type of tone attached to the vowel and the type of syllable in which it occurs. First, full vowels occurring in word final open syllables and bearing contour tones are longest. Second, full vowels which bear level tones are shorter in length than those with contour tones. Third, both the schwa of nominal and verbal prefixes and full vowels reduced to schwa preceding deletion are shortened. If speech is slowed down and the full vowels re-surface, they are also re-lengthened. These observations are primarily subjective. Validation by machine measurement would be very helpful for determining if any of the lexical items noted as long by Schadeberg or in this research can be demonstrated to be so.

Thus, for the present, variations in length are considered predictable based on tone type and syllable
shape. In these instances it is therefore not phonologically significant and need not be marked in the lexicon. In those instances where length is present but does not comply to the conditions outlined above, it will be considered exceptional and marked in the lexicon. Thus far these instances are very rare. It is interesting to note that the language assistant in this study is quite convinced that there is no phonologically significant length on vowels in Tira.

3.2.2 Tone and Loudness

Concerning tone and loudness, Welmers noted that no African language has been reliably reported to have both phonemic tone and stress (1973:113). However, predictable variations in loudness may well exist.

Some subjective observations can be made about levels of loudness on tone-bearing units. Given a subjective scale of loud to soft, full vowels are loudest, then schwa and reduced full vowels are less loud and syllabic consonants are softest. Also, vowels with high tone seem louder than vowels with low tone. It is proposed then that some variation in loudness is predictable based on the type of tone-bearing unit in question and the tone it bears. Loudness, therefore, is not phonologically significant and would not be marked in the lexicon.
3.3 SUMMARY

We have seen now that of the three suprasegmental features, only tone is phonologically significant and must therefore be marked in the lexicon. Both length and loudness appear to be predictable based on the phonological or morphological environment. However, more definitive study on vowel length needs to be done.

We have also seen that there are four contrastive surface tones whose domain is the syllable. These tones have a number of predictable phonetic variants. We have seen that Tira displays at least five of the six features characteristic of tone languages and conforms with the definition given for a tone language. That is, Tira has phonologically significant, contrastive pitch which enters into the composition of at least some morphemes. Thus, we conclude that Tira is a tone language.
CHAPTER 4  THE FUNCTION OF TONE

4.0 INTRODUCTION

In Chapter 3 we saw that Tira has four contrastive surface tones, high, low, rising and falling, realized on syllables. In Chapter 4 we will look at the function of tone. We will look at the role it plays in the lexicon and the grammar and how the tonal system itself functions and is represented. Using autosegmental analysis will help us see that these four surface tones have been derived from underlying high and low tones. We will also see that distinctive patterns of high and low tone, or melodies, have the word as their domain.

We will be concerned primarily with the tonal and segmental tiers. However, it will become clear that for Tira, these two tiers cannot be considered in isolation. Restrictions on Tira syllable and word structure have a great deal of influence on tonal association in Tira. The segmental changes that occur when morphemes are concatenated and syllabified have been described in Chapter 2. These changes will be referred to in the process of explaining association of tone, especially for the verbs. This analysis is restricted to simple nouns and to simple verbs conjugated in what Stevenson called the 'definite' aspect.
4.1 THE TONAL TIER

4.1.1 The Well-formedness Condition and Association Conventions

In autosegmental analysis of tone, there are universal principles that govern the tonal tier and its association to the segmental tier. These universal principles are known as the Well-formedness Condition and the Association Conventions. Early in the development of autosegmental phonology Goldsmith proposed the Well-formedness Condition (Hulst 1982:14). Clements and Ford went on to develop the Association Conventions which are rules for applying the Well-formedness Condition (Hulst 1982:14-15). Both are shown in (65) below.

(65) \vspace{2mm}
Well-formedness Condition as proposed by Goldsmith

1. Each tone is associated with at least one segment.
2. Each segment is associated with at least one tone.
3. Association lines do not cross.

Association Conventions as proposed by Clements and Ford

1. Tones are associated with tone bearers in a one-to-one fashion from left to right until we run out of tones or bearers.
2. Associate the remaining tones with the last bearer.
3. Associate the remaining bearers with the last tone.

It also became apparent that for each autosegmental tier, the 'associating segments' on that tier which would associate with 'associating segments' on any other tier must
be identified. For the tonal tier those 'associating segments' are tones. However, for the segmental tier, the 'association segments' will vary depending on the tier with which it is being associated. Thus, when the segmental tier is associating with the tonal tier, the 'associating segments' on the segmental tier are referred to as tone-bearing units. They are the segments that carry the designation [+syllabic] (Goldsmith 1990:44-45, Hulst 1982:17). In many languages tone-bearing units, henceforth TBUs, are vowels only. But we have already seen that for Tira both vowels and consonants (2.3.3.3), under certain conditions, are [+syllabic]. Therefore, they are both tone-bearers.

Building on the work of a number of other linguists, Pulleyblank proposed that there was only one clause in the Well-formedness Condition and one in the Association Conventions that were universal (1986:9-11). These are seen in (66) below.

(66) Universal Well-formedness Condition and Association Conventions as proposed by Pulleyblank

(a) Well-formedness Condition:
Association lines do not cross.

(b) Association Conventions:
Map a sequence of tones onto a sequence of TBUs:
1. from left to right
2. in a one-to-one relation.
Both Pulleyblank (1986:11) and Goldsmith (1990:18-19) indicated that both the Well-formedness Condition and the Association Conventions in (66) must be augmented to include language specific parameters and rules. The parameters indicate a minimal and maximal number of associations for both tones and TBUs in any given language. The rules apply those parameters to associations between the two tiers.

Therefore, for this study, the following parameters for Tira are presented to augment Pulleyblank's presentation of the Well-formedness Condition, henceforth the WFC.

(67) Tira Tonal Parameters to Augment the WFC

(a) In Tira, each tone is associated to a minimum of one and a maximum of five TBUs.

(b) In Tira, each TBU is associated to a minimum of one tone. Syllabic consonants may associate with a maximum of one and vowels a maximum of two tones.

To augment the universal Association Conventions, henceforth AC, presented in (66), there are two Tira specific association rules. These utilize the parameters in (67) to make additional associations between tones and tone-bearing units. These are presented in (68) below.
Tira Association Rules to Augment the AC

(a) In Tira, any tone-bearers left unassociated are now associated to the last tone in harmony with the parameters in (67). This rule allows for tone spreading in Tira.

(b) In Tira, any tones left unassociated are now associated to the last bearer in harmony with the parameters in (67). This rule allows for contour tones in Tira.

Thus, any time morphemes are concatenated to form words, a tonal tier and a segmental tier are formed. Association of tones to TBUs automatically begins via the AC (66) and then continues on via the two Tira association rules, (68a) and (68b). This is the normal procedure for association. There are, however, two cases in which other steps must intervene between concatenation and association via the AC. They are discussed below in 4.1.2 and 4.1.3.

4.1.2 Tonal Melodies and The Obligatory Contour Principle

When morphemes are concatenated to form words, the tones contributed by each of the morphemes are lined up on the tonal tier. The resultant tonal sequences are the basis for tonal melodies which are often realized over units larger than syllables, such as stems or words. The Obligatory Contour Principal, henceforth the OCP, is a principle that governs the nature of these melodies. The OCP says that sequences of identical tonal segments do not occur but are normally collapsed into one. This process
thus gives only sequences of unlike tones in underlying tonal melodies (Hulst 1982:8). We will see that there is a controversy over apparent violations of this principle that call into question the strictness with which it should be applied. This issue is important for Tira as it displays some of these apparent violations.

4.1.3 Strategies for the Initial Tonal Association

Understanding the issues concerning the OCP violations requires a knowledge of the strategies used by different languages for the association of the first tone to the first TBU. It appears from the AC (66), that all languages begin by associating the left most tone with the left most TBU. That, however, is not always the case. There are at least three strategies used in various languages for this initial association.

The first strategy does in fact apply the AC and so the initial association starts with the left most tone being associated with the left most TBU. Such systems are the most common and are usually called 'lexical' tone systems. They typically use several different melodies for lexical or grammatical contrasts (Hulst 1982:15). The tone system in Tira is primarily a lexical tone system.

Other lexical tone languages do not use the left most tone and TBU for their initial association. Instead, they use a second strategy by employing have a language specific
Initial Association Rule that governs the first association. For example, in Kikuyu, the Initial Association Rule, henceforth the IAR, associates the first tone of any tone melody to the second TBU of the word as seen in (69) below.

(69) Initial Association Rule for Kikuyu

\[
\begin{array}{c}
\text{C V C V} \\
\text{T} \\
\text{word}
\end{array}
\]

Following application of the IAR, the AC and then other language specific rules take over and associate the remaining tones and TBUs (Goldsmith 1990:9-11). This is illustrated for Kikuyu in (70) below.

(70)

\[
\begin{array}{c}
\text{to ma rō rire} \\
\text{L H L H} \\
\text{word}
\end{array}
\]

\text{tomārōrīrē 'we looked at them'}

In contrast to lexical tonal systems, pitch-accent systems use a third strategy. They match 'starred' melodies (e.g. M*HL) with 'starred' lexical items (e.g. Am*erica) to make the initial association. Such systems generally have only one tonal melody for the whole language. The initial association is made between the starred tone of the melody and the starred tone bearer in the word. Then the AC plus any language specific rules will associate the rest of the
tones and TBUs. This is illustrated in (71) below with an examples from English which is sometimes analyzed as a pitch-accent language.

(71) Pitch-accent Initial Association in English

(a) \[ \begin{array}{c}
\text{Am*e ri ca} \\
\text{*H L}
\end{array} \]  
(b) \[ \begin{array}{c}
\text{Ka la ma z*oo} \\
\text{*H L}
\end{array} \]

In (71) we see the initial association has been made by linking the starred items and then the AC and language specific rules have applied. The starred TBU effectively marks the accented syllable of the word (Hulst 1982:16-17). There are a number of pitch-accent languages in the Niger-Congo family.

We will see that Tira basically has a lexical tone system. However, certain groups of nouns and verbal forms have surface melodies in apparent violation of the OCP. It is proposed that these melodies are 'starred' melodies. The starred melodies do conform to the OCP underlyingly and only result in apparent violations on the surface. It is further proposed that these groups of nouns and verbal forms use a starred melody like that of the pitch-accent systems, in combination with a Tira specific IAR, to make the initial tonal association. Therefore, it is being proposed that Tira uses all three strategies.
4.1.4 Syllabification and Tone Association

The conditions governing well-formed syllables and words in Tira were given in 2.3.2. We will review here those that are important for tonal association.

First, the syllable is composed of an optional onset, an obligatory nucleus and an optional coda. The onset and coda are filled by non-syllabic consonants and the nucleus may be filled by either vowels or syllabic consonants. All nuclei bear at least one tone.

Second, no consonant clusters may occupy the onset or the coda of syllables. Only underlying consonant clusters, as defined in 2.3.3.4, are allowed word internal. Any other clusters are violations of Tira word structure rules. They indicate that a vowel has been deleted and that a tone may have been left unassociated as a result.

Third, vowel sequeneces are not allowed word internal. Any vowel sequence formed by the concatenation of morphemes will force either the deletion of one of the vowels in the sequence or the reinterpretation of high vowels as consonants. The vowels therefore, loose their ability to bear tone. Deletion may also leave a tone, once associated with the vowel, now unassociated.

4.2 NOMINAL TONE

The five primary tone melodies are low (L), high (H), low-high (LH), high-low (HL), and low-high-low (LHL). These
melodies are illustrated on disyllabic nouns in (72) below. They will be discussed further in 4.2.3.

(72)  
L  iʃɛɛ 'palm of hand'
H  lʊgɔ 'dress'
LH  ϱɛɔ 'tamarind'
HL  lɔmɔn 'lions'
LHL  ɪlɛɛ 'hoe'

There are also variants of HL and LHL that are distinguished by the use of a starred tone and require application of an IAR specific to Tira. They are the melodies *HL and L*HL as shown in (73) below.

(73)  
*HL  lɑɾɛ 'rock'  L*HL  ūlɪŋɛ 'night'

The melody L*HL only occurs on trisyllabic nouns as it would be redundant on disyllabic nouns, giving the same result as LHL. The starred melodies will be discussed further in 4.2.4.

4.2.1 The Function of Tone in Tira Nouns

The primary function of tone in Tira nouns is lexical. This is most clearly seen with sets of nouns which are identical segmentally but differ in meaning, the difference in meaning being marked by the presence of different tonal melodies. We saw many such contrasts in 3.1.1. Other contrasting pairs are seen in (74) below.
(74) Lexical Contrasts in Nouns

ïlå 'calabash'  ùdɔ 'breath'  ñɛn 'dogs'
ïlå 'fat'       ùdɔ 'worm'      ñɛn 'countries'

4.2.2 Noun Composition

As we saw in 2.3.1, nouns in Tira are composed of an obligatory prefix, an obligatory root and an optional suffix. This structure is reviewed in abbreviated form in (75) below.

(75) Morpheme Composition of Nouns

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Root</th>
<th>(Suffix)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ð</td>
<td>V...</td>
<td>V</td>
</tr>
<tr>
<td>C</td>
<td>C...</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

We recall that Tira noun roots may be vowel-initial or consonant-initial. These roots are composed of segments and one of the tonal melodies. Both prefixes and suffixes are toneless. Some examples are seen in (76) below.

(76) +ànî 'NCP+ear'
+imbirî 'NCP+headpad'
ð+f 'NCP+thorn'
η+av+é 'NCP+water+SUF'
à+pèrî 'NCP+boy'

Once morphemes are concatenated, the noun melodies of the roots are realized over the entire noun. There are a number of morphophonemic changes that occur in nouns when
the concatenated morphemes are syllabified. These were described in 2.3.3. A number of these changes have no affect on tonal association. Others delete vowels or cause consonants to become syllabic. However, since these issues are more clearly illustrated in relation to verbs, the discussion of how these changes affect tone association will be left to section 4.3.3. The discussion of noun tone will be restricted to nouns where segmental changes do not occur.

4.2.3 Noun Melody Association

The tone melodies L, H, LH, HL and LHL, are contributed to the noun from the root but realized over the entire noun. They have different realizations depending on whether they occur on nouns of one, two or three syllables. These are illustrated in (77) below. The hyphen between the tones indicates that both tones are realized on one syllable, thus producing either a rising or falling surface tone.

(77) The Tone Melodies on Nouns of Various Lengths

<table>
<thead>
<tr>
<th></th>
<th>$</th>
<th>$ $</th>
<th>$ $ $</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L L</td>
</tr>
<tr>
<td>H</td>
<td>H</td>
<td>H H</td>
<td>H H H</td>
</tr>
<tr>
<td>LH</td>
<td>L-H</td>
<td>L H</td>
<td>---</td>
</tr>
<tr>
<td>HL</td>
<td>H-L</td>
<td>H L</td>
<td>---</td>
</tr>
<tr>
<td>LHL</td>
<td>---</td>
<td>L H-L</td>
<td>L H L</td>
</tr>
</tbody>
</table>

Looking at (77) above, we see that the LH and HL melodies do not surface on trisyllabic nouns. There is no
obvious explanation for this restriction. It will be seen in 4.2.5, however, that these patterns do surface on suffixed nouns. We see also that the LHL melody does not surface on monosyllabic nouns. This restriction illustrates a language specific restriction in Tira expressed by the tonal parameter in (67b). The parameter specifies that a vowel may not bear more than two tones.

4.2.3.1 Low and High Tone Melody Association

If we look at the low tone melody we can see that it is realized autosegmentally on one, two and three syllable nouns as illustrated in (78) below.

(78) lon 'crop' yaba 'stars' alaci 'wool'

We see in (78) that the AC have been applied to give us the initial association of L to the left most TBU of each noun. At this point we have run out of tones. Then, Tira parameters (67a) tells us that a tone may maximally associate with up to five TBUs. Thus, the Tira spreading rule (68a) will continue to associate the last tone with the remaining tone-bearing units until all are associated.

The association of the high tone melody to one, two and three syllable words works in the same way as seen in (79) below.
4.2.3.2 HL and LH Melody Association

If we look at the HL melody, we see that it is realized on one and two syllable words as illustrated in (80) below.

(80) (a) ṇaw 'water' (b) nana 'mother'
     \ / \ / \ / \
     H L H L H L

We see in (80) above that the AC has associated the left most tone to the left most tone bearing unit in both (80a) and (80b). In (80b), this process was continued in a one-to-one fashion to the right, until both tones and bearers were exhausted. In this case the tones matched the bearers.

In (80a), however, once the initial association of tone to bearer had been made, we then ran out of bearers leaving the L unassociated. The Tira parameters (67) tell us that all tones must be associated and that vowels may be associated with a maximum of two tones. Thus, the Tira contour rule (68b) associates the remaining L to the last TBU and a falling contour tone is created.

The LH melody works in the same manner but creates a rising tone as seen in (81) below.
(81)  ṅOn 'country'  lurɔ 'goat dung'

\  \
L H

\  \
L H

4.2.3.3  LHL Melody Association

Looking at the last melody, LHL, we see that it is only realized on disyllabic and trisyllabic nouns as illustrated in (82) below.

(82)  (a)  ilɛɔ 'hoe'  (b)  ambati 'robber'

\  \
L H L

\  \
L H L

In (82a) above, we see that the AC associates the first two tones to the two bearers. Then the Tira contour rule (68b) applies in accordance with the parameters. A falling contour results when the unassociated L is associated to the last bearer. In (82b), tones and bearers are matched, thus all were associated with application of the AC alone.

In Chapter 3 we saw the contrast between low, high, falling and rising tones demonstrated on single syllables. It is now clear that these four surface contrasts were really derived from the various realizations of tonal melodies on words of varying numbers of syllables. The tonal melodies are all composed of the two underlying tones high and low. Also we see that the appropriate domain of the underlying tones is the word and not the syllable.
4.2.4 Starred Melodies and the Initial Association Rule

4.2.4.1 Apparent Violations of the OCP

As discussed in 4.1, the Obligatory Contour Principle (OCP) states that sequences of identical tonal segments (e.g., two high tones) do not generally occur and that any exceptional sequences are assumed to be marked (Hulst 1982:8).

During the development of autosegmental analysis, some linguists have interpreted the OCP so strictly that any violations of OCP were held to indicate that the language had a pitch-accent system rather than a lexical tone system (Hulst 1982:16). If a language was held to be tonal, then violations of the OCP might force the analysis of underlying contour tones to be considered.

However, more recently, the inviolability of the OCP has been questioned. Goldsmith, at least as of 1990, asserted that adjacent identical segments are not universally reduced to one as the OCP would predict. He claimed that the OCP is a strong tendency in a language but not an inviolable rule. He based this claim on a small number of tone languages where no accent system could be demonstrated but where sequences of like tones occur. Such is the case in Etung, a Niger-Congo language of the Benue-Congo sub-family. He gave as an example the noun ésèbè 'sand' (Goldsmith 1990:309-11). With this type of apparent violation, HHL occurs on a specific group of nouns.
There are also apparent violations of OCP in another group of nouns with a LLH pattern (Edmondson and Bendor-Samuel 1966:1-6).

As noted earlier, Tira also has some surface tonal patterns that appear to be violations of the OCP. The first pattern surfaces on disyllabic nouns as HH-L and on trisyllabic nouns as HHH-L, as illustrated in (83a) below. This pattern occurs on approximately 10% of disyllabic and 1% of trisyllabic nouns.

(83) Apparent Violations of OCP in Tira

\[
\begin{array}{c|c}
\text{arù 'shield'} & \text{côĩ̀nèn 'sun'} \\
\hline
H H L & H H H L \\
\end{array}
\]

\[
\begin{array}{c|c}
\text{**arù 'shield'} & \text{**côĩ̀nèn 'sun'} \\
\hline
H L & H L \\
\end{array}
\]

However, both these realizations of this pattern are violations of the OCP and should be reduced to a simple HL melody. However, the normal association of the HL melody, if applied as we see illustrated in (83b), would produce incorrect surface forms for these two words. It is argued here that the representation in (83a) above is not the correct representation of either the melody or the tonal association process for this class of nouns. In suggesting a solution to this problem we will look for help from Goldsmith.
4.2.4.2 Possible Explanations for OCP Violations

Goldsmith does not tell us directly how the apparent violations in Etung should be handled, but by implication suggests two approaches. First, he shows how McCarthy attempted to solve similar violations of OCP of consonant autosegments in Arabic. McCarthy's solution is called the Morpheme Tier Hypothesis. In this approach, each morpheme occupies a different melodic tier. The autosegments of the melody (in his case these were consonantal autosegments) are associated to the skeletal tier of each morpheme before morphemes are concatenated. Then when morphemes are concatenated, two identical autosegments may occur adjacent to each other. However, these sequences are across morpheme boundaries and thus are only apparent violations of OCP and not actual ones (Goldsmith 1990:311-18).

Indeed, such an approach would work in the case of Etung, as the identical adjacent tones do in fact come from two adjacent morphemes. However, this would not work for Tira, as there is no way to demonstrate that the sequences of identical tones, at least in nouns, come from different morphemes. We will see in the verbal system that they clearly do not.

Goldsmith's other solution is inspired by the starred melodies of pitch-accent languages. For Tira, this solution has more promise. We saw in 4.1.3 that the initial association of a tone to a TBU in pitch-accent languages
takes place between the starred tone of the basic melody and the various starred tone-bearers of each lexical item. The rest of the tones and TBUs will then be associated by the AC.

4.2.4.3 A Proposed Solution for Apparent OCP Violations

The hypotheses presented here is that Tira is a language like Etung, but not identical to it. First, like Etung, the apparent violations of OCP in Tira only occur with certain groups of nouns and certain verbal forms. However, unlike Etung, these sequences of identical tones apparently do not come from different morphemes. Therefore, the Morpheme Tier Hypothesis cannot be applied. However, it would be possible to assign a starred melody only to those noun and verbal forms which demonstrate the violation. Then an Initial Association Rule (IAR) for Tira, similar to the kind described for Kikuyu in 4.1.3, could be applied to those lexical items with starred melodies.

Thus, the following two hypotheses can be made. First, Tira has, in addition to the five basic melodies, a starred melody *HL. Second, after the morphemes of a noun containing a starred melody have been concatenated, the initial association of starred tone to a TBU takes place by a language specific rule. This rule in illustrated in (84) below.
(84) Initial Association Rule for Tira Starred Melodies

\[
\begin{bmatrix}
  t & \ldots & t \\
  \ldots & *T & \ldots \\
\end{bmatrix}
\]

word

This rule says that association for starred melodies starts by associating the starred tone (*T), wherever it occurs in the melody, to the last TBU (t) in the word. We see in (85) below the application of this IAR to a starred melody. This is followed by application of the AC and Tira association rules. The example applies this process to disyllabic nouns only.

(85) (a) aru 'shield'  (b) ingala 'tongue'

\[
\begin{array}{c}
  *H \ L \\
\end{array}
\]

In (85a) above, the IAR (84) makes the initial association by linking the starred tone of the melody with the last vowel in the word as indicated by the solid line. Second, since the left-most tone is already associated, the AC can not apply. Third, the Tira contour rule (68b), applies to associate the remaining unassociated L to the last bearer, creating the final falling tone.

Last of all, the Tira spreading rule (68a) applies to associate any unassociated bearers with the last tone. However, the unassociated bearer in this case, cannot associate to the last tone as this would cause the
association lines to cross and be a violation of the WFC. Instead it must associate to the second to last tone. This has the effect of allowing tone spreading to the left instead of to the right as we saw earlier in (78) and (79).

As noted earlier, this pattern has been observed also with trisyllabic nouns as illustrated in (85b) above. Here again, the starred tone and the last TBU are associated by the IAR. Since the AC can not apply, the Tira contour rule creates the final falling tone. Then the Tira spreading rule links the remaining unassociated bearers to the second to last tone thus avoiding a violation of the WFC. This is similar to the pattern we saw illustrated for English in (71) when it is analyzed autosegmentally as a pitch-accent language (Hulst 1982:16). We will see in 4.3.3.1 that this application of the IAR will also be needed for the description of imperatives.

There is also a small class of trisyllabic words where the IAR is applied to the other starred melody, L*HL. This is illustrated in (86) below.

(86) (a) ulinge 'night' \ \\ \\
\ \\  \\
\ L *H L  \\
\\ \ \\
\\  \\
\\ L *H L

(b) διτιρο 'Tira language'

The application of autosegmental association is particularly interesting in this case. In (86) above the IAR is applied first, this time to the second tone of the
melody since it is the starred tone. Second, the AC can apply in this case since the left-most L is unassociated. The AC associates the L with the first TBU. Third, the Tira contour rule (68b) applies to associate the remaining unassociated low to the last bearer, thus creating the falling tone. Last, the Tira spreading rule (68a) applies to associate the remaining unassociated bearer to the second to last tone. Again, it can not associate to the last tone as the rule specifies, because this would cause the association lines to cross in violation of the WFC.

It is interesting to note here that the association pattern prevents the right spreading of the first L of the melody and requires the left spreading of the starred H. We said earlier that noun prefixes are toneless and that the tonal melody on a noun is composed solely of the tones that are inherent to the root. Perhaps though, the initial L is prevented from spreading precisely because it is an old prefix tone which has become frozen to the noun root melody. The noun in (86a) above has no segmental realization of its noun class prefix while in (86b) it is realized by a single consonant /s/.

It is also interesting to note that the net effect of application of the IAR to the two starred melodies as seen in examples (85) and (86) is to place a falling contour tone on the last syllable of a noun. We noted, in fact, in 3.1.1 that the occurrence of falling is limited to the last
syllable of nouns. In the entire sample of nouns there is only one exception to this restriction, namely /ɔrù/ 'hen'.

In 1.9.1.4 we noted that though tone languages can have a level high tone on the final syllable of a word, stress-accent languages usually have falling tone on a final stressed syllable. We see here that Tira has both. This may underscore the point noted by Williamson that the line between accentual and tonal systems is not easily drawn and that some features of accentual systems may be found in tonal systems and vice versa. If further study of nouns or verbs revealed more starred melodies, it might suggest that Tira is a lexical tone system in transition to a pitch-accent system. This is a pattern of sound change already seen in other Niger-Congo languages (Williamson 1989:26-28).

4.2.5 Suffixed Nouns

The association patterns of tones in suffixed nouns adds to the evidence supporting the hypothesis that the domain of tone is the word. There is a toneless vowel suffix that marks case. This suffix is added to nouns that are the objects of transitive verbs. When nouns are suffixed in this way, the tone melody simply associates to the entire suffixed form, including the added vowel. First, the AC and then the Tira rules are applied as necessary.
The correct surface form is obtained. This is seen in (87) below for both the HL and LH melodies.

(87) ɲɛn 'countries' ɲɛn+c 'countries +OBJ CASE'
      /\                  |     |
     L H                  L H

ɲaw 'water' ɲaw+c 'water +OBJ CASE'
      /\                  |     |
     H L                  H L

When this suffix is added to disyllabic roots, the realizations of the LH and HL melodies that were missing in (77) on trisyllabic nouns are now realized. This is illustrated in (88) below.

(88) culɔm+a 'door +OBJ CASE' lɔmɔn+a 'finger +OBJ CASE'
      /\                  |     |
     L H                  H L

4.2.6 Vowel Deletion and Contour Tones

The process of synchronic vowel reduction and deletion in nouns adds further support to the hypothesis that contour tones are not underlying but rather derived. It also supports the hypothesis that the domain of tone is the word. The segmental conditions that are believed to trigger this deletion were described in 2.3.3.1. In (89) below we see the effects of such deletion on tone association.
(89) itúrù 'official'

In the example above, we see that application of the AC produces the same result for tone association both before and after vowel reduction has taken place. However, when the vowel is subsequently deleted, the H tone is left unassociated. Since the Tira parameters tell us that all tones must be associated to at least one bearer, the AC will automatically re-apply, associating the H to the next bearer to the right. This bearer already has a L associated to it, but since the Tira parameters tell us that a vowel may have up to two tones associated to it, then the association can apply. It is interesting to note that the creation of the final falling contour was achieved here via an entirely different route than that seen in numerous earlier examples.

We should note here also, that in 3.1.2.3, we suggested that an unassociated low may be the cause of downstep at the phrase level in Tira. If this was the case, it would be necessary to modify the Tira parameter for tones. Presently it specifies that all tones must associate with at least one bearer. It would be necessary to specify that at word level, all tones must be associated. At phrasal level, low tones could be delinked and remain unassociated.
The process we see illustrated in (89) above is a common occurrence in Tira. Normal speech produces many forms like ītrû 'official'. There are two points to note here. First, in 2.3.3.4. we saw that only nasals followed by homorganic voiced stops are underlying clusters in Tira. Thus, a cluster like 'tr', is in violation of Tira syllable and word structure. We know, therefore, that a vowel has been deleted and that there may be an unassociated tone to account for.

Second, the issue of the stability of tones is raised. We see here that tones are more stable than segments. When vowels are deleted synchronically in Tira, the tones which were once associated with them remain behind. The discussion raised about the loss of prefix vowel and tone spreading patterns for the L*HL melody may also indicate that this is true even when vowels are lost historically.

4.2.7 Syllabic Consonant Formation and Tone Association

Synchronic vowel deletion can also lead to consonants becoming syllabics and occupying the nucleus of a CV syllable. This creates the CČ syllable type noted in 2.3.2. When this occurs, the newly generated syllabic consonants are unassociated to any tone and thus violate Tira parameters for TBUs. The process of association is illustrated in (90) below.
(90) (a) n+iriðo 'knives' \[\rightarrow \text{n ri do} \rightarrow\]
\[\text{H} \quad \text{H}\]

(b) ñ dři do \[\rightarrow (c) \text{n dř do} \rightarrow (d) \text{n dř dř}\]
\[\text{H} \quad \text{H}\quad \text{H}\]

In (90) above we want to track the changes that the /r/ undergoes. In (90a), we see that when the plural is formed, there has been deletion of the initial root vowel /i/ as detailed in 2.3.3.2. The cluster 'nř' is created but it is not an underlying cluster. In response the process of excrescence as discussed in 2.3.3.4, creates a complex consonant cluster 'ndr'. The /n/ is now in a position normally occupied by a vowel and so it becomes syllabic as seen in (90b).

Tira parameters tell us that syllabic consonants must bear at least one tone so the unassociated syllabic consonant now associates with the high tone via re-application of the Tira spreading rule as seen in (90c). The /r/, however, is now in a surface cluster that is tolerated like the 'tr' of (89) above.

A second vowel is deleted creating the complex cluster 'ndrd' as seen in (90c). The /r/ now is in a position normally occupied by a vowel so it is interpreted as a syllabic nucleus and thus becomes a TBU. Again tone spreading applies to associate the /ř/ to the H tone of the syllable 'dř' and produce the surface form as seen in (90d).
4.3 VERBAL TONE

4.3.1 The Function of Tone in Tira Verbs

The basic function of tone on verbs is grammatical. There is no lexical contrast of tone on verb roots as is found in many other Niger-Congo languages. Instead, tone is used to signal contrasts in person and number, direction of action, and certain aspectual features. Some of these are illustrated in (91) below.

(91) (a) lènàŋù 'we DU IN scratched'
lènàŋù 'they scratched'
ñàŋàŋù 'you PL scratched'
ñàŋàŋù 'we EX scratched'

(b) àpå 'carry toward!'
ápö 'carry away!

(c) lòpò 'they have beaten'
lòpò 'they will beat'

The examples above show three areas where tone is either the sole or a very significant clue to certain grammatical distinctions on verbs. In (91a) we see the person and number contrasted in two sets of the verbal prefixes. In (91b) we see that contrasting melodies in the imperative indicates a contrast in the action being directed toward or away from the speaker. In (91c) we see a contrast in verbal aspect being indicated by tone. With further research, we would expect to see more aspectual distinctions marked by tone alone.
4.3.2 Verb Composition

As we saw in 2.3.1, verb stems are composed minimally of an obligatory root and suffix. The prefix, extensional suffixes and plural suffix are all optional. This structure is reviewed in (92) below.

(92) Morpheme Composition of Verbs

<table>
<thead>
<tr>
<th>(Prefix)</th>
<th>Root</th>
<th>(Ex1)</th>
<th>(Ex2)</th>
<th>ASP</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>CVC</td>
<td>VC</td>
<td>VC</td>
<td>V</td>
</tr>
<tr>
<td>CV</td>
<td>VC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cə</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

We also saw that prefixes have inherent high or low tone. All roots, however, have an underlying low tone. All suffixes with segmental realization are toneless but tone-only suffixes also exist. Some examples of the verbs are seen in (93) below.

(93) t+t 'shake!'
     ûd+t 'burn!'
     ʰəc+t 'give!'

     kə+p+t 'he hit'
     kə+p+əv+ət+t 'he pressed'
     k+əv+əə+əc+i 'he squeezed'

In 2.3.3, we noted that there are ten possible types of morpheme boundary between prefixes and roots. Morpheme boundary type, as used here, refers to the possible combinations of the final prefix segment and the initial root segment that occur at the morpheme boundary between
prefixes and roots. The eight possible boundary types for verbs are reviewed in (94) below.

(94) Prefix and Verb Root Morpheme Boundary Types

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Root</th>
</tr>
</thead>
<tbody>
<tr>
<td>no prefix</td>
<td>C...</td>
</tr>
<tr>
<td>V</td>
<td>1. +C</td>
</tr>
<tr>
<td>CV</td>
<td>3. V+C</td>
</tr>
<tr>
<td>Ca</td>
<td>5. CV+C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Root</th>
<th>V...</th>
</tr>
</thead>
<tbody>
<tr>
<td>C...</td>
<td>2. +V</td>
</tr>
<tr>
<td>V+C</td>
<td>4. V+V</td>
</tr>
<tr>
<td>CV+C</td>
<td>6. CV+V</td>
</tr>
<tr>
<td>Ca+C</td>
<td>8. Ca+V</td>
</tr>
</tbody>
</table>

Four of these boundary types (1, 2, 3 and 5) involve morphemes that are simply concatenated. Tone association takes place and the words are syllabified. No violations of syllable or word structure occur and thus no morphophonemic changes are triggered. With the other four boundary types (4, 6, 7 and 8 outlined above), concatenation produces violations of word structure and thus morphophonemic changes are triggered. These changes either delete vowels or alter the tone-bearing status of certain segments. When these two processes occur, there are significant consequences for tonal association.

We see from (94) that there are still other boundaries between the morphemes of the verb stem. These occur where the suffixes join the root or other suffixes. It should be noted that all verb roots end in consonants and all suffixes begin with vowels. There are morphophonemic changes that take place at these boundaries also, but these changes only
involve a change in vowel quality. They do not involve either deletion of a vowel or a change in the tone-bearing status of segments. So, when these morphemes of the stem are concatenated, there are no affects on tonal association.

In this section, we will look first at examples of those types of morpheme boundary where no morphophonemic changes occur (1,2,3,5) and the association of tone is straightforward. Second, we will look at a boundary type where vowels change their status and become consonants (type 4). Third, we will look as types where vowels are simply deleted (6 and 8). Last we will look at the type (7) where consonants become syllabics.

4.3.3 Verb Tone Association
4.3.3.1 Imperatives

We will begin by looking at verbal imperatives. Imperatives represent morpheme boundary types 1 and 2 where no prefix is present and so no segmental changes are seen. However, it is important to observe for the tonal studies because it tells us what happens tonally and segmentally to free standing verb stems and helps us to identify the underlying tone on prefixes when they do occur.

There are two types of imperatives, general and directional as seen in (95) below.
(95) General Imperatives

(a) wáyif 'wash!'
    úbós 'pray!'

(b) General Imperatives
    Direccionl Imperatives
    óró 'run away!'
    ñó 'run towards!'
    ñó 'jump away!'
    ñó 'jump towards!'
    úrù 'go down!'
    úrù 'come down!'
    ñó 'carry away!'
    ñó 'carry towards!

The general imperative indicates action that is either neutral as to direction as in (95a), or shows direction away from the speaker as in (95b). About 95% of verb roots take only the general imperative and are neutral as to direction. However, about 5% of verb roots may contrast action directed away from the speaker with action directed toward the speaker also seen in (95b) above.

General Imperative: It is proposed that the general imperative morpheme is a tone-only morpheme realized by a HL melody. It is considered a replacive tonal morpheme since its presence causes the deletion of the L on the verb root. Thus, the general imperative is formed with the verb stem, its underlying root L being deleted, plus a HL suffix. An example is seen in (96) below.

(96) y +ó

L

--->

y +ó +

ASP

HL

--->

Ya

eat
ASP

eat

IMP

HL
We see in (96) above that the addition of the HL imperative morpheme has deleted the L of the verb root. Association then takes place via the AC and the Tira contour rule, just as it did in nouns (80) for the association of HL to a monosyllabic root. Syllabification has no effect on segments.

However, with application to multisyllabic stems, we can see in (97) below, that the imperative melody is really a starred melody, *HL.

(97) General Imperative with Multisyllabic Stems

(a) ap +ο X + +HL --> a.pο 'carry!'
carry ASP IMP *H L

(b) liv +ic +i X + +HL --> li.vi.ci 'steal!'
steal E1 ASP IMP *H L

(c) av +aδ +ac +i X + + +HL --> a.va.δa.ci 'squeeze!'
squeeze E1 E2 ASP IMP *H L

We see in (97) above that the morpheme composition of the imperative is the same as in (96) but that in (97a) the root is VC rather than just C and in (97b) and (97c) first one and then two extensional suffixes have been added. Once we move to multisyllabic verb stems, we see that association must take place just as it did for the starred *HL melody we saw with the nouns in (85). This is the only way the correct surface form can be obtained. Deletion of the root
low tone takes place and then association begins with application of the IAR. Next, the AC and the Tira contour and spreading rules apply, creating first the final falling tone and then the left-ward spreading of the H.

**Directional Imperatives:** In (98) below we see the formation of the directional imperative.

(98) \[ \begin{array}{c}
\text{ap} & +a & +HL \\
\text{L} & + & \text{IMP}
\end{array} \rightarrow \frac{a}{p} \frac{a}{L} \frac{H}{L} \frac{L}{L} \]

The directional imperative morpheme, a HL melody, is also a tone-only morpheme. However, unlike the general imperative, it is not starred. It also is not replacive and therefore does not delete the L of the verb root. Instead the L of the verb root plus the HL of the directional imperative creates a LHL melody. It has only been clearly found thus far on disyllabic stems. Association proceeds just as it did for the LHL melody on nouns in (82) with first the AC and then the Tira contour rule applying. A number of these were illustrated in (95b).

4.3.3.2 Boundary Types With No Morphophonemic Changes

We recall that morpheme boundary types 3 and 5 are the other two types that do not trigger morphophonemic changes. We will take type 5 as an example. This boundary type is formed when either the CV prefix \{nà-\} 'we EX' or \{nà-\} 'you
PL' is added to a consonant-initial root. An example is seen in (99) below.

(99) 녕 +녕 +ゅ  -->  녕녕녕

H  L  ASP  -->  H  L
you PL  scratch  ASP  -->  H  L

The morphemes are concatenated and association of tone proceeds with application of first the AC and then the Tira spreading rule as shown in (99) above. Syllabification then takes place without any segmental changes or affect on tone association.

4.4.3.3 Boundary Types that Change Vowels to Consonants

For the four remaining morpheme boundary types, syllabification of the concatenated morphemes leads to a number of morphophonemic changes that affect tonal association. It is here that a question concerning the ordering of tonal association and syllabification is raised.

Boundary type 4 may involve either deletion of the prefix vowel or a change in the tone-bearing status of high vowels as described in 2.3.3.4. The latter case occurs when the V prefix {ऍ-} 'I' is joined to a vowel-initial root. This is illustrated in (100) below.
We see in (100a), the morphemes that compose this verbal form. In (100b) the AC and Tira spreading rule are applied to associate all tones and TBUs. Syllabification now takes place. However the vowel sequence occurring word initial is a violation of Tira word structure since vowel sequences are not allowed within a word. This violation triggers the change of the vowel /i/ [+syllabic] to a consonant /y/ [-syllabic]. And so, a well formed word of two CV syllables is formed.

This change in the tone-bearing status of the vowel /i/, leaves the H associated to the semi-vowel /y/, a non TBU. This is a violation of the Tira parameters. So, the H is delinked and reassigned to the first vowel as seen in (100c). This, however, creates a falling contour tone on the first syllable of the word. As we noted in 3.1.1, falling tone almost never occurs on the first syllable of nouns in Tira, only on the last. The only exception is the noun /šrù/ 'hen'. Thus, another language specific rule is needed to prevent this violation from occurring. It is possible that this rule applies only to verbs. This rule is illustrated in (101) below.
(101) Falling Tone Simplification Rule

\[
\begin{align*}
** & \begin{array}{c}
\text{word} \\
\text{t} & \text{t} \\
\text{H} & \text{L}
\end{array} \quad \longrightarrow \quad \begin{array}{c}
\text{word} \\
\text{t} & \text{t} \\
\text{H} & \text{L}
\end{array} \\
\end{align*}
\]

This rule says that a sequence of H and L may not both associate to the first TBU of a word. This falling tone will be simplified to H by delinking the L.

Thus the rule in (101) forces the delinking of /a/ and the L tone as seen in (100c) in order to produce the correct surface form in (100d). The net effect of this process is that the tone which was contributed to the melody from the prefix is shifted to the vowel of the verb root.

If syllabification had taken place before association, we could have proceeded from (100b) directly to (100d). This alternative is illustrated in (102) below.

(102) \[
\begin{align*}
i & +a.p +o \quad \longrightarrow \quad y.a.p_o & \quad \longrightarrow \quad \quad y.a.p_o \\
\text{H} & \text{L} & \quad \longrightarrow \quad \text{H} & \text{L} & \quad \longrightarrow \quad \text{H} & \text{L}
\end{align*}
\]

Here we see that syllabification has been completed. Once complete, tonal association takes place without need for delinking and reassociation and without need for the added rule.

In reviewing the literature it appears that typically, application of Autosegmental theory begins by automatic association of the tones to the segmental tier before
syllabification takes place. Pulleyblank (1986:11-12) raises the question of when association conventions apply. However, his question is whether the conventions automatically reapply after syllabification issues have added or deleted vowels. The assumption is that the first application of association conventions will take place automatically and therefore before syllabification.

Goldsmith notes that all words must be syllabified in accordance with the rules for syllable and word structure (W-level phonotactic as he puts it) of the language in question. This requirement motivates a number of rules resulting in morphophonemic change. He discusses at length the kinds of rules that are triggered and later the mode of rule application that applies to such situations (Goldsmith 1990: 113, 155-57). However, he does not clearly address the issue of whether the order of syllabification and tonal association can be reversed.

However, as we have seen, if syllabification could precede association the analysis would be greatly simplified. Starting with tonal association first results in unassociated tones and/or TBUs. There is need for repair requiring extra steps in the derivation and extra language specific rules before the correct surface form can be obtained. This repair will be necessary for the three remaining boundary types also, thus applying to more than half of the occurrences of conjugated verbs in Tira. It
also occurs in a number of boundary types for nouns. This makes the issue of ordering a significant one for Tira. If syllabification were to precede association, neither the extra steps in the derivation or the falling tone simplification rule would be necessary. Nevertheless, since there seems to be no precedent in the literature for reversing the order, we will proceed with the tonal association occurring first.

4.3.3.4 Boundary Types that Trigger Vowel Deletion

Morpheme boundary types 6 and 8 are essentially the same as concerns tone association and syllabification. They both involve the loss of a vowel. They are formed when any of the prefixes of CV- or Cə- shape are joined to a vowel-initial root. An example is given in (103) below.

(103) (a)  lə  +ər  +ə  
                  H  L  ASP
                        we  DU  IN  put

(b)  lə  ar  ə  --
        H  L
(c)  l  ar  ə  --
        H  L
(d)  lə rə  
        H  L

In (103a) above we see the morphemes that make up this verb. In (103b) we see the results of applying the AC and the Tira tone spreading rule. We further see that a vowel sequence has resulted from this combination of morphemes. This is a violation of Tira word structure rules as vowel
sequences are not allowed word internal. In this case, however, the vowel can not change its tone-bearing status both because it is not a high vowel and because a consonant cluster would be created in the syllable onset. Thus, the prefix vowel is deleted but the consonant and tone are retained. The prefix tone, however, is now shifted onto the vowel of the verb root. The verb root tone is now only realized on the vowel of the suffix. Well-formed syllables and words result.

In (103c) we see that the vowel deletion has left H unassociated so re-association takes place automatically and the H is associated to the left most TBU. This creates a falling tone on the first syllable of the word which our Falling Tone Simplification Rule (101) simplifies to H by delinking the L. We see the surface form in (103d).

Again, if syllabification were allowed to precede tonal association, we could have moved from (103b) directly to (103d) without needing to repair or apply the rule in order to reach the correct surface form.

On the other hand, there is some support in the data for association preceding syllabification. Some free variation between falling and high tone on the initial syllable of a word has been observed as seen in (104) below.

(104) / lárò ~ lárò / 'we DU IN put'
This free variation would be more easily explained if the analysis allowed for a falling tone at some point in the derivation. If syllabification preceded tone association, it would never occur.

4.3.3.5 Boundary Types that Change Consonants to Syllabics

Morpheme boundary type 7 occurs when Cə prefixes {kə-} 'he', {lə-} 'we DU IN' or {lə-} 'they' are added to a consonant-initial root. In certain cases, as described in 2.3.3.2, the schwa of the prefix is deleted. The prefix consonant changes to an appropriate syllabic sonorant as detailed in 2.3.3.3, and thus becomes a TBU. An example of this case is illustrated in (105) below.

(105) (a) kə +ŋəŋ +u  
   L  L  -->  he scratch ASP

(b) kə ŋəŋ u  (c) ŋ ŋəŋ u  (d) ŋ ŋəŋ u
   L   -->   L   -->   L

Looking at (105a) and (105b) we see that the OCP has reduced a LL sequence to L. Next application of the AC and Tira tone spreading rule gives the results seen in (105b). When syllabification is attempted, morphophonemic changes are triggered as seen in (105c). First, the vowel is deleted and the /k/ assimilates to /ŋ/. A consonant cluster
results that is in violation of Tira word structure rules. So, the nasal becomes syllabic and therefore a TBU.

The segmental changes seen in (105c) leave the syllabic consonant /ŋ/ unassociated to any tone. This violates Tira parameters which state that syllabic consonants must be associated with a tone. Thus, the Tira tone spreading rule applies to associate the syllabic consonant with the L and produce the correct surface form as seen in (105d).

4.4.4 Verb Melodies

Like nouns, verbal tone melodies are based on the concatenation of the tones present in the morphemes that compose a word. What is perhaps surprising to note, is that once the OCP has applied to any sequences of identical tones, the resultant melodies realized over verbs are the same as those realized over nouns. This is true even though verbs typically may have up to five syllables and nouns only three.

Thus far, we have seen the melodies L, HL, *HL, LHL and realized on verbs. There are still three melodies that were seen on nouns that have not as yet been observed on verbs. They are H, LH and L*HL. These may be realized on other verbal aspects not yet investigated. However, they have been observed already on the 'definite' aspect when verbs are not phrase final. Thus, in the middle of a sentence, /lápɔ/ 'we DU IN brought' would be realized as /lápɔ/. Also
/ləpɔ/ 'they brought' would be realized as /ləpɔ/. Thus, we see that with the exception of L*HL, all the melodies that were realized on nouns, are also realized on verbs.

4.4 SUMMARY

In Chapter four we began with the four surface tones that were demonstrated in Chapter 3. We saw that these contrastive tones were lexically significant for nouns and grammatically significant for verbs. Then we saw that by applying autosegmental analysis to these surface tones we could discover their underlying nature. We learned that these surface tones are really derived from underlying high and low tone.

These underlying high and low tones form certain tonal patterns or melodies that expand or contract over nouns and verbs of various lengths. The melodies remain the same, but their realization on words of different lengths causes the contour tones to surface. Thus we saw that the domain of tone in Tira is the word and not the syllable.

We further saw that a tonal system that might have otherwise appeared very complex could be explained with two universal principles, tone melodies, two Tira specific parameters and four Tira specific rules.
5.0 INTRODUCTION

In this chapter we will attempt three things. First, we will provide an overall summary of Chapters 1 to 4. Second, we will make some concluding remarks regarding tone in Tira. Third, we will suggest areas for further research.

5.1 SUMMARY

In Chapter 1 the research problem and objectives were presented. The problem was to investigate the pitch patterns found in Tira and determine: 1) their phonological significance and role in the composition of morphemes and 2) their lexical and grammatical functions and how they are assigned to tone-bearing units within words.

In order to determine the phonological significance of pitch we had to define what a tone language is. Our definition of a tone language was a language in which both tonal and segmental phonemes enter into the composition of at least some morphemes.

There were eight research objectives which needed to be met in order to solve the research problem. Each had a corresponding hypothesis. The objectives were:
1) Determine the tones in Tira.
2) Determine the allotones of those tones.
3) Suggest how loudness and length interact with tone.
4) Re-examine the segmental phonemes, focus on TBUs.
5) Determine the effect of vowel deletion on tone.
6) Determine if tone has lexical and grammatical function.
7) Demonstrate how tone is assigned to TBUs in the word.
8) Show that Tira has features typical of tone languages.

During the course of research, each objective was addressed and a conclusion drawn about each hypothesis. The results can be summarized as follows.

In Chapter 2 the segmental phonemes suggested by Stevenson were re-examined and the tone-bearing units identified. Our hypothesis that Tira had eight vowel phonemes was correct. In addition we identified 24 consonant phonemes. Our hypothesis concerning the presence of syllabic consonants proved correct only we did not anticipate there would be as many as five sonorants that could become [+syllabic] and thereby fill the nuclei of syllables. Thus, Objective 4 was met.

Further in Chapter 2 we defined the structure of morphemes, syllables and words. We saw that tone does play a role in the composition of many morphemes. Other morphemes are toneless and still others consist of tone only. We also saw the interaction of morpheme structure, syllable structure and word structure. We learned that well-formed words do not allow vowel sequences and only certain consonant clusters are allowed underlyingly.
We also saw that when morphemes concatenate, vowel sequences may result in violation of Tira word structure rules. The violation causes vowels either to become consonants [-syllabic] or to be deleted thus reducing the number of tone-bearing units in a word.

Vowel deletion results in derived consonant clusters word initial which also violates word structure. Thus some consonants become [+syllabic] and are able to bear tone. The hypothesis that vowel loss would lead to consonant clusters and syllabic consonant formation was correct, but the assertion that it would lead to epenthetic vowel insertion was incorrect. Instead we saw that the 'epenthetic' schwa is present underlyingly in certain prefixes. So, Objective 5 was met in part by determining how vowel deletion affects tone-bearing units.

In Chapter 3 we saw that there were four contrastive surface tones in Tira: high, low, falling and rising. We also saw that downstepped high is present at least at the phrase level. Phonetic tonal processes included downdrift, downglide and depressor consonants. Thus, Objectives 1 and 2, which called for determining the tones and allotones, were met. The hypothesis that allotones would result due to influence from other tones and certain segments proved correct. However, the presence of the downstepped high was unexpected.
Of the three suprasegmentals -- tone, length and loudness -- we found that only tone can be clearly shown to be phonologically significant. However, there is some evidence that length (duration) may be contrastive. Thus, we met Objective 3 by suggesting how length and loudness relate to tone but the phonological significance of length is unclear.

Also in Chapter 3 we found that Tira displays at least five of the six features indentified by Hyman and Welmers as typical of tone languages. The five features are: 1) tones contrast in identical environments; 2) tones are influenced by adjacent consonants; 3) some words have all high tones while others have all low; 4) some words end in high tone; and 5) tonal phonemes contribute to the composition of some morphemes. We concluded as hypothesized, that Tira is indeed a tone language and so met Objective 8. At this point we had also solved the first half of the research problem: specifically we had showed that pitch is phonologically distinctive and that it enters into the composition of at least some morphemes.

In Chapter 4 we saw that the surface tones have lexical function in nouns and grammatical function in verbs. This conclusion satisfies Objective 6, showing as was hypothesized, that tone in Tira signals both lexical and grammatical meaning.
We also saw how Tira uses a limited number of tonal patterns or melodies and realizes them on whole words. The melodies are the same for nouns and verbs. We demonstrated how underlyingly only high and low tones are necessary to account for all surface tones, both level and contour tones. The melodies are H, L, HL, LH, and LHL. The processes of associating the individual tones in these melodies with tone-bearing units (i.e. [+syllabic] segments) in the words were specified. These processes included application of the Well-Formedness Condition, the universal Association Conventions, the Obligatory Contour Principle, two Tira specific tonal parameters, four Tira specific association rules and two starred melodies *HL and L*HL. These processes account for all tonal patterns found thus far in the language. Thus Objective 7 has been met, confirming our hypothesis that understanding of the tonal system would be aided by autosegmental analysis. Also Objective 1 was met confirming our hypothesis that Tira has only underlying high and low tone.

Finally, the effects of vowel deletion on tone were seen. We saw that deletion of stem vowels, lead to contour tone formation as was hypothesized. However, we also saw that prefix vowel deletion lead to tone shifting its association to the root vowel or to the prefix consonant which had become [+syllabic]. This process of tone shifting was not an anticipated result of vowel deletion.
Thus, the second half of the research problem regarding lexical and grammatical functions of tone, and the assignment of tones to tone-bearing units was addressed. Both parts of the research problem were solved and Objectives 1 through 8 were met.

4.2 CONCLUSIONS

We conclude then that Tira is a tone language. Tone is phonologically significant and tonal phonemes enter into the composition of morphemes. Tone signals lexical distinctions in noun roots and grammatical distinctions of aspect, direction, person and number in verbs. Both vowels and syllabic consonants fill the nuclei of Tira syllables and thus are the tone-bearers in words.

There are two underlying tones in Tira, low and high. These tones are distributed in tonal melodies realized over nouns and verbs. Realization of these melodies on words of various lengths leads to the surfacing of the contour tones. Vowel deletion triggered by various causes is another cause of contour tone formation and leads to tone shifting and syllabic consonant formation.

Tira displays those characteristics which show it to be a lexical tone language. However, the presence of starred melodies and falling tone simplification which restricts falling surface tone to the final syllable of a word suggest that Tira may be in transition to a pitch-accent system.
5.3 RECOMMENDATIONS FOR FURTHER STUDY

There have been a number of areas touched on in the course of this research that have raised questions for further study. First, at the word level, the study of noun tone for three and four syllable nouns is incomplete. One would look particularly for any other apparent violations of the Obligatory Contour Principle that would lead to starred melodies. The tonal patterns for the other verbal aspects also needs investigation.

Second, at the phrase level, perturbations of noun tone in noun phrases was not addressed although preliminary investigation showed it to be present. Also, there was indication of anaphoric reference and location in noun phrases being indicated only by tone. The relation of modals and clitics to the verb also needs exploration. Last, there is a tonal distinction between phrase final and medial utterances that seems to neutralize the lexical distinctions on nouns. This process is not well understood at the moment, but may be another indication of some move toward a pitch-accent system.
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