A STUDY OF TONE AND LENGTH IN LUBUKUSU AND LULOGOOLI DIALECTS OF LULUYIA

by

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DECLARATION

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

Mwanda.

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This dissertation has been submitted with my approval as the University Supervisor:

SUPERVISOR: _____

DR. KIMANI NJOROGE 2/12/96

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J.M.W.

July, 1995.

DEDICATION

To

My father

Whose words of wisdom

Led me by the hand

To the path that is right

My mother

Whose endearing spiritual support

Saw me smile through

Against gigantic odds

My brothers

With whom together we learnt

To so patiently wade

In the mucky waters of life

My sisters

With whom together we joined

The endless fight against

A corrupt rooted culture

Hellen

Who together we conspired

To endure the tribulations

Of the emeralded highways

Little Faith

Whose smiles of innocence

Was a reminder so constant

Of the value of it all

Yet finally still

The intellectual circles

Within which always we grapple

For greater academic ascendancy

And knowledge so perfected.

ABSTRACT

This work is an attempt to investigate and establish the nature and functions of the prosodic features of tone and length in Lubukusu and Lulogooli dialects of Luluyia using the principles of Autosegmental Phonology.

In chapter one a preliminary survey of the language is given followed by an overview of the principles of the Autosegmental Theory as opposed to the unidimensional generative Sound Patterns of English (SPE) model. The second chapter is a review of relevant literature while in chapters three and four a scientific analysis of the prosodies is made. In these chapters tone and length in Lubukusu and Lulogooli are found to be phonemic, specifiable and best represented on autonomous phonological tiers from the segmental tier on which segmental phonemes are represented. Overall speech output is given as a product of the complementary activities of these tiers whose elements are associated with syllables and larger morphosyntactic units.

In the fifth and last chapter an evaluation of the viability of a multilinear approach over the generative SPE edifice is made and conclusion reached that the Autosegmental Theory, together with insights borrowed from Metrical and Multidimensional Phonology, adequately account for the phenomenologies of tone and length in Lubukusu and Lulogooli in a unified and principled way.

TABLE OF CONTENTS

List of Diagrams

List of maps

List of tables

List of figures

List of abbreviations

AL	Autosegmental licensing
AP	Autosegmental Phonology
cps	Cycles per second
H	High tone
Hz	Hertz
IPA	International Phonetic Alphabet
L	Low tone
ms	milliseconds
OCP	Obligatory Contour Principle
SPE	Sound Patterns of English
TGP	Transformational Generative Phonology
WFC	Well Formedness Condition

CHAPTER ONE

1.0. INTRODUCTION

1.1. BACKGROUND TO THE LANGUAGE

Lubukusu and Lulogooli are the largest dialects of Luluyia language which is spoken by people in Western province and a small part of Rift Valley province. These people inhabit Bungoma and Vihiga districts in Western province and parts of Trans Nzoia in the Rift Valley province. The entire area which is inhabited by speakers of this language covers over 3,000 square miles (4,800 sq. km.) between the equator and latitude 1.2^0N and longitudes 34^0E and 35.2^0E.

Luluyia is a Bantu language whose speakers belong to a group historically referred to as the Interlacustrine Bantu (Osaka Odaka, 1971:21). The Babukusu settled along the southern slopes of Mt.Masaaba (Mt.Elgon) in Bungoma and parts of Trans-Nzoia while the Balogooli settled in present day Vihiga district. Essentially, as can be witnessed from maps 1(a) and 1(b) (see pages 20 and 21) Luluyia dialects could be described in sociolinguistic terms as 'regional dialects'.

According to the 1991 statistical abstracts which reflect the 1989 population census Luluyia speakers number two million, five hundred and forty-seven thousand (2,547,000). This figure excludes the various Luluyia speaking peoples who live outside Western province and Trans-Nzoia district. Basing on the population of the various dialect speakers Makila(1978:31) says that "Bukusu is the largest single ethnic unit of Buluyia nation,

being followed by Barakoli[1] and Bawanga respectively". Were (1967:155), Angogo (1983:80) and Kasaya (1992:1) agree that Luluyia has seventeen dialects. Some scholars have attempted to sub-devide these seventeen dialects into the northern, central and southern dialects, a breakdown which Angogo(1983) claims was based upon intelligibility tests and attitudes of the speakers of the various dialects. These subdivisions are reflected in diagram (I) below:

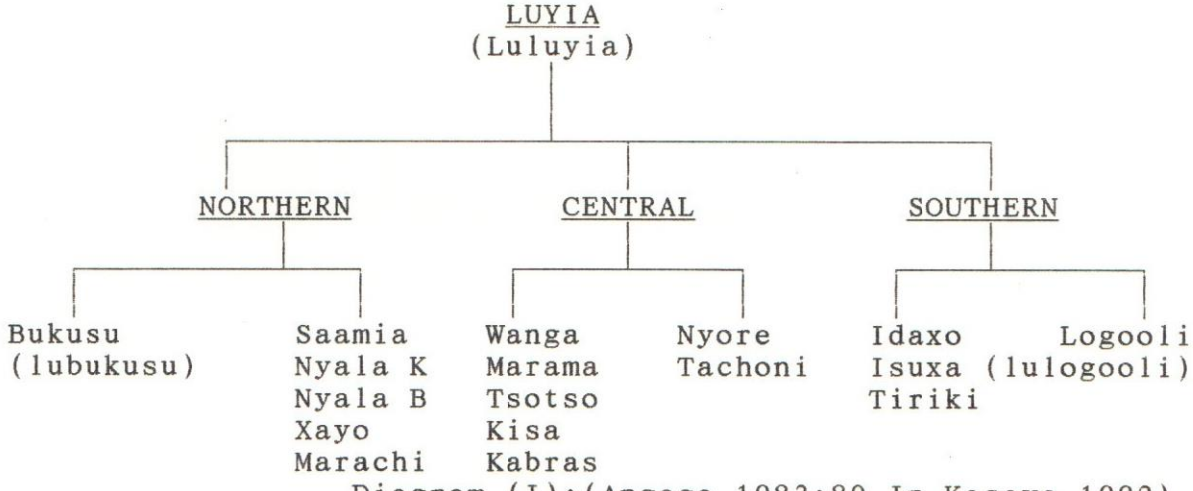

Diagram (I):(Angogo,1983:80,In Kasaya,1992)

Interestingly the adminstrative units (i.e. locational divisions) of Western Province and Trans-Nzoia district seem to geographically coincide with these dialect divisions [see maps 1(a) and 1(b) on page 20 and 21 respectively]. For purposes of this study only Lubukusu and Lulogooli were be considered.

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[1].'Barakoli' in this study are refered to as 'Balogooli'.

1.2. BACKGROUND TO THE STUDY

This study dealt with aspects of the phonological systems of Lubukusu and Lulogooli dialects of Luluyia language. Briefly, phonology is the study of sound systems of particular languages, that is, speech sounds and how they are realized and used in a language. Every language, therefore, must have a phonology - an inventory of sound segments and prosodic features which are structured in specific combinations and constrained in specific ways to function or bring about meaning in the language. A major distinction is often drawn in contemporary phonological analysis, namely, the dual division between segmental phonology and non-segmental phonology.

This study was based on the theory of non-segmentalism. However, it is important to gain an insight into the operations of segmental theories. This is because non-segmental aspects function concurrently with segmental aspects, albeit at different levels, to constitute speech.

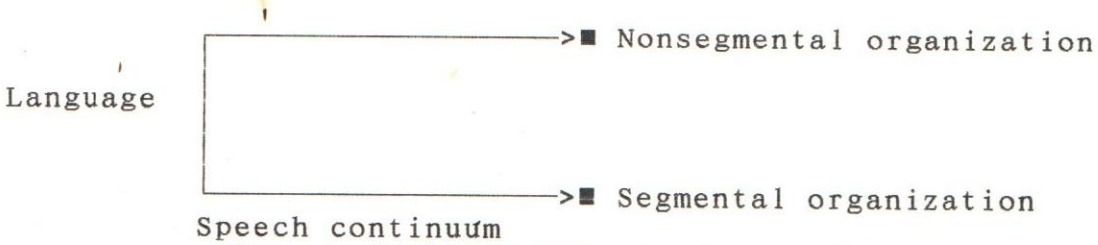


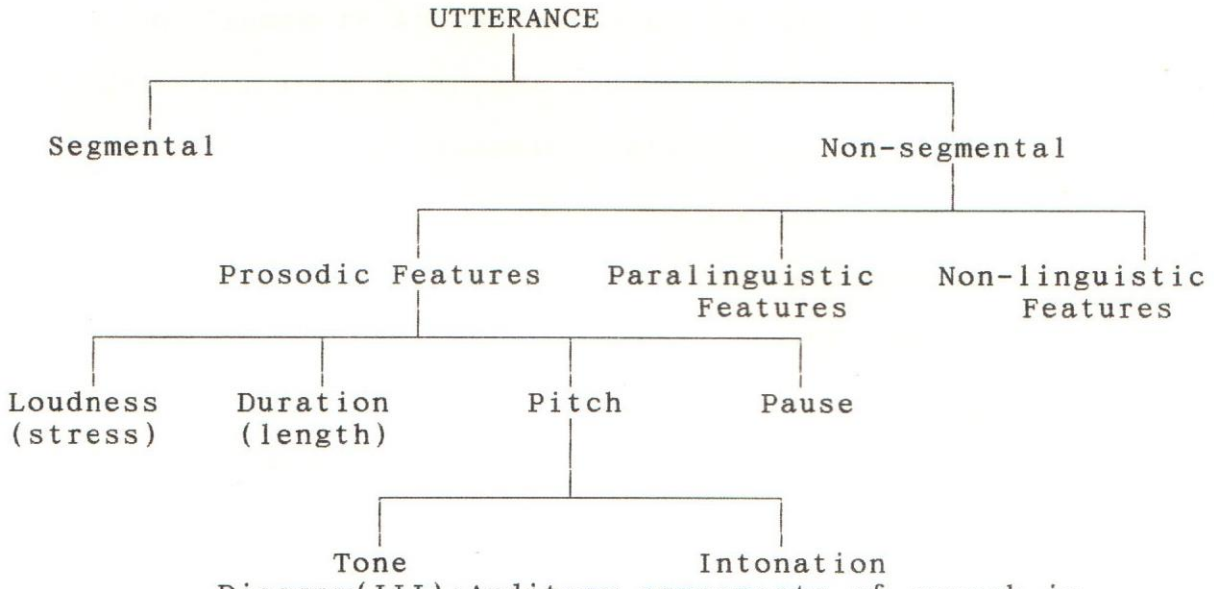
Diagram (II): Phonological organization of speech

A strictly segmental approach to phonology lays emphasis on the existence of the segment as the smallest structural unit of language. In the relevant literature sighted in this work (Chomsky and Halle,1968; Crystal,1987; Hyman,1975; Trubetskoy,1939) 'segment' is technically used to mean 'phoneme' which the Prague School defines as a minimal unit endowed with

a 'distinctive function'. Within the generative Sound Patterns of English (SPE) model (Chomsky and Halle,1968) the phoneme is viewed as the indivisible sound unit of language which can be described in terms of features.

The classical SPE model is a segmental theory which assumes that every language has a small set of sounds whose function is to distinguish words from one another; it is a structuralist model which further assumes that the building blocks of a language are segmental phonemes and that their identification is of utmost importance to the linguist. In Lubukusu, for instance, /e/ and /a/ are distinctive sounds or phonemes because they function to semantically distinguish /rema/ ('chop') from /rama/ ('remain'). Phonemes occur in a linear sequence according to both universal constraints and language specific phonotactic rules, even though each phoneme is composed of simultaneously occurring features. Segmental theories thus emphasize the existence of consonants and vowels which are uttered in specific sequences to constitute speech.

Nonsegmental approaches deal with aspects of phonology other than the segments. In recent years the development of a variety of non-linear frameworks, including Autosegmental Phonology, Metrical Phonology, Multidimensional Phonology and Dependency Phonology among others, have fundamentally questioned the adequacy of segmental or linear theories in handling non-linear aspects of the speech make-up. As early as 1969 it was clear that speech in communication is made up of segmental as well as non-segmental features as exemplified below:



Diagram(III):Auditory components of speech in communication (modified from Crystal,1969:131)

The chief nonsegmental features of language in communication are prosodies or prosodic features which have traditionally been referred to as **suprasegmentals.** The term suprasegmental is used to refer to those aspects of speech that involve more than just single consonants and vowels; it refers to vocal effects which extend over more than one sound or phoneme. Crystal (1990) argues that a suprasegment can logically be seen as a 'plurisegment' or 'superfix'. Among the major suprasegmentals of language are stress, length, tone and intonation. These aspects of phonology had been largely ignored prior to the emergence of non-linear models, much to the advantage of structural linguists who maintained the view that the building blocks of a language are **phonemes** and that their identification is of utmost importance in phonological endeavour.

For purposes of this study suprasegmentals are referred to simply as PROSODIC FEATURES. This is because the term suprasegmental is a structuralist term that is tied to segments

while the framework which this study employed seeks to divorce prosodic features from the segmentals of language. Durand (1990:256) says that prosodic features are phonetic properties best thought of as not being tied to segments but rather span various domains defined in metrical or morphosyntactic terms.

Thus, before the revolution that saw the emergence of non-linear phonology the basic view that had been overlooked was the fact that total understanding of a language must entail a mastery of how the prosodic features structure and function in the language. This study was specifically tailored to deal with the non-linear aspects of tone and length within the framework of AUTOSEGMENTAL PHONOLOGY. It was hoped that with specific examples drawn from Lubukusu and Lulogooli dialects of Luluyia language the findings would serve as a further reaction against the inadequacies of unidimentional or linear models of phonological analysis.

1.3. STATEMENT OF THE PROBLEM

This study investigated the nature and functions of the prosodic features of tone and length in the Luluyia dialects of Lubukusu and Lulogooli with a view to establishing whether or not these features are distinctive and how they are used in the dialects under analysis. The study further sought to establish, with natural and formal evidence, whether these features can be treated as AUTOSEGMENTS which are independent from the other features of which the segment is composed. By so doing the study has assessed the validity of the universal claims made by

autosegmental theorists like Cook,1987; Durand,1990; Goldsmith,1976,1990; and Katamba,1989, about prosodic features and prosodic processes. One such universal claim is that prosodic features function autonomously from the segmentals of language (Durand,1990:244; Katamba,1989:196: c.f.1.8.0.).

To illustrate the kind of problem that this study investigated it is imperative to look at an example from one of the dialects under analysis. In Lubukusu, for instance, the words for 'ear' and 'banana leaf' are both phonemically transcribed as /liru/. However, it would be erroneous to assume that this word is ambiguous and that the semantic difference between the two words it stands for can be percieved only in context. The following phonetic realizations with tonal indications give further insight into this:

(i) /liru/ [lírú] 'an ear'

(ii) /liru/ [lírù] 'a banana leaf'

Despite the structural similarity between (i) and (ii) there is clearly a meaning contrast brought about by the disparity of tone on the second syllable of both forms which is not indicated in the orthographic or phonemic forms. It could well be postulated that [ú] and [ù] are phonetic realizations of two different phonemes. This, it could be explained, is because the meaning contrast between the two examples above is brought about by the substitution of the high-toned high back vowel [ú] by the low-toned high back vowel [ù]. The problem with such a position is twofold: first, proponents of the autosgmental approach postulate that tone is syllabic. Tones are seen to be associated with key elements within syllables, that is, the tone-bearing units. These

are typically vowels though other segment types like liquids and nasals can also bear tone. Secondly, the vowel inventory of Lubukusu has only one high back vowel /u/. The high and low tones in the dialect cannot therefore be merged to such a single vowel to produce two different vowels. The alternative explanation which this study investigated was whether the high and low tones in this dialect function distinctively, and whether they can be completely divorced from the segmental make-up of the dialect (c.f.3.0.). The tones seemed to behave as if they belonged to a seperate level or tier in relation to the other features of which the segments are composed.

1.4. HYPOTHESES

(i) Tone and Length in Lubukusu and Lulogooli dialects of Luluyia are phonemic and occur in sequentially constrained patterns;

(ii) Tone and Length in Lubukusu and Lulogooli dialects of Luluyia are autosegments;

(iii) Tone and Length in Lubukusu and Lulogooli dialects can adequately be captured and accounted for within the autosegmental framework.

1.5. SCOPE AND LIMITATIONS OF THE STUDY

Fromkin and Rodman(1988) state quite simply that

> Grammar includes everythig speakers know about their language - the sound system, called PHONOLOGY; the system of meaning, called SEMANTICS; the rules of word formation, called MORPHOLOGY; and the rules of sentence formation, called SYNTAX.
>
> (p:17)

This study was confined to the area of language study known as PHONOLOGY.

In phonological inquiry language is seen as a combination of several activities - the segmental activity and the non-segmental activity. The nonsegmental activity can be either linguistic, non-linguistic or paralinguistic. This study was specifically tailored to deal with nonsegmental linguistic activity which in the relevant literature is referred to as PROSODIC PHONOLOGY.

One major limitation of this study was that it was conducted in only two of the seventeen dialects of Luluyia. Due to limitations on time and resources it was not possible to carry out a study on all the seventeen dialects. Thus, Lubukusu was sampled from the northern dialects and Lulogooli from the southern dialects. It was hoped that this sampling procedure would highly reduce inaccuracy in the generalizations made by providing data from the two Luluyia subdivisions which are considered to be furthest removed from each other in terms of intelligibility.

Another limitation was the fact that, given the time limit within which the study was to be conducted, a wholistic approach to the analysis of prosodic features was not possible (c.f.

diagram (iv) below). As a result the scope of this study was restricted to the features of tone and length. These were analysed from within the framework of Autosegmental Phonology. Furthermore, only synchronic forms of these aspects were considered despite their being appreciably the product of diachronic changes through time.

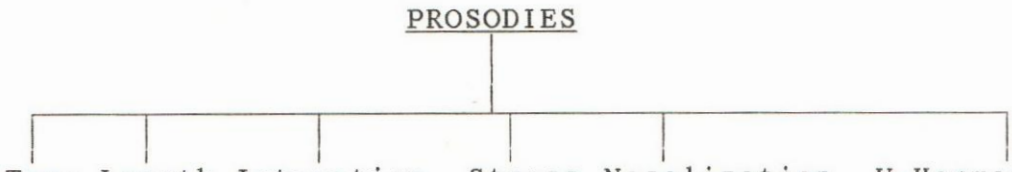


Diagram (iv): The scope of prosody

Of even greater significance is the fact that employing an instrumentalist approach as the data analysis technique was both expensive and time consuming. This is due to the fact that the computer cecil package for acoustic data analysis was (and is) not locally available. Relevant data for this dissertation therefore had to be sent to the University of Illinois, subsequently to Ohio State University, U.S.A., for analysis, with the consequent factors of air freight charges and extra time lapse to allow for the two-way parcel delivery and spectroanalysis.

1.6. OBJECTIVES

The aims of this study were to:

(i) determine whether the prosodic features of tone and length in Lubukusu and Lulogooli are phonemic and whether they occur in any specifiable patterns;

(ii) establish whether tone and length in Lubukusu and Lulogooli

are **autosegments;**

(iii) evaluate the adequacy of the framework of autosegmental phonology in explicating the phenomena of tone and length in the dialects.

1.7. JUSTIFICATION

Several reasons can be put forward to justify a phonological study of prosodic features in Lubukusu and Lulogooli. One major reason is that to date no work of this kind has been carried out in these dialects, or more generally, in Luluyia language. Studies which have been carried out on the phonologies of Lubukusu and/or Lulogooli include De Blois(1975); Mutonyi (1986); and Kasaya(1992). Mutonyi(op.cit.) studied the morphophonological processes involving consonants in Lubukusu and therefore only touches on a part of the segmental base from which this study proceeds.

Kasaya(op.cit) concentrated on the major phonological processes in Lulogooli, Luwanga and Lubukusu. Kasaya(Ibid), however, dwells largely on consonantal processes and only mentions the prosodic feature of length in passing. De Blois(op.cit.) deals with Lubukusu generative phonology but does so by largely dwelling on consonantal and vowel processes. He singles out the phenomena of tone but handles it from the generative model devised by Chomsky and Halle (1968).

Moreover, the work by De Blois(Ibid) is based entirely on auditory analysis which is rather unscientific and too impressionistic. Instrumentalists have long argued that even

those trained to listen to pitch patterns in language will hear only that which they have been trained to hear, hence propagating prosodic myths. On the contrary, this study employs an instrumental approach to the study of tone and length in the dialects under focus. An instrumental approach involves procedural computer spectroanalysis of relevant data and gives precise and verifiable measurements. Such precise instrumental measurements are scientifically respectable, making this study highly justifiable over any previous attempts at prosodic analyses of some Kenyan languages which have been wholly based on auditory analyses.

The studies mentioned above reveal that much work has been done on segmentals, unfortunately at the expense of studies on prosodies. This work is an attempt to bridge this gap since it will, in a scientific and systematic manner, analyse tone and length in Lubukusu and Lulogooli dialects. Of importance here is the debate raised in recent literature on prosodic phonology which clearly indicate that the role of prosodies in language needs to be re-emphasized and, if possible, redefined and given a new place in linguistic inquiry. Clark and Yallop justify this assertion in the following way:

> The implication that suprasegmentals are somehow superimposed on a basic message of consonants and vowels is decidedly misleading, given that prosody is an integral part of speech production and often a fully meaningful contribution to the message itself.
> (Clark and Yallop,1990:276)

Another justification of this study is that it employed a current theoretical framework which has not been exhaustively applied in linguistic studies. Preference for an autosegmental

rather than generative base as the descriptive tool emanates from the observed inadequacies of generative models to handle prosodic phenomena like tone stability and independence (c.f.1.8.). Furthemore, Autosegmental Phonology has been central in recent and current debate on the place of prosodic features in natural languages. Consequently, much research is needed to qualify or modulate the authenticity of the universal claims made by autosegmental theorists, which is what this study attempted to fulfil.

1.8. THEORETICAL FRAMEWORK

The theoretical model that was employed in this study is that of Autosegmental Phonology (Goldsmith,1976;1990). The Autosegmental framework is a break away from the unidimensional Sound Patterns of English generative framework devised by Chomsky and Halle (1968) which has been found to be inadequate by non-linear phonologists (Cook,1987; Durand,op.cit; Goldsmith,op.cit) in the analysis of non-linear phonology. In Transformational Generative Phonology (TGP) prosodic features were seen as features just like any other features in the distinctive feature matrixes. Phonological representations were simply depicted as a linear arrangement of sound segments, each segment being composed of simultaneously occurring features. Furthermore, it was assumed that phonological rules operate on such strings, deleting, permuting and inserting segments, or changing their feature values. The tonal feature [+High], for instance, was taken just like [+coronal] or [+anterior]. Thus, for instance,

sequences like [bá],[bà] and [ba] could be analysed in the following way:

	b	á	b	à	b	a
Syllabic	-	+	-	+	-	+
Consonantal	+	-	+	-	+	-
Sonorant	-	+	-	+	-	+
Anterior	+		+		+	
Coronal	-	-	-	-	-	-
High		+		-		-
Low		-		+		-

(Durand,1990:243).

In SPE therefore, it was assumed that superimposed on the segmental layer were other phenomena such as tone, stress and length. The **absolute slicing hypothesis** was highly entertained. This is the claim that speech can be exhaustively sliced into sounds or segments which consist of unordered bundles of features which are linearly ordered (Katamba,1989). These bundles of features are the internal feature specifications of segments, such as for instance [+/-consonantal], [+/-continuant], [+/-coronal], and [+/-sonorant].

AP offers a radical reaction against this hypothesis. This is because the hypothesis cannot be extended to phenomena such as pitch. Pitch cannot be vertically sliced and allocated to a single segment without any leakage into adjacent segments. The SPE edifice is further attacked by Durand (op.cit) and Goldsmith (1990) who say that if prosodic features like tone, stress and length are considered to be mere features of segments some striking generalizations like tone stability and independence are missed. This observation renders TGP inadequate as a theoretical tool with which to capture prosodic processes, since,

> The long-range goal of theoretical linguistics is to formulate a theory that is just powerful enough to describe correctly all the facts of natural language. (Hooper, 1976:4, In Kasaya, op.cit:14).

The alternative model proposed to analyse the behaviour of prosodic features is the **autosegmental framework** first postulated by non-linear and subsequently developed by multidimensional phonologists. **'Autosegmental phonology'(AP)** is the brainchild of Goldsmith (1976) who is concerned with "phenomena that have evaded segmental classification"(p.6). The basic assumption of this framework is that prosodic features operate at a separate level of activity from that of 'segmental' phonemes (Cook, 1987; Crystal, 1990; Goldsmith, 1990).

The fundamental point in AP is that speech consists of a series of concurrent activities which can be captured from a multilinear approach in which different features may be placed on adjacent tiers (Goldsmith, 1979:202). Features such as tone, length, stress and vowel harmony have been observed to span domains of varying sizes - from portions of syllables to whole syllables, feet and words - and are considered independent from other features making up segmental phonemes. Durand (1990:256) says that some phonetic properties best thought of as prosodies are not tied to segments but rather span various domains defined in metrical or morphosyntactic terms. Consequently such features are treated as **'autosegments'** and are represented on the autosegmental tier which is separate from the segmental tier on which segmental phonemes are represented.

Among the Universal claims made by Autosegmental theorists are that:

i) All autosegments must be phonemic or contrastive;

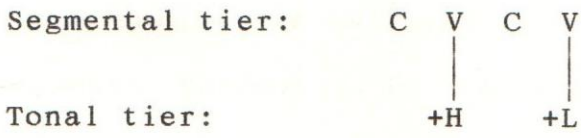
ii) All autosegments are manifested on syllables and larger morphosyntactic units though they are basically marked on vowels;

iii) All autosegments occur in a systematic and specifiable manner, guided for instance by the Obligatory Contour Principle (OCP);

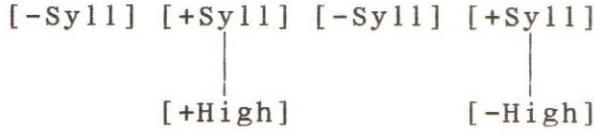
iv) All autosegments are autonomous from the segmental makeup of speech.

Within this framework, autosegmental and segmental tiers are connected to each other by association lines, which allow that there may not always be a neat one-to-one mapping between tiers. Clark and Yallop (1990:345) say that the formalism of AP was much aided by Consonant-Vowel Phonology developed by Kahn (1980) and Clements and Keyser (1983) who postulated the notion of a CV tier. This tier, often also referred to as the skeletal tier, has as its basic elements vowel and consonant 'slots' which are filled by segments. These segments are mapped to the autosegmental tier by association lines. Durand (1990:242) says that the CV tier can be seen as an anchor or a device which relates the internal content of segments to other types of information.

In tone languages, for instance, tones can be seen as autosegments and are represented on a separate tier - the tonal tier - on which each segment is specified for tone and nothing else. The segments on the non-tonal tier are specified for all other features as exemplified below:



This information can be anchored in feature specifications as:



Each feature that plays a role in language appears on exactly one tier. A tier can be defined by which features are found on it.

Within the autosegmental framework, therefore, phonology is seen as a multi-tiered activity comprising several 'tiers', each tier consisting of a linear arrangement of "features". These "features" are linked to each other by association lines which indicate, via association rules, how they are to be 'licenced' or 'coarticulated'(c.f.2.4.). Thus, argues Goldsmith (1990), the basic notion of "coregistration or simulataneiety in time" in prosodic phonology is adequately catered for.

The system of AP was originally suited to fit the intricacies of African tone languages. Bantu languages such as Igbo, Bakwiri and Igala in Nigeria, Luganda in Uganda and Luluyia and Kikamba in Kenya are examples of such tone languages. However, various works developing the autosegmental framework (Clements,1977; Goldsmith,1984; Cook,1987) show how it can be applied to other phenomena such as vowel harmony, stress, length, intonation, nasality and flattening.

This study attempted an autosegmental analysis of tone and length in Lubukusu and Lulogooli dialects of Luluyia. Preference for the Autosegmental theory emanated from the fact that it is a theory of prosodic phonology unlike other theories like TGP

which was originally tailored as a theory of general grammar. Autosegmental phonology, for instance, makes strong claims about the autonomy of prosodic features which this study, with data from a natural language, aimed to investigate.

1.9. METHODOLOGY

The first part of this study utilized library research techniques. A critical review of previous literature on the topic under analysis was attempted. The second part of the study entailed field research. The services of Research Assistants were employed in the elicitation and collection of data from the Babukusu and Balogooli respondents from Bungoma and Vihiga districts respectively. The study was conducted in a cross-sectional manner.

1.9.1. Sample Selection

Both random and stratified sampling procedures were used in selecting the subjects interviewd. The subjects were selected from the two main regional settlements of the speakers of the dialects under analysis, namely, Bungoma and Vihiga districts. A total of thirty six subjects were interviewed, eighteen from each region. Each sample of eighteen was stratified along the dimensions of age and sex as follows:

10-30 years	31-50 years	Over 50 years
6 subjects	6 subjects	6 subjects
3 male/3 female	3 male/3 female	3 male/3 female

At least half of the subjects inteviewed were literate, that is, they were either secondary or post secondary students.

It is worth noting here that the variables of literacy, age and sex were not in any way the focus of this research. However, the selected respondents were stratified along these dimensions on the strict logic of yielding a truely representative cross-sectional sample.

1.9.2. Instrumentation and Data Collection

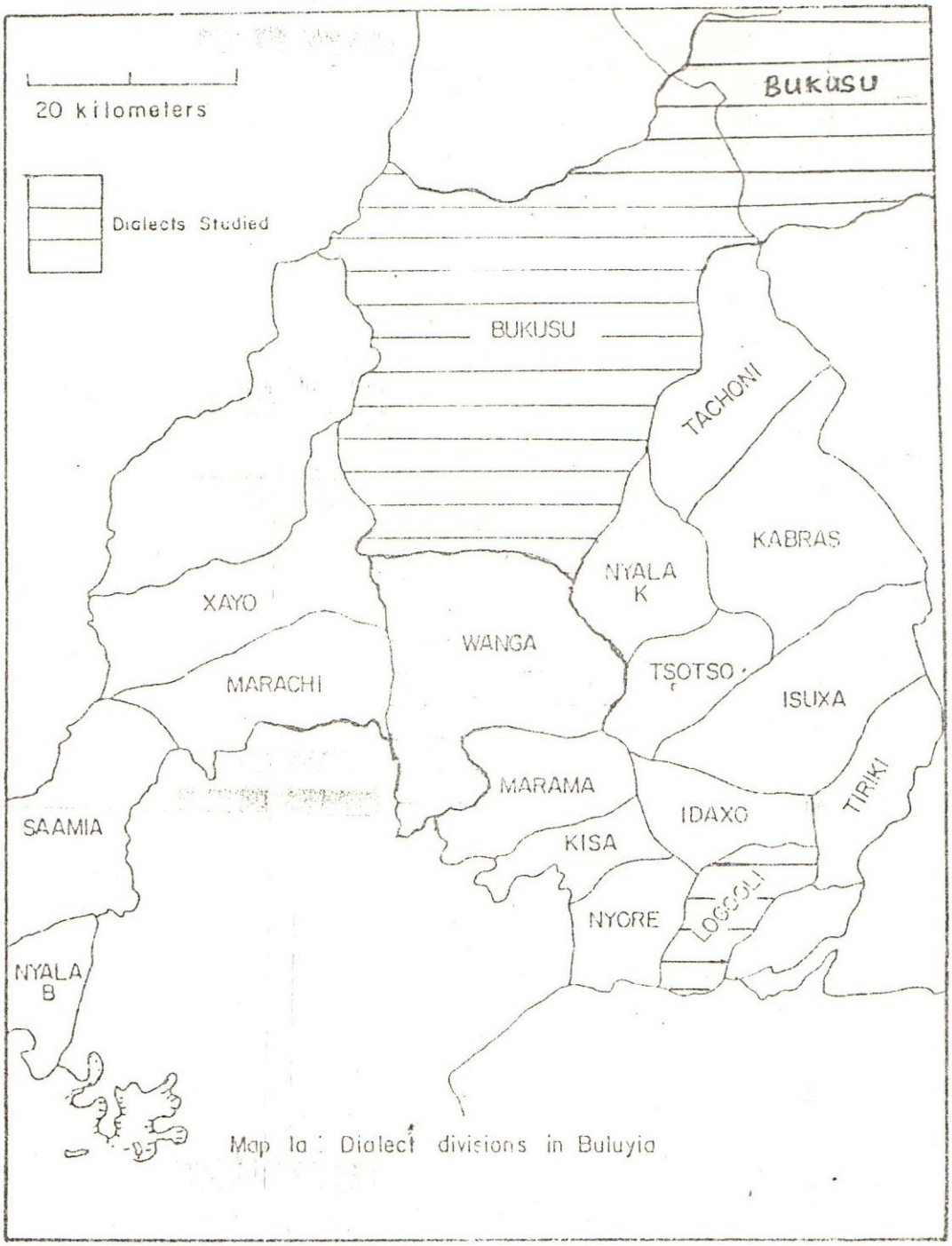
The main data elicitation instrument was oral interviewing. An interview schedule program (c.f.appendix II) was administered to literate respondents and oral discussions generated on the same. Non-literate respondents were orally interviewed directly. The responses of respondents were tape-recorded as data.

1.9.3. Data Analysis

Data from the recorded compact cassettes was replayed and transcribed in phonetic form. Decoding of the data was done scientifically with help of computer technology and the analytic principles of Autosegmental Phonology applied.

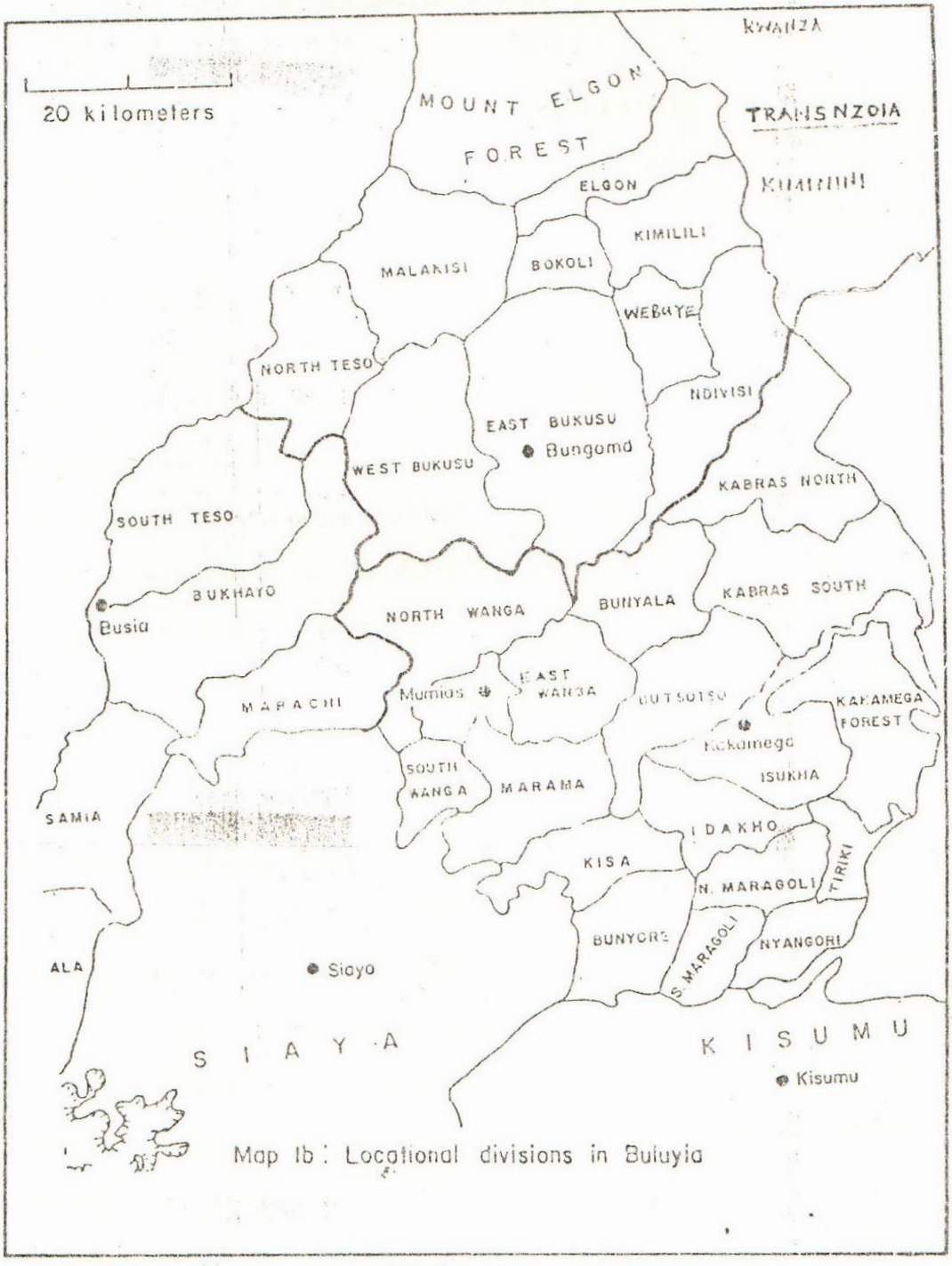
Note:

In the maps on pages 20 and 21 the term "Buluyia" refers to the entire area inhabited by Luluyia-speaking peoples.



Map 1a : Dialect divisions in Buluyia

Source : Adapted from Angogo (1983)



Map Ib: Locational divisions in Buluyia

Source: Adapted from Angogo (1983)

CHAPTER TWO

2.0. PROSODIC FEATURES AND AUTOSEGMENTAL PHONOLOGY

2.1. INTRODUCTION

Several claims made in theoretical linguistics about prosodic features were considered relevant to this study. Literature on the phonology of Lubukusu and Lulogooli, and Luluyia language in general, was also considered relevant to our purpose. Also relevant were the claims made by Autosegmental (Goldsmith, 1976,1990; Cook,1987) and non-linear theorists (Durand,1990; Katamba,1989) who provide the framework within which this study was conducted. This section is a review of this related literature and is devided into three sections as follows:

(i) Phonetic inventory

(ii) Prosodic features

(iii) Autosegmental Phonology.

2.2. PHONETIC INVENTORY

It is necessary to introduce the phonetic inventories of Lubukusu and Lulogooli dialects. First, as earlier highlighted in chapter one, there exist a distinction between segmental and prosodic elements. It was also noted that any attempt to analyse prosodic phenomena must necessarily entail sound knowlegdge of segmental elements. What then, are the segmental elements that will be of use, and what are the prosodic elements that will be analysed in this study? Briefly, the answer to this question is that the segmental elements are the consonantal and vowel systems of the dialects while the prosodic elements are the features of

tone and length.

2.2.1. Consonantal Elements

The sound systems of the two dialects differ slightly. Lubukusu has twenty distinct consonantal elements which occur in the following manner: three plosives, four nasals, four fricatives, one affricate, one trill, one lateral, two glides, and four nasal compounds. Lulogooli has a wider range of non-vocalic segments since it has twenty-eight consonantals. This dialect has six plosives, four nasals, six fricatives, three affricates, one trill, one lateral, two glides, and five nasal compounds.

A classification of the sounds of the two dialects according to the parameters of place and manner of articulation is tabulated below. In these dialects stops are categorized into two groups: oral stops and nasal stops. Oral stops include plosives and affricates while nasal stops include pure nasals (also referred to as nasal non-compounds) and nasal-compounds (also referred to as prenasalized stops).

LUBUKUSU

(Table I)

	bilabial	Labio-dental	Alveolar	Palato-alveolar	Palatal	Velar
plosives	p		t			k
Nasals	m		n		n	ŋ
Fricatives	β	f	s			x
Affricates				t		
Trill (liquid)			r			
Lateral (liquid)			l			
Glides	w				j	
Nas.Comp.	mb		nd	ɲʃ		ŋg

(Source: Adapted from Kasaya, 1992: 24)

LULOGOOLI
(Table II)

	Bi-labial	Labio-dental	Alveolar	Palato-alveolar	Palatal	Velar	Glottal
Plosives	p,b		t , d			k , g	
Nasals	m		n		ɲ	n	
Fricatives	β	f	s , z				h
Affricates			dz	tʃ , dʒ			
Trill (liquid)			r				
Lateral (liquid)			l				
Glides	w				j		
Nasal-Comp	mb		nd , nz	nʃ		ŋg	

(Source: Adapted from Kasaya, 1992: 25)

Kasaya (1992) states that nasal compounds in Lubukusu and Lulogooli dialects are 'homorganic coarticulations in which the first phonetic entity is a nasal and the second a non-nasal consonant'. However, they function as unit phonemes since, for instance, voiced plosives occur only in the company of corresponding nasal sounds. Thus, in Lubukusu, for example, the sounds /b/, /d/, and /g/ are not granted phonetic status. The correspondences between the standard orthography of the consonants in the two dialects and their phonetic inventories are is given below. Note that this correspondence will be utilized in this study.

Orthographic representation	Phonetic inventory
p	p
b	β
t	t
d	d
k	k
g	g
m	m
n	n
ny	ɲ
ng'	ŋ
f	f
s	s
z	z
sh	ʃ

h	h
ch	tʃ
j	ʤ
r	r
l	l
w	w
y	j
kh	x
dz	dz
ts	ts
ng	ŋg
nj	ɲʃ
nz	nz
nd	nd
mb	mb

TABLE III: Correspondence between standard orthography and the phonetic symbols used in this study.

2.2.2. Vowel Elements

The vowel system of Lubukusu contains five vowel segments. These are tabulated below according to the parameters of tongue-position (seen from a horizontal dimension) and tongue-height (seen from a vertical dimension):

	Front	Central	Back
High	i		u
Mid	e		o
Low		a	

Table IV: Lubukusu vowel system
(Source: Adapted from Kasaya, 1992:20).

The vowel inventory of Lulogooli differs from that of Lubukusu in that it has seven vowels. As table V below reveals, this dialect distinguishes between tense and lax high vowels despite the fact that there is a lack of orthographic representation for this distinction.

	Front	Central	Back
High	i		u
	i		*u*
Mid	e		o
Low		a	

Table V: Lulogooli vowel system
(Source: Adapted from Kasaya, 1992:21).

Kasaya (1992:20-1) says that Lubukusu has ten vowels, five short and five long vowels. These are [a], [a:], [e], [e:], [i], [i:], [o], [o:], [u] and [u:]. She further contends that all the seven vowels in Lulogooli can be either short or long. Thus to Kasaya, [a] and [a:], for instance, are different phonemes. Taking the same direction but on a different lane, De Blois (1975) is of the opinion that Luluyia vowels have to be analysed along the dimension of tonal differentiation. He contends that Lubukusu, for instance, has ten vowels - i , e , a , o , u - each with a high and low tone. Thus, for De Blois, [a] and [a] must be considered as different phonemes on the basis of differences in tone, just like [u] and [u]. Note here that length is phonetically symbolised as [:] while tone is symbolised by an

acute mark over the vowel segment [ ] for high tone and a grave mark [ ] for low tone.

The two positions taken by Kasaya and De Blois explicated above take the prosodic features of length and tone just like other Jakobsonian or Chomskyan - Halle features making up segmental phonemes. In this work the validity of both these positions were examined. This is because recent works by non-linear phonologists such as Cook,1987, and Durand,1990, consider length and tone as features which are not locked within single segment-sized units like vowels but rather as features which spin over domains best described in metrical and morphosyntactic terms. This later position takes prosodic features as independent from segmental features and posits the notion of a **multi - tiered phonological analysis** which is opposed to the Transformational Generative Phonology approach. A multi-tiered approach lays emphasis on the fact that each prosodic feature such as length or tone must be analysed functionally as a system on its own right but which meaningfully contributes towards speech in communication. In chapters 3 and 4 practical credence is given to this debate. But first, an insight into Prosodic Phonology and the operations of Autosegmental Phonology are crucial prerequisites for our purpose.

2.3. PROSODIC FEATURES

The term 'prosody' is defined variously by various scholars. It is, nevertheless, a cover-term used in phonetics and phonology to refer to vocal effects or features of speech which extend over

more than one sound segment or phoneme in an utterance (Lehiste, 1970:1; Catford, 1977; Ladefoged, 1982; Couper - Kuhlen, 1986). Crystal (1975:94) equates prosodic features to 'suprasegmental features' or 'plurisegments' which he says include pitch, loudness, tempo and rythmicality. Crystal makes the following comment in his earlier work:-

> The primary prosodic parameters, along which systems of linguistically contrastive features can be plotted, are the psychological attributes of sound described below as pitch, loudness and duration, which have a primary (but not an identifying) relationship with the physical dimensions of fundamental frequency, amplitude and time respectively. (Crystal, 1969a:5-6).

This means that, first, pitch has a primary relationship with fundamental frequency(F_0). The faster the rate of vibration of the vocal folds, the higher the pitch of a sound. Secondly, loudness is linked to amplitude. A sound produced with a high amplitude is correspondingly louder than that produced with a low amplitude. Lastly, duration or length has a primary relationship with the physical dimension of time. This is because more time is taken in the articulation of sounds described as being 'long' than in the production of those described as being 'short'.

Fromkin and Rodman (1988:88) and Clark and Yallop (1990: 276) also equate prosodic features to suprasegmental features. Couper-Kuhlen (1986) says that the term 'suprasegmental' is preferred to 'prosody' in the American structuralist tradition. She defines prosody as "those auditory components of an utterance which remain once segments as well as non-linguistic and paralinguistic vocal effects have been removed" (Ibid:2). What this means is that prosodic features such as tone, stress, length

and intonation can be seperated, divorced or extracted from the phoneme layer of a language. A further implication of this statement is that, in essence, prosodic features can be seen as having the ability of being independent from the segmental make-up of language.

Couper-Kuhlen (Ibid) further observes that one striking aspect and therefore virtually a defining characteristic of prosodic features is their dependence on the syllable. This observation supports the controversial position first taken by Hooper (1976) that the syllable is the smallest phonological unit which is pivotal in the expression of phonological processes in a general and explanatory way. Katamba (1989) says that the syllable is at the heart of phonological representations since it is the unit in terms of which phonological systems are organised; it is therefore a purely phonological entity which cannot be identified with any grammatical or semantic unit. Going by this prosodic debate the syllable emerges as the basic motivation for the operation of certain phonological processes.

2.3.1. TONE

In the relevant literature the notions of tone and intonation are intricately interrelated, such that both are often referred to as pitch (Ladefoged,1982; Gimson,1989; Roach,1983). The pitch of a voice is determined by several factors, the most important of which is tension of the vocal cords. Crystal (1987:428) defines pitch as "the auditory sensation of the height of a sound." The same sound can therefore have a low auditory sensation, or it can have a high auditory sensation. The auditory

sensation of a sound can thus be varied while the sound remains the same. This attests to the flexibility of the "auditory sensation" which is actually the 'pitch'.

It is important here to note that ther are certain pitch variations that affect the meanings of words; these according to Ladefoged (op.cit) are called tones. Tone can therefore be seen as the distinctive pitch level of a sound which in some languages can signal lexical contrasts. This means that tone refers to the way in which a particular sound is uttered, whether it has a high auditory sensation, stemming from high frequency or a low auditory sensation, stemming from low frequency.

As earlier noted in section 2.3., pitch has a primary relationship with the physical dimension of Fundamental Frequency (F_0). The source of energy generating the production of a sound results in vibrations which cause variations in the propagating medium, usually the air. This means that there is displacement of air particles, and the rate at which such displacement takes place determines the pitch of a sound. Displacement can be represented on graphs as waveforms, with both negative and positive displacement. A number of pure tones represented by sinusoidal components can be computed by Fourier analysis to produce a complex wave. The Fourier analysis is a simple basic theorem in acoustic phonetics which provides for the addition of all the positives and negatives of sine waves at a given point in time to produce a complex wave or the fundamental.

Pitch, therefore, depends on the frequency or rate of variations in air pressure which is measured in Cycles per second (Cps, renamed hertz). A sound with an F_0 of 300 Hz, therefore,

has a higher frequency and is more likely to result in a higher-pitch when compared with that which has an F_0 of 100 Hz.

The human ear perceives frequencies from as low as 16Hz to as high as 20,000Hz, in some cases even higher (note here that the propagating medium, the chief of which is air in human communication, may affect this range). This upper limit may be affected by age; in fact at the age of fifty it might be no higher than 10,000Hz. However, such a reduced range has no impediment to perfect understanding of speech since the normal human speech range falls below 8,000Hz, with a high percentage of acoustic cues falling below 4,000Hz.

The 'visible speech' spectrographic techniques introduced by the Bell Telephone Laboratories in the mid 1940s were an important breakthrough in acoustic phonetics since for the first time in the history of linguistic science actual pitch measurements were made possible. The classical format is known as the **speech spectrogram** which portrays three continuously variable dimensions on a two-dimensional display (c.f.3.2.). Instrumental speech processing, though expensive, has in recent years overtaken much of the traditional approaches in acoustic phonetics. The original **speech spectrograph** has in fact been overshodowed by the use of computers and special purpose digital hardware which have proved more precise and efficient in the analysis of continuous speech with respect to F_0 estimations and time.

In tonetic analysis a conventional division is made between level tones and contour tones. A contour tone involves either a rising or falling pitch. A level tone is one in which, within

the limits of perception, the pitch of a syllable does not rise or fall during its production. A language that makes use of level tones to contrast the meanings of words is technically referred to as a **register tone language**. Such a register tone language can make use of up to five contrasts of level tones defined as Extra-High, High, Central, Low, Extra-low. However, most Bantu languages employ two or three contrastive pitch levels. A high tone is conventionally marked by an acute accent over a segment [a] while a low tone is marked by a grave accent [a]. Central (or mid-level) tones are marked by a level accent [a]. But whereas register tone languages make use of level tones only contour tone languages employ rising and falling tones marked by the accents [ ] for rising tone and [ ] for falling tone.

The complexity of the feature of tone can be seen in the following contrasting views on the place of tone in tonetic analysis: Welmers (1962) views tone as a feature of words and morphemes. On the other hand Wang (1967); McCawley (1970) and Ladefoged (1982) view it as a feature of syllables. By extension, Maddieson (1971) and Fromkin (1968) propose and express tone phonologically as a feature of segments (i.e. phonemes). Thus, to these later linguists tone, for instance [+High] or [+Low], is considered as part of the internal make-up of vowels, just like [+/-round] or [+/-back]. The outcome of this prosodic debate is the fact that agreement is still yet to be reached on whether tone should be seen as a segmental property or whether it should be given either metrical or morphosyntactic treatment. The controversy with which this study is concerned is whether or not tone can be divorced from the vowel segment and whether or not

it can be assigned to any of the grammatical categories mentioned above.

De Blois (1975) says that tone in Lubukusu is distinctive and that the dialect employs two level tones - high tones [+H] and low tones [-H]. Furthermore, all tones at the end of syntactic units in the dialect are [-H]. Recent literature (Crystal,op.cit:172) on tonetic analysis refer to such significant tone segments as 'tonemes'. This is because for speakers of a tone language a difference in tone is just as significant as a difference in consonant or vowel quality.

2.3.2. LENGTH

Relevant literature on the feature of length suggests that it is "a durational property of segments" (Lass, 1984:254). Crystal (Ibid:419) contradicts this defination by viewing length as the duration of time taken in the articulation of a syllable. This study will attempt to establish whether length can be defined in terms of any such structural units or be seen comprising its own layer of activity. Length is traditionally symbolized as [:]. Recent spectrographic techniques heve made it possible for the length over which syllables, words and phrases are articulated to be measured in seconds (or more appropriately, in milliseconds).

Ladefoged (op.cit) observes that in some languages, such as in most varieties of English, variations in length are completely allophonic. In such cases length is not distinctive. A syllable with voiced consonants, for instance 'judge' [^{d} ^{d}], is longer than its voiceless counterpart 'church' [^{t} t]. He however, notes

that in other languages, such as most Bantu languages, length may be used contrastively. This means that length can be phonemic.

According to Kasaya (op.cit:20-1) length in Lubukusu and Lulogooli dialects is a feature of vowels. This is a controversial position since it implies that length is merged to the vowel segment, such that [a] and [a:], for instance, are different phonemes. The strong implication herein is that the addition of the feature [+Long] to a vowel segment completely alters its phonemic characteristics. According to this position the feature [+Long] alters the internal content of a segment as illustrated by the feature specification matrix below:

[a:]	[a]
+Low	+Low
+Front	+Front
+Long	-Long

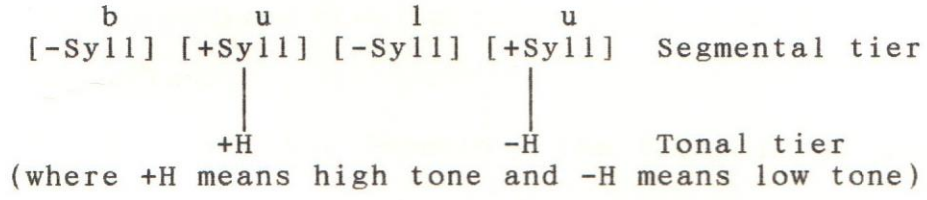
This theoretical viewpoint, however, is lacking in one aspect: it conclusively assumes that speech consists of linearly ordered segmental phonemes whose feature specifications include prosodies such as length. Length is therefore taken as being at par with other features like [/-coronal], [+/-sonorant] or [+/-continuant]. However, the recent debate in Autosegmental Phonology sharply contradicts such a position. The contention is that the behaviour of such prosodic features seem to contrast sharply with that of other features making up segmental phonemes. Thus one prime motive of this study is to establish whether or not the feature of length can be divorced from the segmental makeup of speech and be treated as an autonomous tier which contributes significantly toward language in communication.

2.4. AUTOSEGMENTAL PHONOLOGY (AP)

The phrase 'Autosegmental Phonology' is the title of Goldsmith's dissertation submitted to the MIT in 1976 and published the same year. His concern with phenomena that have evaded segmental classification has raised great interest in non-linear phonology. This section is devoted to a review of the literature on AP and how the features of length and tone are treated autosegmentally.

Goldsmith (Ibid:6) says that the linearity assumption that distinctive sound units or phonemes are building blocks which occur in a row comes to be seriously questioned by the development of non-linear phonology. He argues that prosodic features like stress, tone and length, which stretch over more than a single vowel or consonant, require a different approach from that offered by segmental theories. Consequently, a feature such as tone must be seen as constituting a separate tier of linguistic activity from the segmental tier which is made up of consonants and vowels. This separate tier is the **autosegmental** tier (Goldsmith,Ibid).

Autosegmental representation differs from the familiar generative and traditional phonemic representations since it consists of two tiers of segments. Each tier consists of a string of segments but the segments on each tier differ with regard to what is specified in them. These tiers are formally linked by "association lines" which represent simultaneiety in time. An autosegmental analysis of the word [bulu] would thus yield the following results:



(where +H means high tone and -H means low tone).

In the above representation the tones are linked to the [+Syll] elements on the segmental tier. This does not, however, imply that tones are confined to the [+Syll] elements only. The formalism of AP assumes that the tones spread onto the [-Syll] elements as well, though their peaks are realized on the [+Syll] elements.

What this means is that an autosegmental approach contrasts sharply with strictly segmental theories of phonology since phonology is seen as comprising several 'tiers' of activity. These tiers, despite being autonomous from each other, are linked to each other in the process of speech production, that is, they are **coarticulated**. What this means is that the activities represented on these seperate "tiers" takeplace simultaneously in the process of speech production. Phonology should not therefore merely be seen as a matter of sequencing phonemes such as /p/, /a / and /t/ to produce such meaningful words as /pa t/ and /ta p/. On the contrary, it should be seen as a reflection of the parallel activities that go on at the same time during speech production. The tonal acvtivity, for instance, is conventionally linked to the segmental activity by association lines, meaning that they take place simultaneously. This does not mean that segments are devoid of tone; rather, the implication is that a single tone is usually realized over the duration of more that just a single segment. The theory of AP was originally devised to handle tone but has now been extended to deal with

other features like vowel and consonant harmony, length, stress and intonation.

In Autosegmental Phonology the focus is on ways in which phonological rules can change the organization of phonological representations, that is, the focus shifts to the nature of phonological representations. Phonological representations are no longer seen as simple rows of segments but as complex arrays of independent elements arranged on different levels or **tiers**. Various types of phonological rules operate independently on the various tiers. Segmental rules, for instance, operate on the segmental tier, leaving other tiers unaffected, while tonal rules operate only on the tonal tier. Various analogies can be used to express this insight:

> Phonological representations can be compared to a multi-storied building, with syllables as the structural pillars and beams which support the weight of different levels of the building. In this building various events can take place at the different levels (e.g. the stress level, the tonal level, e.t.c.) without necessarily having any effect on what goes on at another level. (Katamba,1986:196)

The syllable is therefore central in an autosegmental representation since features such as tone and length are anchored on it.

Another analogy that can be used to illustrate the autosegmental model of the organization of phonology is a spiral-bound notebook with many pages, each page standing for a different phonological tier. All languages have the vowel and consonants segments page (tier). However, there is some variation as to what other pages (tiers) are selected by any one language. There could be a page each, for example, for stress, tone, nasalization and vowel harmony. But the binding core that holds

the the pages of the book together is the syllable (represented in this case by the spiral binding).

The autosegmental approach is a break away from the unidimensional SPE approach, since from a three dimensional phonology, segments are argued to be linked to:

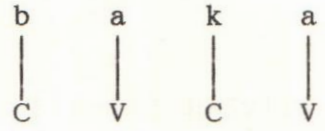
(i). Suprasegmental or Prosodic structure

(ii). Morphosyntactic structure

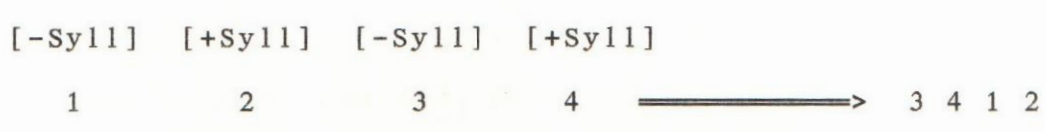
(iii).Patterns of rhythm and prominence

First, as already discussed above, segments are linked to prosodic structure like [+H] and [+L] tones. This in AP is effected by association lines. Secondly, segments are also linked to morphosyntactic structure like syllables and morphemes. This in Metrical Phonology is effected by metrical structures. Thirdly, segments are linked to such aspects of the speech continuum as intonation.

The autosegmental approach introduces the notion of a CV (Consonant Vowel) or skeletal tier as a device which relates the internal content of segments to other types of information. The central notion of a skeletal or CV tier in AP is the outcome of CV phonology developed by Kahn (1980) and Clements and Keyser (1983) who postulated a CV tier - a tier of V and C 'slots' which are filled by segments mapped straightforwardly using association lines which are subject to a well formedness condition. Certain universal conditions have to be adhered to when relating the CV tier to the segmental tier. The V elements are linked to the [+syllabic] segments (which are usually [+vocalic]) and C elements to [-syllabic] segments (which are usually [-vocalic]) as in:



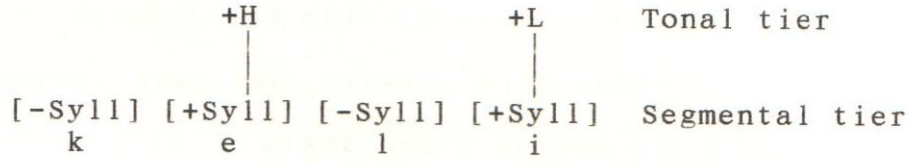
AP can adequately account for the phenomena of tone stability and independence in natural languages. Durand (1990) gives an example from Bakwiri, a Bantu language which makes use of only two tones, +H and +L. Durand observes that in Bakwiri "there's a language game in which the two syllables of disyllabic words are transposed." The word for 'dead' is [k^{w}eli] and is transposed as [lik^{w}e]. We can draw a transformation rule as:



If the transposition rule is taken strictly as it is the product would be [lik^{w}e], meaning each syllable is transposed along with its tone. However, such a rule is wrong since /e/ moves and leaves the high tone [ ] in its original place while /i/ moves and leaves the low tone [ ] in its place. The transposition therefore yields [lik^{w}e] and not [lik$_{w}$e]. Thus,

> Though the segments making up the two syllables change places the tones have stayed in their original position. The tones are not transposed along with the segmental make-up of each syllable. They behave as if they belonged to a separate level or TIER in relation to other features of which the segments are composed.
>
> (Durand, Ibid:244).

In AP association lines are drawn to connect tones to the relevant tone-bearing units:



Durand says that we can maintain our transposition rule 1 2 3 4 ⟹ 3 4 1 2 by assuming that it applied only to units on the segmental tier but left the tonal tier unaffected. Tone features are thus treated as 'autosegments' which are independent from other features making up a segment. Durand contends that this notion of 'autosegments' adequately explicates tone stability and independence, that is, "the tonal tier does not necessarily behave in unison with the segmental tier", that is, segments can be deleted, permuted or inserted in an utterance without necessarily affecting the basic tone pattern of that utterance.

According to AP a central task of phonology is to establish the principles that govern the ways in which elements on adjacent tiers are associated. Tiers cannot be randomly linked by association lines. Phonological theory has to establish universal principles of association and descriptions of particular languages have to show any idiosyncratic aspects on the ways in which association between different tiers take place. The autosegments and segments are not paired underlyingly but associated by well-formedness principles, sometimes also referred to as 'principles of association'. In the formalization of these conventions tones and vowels are used for purposes of simplification but they are assumed to apply to any autosegmentalized feature and the units the autosegmental feature in question is connected to on the segmental tier. Durand

(Ibid:249) gives these principles as follows:

i) **Mapping**: Associate vowels with tones in a one-to-one fashion left to right until we run out of tones or vowels;

ii) **Dumping**: If after applying (i) some tones are still free (that is, unassociated) link them to the last vowel to the right;

iii) **Spreading**: If after applying (i) some vowels are still unassociated link them to the last tone on the right.

These principles of association are sometimes given in the form of well-formedness condition (WFC). Goldsmith (1976) gives the WFC as follows:

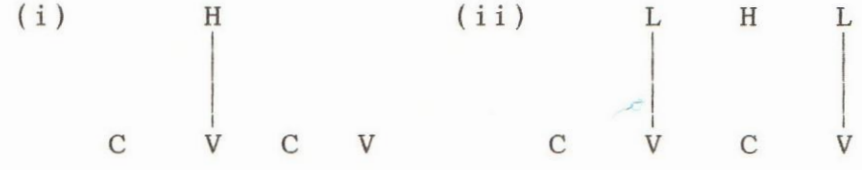
i) Each vowel must be associated with at least one tone;

ii) Each tone must be associated with at least one vowel

iii) Association lines are not allowed to cross.

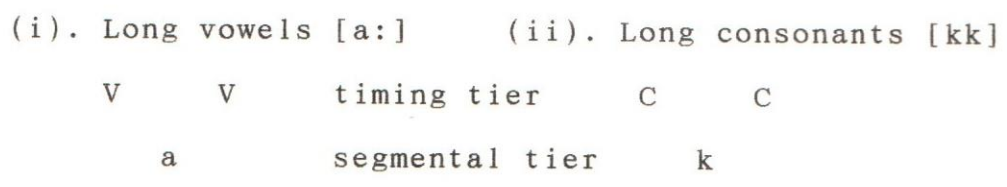
These WFC are completed by marked association conventions specifying the direction of the association (left to right or right to left) and its starting point.

The effect of these conventions has been that of adding and deleting (that is, linking and delinking) association lines as appropriate at any point during a derivation. This makes possible the existence of multiple associations on different tiers as illustrated below:



The WFC makes possible a satisfactory representation of

length which is best thought of neither as sequences of identical segments nor single segments marked with the feature of length. An autosegmental approach with multiple associations is the key to the analysis of length. Long vowels, for instance, are seen as consisting of a single vowel associated with two positions on a facing tier as exemplified below (Goldsmith 1990):

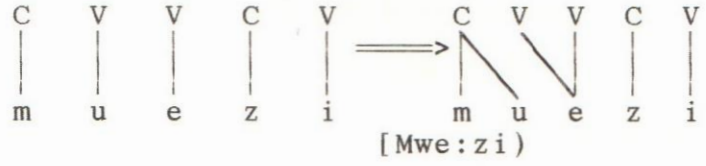


In this representation the Vs and Cs represent timing units on the timing tier (also called the length tier). One V slot, for instance, is equivalent to the time taken in the articulation of a single vowel and is therefore linked to one element on the segmental tier. Two V slots therefore represent a duration equivalent to the articulation of two segmental elements. In the above notation two V slots are linked to a single element on the segmental tier, meaning that the segmental element in question is articulated over a period double its normal duration (c.f. chapter 4).

Clark and Yallop (1990:346) also contend that length is best handled autosegmentally. They give an example of the words 'mweezi' (sweeper) and 'beezi' (sweepers) in Luganda. These words have the underlying regular forms /muezi/ and /baezi/ respectively. However, since the sequences /ue/ and /ae/ are not tolerated in the language its rules dissociate the first vowel and associate the second to the CV slot. Clark and Yallop say

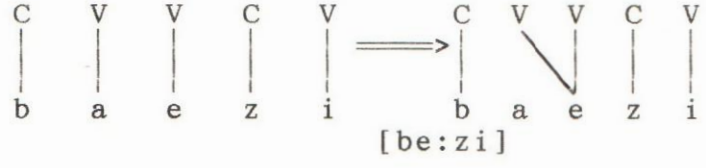
that if the dissociated vowel is high it can combine with the preceeding consonant as secondary labialization, otherwise it remains dissociated:

(i). 'Mweezi'



[Mwe:zi)

(ii). 'beezi'

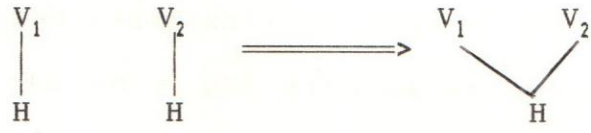


[be:zi]

(Clark and Yallop, Ibid:346)

These exemplifications depict a clear case of **compensatory lengthening** (c.f.4.3.). Despite the deletion of [a], which reduces the number of elements on the segmental tier, the number of CV positions remains the same; instead, the segment [e] is lengthened in compensation.

In the relevant literature on AP the Obligatory Contour Principle (OCP) and Autosegmental Licensing (AL) are given credence. Leben (1973) observes that there exist an OCP that any two adjacent tonemes at the melodic level of grammar must be distinct. The OCP is seen as a morphotonological constraint and sequences such as HHL or HHHL are automatically simplified to HL. Goldsmith (1984:84) argues that such a position is too strong and that the OCP should be seen as a phonetic constraint; that at the phonetic level any contiguous identical segments must be collapsed into each other:



Mauseen's Rule: $T_1, T_2 \Longrightarrow T_{1,2}$

where T_1 & T_2 are identical

(Goldsmith, Ibid:84).

Goldsmith (1990) employs the notion of autosegmental licensing to qualify the autosegmental theory:

> Prosodic licensing require that all elements be a member of some syllable or else be marked as contigently extrasyllabic...Prosodic units are licensers - the syllable node as the primary licenser, the coda node and certain word final morphemes as secondary licensers.
> (Goldsmith, 1990).

A licenser is endowed by the grammar of a language with the ability to license autosegments; AL therefore serves to link together autosegmental structures with hierarchical syllable structures, such that no structures are left unassociated in a truely multi-tiered representation.

It is significant to take into account the fact that Goldsmith places AP within the generative tradition of formalism, maintaining a discourse of 'rules' and 'well-formedness conditions' even though his theme is autosegmental organization rather than feature changing processes. What must be noted, however, is that in providing a fully autosegmentalized representation of the phonology of a natural language the SKELETON is prefered to the CV-tier.

By introducing a set of timing positions between syllable structure and segmental structure the CV-tier provides an adequate treatment of prosodic phenomena like tone, length,

vowel-harmony and nasalization; however, it misleadingly places the timing slots on a par with other autosegmental units. A representation which makes possible the intersection of all planes is the **skeleton core** which, for this reason, can be compared to the spine of a spiral- bound notebook. The skeleton should therefore be thought of as what unifies an essentially multi-dimensional representation.

CHAPTER THREE

3.0. TONE

3.1. INTRODUCTION

In Lubukusu and Lulogooli dialects of Luluyia the feature of tone behaves in a peculiar manner. As earlier noted in section 1.8. Transformational Generative Phonology treated tone just like other Chomskyan - Halle features of which the segment is composed. Tone was seen to occur as one of the 'unordered bundles of features' which are linearly ordered, meaning that the prosodic order was tied within the domain of the segmental order. But should a phenomenon such as tone be treated as part of the segmental feature specifications rather than as an **autosegment**? Are there any specific conventions or rules constraining the occurence and patterning of tone? In other words, should phonological representations be depicted simply as sequential or lineal rather than as parallel hierarchies which relate to each other at different levels? This study presently focuses on the answer to these questions.

3.2. TONAL TRENDS

There exist at the lexical level a certain behaviour running across the dialects under study which, from the surface, can best be described as an interesting tonal trend. The following example drawn from Lubukusu can serve as an appropriate launching pad from which investigations into the behaviour of tones in the dialects can be attempted:

Data 1: Lubukusu

Orthographic representation	Phonemic representation	Gloss
enda	/enda/	'stomach'
enda	/enda/	'louse'

The pair of words in data 1 above are structurally similar. It would in fact appear to a non-native learner that there is outright reproduction of the same word despite the differences in meaning. The conclusion to be derived from such an assumption is that the word '**enda**' in Lubukusu is ambiguous and that it can only be disambiguated contextually, that is, the choice of semantic implication by a speaker using the word can be perceived only in context.

This assumption, however, is quite erroneous. Rather than posit the notion of ambiguity to explain this phenomenon the postulation of two different bisyllabic words is more plausible. This is because native speakers of the dialect are usually able to discern which meaning is implied even when the words are uttered in isolation. This, in effect, means that context is not the determining factor in the semantic decoding of the words. There are certain neurophysiological factors of speaking and hearing (such as vocal tract muscle tenseness, rate of vibration of the vocal folds, and articulatory duration and force) which hold the key to the perception of the semantic differences between the pair. The relevant aspect in this case is the rate of vibration of the vocal folds. This can be captured after a consideration of the spectrographic analyses of the examples in the data displayed overleaf.

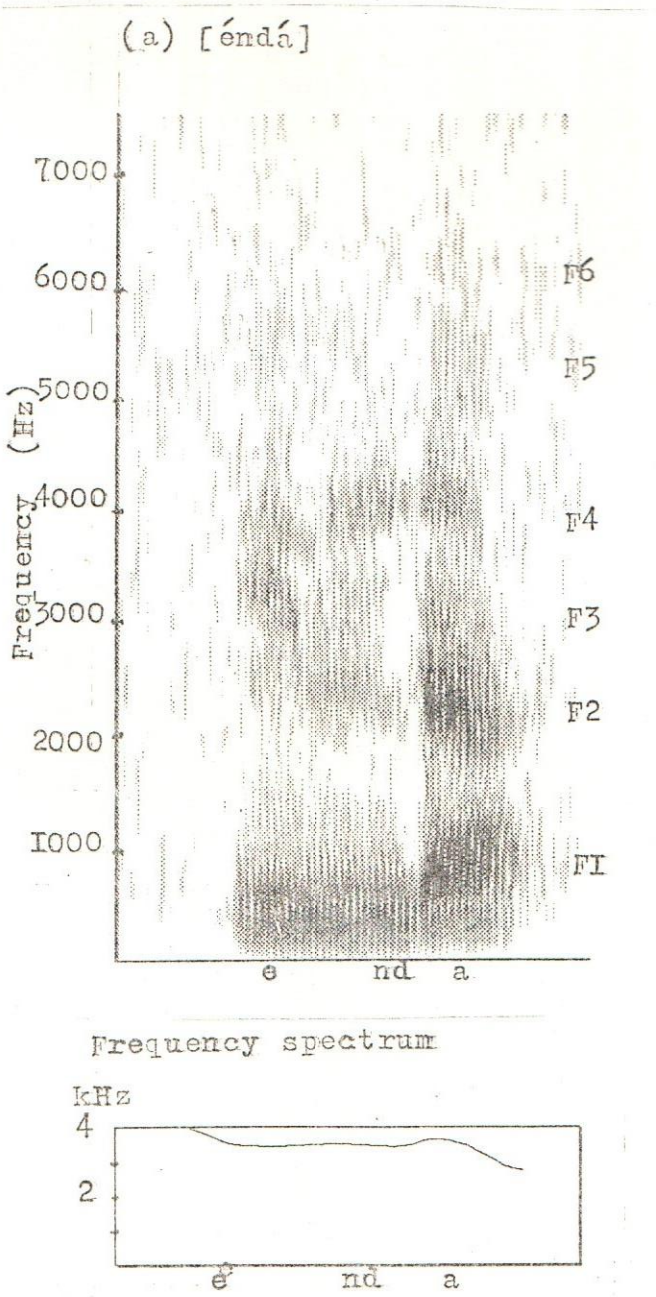
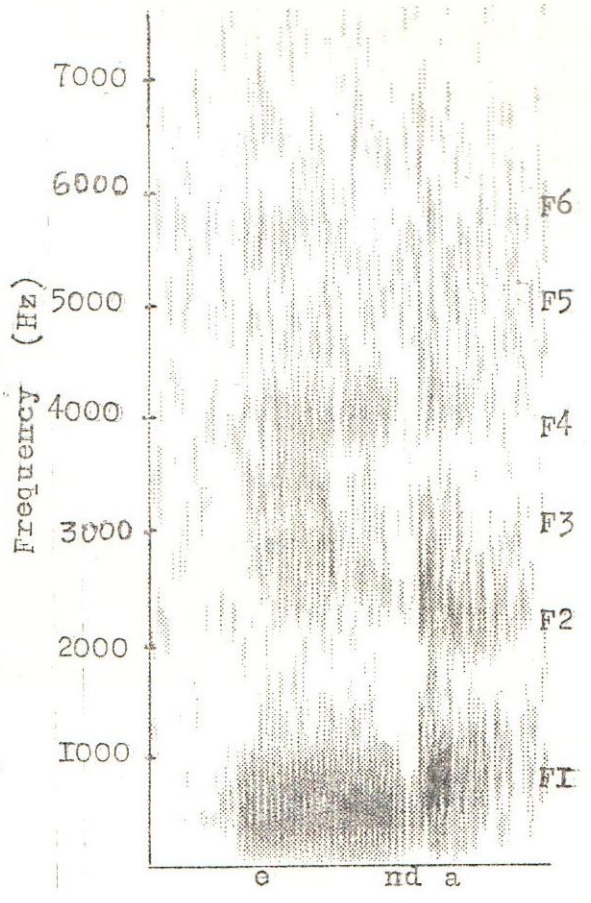


FIGURE I(a): Spectrogram and frequency spectrum for [éndá] ('stomach').

(b) [éndà]



Frequency spectrum

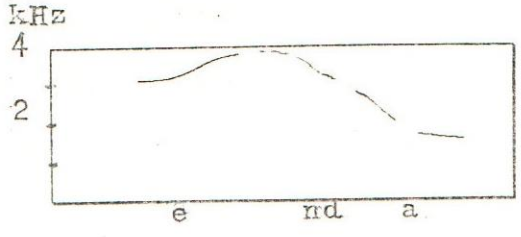


FIGURE I(b): Spectrogram and frequency spectrum for [éndà] ('louse').

The spectrograms in Figure 1 have time indicated on the horizontal axis and frequency on the vertical axis. The high-frequency bounded areas are displayed by the relative blackness or brightness of the picture marking. What this means is that the dark areas reflect regions of greater acoustic energy in the process of speech production. Only vowels and voiced consonants possess periodic or rather quasi-periodic (i.e. repetitive) waveforms and accordingly display harmonic spectra. Periodic waveforms display regular displacement of air particles. Quasi-periodic waveforms, on the other hand, involve some degree of dumping, such that the extent of the displacement of air particles decreases and eventually dies away in the course of time.

Briefly, a harmonic is any one of the frequency components of a waveform, including the fundamental frequency (F_0) which is the lowest, from which the frequency of a sound can be calculated. The frequency of a sound at a point in time can be calculated by adding up the frequencies of the harmonics in the spectrum and dividing the sum total by the number of harmonics present. Voiceless sounds have no harmonics and consequently no F_0; they create 'gaps' (that is, the less bright areas) in the overall pitch pattern and are therefore less distinct (consequently more difficult to handle) in spectrographic analyses.

Speech output from the lips as displayed in spectrograms actually reflects the combined acoustic properties of phonation, tract resonance and the acoustic radiation properties of the human head. Resonance variations in speech results in **resonant**

peaks which are peaks of energy produced by selective enhancement of the source by vocal tract resonance. These peaks are known as '**formants**' and are pivotal in spectrographic analysis. The information-bearing formants of the speech spectrum are reflected in the darkened areas in the spectrograms in figure 1; these have been conventionally numbered upwards from the lowest in frequency as F_1, F_2, F_3, and F_4.

The essential formant patterns in the spectrograms fall below 5,000Hz. The harmonic structure of the speech signal can be captured from the locations of formant energy which are distinct; the harmonics have been effectively smeared such that the darkest areas indicate the peaks of energy of the formants. The display also shows vertical lines which correspond to the individual pulses of phonation, and these can be seen to be more widely seperated as F_0 falls.

In figure 1(a) the first formant for the initial syllable [e] begins in the region of about 800Hz, the second in the region of about 2,600Hz, the third 3,500Hz and the fourth 4,000Hz. These formants bend into the second syllable [nda], with the release phase of the [nd] compound represented by the vertical light area slightly breaking the formants. Over this last syllable the first formant bends from about 600Hz to about 1,100Hz, the second from the region of about 2,500Hz to 2,300Hz, the third from 3,400Hz to 3,200Hz, and the fourth from 4,200Hz to 4,100Hz. In figure 1(b) the first formant of the initial syllable is in the region of about 600Hz, the second 2,800Hz, the third 3,200Hz and the fourth 4,000Hz. These formants bend over the last syllable, the first from about 500Hz to the region of 1,000Hz, the second from

about 2,600Hz to 2,100Hz, the third from 3,500Hz to 2,900Hz and the fourth from 4,100Hz to 4,000Hz.

In both spectrograms the fifth and sixth formants can be traced around and above the 5,000Hz mark, though these are not distinctly visible in the manner displayed by the first four formants. These upper formants are nevertheless just as useful in the final calculation of the final frequencies of the sounds which have been simplified in the frequency spectra with time on the horizontal dimension and frequency on the vertical dimension. As noted above, F_0 value is simply the harmonic frequency (in this case represented by formant frequency) divided by the harmonic number (represented by the formant number). From the point at which the above frequencies have been extracted from the spectrograms the frequency of the first syllable [e] at that given point in time can be computed as follows:

(i) For spectrogram 1(a)

Formants	Frequency (Hz)
1st	800
2nd	2,600
3rd	3,500
4th	4,000
5th	5,700
6th	6,600
TOTAL	**23,200Hz**

Thus, $\frac{23,200}{6} = 3,866.666... = \mathbf{3,867Hz.}$

(ii) For spectrogram 1(b)

Formants	Frequency (Hz)
1st	600
2nd	2,800
3rd	3,200
4th	4,000
5th	5,400
6th	6,200
TOTAL	**22,200**

Thus, $\frac{22,200}{6} = \mathbf{3,700Hz.}$

These frequencies are reflected in the frequency spectra. The spectrum for spectrogram 1(a) shows that the initial syllable begins with a frequency of about 4,000Hz and comes down slightly to 3,500Hz; the computed 3,867Hz falls within this range. On the other hand the spectrum for 1(b) shows that the initial syllable begins with a frequency of 3,200Hz which rises to 3,800Hz; the computed 3,700Hz falls within this range.

Since frequency directly reflects tone the initial syllable [e] in both cases can be said to have high tone [+H]. This is because the frequencies of these initial syllables in both cases are above 2000Hz which is acoustically considered high frequency phonation. But while the second syllable in 1(a) maintains a high frequency, in fact rising from about 3,500Hz to 3,600Hz before slightly falling to just below 3,000Hz at the end of the utterance, the frequency of the second syllable in 1(b) falls rather drastically from above 3,000Hz to 1,700Hz which is acoustically considered low frequency phonation.

Consequently, the Lubukusu word for 'stomach' has a high tone on the last syllable [nda] whereas that for 'louse' has a low tone on the same final syllable. This is visually reflected in the spectrograms when the degree of darkening of the various formants are considered. In 1(a) the first and second formants above the final element [a] are dark, reflecting greater intensity, as compared to the same areas in 1(b) which are relatively light. Again, the third, fourth and fifth formants are clearly seen in (a) as compared to (b) in which they tend to fade. Moreover, the vertical lines above this last element, which correspond to individual pulses of phonation, are more widely

spaced in (b), reflecting a fall in the frequency and, consequently, low tone.

A critical observation ofthe frequencies in the spectrograms reveals that whereas there is a difference in the frequencies of the second syllable another difference also exists between the frequencies of the first syllable. The values of these differences can be computed by subtracting the values of (b) from the values of (a):

	1st syllable	2nd syllable
1(a)	3,867	3,600
1(b)	3,700	1,700
value differences	167	1,900

Given that frequency variations exist between both syllables inboth cases the question could beasked as to which ofthe differences is significant. This can be resolved after computing the proportions of the value differences expressed as percentages of the means of the frequencies using the formula

$$\frac{X}{M} \times 100$$

(where X = value difference
M = mean)

The critical percentage value for this statistic is 10% (the 0.1 significance level). Any computed value that is less than 10% is considered nonsignificant and inconsequential whereas any value that isgreater than 10% is considered significant:

$$\text{1st syllable proportion} = \frac{167}{3,784} \times 100 = 4.41\%$$

$$\text{2nd syllable proportion} = \frac{1,900}{2,650} \times 100 = 71.1\%$$

The first syllable proportion value of 4.41% is less than 10% and is therefore not significant at the 10% level of significance. The second syllable proportion value of 71.1% is highly

significant and cannot be said to be a chance occurence. Sound conclusion can thus be reached that it is the difference in the frequencies ofthe second syllables that is contrastive.

Thus, despite the structural similarity between the words in data 1, the semantic difference between the two is clearly brought about by the disparity of tone on the second syllable of both forms as indicated by the statistical test of significance. Whereas /enda/ [enda] (meaning 'stomach') has a high tone on the first syllable followed by another high tone on the second [+H,+H] its counterpart in the minimal pair /enda/ [enda] (meaning 'louse') has a high tone on the first syllable followed by a low tone on the second [+H,+L]. This difference is highly significant at the 5% level, lending support to the hypothesis that tone is distinctive. (Note here that the traditional diacritics [ ] and [ ] have been used to designate high tone and low tone respectively in the phonetic representation).

Another set of data with spectrographic illustrations drawn from Lulogooli will give further insight into this important linguistic function of tone. In this dialect the words denoting 'these ones' (referring to humans) and 'dig' (for instance a hole) are structurally similar with respect to orthographic representation:

Data 2: Lulogooli

Orthograpic representation	Phonemic representation	Gloss
yaba	/jaba/	'dig'
yaba	/jaba/	'these ones'

A consideration of the spectrographic analysis of the words in the data will help resolve the question of what it is that makes the native speaker of Lulogooli able to distinguish between the two words even when they are uttered in isolation.

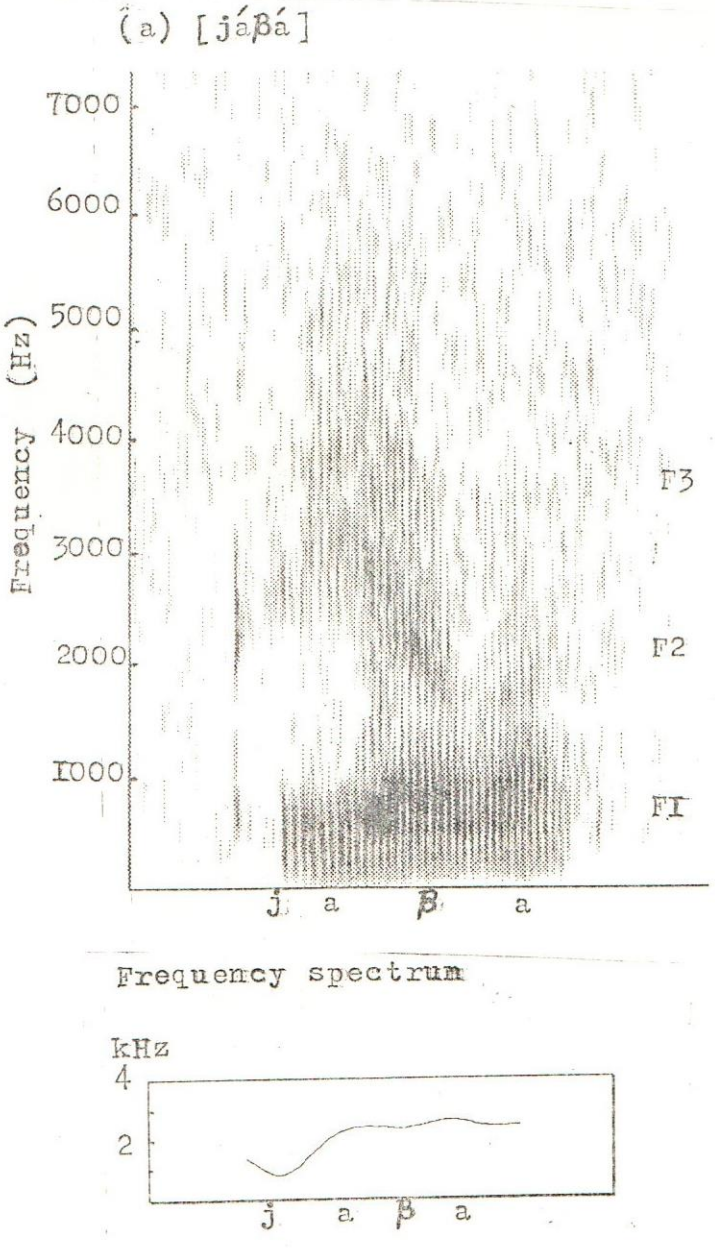


FIGURE 2(a): Spectrogram and frequency spectrum for [jáβá] ('dig').

(b) [já βà]

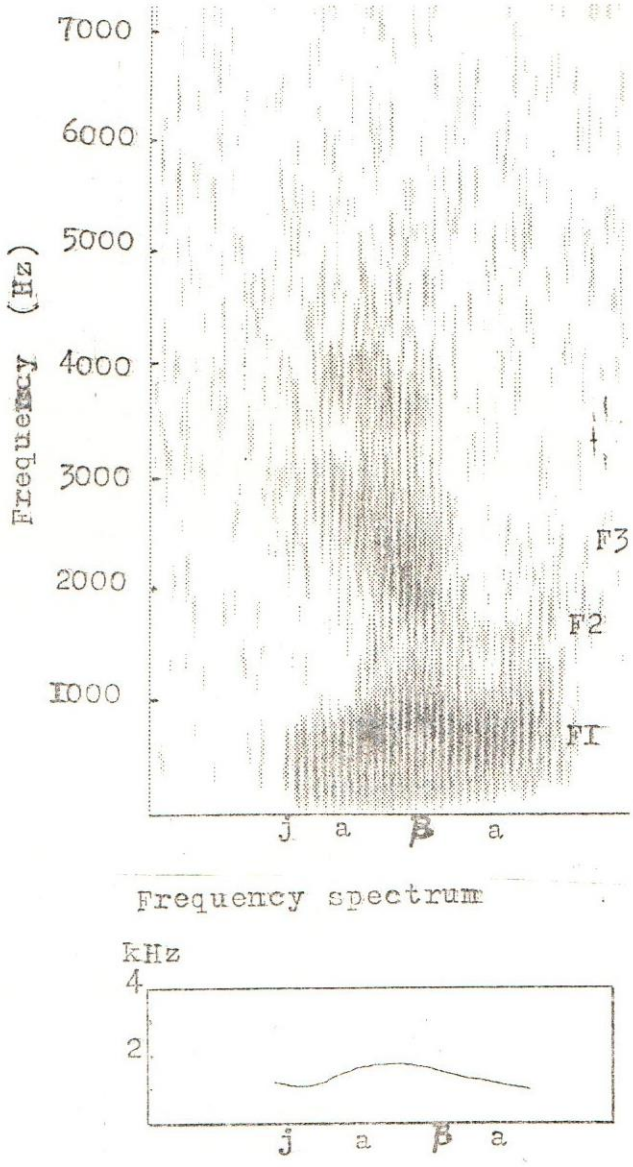


FIGURE 2(b): Spectrogram and frequency spectrum for [já βà] ('these ones').

In the spectrogram in figure 2(a) the first formant begins in the region of 800Hz and runs across the utterance to about 1,000Hz, the second from 2,600Hz to 2,200Hz, and the third from 3,800Hz to 3,600Hz. In 2(b) the first formant runs from about 400Hz to 700Hz, the second from 2,900Hz to 1,700Hz, and the third from 3,900Hz to 3,100Hz. There are two other formants which can be traced above the first syllable [ja] in 2(a), one at about 4,400Hz and the other at about 5,000Hz, but these are not easily visible in 2(b).

It is evident from the frequency spectra that in 2(a) the frequency of the first syllable [ja] rises to about 2,200Hz while in 2(b) it does so to about 2,000Hz. Since tone is relative rather than absolute both these syllables can be considered as bearing high tone. But while the second syllable in 2(a) is realized with a high frequency phonation of up to 2,600Hz, in 2(b) it is realized with a low frequency phonation that falls to 1,000Hz. Consequently, the second syllable [ba] in (a) has a high tone while in (b) it has a low tone.

Closer observation of the frequencies in the spectrograms, however, reveals that the frequencies of both syllables in both spectrograms differ. These differences can be calculated as follows:

	1st syllable	2nd syllable
2(a)	2,200	2,600
2(b)	2,000	1,000
value difference	200	1,600

Using our previous formula we can compute the significance of these differences as percentage proportions ofthe means, taking the 10% level as the critical value:

$$\text{1st syllable proportion} = \frac{200}{2,100} \times 100 = 9.52\%$$

$$\text{2nd syllable proportion} = \frac{1,600}{1,800} \times 100 = 88.89\%$$

The first syllableproportion value of 9.52% is less than the 10% level of significance and is consequently not significant. Thesecond syllable proportion value of 88.89% is highly significant and can safely be said to account for the observed contrast.

This statistical computation supports the position that the difference between the words in data 2 is brought about by variations in the tone of the second syllable, much in the same way as discussed above for data 1. Whereas [jaba] (meaning 'dig') has a high tone on the first syllable followed by another high tone on the second [+H,+H], [jaba] (meaning 'these ones') has a high tone on the first syllable followed by a low tone on the second [+H,+L].

The spectrographic and statistical evidence adduced from data 1 and data 2 supports the position that tone in Lubukusu and Lulogooli is phonemic. This is further supported by the data below:

Data 3: Lubukusu

	Phonemic representation	Phonetic representation	Gloss Gloss
(i)	/liru/	[liru]	'banana leaf'
	/liru/	[liru]	'ear'
(ii)	/ o:la/	[o:la]	'(they) reach'
	/ o:la/	[o:la]	'say'
(iii)	/mona/	[mona]	'whisper'

	/mona/	[mona]	'drizzle'
(iv)	/xo a/	[xo a]	'uncle'
	/xo a/	[xo a]	'you are going'

Data 4: Lulogooli

(i)	/inda/	[inda]	'stomach'
	/inda/	[inda]	'louse'
(ii)	/tula/	[tula]	'get out'
	/tula/	[tula]	'small intestines'
(iii)	/sama/	[sama]	'(dog's) bark'
	/sama/	[sama]	'sprinkle'
(iv)	/koma/	[koma]	'sow'/'plant'
	/koma/	[koma]	'go after cattle'

Phonetically the words in data 3 and 4 above are minimal pairs. The meaning difference between each pair is brought about solely by tonal differences. In each of the bisyllabic pairs the first example has a [+H,+H] tone sequence while the second has a [+H,+L] tone sequence. The data gives supportive evidence in favour of the position that in these dialects tones are phonemic, that is, tones can be used distinctively to signal meaning contrasts between two otherwise structurally similar words. This evidence overwhelmingly supports the notion of a **'toneme'** - that the tonemes [+H] (that is, high tone) and [+L] (that is, low tone) are responsible for the meaning differences between the pairs. In this way the data supports the first hypothesis put forward in section 1.4 that in these dialects tone is phonemic.

A Transformational Generative analysis of the above forms

would outrightly take tone as a segmental property of vocalic segments. In TGP segmental phonemes, which are linearly ordered one after another in speewch production, are seen as consisting of bundles of phonetic features of which tone can be a member. These "features" make up the internal content of segments and their representation does not adhere to any specific order. What this means is that a segment such as [a] can be represented either as in (i) or (ii) below:

(i) [a]	(ii) [a]
+syllabic	+High
+sonorant	-coronal
-coronal	+syllabic
+High	+sonorant

(where +High represents high tone).

Consequently, the TGP 'linearly ordered unordered bundles of features' would be taken to be responsible for the meaning contrast between, for instance, [liru] (banana leaf) and [liru] (ear) in Lubukusu. It would be assumed that the semantic contrast between these words is simply brought about by the substitution of the word-final high-toned high back vowel [u] by a low-toned high back vowel [u].

As highlighted in 1.8 and exemplified in 2.4, such an approach handles tone as an integral part of the internal make-up of vowels. But while the assignment of the various Jakobsonian or Chomskyan - Halle features to single segments seem plausible the same procedure cannot be extended to the analysis of tone. The following reasons can be advanced to support this position:

First, one can argue from simple logic that since tones function phonemically (that is, like a phoneme) to distinguish meaning between two otherwise identical words then they (tones)

should not be seen as being tied to any other phonemes (in this case vocalic segments). A tone should be regarded as a 'phoneme' - technically a toneme - in its own right if the Prague School definition of a phoneme as 'a minimal unit endowed with a distinctive function' is anything to go by. To say that tones can be merged to the vowel segment is tatamount to stating that, by extension, a segment such as /p/ can be merged to another such as /b/. Since a phoneme cannot be exclusively tied to another phoneme (except, perhaps, at the phonetic level where allophonic variants are phonetically predictable by virtue of phonological conditioning) then a 'toneme' must not be seen as being tied to any segmental phoneme. Consequently, tones must be seen as constituting a system on their own right which nevertheless has significant input in speech communication alongside the system of segmental phonemes.

Secondly, pitch (which is the psychological attribute of sound that strikes a primary relationship with the physical dimension of fundamental frequency which in turn determines tone) cannot be vertically sliced and allocated to a single segment without any leakage onto adjacent segments. Pitch often extends over a given stretch of an utterance since itis acontinuous aspect of speech. Spectrographic evidence clearly reveals the way in which, at the acoustic level, there tends to be a merging of features which are often linguistically treated seperately. For example, an examination of the spectrograms given in figures 1 and 2 reveals that no clear-cut boundary can be satisfactorily drawn between one speech element and the next in the exclusive manner suggested by segmental theorists. From the spectrograms

presented in figure 1 it can be discerned that though [e] can be clearly distinguished from [nd] and [a] at the segmental level, at the acoustic level the various components of speech merge into each other as seen from the formants represented by the darkened areas which are 'smeared' into each other. In other words, instead of there being distinct formants representing each segmental element there is characteristic bending of the visible formants of one element into the domain of the next. This phenomenon is also evident in the spectrograms in figure 2.

Again, all aspects being constant, an element such as [nd] or [b] would be expected to have the same frequency articulation in all environments. However, an examination of the spectrograms in figures 1 and 2 as reflected in the time - frequency domain spectra reveals otherwise.

In the articulation of [enda] 'stomach' in Lubukusu the [nd] compound has a relatively high pitch of about 3,500Hz as compared to the same element in [enda] 'louse' which has a frequency of about 2,900Hz. These pitch differences in the pronunciation of [nd] can be accounted for in the following way: in the articulation of [enda] ('stomach') the high tone marked above the word-final vowel [a] is not just confined to the vowel; instead, it spreads onto the preceeding [nd] resulting in its being correspondingly high-pitched. Similarly, in the articulation of [enda] ('louse') the low tone marked above the final vowel [a] is not just confined to that vowel but spreads onto the preceeding nasal compound as well, making it correspondingly low-pitched. In Lulogooli, on the other hand, the phoneme [b] in [jaba] ('dig') is realized with a relatively high

pitch of about 2,600Hz due to the effect of the high tone marked above the final vowel. The same phoneme in [jaba] ('these ones') is realized with a relatively low pitch of about 1,500Hz due to the effect of the low tone marked above the word-final vowel.

What this means is that tones are not confined to single segments but spread over adjacent elements. The examples given lend credibility to the notion of **tonal syllabicity**, that is, the contention that tones are realized along with syllables rather than with single segments. The acoustic implication of the phonotactic process of juxtaposition is that tone has the effect of spreading over adjacent segmental elements. This evidence supports the position taken by autosegmental theorists (Katamba,1989; Goldsmith,1990; Durand,1990) that tones must be seen as spanning domains which are larger than single segments.

It is of significance here to note that phonological processes like phonetic conditioning also apply to tone with varying degrees of explanatory power. Just like allophonic variants are phonetically conditioned at the segmental level, so are tones phonetically conditioned at the acoustic level. How high or how low a particular tone is depends largely on neighbouring tones. For example, in figure 1(a) the tone on the first syllable has been calculated to have a frequency of 3,867Hz while in 1(b) it has been found to have a frequency of 3,700Hz. Both these frequencies nevertheless represent high tone; the high tone in (a) is therefore slightly higher than the high tone in (b). This is because the succeeding syllable in (a) is also high (with a peak of 3,600Hz) while in (b) the succeeding syllable is low-toned (falling to as low as 1,700Hz). In the spectrograms in

figure 2, on the other hand, the high tone on the first syllable has a frequency of 2,200Hz in (a) and 2,000Hz in (b); these are regulated by the tone on the second syllable which has a high frequency of 2,600Hz in (a) and a low frequency of 1,700Hz in (b) respectively. The range within which one tone falls is therefore largely dependent on the next or, by extension, the preceeding tone.

The two arguments raised above, first, that tones should be seen as **tonemes** in their own right, and second, that tones spread over domains which are larger than those of single segmental phonemes (in this case syllables) destroy the basic TGP assumption which treats tone as a feature of segmental phonemes. Just like the segmental phonemes /p/ and /f/ serve to distinguish between the semantics of [pin] and [fin] in English, so does the tonemes [+H] and [+L] serve to distinguish between the semantics of [enda] ('stomach') and [enda] ('louse') in Lubukusu. By extension, just like segmental phonemes are building blocks of language on the one hand, so are tones similar building blocks on the other. In brief, the two are complimentary rather than one being dependent or wholly subsumed under the other.

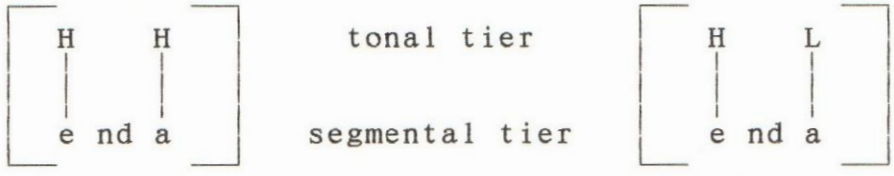
3.3. TONE AS AN AUTOSEGMENT

It is evident from the discussion in section 3.2. that the representation of tone in the dialects under analysis cannot be satisfactorily handled within the TGP model devised by Chomsky and Halle (op.cit). Principally, tones cannot be tied to vocalic segments but rather must be seen to constitute their own system which spans domains of more than just single segments. The

traditional and classical SPE representation of tone through the use of diacritic marks ([ ] for high and [ ] for low) has been criticized, and rightly so, by autosegmental and non-linear theorists (Durand, op.cit; Goldsmith, op.cit) for relegating to the periphery the significance of tone in phonological inquiry. The problem of the representation of tone in phonological analysis is such that tones have to be represented as being at par with segmental phonemes while at the same time having the freedom to span over domains definable in metrical terms.

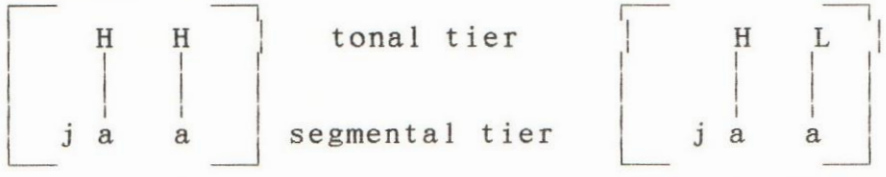
Suppose, as postulated by non-linear theorists (Durand, op.cit), tones are taken as constituting their own system which is independent from the system of segments, and that a system of notation which frees the tonal system from the segmental system be used in the representation of this phenomena. Suppose, again, vertical lines (referred to in the autosegmental formalism as **'association lines'** [see section 1.8.]) are used in such a notation to connect tones to the relevant tone-bearing units (which actually represent syllable nuclei). Then data 1 and data 2 above can be represented in the following way:

Data 5(a): Lubukusu



(stomach) (louse)

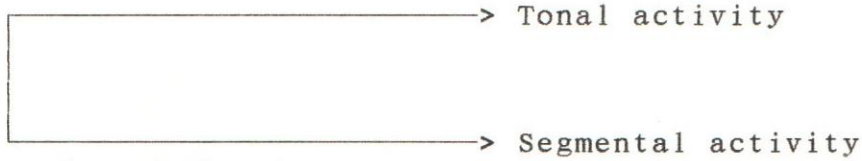
Data 5(b): Lulogooli



(dig) (these ones)

In this analysis tones are represented on their own phonological tier, though they are conventionally linked to syllable nuclei. The tones are represented as being free from the segmental tier which is made up of segmental phonemes; the only links between them (tones) and the segments are the association lines which indicate simultaneiety in time. What this means is that the tones are not realized as seperate entities in the speech continuum but rather are co-articulated along with the segments.

This analysis emphasizes the autonimity of tone. Rather than be seen as being tied to the vowel segments tone is represented as being free from the segmental set-up. The tonal system and the segmental system constitute seperate tiers of activity which complement each other in the process of speech production. In other words, the tonal activity can be seen as running parallel to the segmental activity in speech communication. This representation, while acknowledging the freedom of tone from the segmental phonemes, fully embraces the notion of co-registration, that is, that tones and segments occur simultaneously in the process of speech production as depicted in the simple diagram below representing the speech continuum:

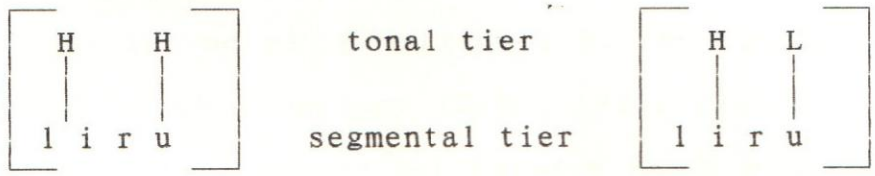


Speech Continuum

Diadram V: Tonal and Segmental activities in speech in communication

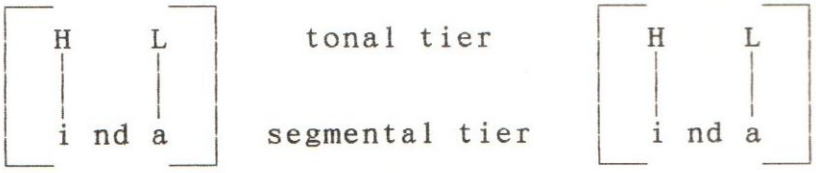
An autosegmental analysis of the data in 3(i) and 4(i) would thus take the forms below:

Data 6(a): Lubukusu



(banana leaf) (ear)

Data 6(b): Lulogooli



(stomach) (louse)

In autosegmental phonology, therefore, tones are seen as constituting a seperate phonological level from that of segmental phonemes. This 'seperate phonological level' is formally represented as the TONAL TIER which is seperate from the SEGMENTAL TIER on which segmental phonemes are represented. Tone, therefore, is seen as an AUTOSEGMENT which is free to span over varying domains of the segmental order. The emphasis is on hte revolution in the nature of the organization of phonological representations from a linear to a multi-linear representation:

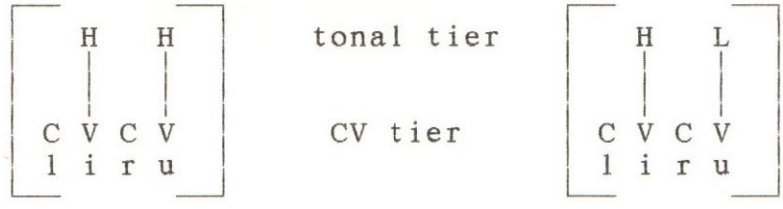
> In autosegmental phonology the focus shifts to ways in which phonological rules can change the ORGANIZATION of phonological representations. In autosegmental phonology phonological representations are no longer seen as simple rows of segments, with all phonological processes taking place at one single level. Rather, they are regarded as complex arrays of (in principle independent) elements arranged on different levels or tiers.
>
> (Katamba, op.cit:196)

Katamba(ibid) explicitly supports the representation shown in data 5 and 6 above, where different phonological elements are placed on seperate tiers. Thus, the emphasis is on the shift in the organization of phonological representations from a linear

to a multi-linear approach.

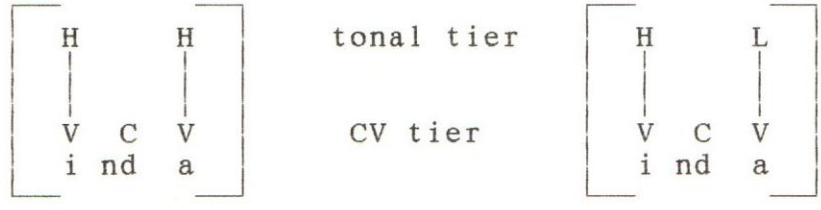
As earlier noted in section 1.8. the formalism of AP was much aided by CV phonology (Kahn, 1980; Clements and Keyser, 1983). The central notion put forward in CV phonology was that of a CV (or skeletal) tier which has as its basic elements vowel and consonant 'slots'. These CV 'slots' are filled by segments, that is, the Chomskyan - Halle "unordered bundles of features" or feature specifications abbreviated as phonetic symbols. An incorporation of the CV Phonology model into an autosegmental representation results in the modification of the above analysis in the manner explicated below:

Data 7(a): Lubukusu



(banana leaf) (ear)

Data 7(b): Lulugooli



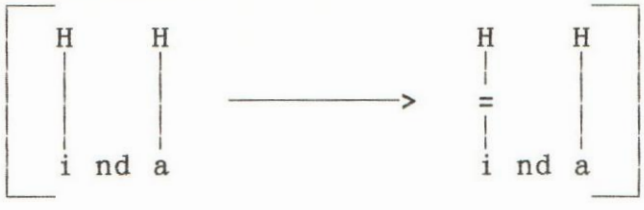
(stomach) (louse)

The representation given above is cumbersome in some respects: a truely autosegmental notation exibits some constraints on the tone sequences. The principles of association highlighted in section 2.4. require that every tone be associated with at least one tone-bearing unit and vice-versa - to this far the above representation is acceptable. However, the Obligatory Contour

Principle (OCP) constraints the tone sequences since for any pair of adjacent autosegments **a** and **b**, **a** is not equal to **b**. This means that (as noted in 2.4. under Mauseen's rule) any two identical autosegments must be collapsed into each other. This 'collapsing process' is effected by LINKING and DELINKING association lines. The words for 'stomach' in Lubukusu and Lulogooli can thus be reanalysed in the following way:

Data 8(a): Lubukusu

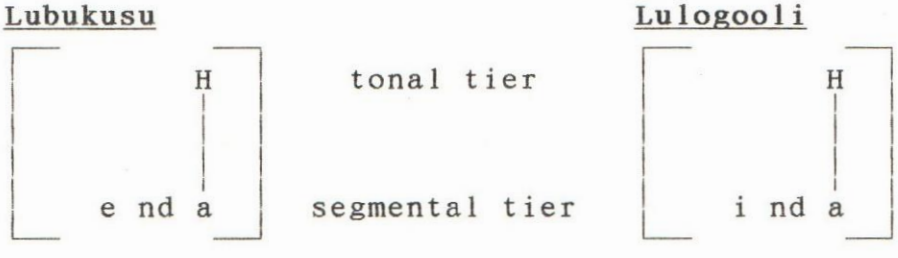
Data 8(b): Lulogooli



The severed line (=) indicates a delinking process while the broken line indicates a linking process.

The OCP therefore has the effect of dissimilating tones on the tonal tier in the phonetic representation. Consequently, the ultimate autosegmental analyses of the representation in data 8(a) and 8(b) above is given as 8(c) below:

Data 8(c):



3.4. TONE STABILITY

In Lubukusu and Lulogooli there is a certain kind of tone stability which augments the autosegmental postulation of the autonimity of tone from segmental phenomena. In these dialects, for instance, the plural forms of nominals always maintain the tones of the singular forms. The data below from Lulogooli gives further insight into this:

Data 9(a): Lulogooli

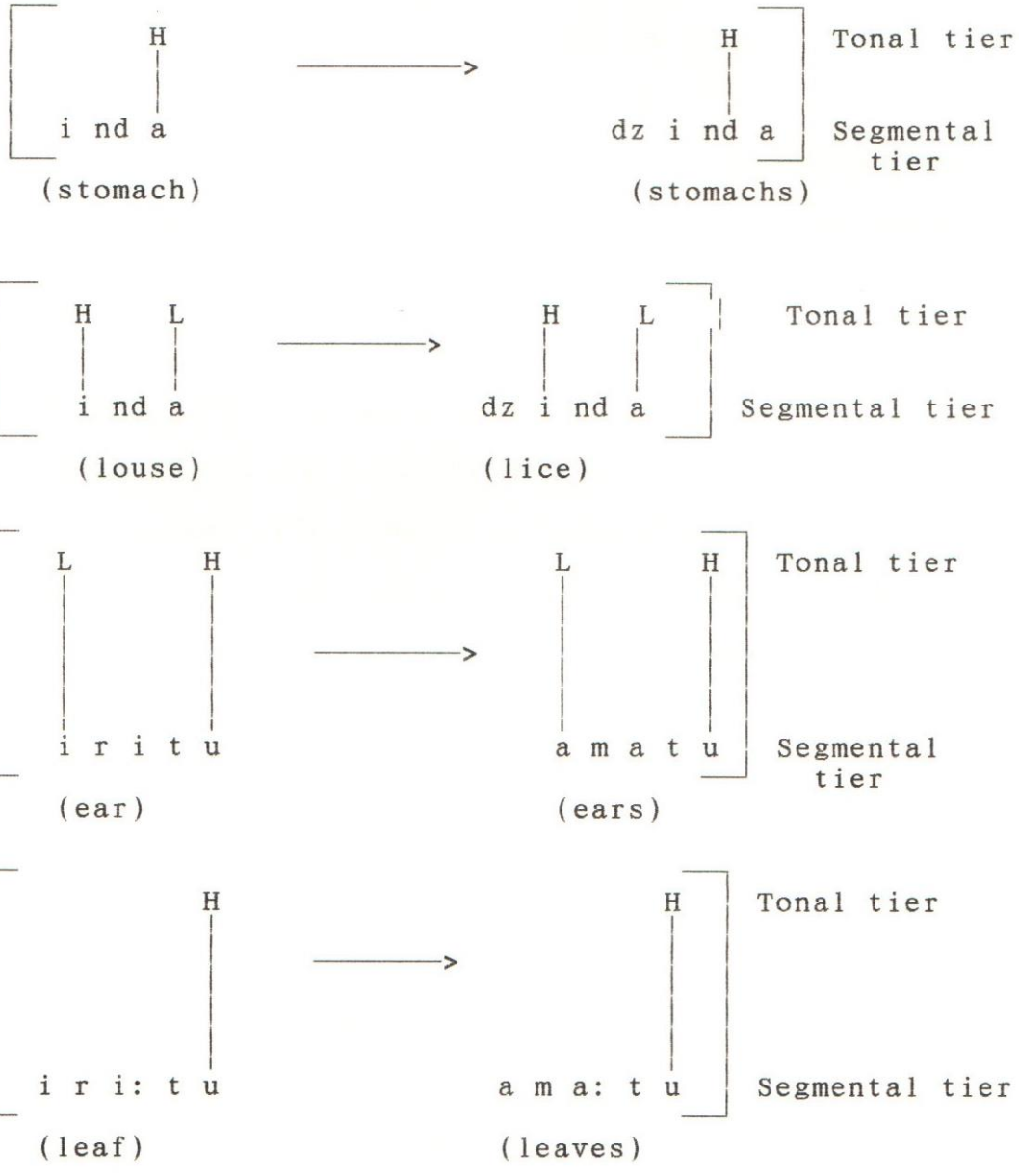
Singular		Plural	
[inda]	(stomach)	[dzinda]	(stomachs)
[inda]	(louse)	[dzinda]	(lice)
[iritu]	(ear)*	[amatu]	(ears)
[iri:tu]	(leaf)*	[ama:tu]	(leaves)

(*see the spectrographic evidence of the tonal realizations in [iritu] and [iri:tu] in section 4.2.).

The evidence to be adduced from data 9 is that when segmental variation is effected to indicate pluralization the tonal order remains unchanged or **stable**. The addition of the plural marker [dz] in the first two examples, and the substitution of the singular marker [iri] by the plural marker [ama] in the last two examples, does not in any way affect the tones. For this reason tones should be seen as being divorced from the segments since segmental processes do not affect the tone realizations. The pluralization rule, for example, does not affect the tones in Lulogooli; consequently phonological representations should be presented in a multi-tiered manner as in 9(b) below, each tier

having the autonomy to change or remain stable irrespective of what goes on on the adjacent tier:

Data 9(b): Lulogooli (pluralization rule)



A different kind of the stability and independence of tone which further augments the autosegmental theory can be evidenced from the cliticization process in Lubukusu. A 'clitic' is a particle which is attached to a HOST or main word and is

incapable of standing on its own. Proclitics are grammatical particles attached to the beginnings of words while enclitics are particles attached to the endings of words. In the Lubukusu word [embakosi] (meaning 'which hoe'), for instance, [mbako] is the root; [e] is the singular class marker (a proclitic) while [si] is the interrogative marker (an enclitic).

In Lubukusu dialect the procliticization process is such that the nominal prefixes always inherit the tone of the neutral form, that is, the singular class marker. The following cases are met with:

(i) singular versus plural;

(ii) diminutive (singular) versus diminutive (plural);

(iii) the subclass referring to objects of an unusually big size referred to herein as exaggeratively big (exagg. big), thus: exagg. big (singular) versus exagg. big (plural).

An analysis of data 10 below gives further insight into this phenomenon:

Data 10: Lubukusu

	singular		**plural**	
(i)	(a) [enda]	'stomach'	[inda]	'stomachs'
	(b) [enda]	'louse'	[inda]	'lice'
	(c) [liru]	'banana leaf'	[kamaru]	'banana leaves'
	(d) [liru]	'ear'	[kamaru]	'ears'

	diminutive (singular)		**diminutive (plural)**	
(ii)	(a) [xata]	'small stomach'	[ita]	'small stomachs'

(b)	[xata]	'small louse'	[ita]	'small lice'
(c)	[xaru]	'small banana leaf'	[iru]	'small banana leaves'
(d)	[xaru]	'small ear'	[iru]	'small ears'

(iii)	**exagg. big (singular)**		**exagg. big (plural)**	
(a)	[kuta]	'big stomach'	[kimita]	'big stomachs'
(b)	[kuta]	'big louse'	[kimita]	'big lice'
(c)	[kuru]	'big banana leaf'	[kimiru]	'big banana leaves'
(d)	[kuru]	'big ear'	[kimiru]	'big ears'

The words in data 10 depict a clear case of the stability of tone. The tones remain stable even though the prefixes, which are made up of segmental phonemes, are altered to denote differences in number and size. Taking (i)(a), (ii)(a) and (iii)(a) as an example the **H - H** tone pattern (simplified to **H** by the OCP) is preserved despite the substitution of the medial **[-nd-]** by **[-t-]** and the alteration of the singular class marker **[e-]** by **[i-]**, **[xa-]**, **[i-]**, **[ku-]** and **[kimi-]**. This also applies to all the (c) cases in the data which maintain a **H - H** tone pattern despite the segmental processes which change the initial syllable **[li-]** to **[kama-]**, **[xa-]**, **[i-]**, **[ku-]** and **[kimi-]**.

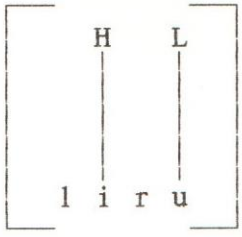
Similarly, in all the (b) and (d) cases the segmental changes which account for the different implications for 'louse' and 'ear' do not affect the **H - L** tone pattern which remains STABLE. The tones defy the segmental order - they are independent and do not behave in unison with segmental organization.

> Tone shows a kind of STABILITY which cannot be accounted for if it is assumed to be an integral part

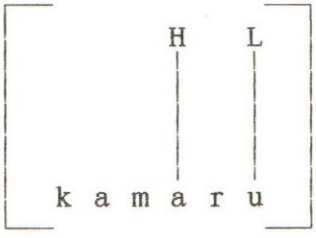
> of the phonological segment on which it appears in the phonetic representation.
>
> (Katamba,1989:194)

The autosegmental notation of representing tone on an autonomous tier from the segmental tier is thus highly justified : each tier can exercise its own procedural freedom without necessarily interfering with the freedom of adjacent tiers. A representation of the data in (i)(d), (ii)(d) and (iii)(d) shows that the segemental tier exercises its freedom to change or alter segmental order but this does not affect the autonomy of the tonal tier which preserves the H - L tone pattern:

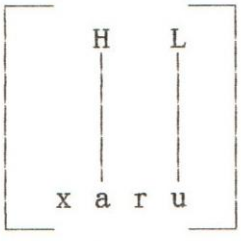
Data 11: Lubukusu



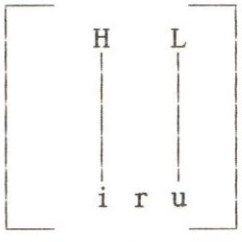
(ear)



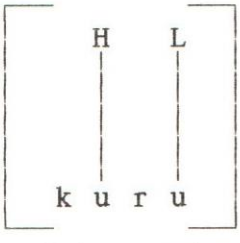
(ears)



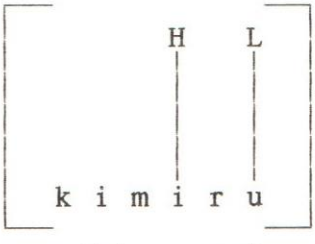
(small ear)



(small ears)



(big ear)



(big ears)

By behaving in this autonomous manner and defying segmental

processes tones in Lubukusu and Lulogooli are qualified as having an imporant characteristic typical of autosegments, namely, that of stability and independence from other phonological activities.

3.5. TONES AND THE AUTOSEGMENTAL FRAMEWORK

From the discussion presented in this chapter it is evident that Lubukusu and Lulogooli basically employ two contrastive tones, high tone [+H] and low tone [+L], which can be classified as being AUTOSEGMENTS. Tonal behaviour fulfils the fundamental claims of Autosegmental Phonology (see 1.8). It has been proved in section 3.2. that tone in Lubukusu and Lulogooli is phonemic and is just as significant as other distinctive sound units of the language. The first hypothesis of this study with reference to the phenomenon of tone is thus approved. In addition to the consonantal and vowel inventories reviewed in section 2.2.1. and 2.2.2., the dialects employ two phonemic or contrastive tones, [+H] and [+L].

In section 1.8. it was argued that among the claims put forward in autosegemental phonology is the theorization that autosegments must be defined in terms of units which are larger than individual segments. In 3.2. and 3.4. tone has been proved to span the domain of syllables and being divorced from segments by surviving segmental processes (like segment - substitution) unchanged. Consequently, tones have been found to be most appropriately defined in metrical terms.

In section 3.3. it has been demonstrated that tones in Lubukusu and Lulogooli are best handled autosegmentally. This is because, first, by representing tone on its own tier its

significance is emphasized just as much as the significance of segmental phonemes, and second, by representing tone as being free from the segments emphasis is put on the fact that segmental processes need not interfere with tonal processes and vice-versa. The hypothesis that the autosegmental framework can adequately capture the phenomena of tone in the two dialects is thus also positively proved. Tone anchoring, supported by the CV tier, gives tones the autonomy deservedly required.

CHAPTER FOUR

4.0. LENGTH

4.1. PRELIMINARIES

It was noted in section 2.3.2. that most studies done on the feature of length have posited that the duration of time taken in segmental articulation is at variance with respect to different segment types. This means that some segments have the ability of being articulated over a longer timespan than others. The postulation that voiced segments, for instance, are articulated over a relatively longer span of time than their voiceless counterparts has for long been held in high esteem by segmental theorists (Gimson, 1989). However, this study is tailored to deal with the feature of length which in conventional orthography is marked by a reduplication of the representative vowel or consonant symbol, for example 'aa' or 'kk', phonetically represented by segmental theorists as [a:] or [k:].

In the dialects under study length is a widely occurring phonological phenomenon both at the lexical and grammatical levels. Phonemic length is manifested at the lexical or word level. Length which is evident at the grammatical level is a product of phonological derivational processes and is technically referred to as **compensatory lengthening.**

The concerns of recent non-linear theories center around the debate on the phonological representation of length. There are two prime issues in this argument. First, there is the issue of whether or not there exist any constraining factors determining the occurrance and patterning of length. The second issue concerns the question of whether this feature, like tone, can be

liberated from segmental organization and be treated as an **autosegment**. The present focus is an extension of this debate.

4.2. PHONEMIC LENGTH

In the two dialects under study the feature of length manifested at the lexical level is a widely occurring phenomenon. Nominal, adjectival and verbal stems can have the phonetic feature oflength as part of their phonetic setup. As discussed in chapter two (cf.2.2.2) speakers of these dialects have the capability of distinguishing between lengthened and non-lengthened co-articulation. The following example drawn from Lulogooli can serve as a starting point into the explication of this phenomenon:

Data 12: Lulogooli

Orthographic Representation	Phonetic Representation	Gloss
iritu	[iritu]	'ear'
iriitu	[iri:tu]	'leaf'

In the event of the words in data 12 above being uttered native speakers of Lulogooli are able to discern with ease which meaning is implied even when the word is placed in a context-free environment. An examination of the relevant spectrograms for the words displayed overleaf (figure 3) will help in the determination of the cause of this automatic native speaker recognition of the relevant semantic implications:

(a) [iritu] ('ear')

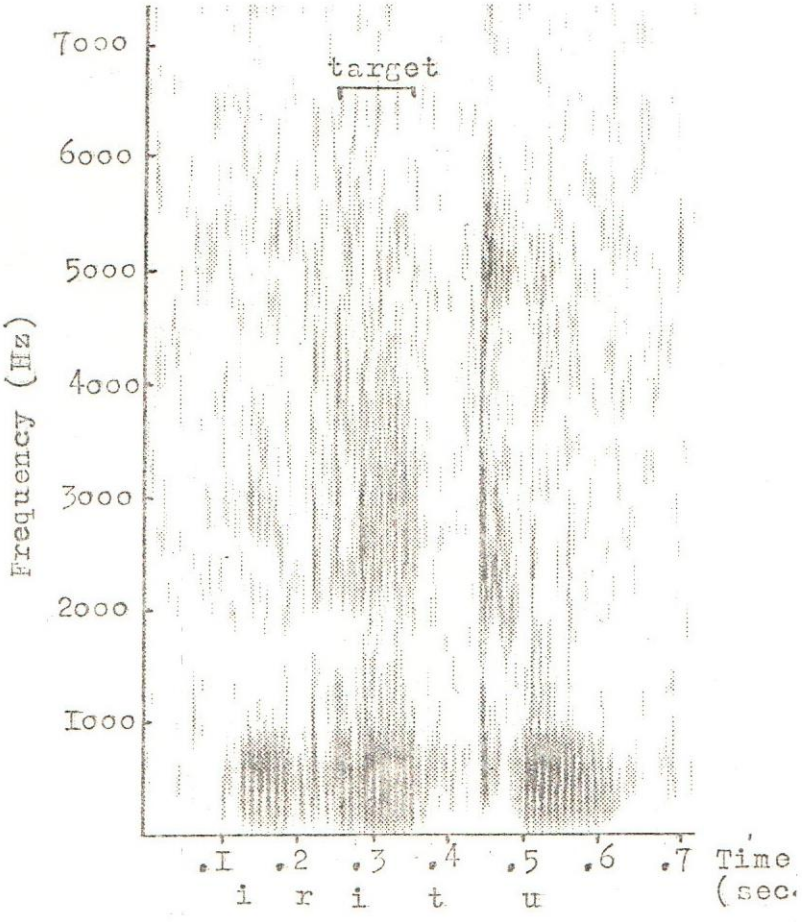


FIGURE 3(a): Spectrogram for [iritu] ('ear').

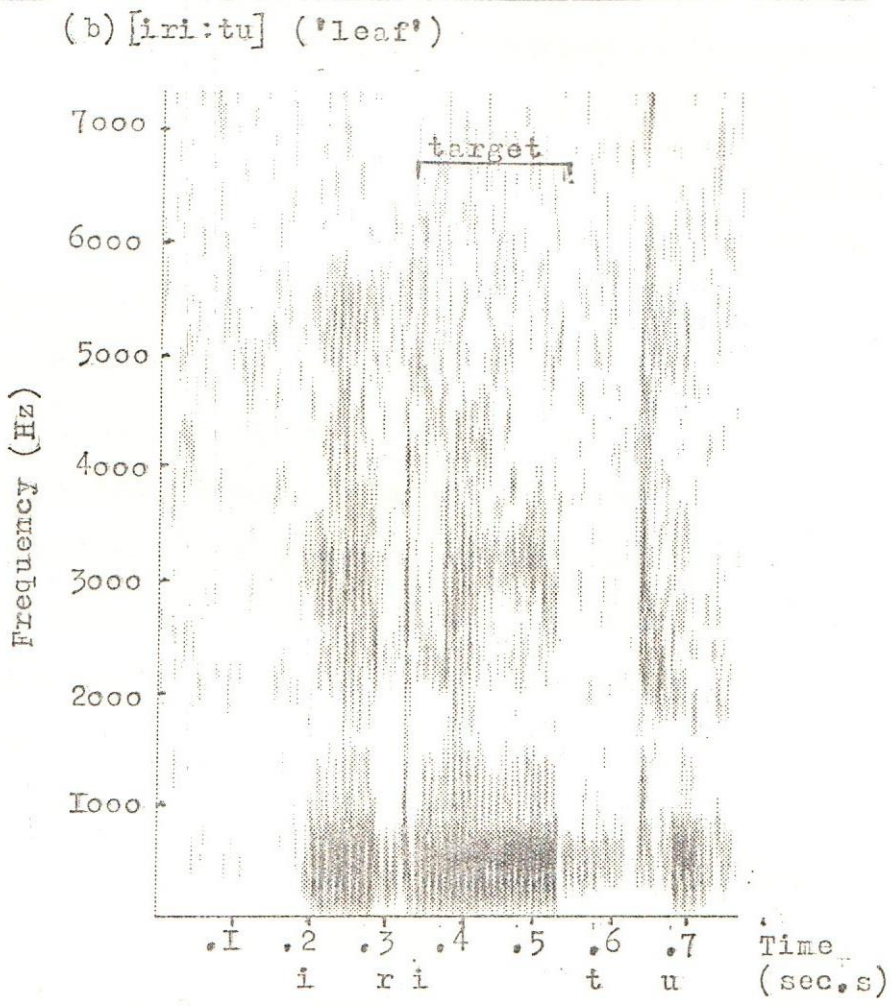


FIGURE 3(b): Spectrogram for [iri:tu] ('leaf').

The spectrograms in figure 3 have frequency displayed along the vertical dimension while time is displayed along the horizontal dimension which is marked in seconds (convertible into milliseconds (ms)). Since 1,000ms is equivalent to 1 second, the conversion formula for the spectrograms is the specified decimal multiplied by 1,000. Thus, for instance, .1 is 1/10 x 1000 = 100ms. The intensity of time-frequency bounded areas is displayed by the relative blackness or brightness of the picture marking.

What is marked as the 'target' is the point of contrast between the two spectrograms and the syllable over which this is marked is consequently of prime importance in the present concern. Since length is a dynamic aspect of the continuous speech spectrum the present concern in the spectrograms will focus on changes on the horizontal time axis.

The horizontal time axis reflects the duration of time taken in the articulation of an utterance and is consequently pivotal in the **approximation** of the time taken in the articulation of syllables. **'Approximation'** is the appropriate word to use in this case since stable acoustic targets are often elusive especially in the absence of lengthemes where juxtaposed targets quickly merge, each into the domain of the next.

A lengtheme can be spectrographically recognized due to its physiological characteristics which result in the establishment of a single stable articulatory target of a section of a syllable over which it is evident. This, in turn, results in the establishment of a single stable acoustic target value of the same section of the syllable (usually the syllable nucleus) which is reflected on a spectrogram by stable spectral structure

running parallel to the horizontal time axis.

The difference between the spectrograms in figure 3(a) and 3(b) can be clearly seen after a consideration of the stability of the formant sections over the medial syllable [ri]. In 3(a) the darkened area over the nucleus [i] of the first formant of this medial syllable is short-lived and quickly fades into the domain of the succeeding voiceless [t]; the formant representing this nucleus starts from around 0.25 seconds to 0.35 seconds. The nucleus therefore lasts for about 0.35 - 0.25 = 0.1 seconds. By contrast, the medial syllable in 3(b) is relatively stable and lasts over a longer span of time; it begins at about 0.34 seconds to 0.54 seconds and hence lasts 0.2 seconds.

The duration of each of the syllables in both spectrograms can be obtained after a consideration of the point in time where each begins and ends. The duration can then be computed by subtracting the value of where a syllable begins from that of where it ends:

		syllable length
3(a)	1st syllable	0.25 - 0.12 = 0.13
	2nd syllable	0.35 - 0.25 = 0.1
	3rd syllable	0.62 - 0.35 = 0.27
3(b)	1st syllable	0.34 - 0.18 = 0.16
	2nd syllable	0.54 - 0.34 = 0.2
	3rd syllable	0.78 - 0.54 = 0.24

The differences in duration between the three syllables in the spectrograms can be obtained after deducting the syllable lengths of (a) from (b). This can be computed in the following way:

Durational difference = b-a.	
1st syllable	0.16 - 0.13 = 0.03
2nd syllable	0.2 - 0.1 = 0.1
3rd syllable	0.24 - 0.27 = -0.03

The question then arises as to which of the three durational

differences above is significant and therefore responsible for the meaning contrast between the words in the two spectrograms. This can be resolved after computing the simple percentage proportions of the differences, taking the 0.05 significance level. Any value that is less than 5% is considered non-significant whileany value thatisgreater than 5% is considered significant:

Formula: $\frac{1}{x} \times 100$

(where x = any value being computed).

The proportions of the durational differences between the syllables in (a) and (b) expressed as percentages can thus be computed as follows:

1st syllable $\frac{1}{0.03} \times 100 = 3\%$

2nd syllable $\frac{1}{0.1} \times 100 = 10\%$

3rd syllable $\frac{1}{-0.03} \times 100 = -3\%$

The first and third syllable values 3% and -3% respectively are less than the critical 5% value and are therefore non-significant. The10% value for the second syllable is greater than 5% and is consequently significant.

Clearly, it is this significant difference in the length or duration of the medial syllable [ri] that leads to the semantic difference between the word displayed in (a) and that displayed in (b). Consequently, it can be soundly concluded that there is something inherently **phonemic** about length which is responsible for the meaning contrasts between the words. The hypothesis that length is phonemic is thus statistically supported. This assertion can be further authenticated after a consideration of

another set of data, this time from Lubukusu, with spectrographic back-up:

Data 13: Lubukusu

Orthographic Representation	Phonetic Representation	Gloss
amala	[amala]	'he finishes'
amaala	[ama:la]	'he is smearing (with cowdung)'

The words in data 13, though structurally similar, have different semantic implications whether contextualized or not. This difference can be accredited to the length of the medial syllable as reflected in the spectrograms overleaf:

(a)[amala] ('he finishes')

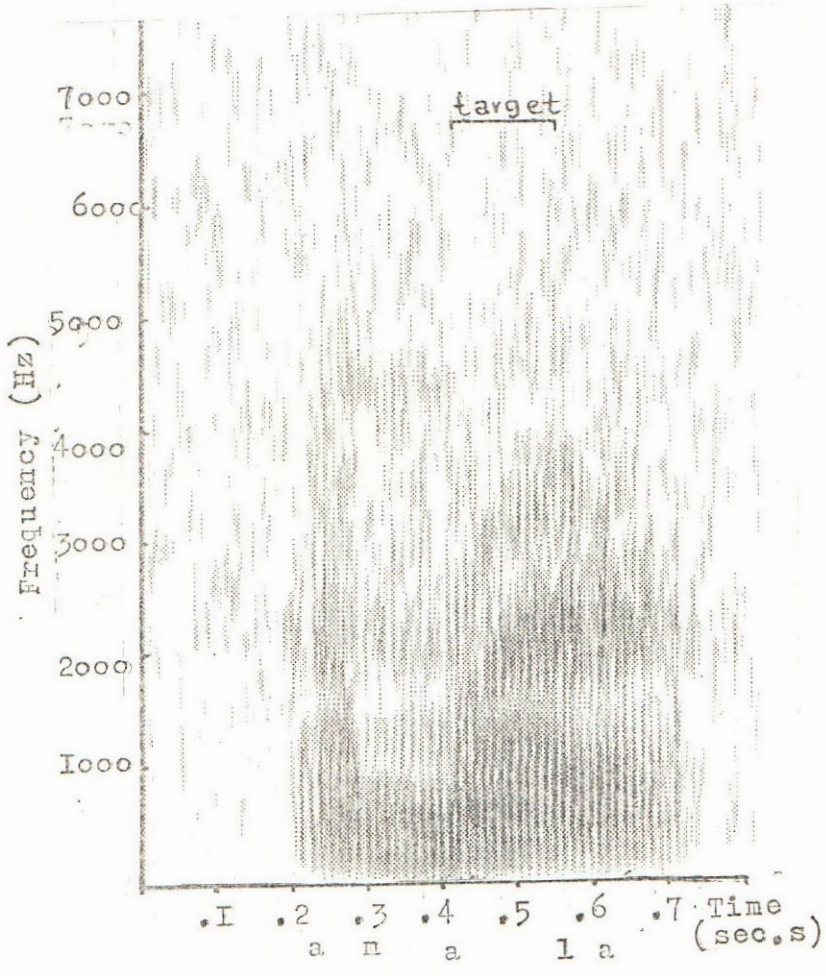


FIGURE 4(a): Spectrogram for [amala] ('he finishes').

(b) [ama:la] ('he smears')

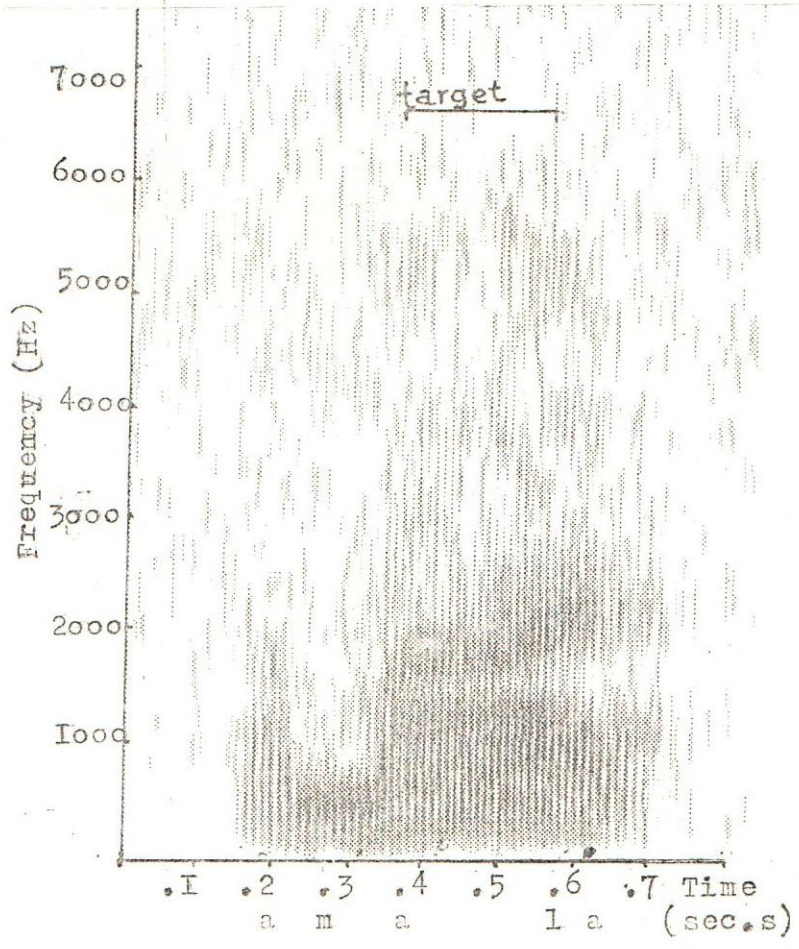


FIGURE 4(b): Spectrogram for [ama:la] ('he smears').

In the spectrograms in figure 4 the first formant begins in the region of 1000Hz and comes down to about 400Hz over [m] before rising again to 1000Hz. A glance at the spectrograms reveals that there is a region of stable formant structure around the middle syllable in (b) as opposed to (a). This is identified by the spectral sequence in which the formants are parallel to the time axis and thus not changing, creating in (b) a stable target of substantial duration.

The acoustic syllable target the medial syllable [ma] in 4(a) lasts from about 0.41 seconds to 0.55 seconds, a duration of about 0.14 seconds. This is in contrast with the same target in 4(b) which lasts from about 0.36 seconds to 0.56 seconds, a duration of about 0.20 seconds. The difference between these acoustic targets is 0.06 seconds (i.e. 0.20 - 0.14 = 0.06).

The duration of each ofthe syllables in both spectrograms can be computed as follows:

			syllable length
4(a)	1st syllable	0.41 - 0.2	= 0.21
	2nd syllable	0.55 - 0.41	= 0.14
	3rd syllable	0.72 - 0.55	= 0.17
4(b)	1st syllable	0.36 - 0.14	= 0.22
	2nd syllable	0.56 - 0.36	= 0.2
	3rd syllable	0.72 - 0.56	= 0.16

The durational differences between the corresponding syllables in both spectrograms can be computed using the formula b-a:

Durational difference: b - a.		
1st syllable	0.22 - 0.21	= 0.01
2nd syllable	0.20 - 0.14	= 0.06
3rd syllable	0.16 - 0.17	= -0.01

In order to discover which of the three durational differences above is significant we can compute their proportions expressed as percentages using our previous formula

$$\frac{1}{x} \times 100$$

Thus,

1st syllable $\frac{1}{0.01} \times 100 = 1\%$

2nd syllable $\frac{1}{0.06} \times 100 = 6\%$

3rd syllable $\frac{1}{-0.01} \times 100 = -1\%$

The values for the first and third syllables, 1% and -1% respectively, are less than 5% and are consequently nonsignificant. The 6% value for the medial syllable is greater than 5% and is considered significant.

It is evident from the computation that the significant durational difference between the spectrograms in (a) and (b) lies with the medial syllable [ma]. Just as discussed for figure 3 above, this difference in time (or articulatory duration) is the only significant difference between spectrogram 4(a) and 4(b). Consequently, length is the distinctive element which gives rise to the semantic distinction between the words. This clearly points to the phonemic status of length. Length, just like phonemes, can be used to contrast the meanings of words. Data 14 and 15 below can further be used to support this position:

Data 14: Lubukusu

	Orthographic Representation	Phonetic Representation	Gloss
(i)	bola	[ola]	'rot'
	boola	[o:la]	'say'
(ii)	beka	[eka]	'shave'
	beeka	[e:ka]	'they are learning'

(iii)	fuma	[fuma]	'be popular'
	fuuma	[fu:ma]	'cover (verb)'
(iv)	kamandu	[kamandu]	'rubbish'
	kamaandu	[kama:ndu]	'dry ugali'
(v)	khula	[xula]	'grow up'
	khuula	[xu:la]	'uproot'
(vi)	kula	[kula]	'buy'
	kuula	[ku:la]	'roof (verb)'
(vii)	kuta	[kuta]	'back-bite'
	kuuta	[ku:ta]	'scoop'
(viii)	lila	[lila]	'cry'
	liila	[li:la]	'eat with'
(ix)	lilo	[lilo]	'sleep'
	liloo	[lilo:]	'a hole'
(x)	mela	[mela]	'germinate'
	meela	[me:la]	'get drunk'
(xi)	nula	[nula]	'taste sweeter'
	nuula	[nu:la]	'snatch'
(xii)	rura	[rura]	'get out'
	ruura	[ru:ra]	'unload'

Data 15: Lulogooli

(i)	amara	[amara]	'intestines'
	amaara	[ama:ra]	's/he is finishing'
(ii)	hamba	[hamba]	'touch'
	haamba	[ha:mba]	'come'
(iii)	hana	[hana]	'close,e.g.the door'
	haana	[ha:na]	'give out'

(iv)	kera	[kera]	'milk (verb)'
	keera	[ke:ra]	'grow old'
(v)	keno	[keno]	'this one'
	kenoo	[keno:]	'toe'
(vi)	rira	[rira]	'cry'
	riira	[ri:ra]	'eat with'
(vii)	nyola	[nola]	'pick vegetables'
	nyoola	[no:la]	'get/find'
(viii)	sinya	[sina]	'fed up with'
	siinya	[si:na]	'uproot, e.g.potatoes'
(ix)	tula	[tula]	'get out'
	tuula	[tu:la]	'unload (from the head)'
(x)	bula	[bula]	'I do not have'
	buula	[bu:la]	'found out'
(xi)	yabo	[jabo]	'those ones'
	yaabo	[ja:bo]	'theirs'

Except for durational differences indicated by vowel reduplication in the orthographic representation the pairs of words in data 14 and 15 are structurally similar. It would appear, according to traditional phoneticians and proponents of the unilinear TGP model, that the resultant meaning differences in each case could be accounted for solely by the presence of a long vowel, phonetically denoted by the length - marker [:], where originally a short one existed; it could be argued out in this school of thought that this is a clear case of phonemic vowel length, that is, that the data attests to the phonemic

status of short and long vowels in the dialects. But this is clearly not the case.

Supposing an approach is adopted that takes the length marker [:] in the phonetic representation as representing a minimal acoustic unit technically called a lengtheme. Then the only difference between the minimal pairs in data 14 and 15 is the presence of the lengtheme in the second word of each pair where in the first it was absent. The difference in meaning between the pairs can therefore be accounted for solely by the presence or absence of the lengtheme. Since the lengtheme is representative of length then sound conclusion can be reached that a difference in length can result in a difference in meaning between two otherwise similar words. What this means is that length in these dialects is phonemic and can be used to signal semantic contrasts between two otherwise similar words. Consequently, the phonemic status of length is treated as being at par with the phonemic status of other segmental phonemes.

A traditional or TGP an analysis, albeit acknowledging that there is something inherently phonemic about length, takes this feature as being tied to the vowel segment. Most previous studies on length have taken this stance, coining terms such as long and short vowels, consonant gemination and consonant and vowel reduplication. These studies assumed that the vowels described as being long were directly substitutable at the same phonological level with discrete and specific short vowels to produce different words. The implication for this position is that an exhaustive chart of the phonetic symbols of Lubukusu and Lulogooli would require that each symbol appear in duplicate -

one representing a short segment and the other its lengthened counterpart, for example [a], [a:] and [k], [k:]. Alternatively it would be required that such a chart be accompanied by conditions stating that for each symbol there exist a short form and a corresponding long form.

Such a position that takes length to be merged to the vowel segment in linearly ordered phonological representations could be described as ridiculously uneconomical and misleading since, apart from the fact that it would require double the number of phonetic units or conditions for their operation, it fails to capture the notion of a 'lengtheme' - that at the phonetic level the presence of a lengtheme is just as significant as the presence or absence of a given phoneme. The following arguements can be advanced to support the position that length, rather than be seen as being merged to the vowel (or consonant) segment, should be seen as a distinctive unit in its own right which require due recognition in phonological analysis:

First, since length functions phonemically to semantically contrast between two otherwise similar words, much in the same way like phonemes do, then it should not be seen as being tied to any other phoneme. Length must therefore be seen as a 'phoneme' in its own right - technically, a **lengtheme.** To tie length to any type of segmental phonemes would logically be the equivalent of the suggestion that phonemes can randomly be tied to other phonemes which, from the inside to the outside, is an absurd premise. Consequently the representation of length as a feature of vowels (or consonants) needs to be fully revised.

Secondly, just like tone, length is associated with syllable

nuclei. The spectrograms in figures 3 and 4 reveal that the 'target', which is the point of contrast or region of significance, is the nuclei of the medial syllables [ri] and [ma]. At the acoustic level the time-domain aspects of these syllables vary as computed above. In figure 3, the fact that the target in 3(a) is 100 milliseconds shorter than the same target in 3(b) does not alter the segmentality of the nucleus which remains [i]. By extension, the medial syllable in 4(a) and 4(b) remains [ma] despite the fact that in 4(b) the nucleus is 60ms longer than in 4(a). This points to the fact that the length of these syllables is distinctive in its own right.

Thus, the overlapping of aspects traditionally associated with vowels and consonants (such as phonemicity and length) suggest that in any attempt at speech analysis based solely upon acoustic data it is extremely convinient to operate with units larger than the sound segment or phoneme. To mark length on the vowel segment is to underplay its significance in the system of language. Moreover, to mark this feature by double dots [:] as being affiliated to segments is to emphasize its peripheral status in relation to the segment on which it is marked. Consequently, the place of length in phonological inquiry needs to be revised and redefined to give it due phonemic and metrical recognition. In phonological analysis the feature of length (more appropriately the lengtheme) needs to be represented as a distinctive unit on its own right and its phonemic status placed at par with the status of segmental phonemes.

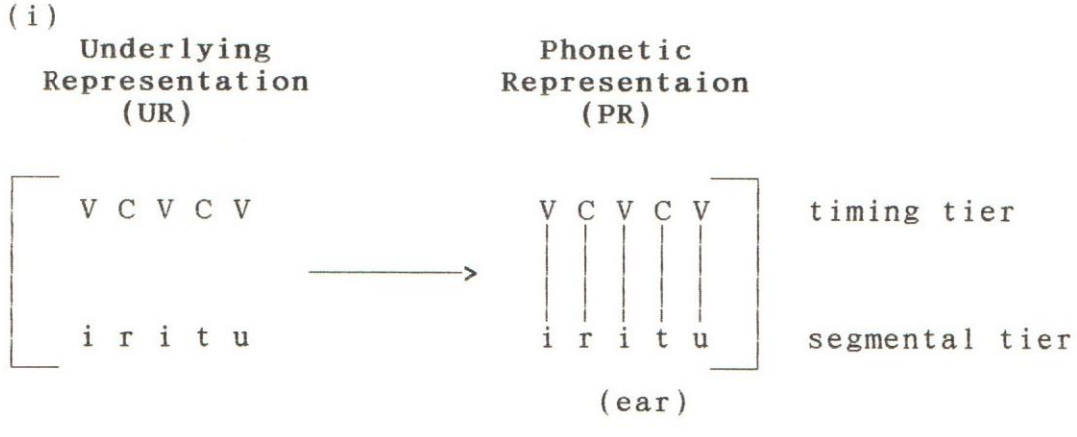
To capture this phenomenon of a **lengtheme** the feature of length is best handled autosegmentally. This feature is best

represented phonologically on an autonomous phonological tier from the tier on which segmental phonemes are represented. The most ideal methodology of effecting this autonimity-representation is by associating (by the linking conventions spelt out in 2.4.) a single segmental element with two positions on a facing phonetic tier. This is best done after a consideration of the underlying forms of surface phonetic realizations.

At the underlying level language consists of a sequence of C and V positions which are filled by segments. Each of these positions represent, at the phonetic level, a certain amount of potential duration which, at the acoustic level, indicate length. The derivation which maps underlying forms onto surface representations retains the lengtheme, represented by two identical positions, on its tier (technically referred to as the **timing tier** or **length tier**); these identical positions are associated with a single element on the segmental tier. Taking data 12 and 13 as input, the result would be as follows:

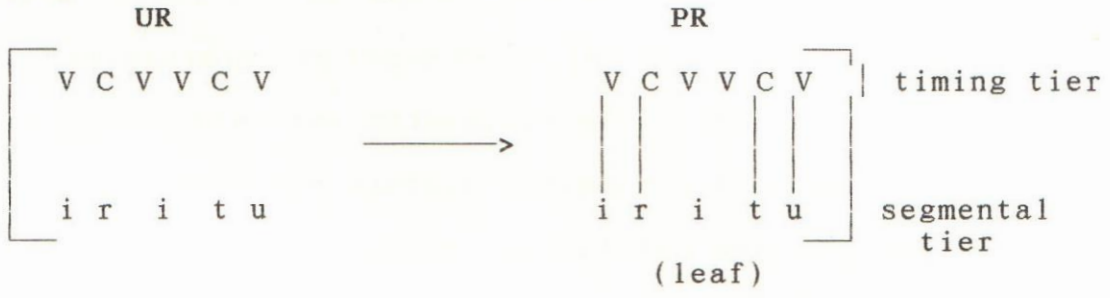
Data 16(a): Lulogooli

(i)



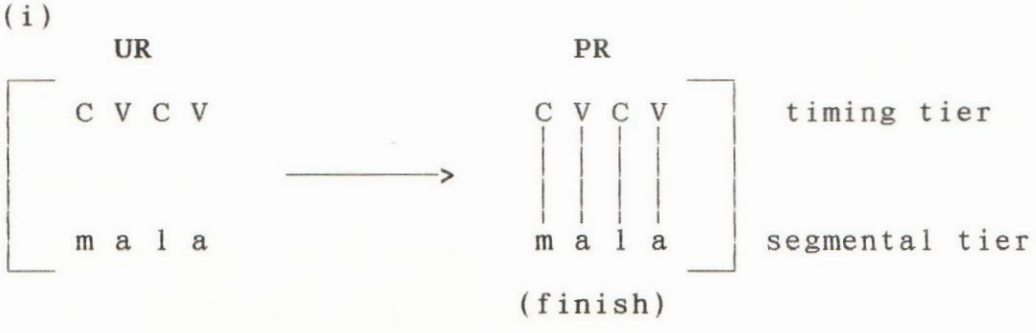
(ear)

(ii)

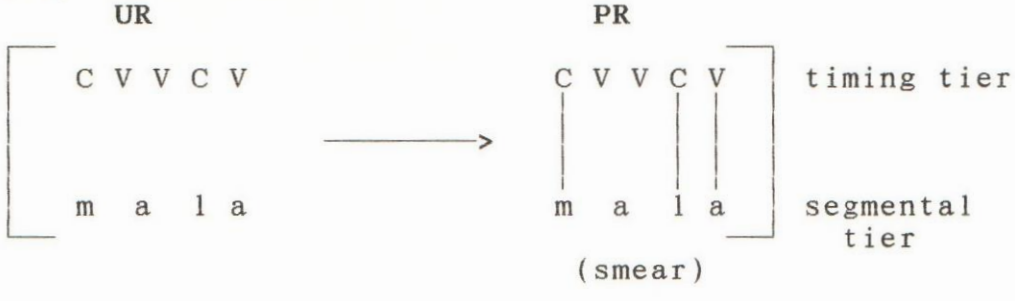


Data 16(b): Lubukusu

(i)



(ii)



In these representations the timing tier, on which the lengtheme is realized, is represented as a seperate phonological tier which runs parallel to the segmental tier on which segmental phonemes are realized. The lengtheme is represented by double V 'slots' (VV). Such a representation frees the lengthemes from the segments since the two are represented on seperate (though adjacent) tiers, giving both the same phonological weight or importance in phonological analysis.

Clearly, in 16(a)(ii) and 16(b)(ii) there is the presence of a lengtheme represented by VV which is associated with the

syllable nuclei of the medial and initial syllables [-ri-] and [ma-] respectively. In these cases the underlying VV timing units on the timing tier are maintained after the derivation mapping underlying forms onto surface representations despite the fact that they are simultaneously associated with a single element on the segmental tier. In autosegmental phonology such multiple associations are entertained since no element on any tier is to be left unassociated otherwise such an element is not realized in the phonetic output. This representation indicates that length should not be considered as part of the segmental layer since two positions are associated simultaneously with a single segment whereas in the conventional way only one position should be linked to any one segment.

The contrasts between the representations in (i) and (ii) in data 16 above depict the phonemic status of length (which can then justifiably be called **lengtheme**). The only difference between the phonetic output in (ii) as opposed to (i) is the presence of a lengtheme represented as VV in (ii). The position that the presence of the lengtheme is responsible for the meaning contrasts between the words in data 12 and 13 is thus credited. This argument is taken up in section 4.3 below which highlights the significant contribution of length in speech and posits that length, like tone, is an autosegment on its own right.

4.3. THE AUTONOMY OF LENGTH

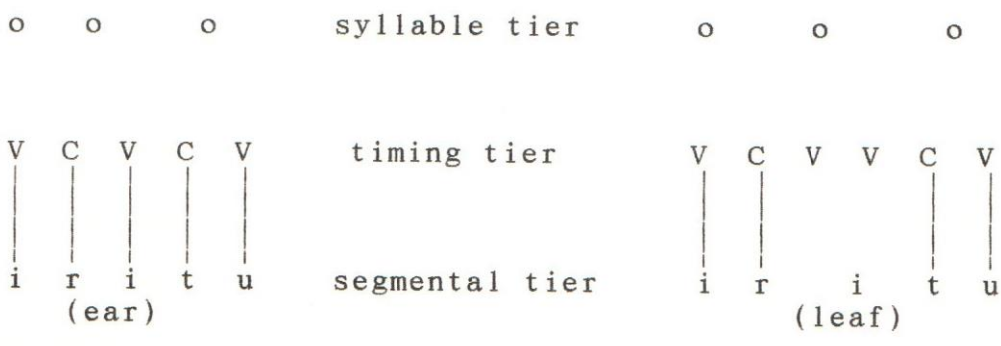
The notion of seperate phonological tiers and the effect of linking and delinking conventions perfected by AP provide ideal ground for the representation of length as an autonomous prosodic

feature. As earlier noted in section 2.4., a multi - tiered CV approach with multiple associations is the key to the analysis of this feature. Simultaneous association of one segment with two C or V slots is effected when the same consonantal articulatory gesture is held for the duration of two consonantal beats, or when the same vowel quality is maintained over the duration of two V slots.

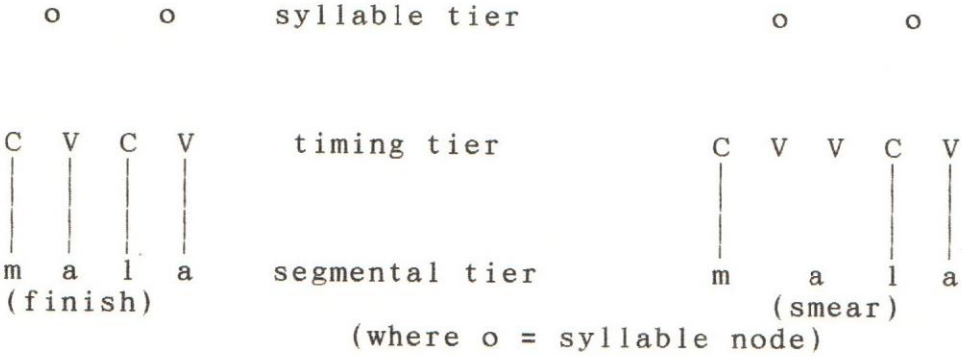
The C and V positions or 'slots' in effect represent **timing units** which in Metrical Phonology are called **morae** (singular **mora**). The mora is pivotal in the expression of syllable weight since "a heavy (or long) syllable contains two morae in its rhyme, whereas a light (or short) syllable contains only one mora" (Hogg and McCully, 1987:41). The data in 16(a) and 16(b) above can thus be reanalysed as 16(c) below:

<u>Data 16(c):</u>

Lulogooli:



Lubukusu:



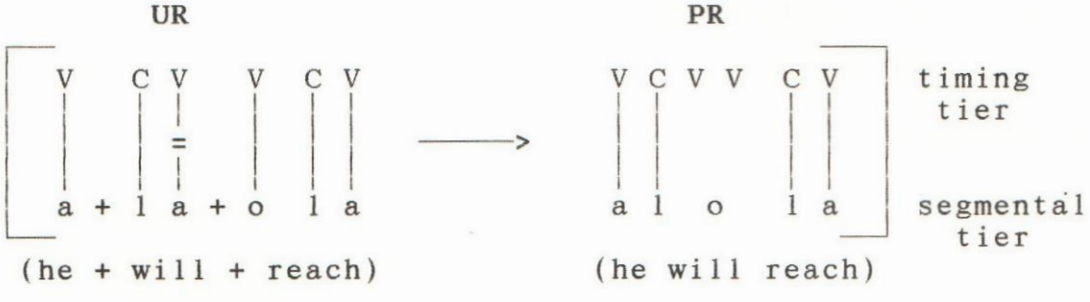
(where o = syllable node)

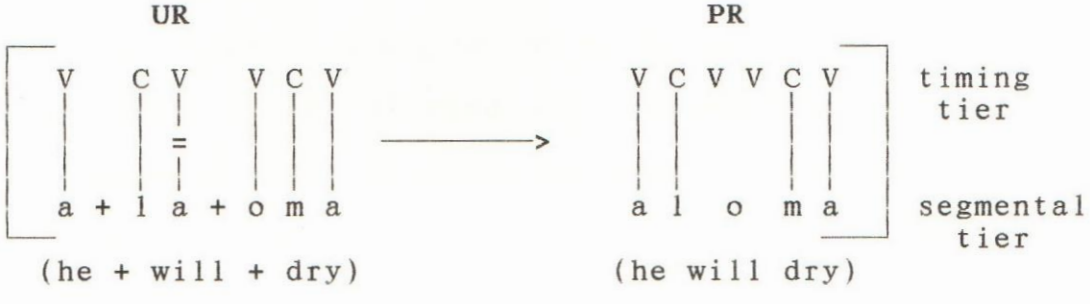
The difference between the words in the adjacent representations in 16(c) can be explained simply in terms of the presence of a heavy syllable (or lengtheme) in the words to the right designated by a tribranching syllable node. In Autosegmental Phonology, therefore, the lengtheme is represented by two morae on the timing tier and hence is **bimoric** as opposed to the segmental tier which is represented by **monomoric** units. Such an approach unravels the traditional problem of **COMPENSATORY LENGTHENING**, giving support to the position that length is autonomous from the segmentals. This becomes explicit after a consideration of the segmental processes of **vowel deletion** (also referred to as **complete vowel assimilation**), **vowel coalescence** (also referred to as **reciprocal vowel assimilation**), and **glide formation**, which are the focus of what follows:

In these dialects, if an underlying syllabic is deleted, an adjacent syllabic gets lengthened in compensation. This happens in cases of **complete vowel assimilation** across the dialects where one vowel may influence another totally so that it shades off its own features and takes on features of the influencing vowel. In this process the nominal prefix vowel [a] contiguous to initial vowels of either nominal or adjectival roots are affected. The tense morpheme vowel [a] juxtaposed to vowels of verbal stems are also affected. The assimilation process is such that this low vowel [a] of the nominal prefixes and tense morphemes is completely assimilated and is consequently not realized in the phonetic output. However, its durational property, rather than be deleted, is retained in the phonetic output. This is best observed after a consideration of the underlying forms of the

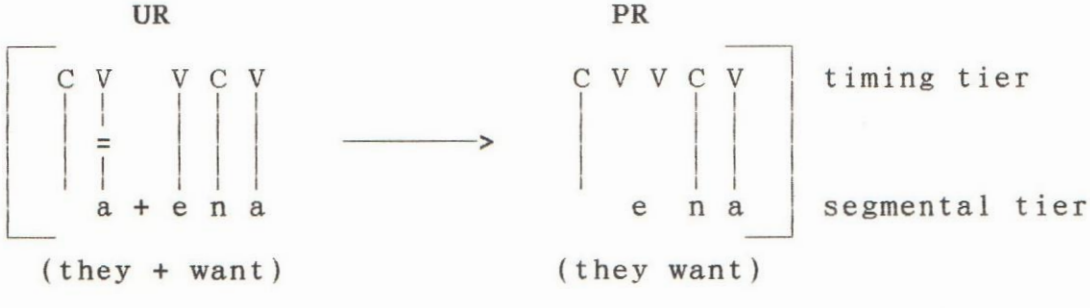
surface phonetic realizations . The derivations shown in data 17 below mapping underlying forms onto surface phonetic representations exemplify this phenomenon:

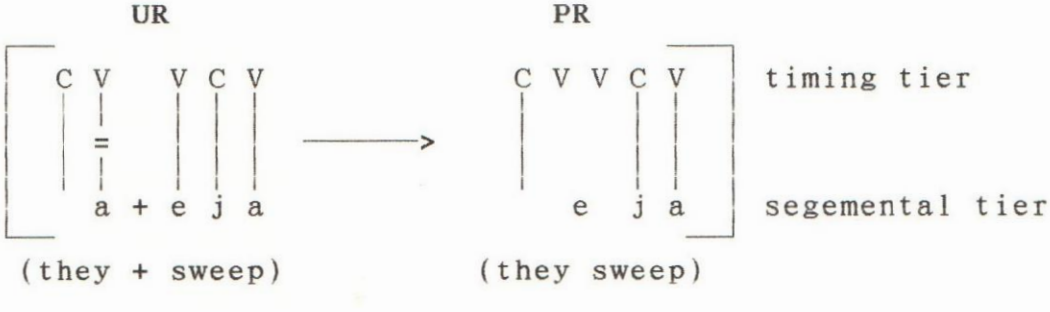
Data 17(a) Lubukusu





Data 17(b) Lulogooli





These representations reveal that when the low vowel /a/ is delinked from its timing slot during a derivation it remains dissociated and is not realized phonetically. Instead, the vacated slot is linked to the next vowel which is then realized over a timespan equivalent to the duration of two morae. In 17(a), although one segmental element has been completely assimilated, resulting in the reduction of the number of segmental elements from six to five, the timing units on the timing tier remain six. In 17(b), on the other hand, the timing units remain five in the phonetic output although the segmental units are reduced from five to four, Thus, despite changes on the segmental order (leading to the deletion of a vowel segment) the length tier is not changed and remains STABLE, asserting its autonomy within the phonetic setup of the dialects.

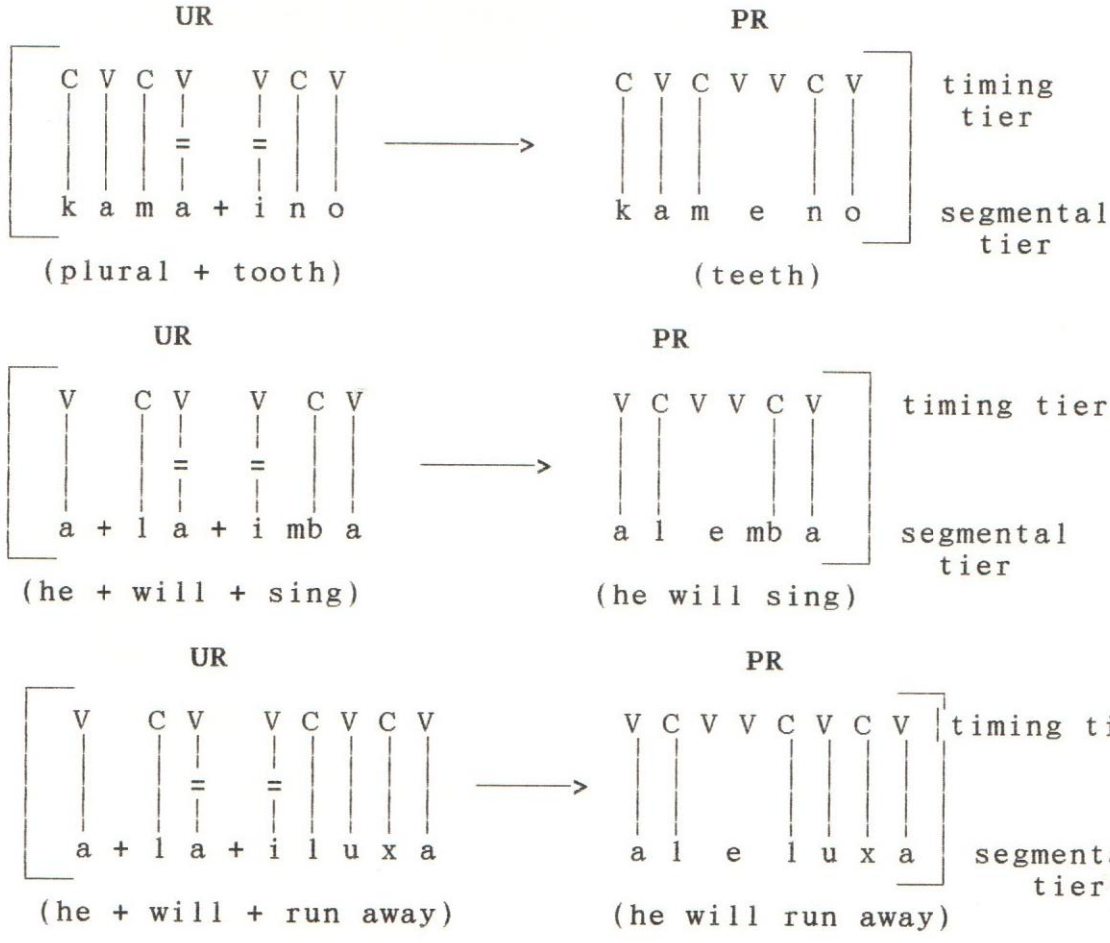
In the above representation (data 17) the underlying segments are directly mapped onto the CV tier. In the underlying representation each C and V element of a CV tier has a certain amount of potential duration. This 'potential duration' can be represented as a **mora** or **timing unit** on the **timing tier** (or **length tier**) which reflect the potential duration of the elements with which it is associated on the semental tier. During a derivation syllabification rules require that no mora is lost during a derivation.

Of great significance to note here is the fact that the timing units on the timing tier remain unaffected irrespective of what goes on at the segmental level. The reduction of the number of units on the segmental tier does not affect the number of units on the timing tier. This means that the length tier is

in principle independent from the segmental tier.

In Lubukusu the process of **vowel coalescence** also points at the stability and independence of length. In this dialect the low vowel of the nominal prefix or tense morpheme and a root initial high vowel are drawn to a mid position. The low vowel [a] and the high vowel [i], when juxtaposed, become a single vowel [e], hence reducing the number of elements on the segmental tier. However, the length tier behaves as if it is not aware of any changes taking place outside its own domain. This is exemplified in data 18 below:

Data 18: Lubukusu



In data 18 the final vowel of the plural marker [kama] and the

vowel of the tense morpheme [la] are drawn to a mid position [e] when juxtaposed to the stem-initial high vowel [i]. However, this coalescence does not lead to the coalescence of elements on the timing tier. This data shows that the reduction of the number of elements on the segmental tier neither disrupts nor affects the organization of elements on the timing tier. Timing units maintain their rigid stability irrespective of what goes on at the segmental level. The links between the two contiguous V - timing units fomerly linked to the merged segments [a] and [i] are severed and new links established between the now empty V - positions and the emergent single segment [e]. What this means is that the segmental layer seeks compensation via linkages from the timing tier which, nevertheless, maintains its autonomous organization.

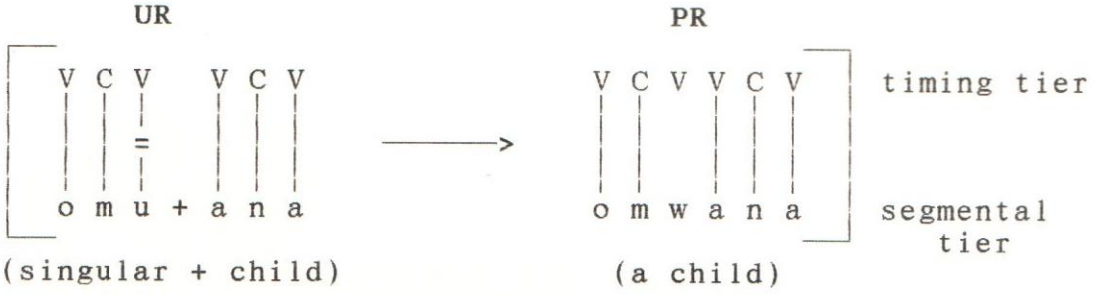
An interesting kind of compensatory lengthening is observed when **glide formation** processes take place. In both Lubukusu and Lulogooli when an underlying syllabic is released as a non-syllabic glide an adjacent syllabic gets lengthened in compensation.

In the complete vowel assimilation process discussed above the low vowel /a/ of the prefix is not reassociated with any element on the autosegmental tier by the derivation which maps the underlying forms onto the surface phonetic representations. When the vowel of the nominal prefix or tense morpheme is high, however, it does not remain dissociated but is instead realized as a word internal glide.

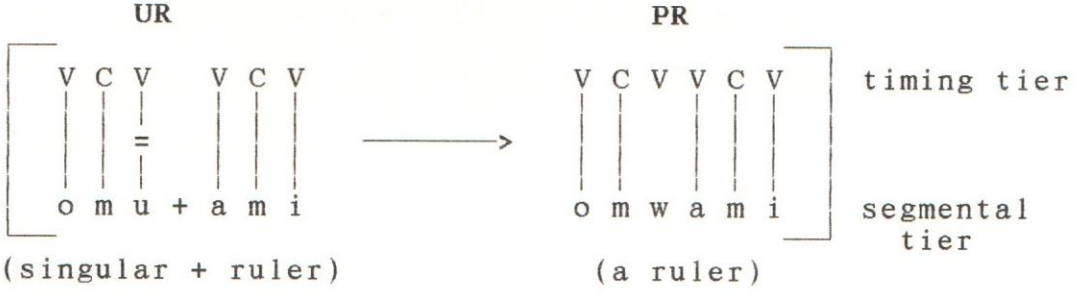
What this means is that the rule that severs the association line between the prefix high vowel and its autosegmental timing

unit during a derivation also provides for its reassociation to the preceeding C position in the phonetic output. The result is that this prefix high vowel is phonetically realized as a word internal glide. This process is reflected in data 19 below:

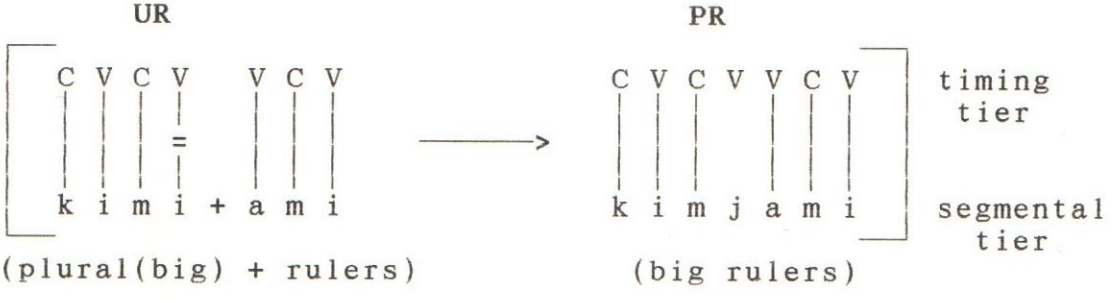
Data 19(a): Lubukusu



(singular + child) (a child)

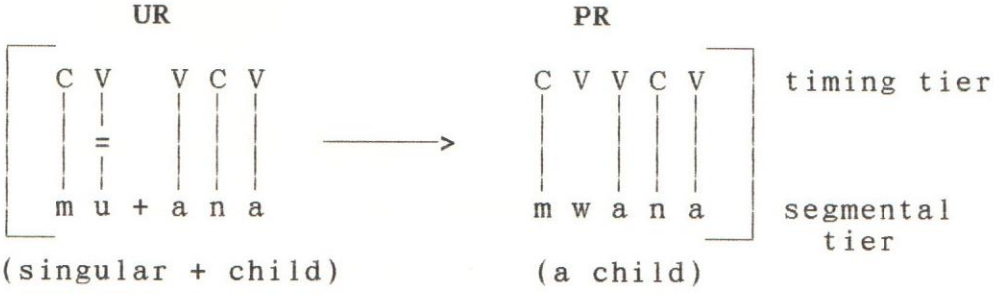


(singular + ruler) (a ruler)

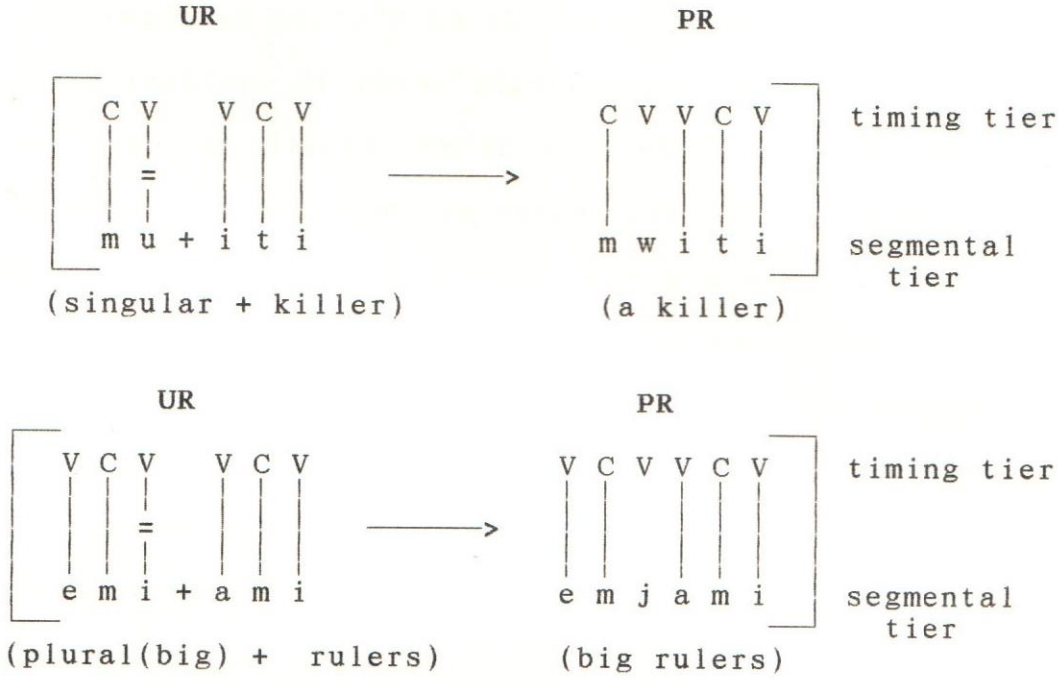


(plural(big) + rulers) (big rulers)

Data 19(b): Lulogooli



(singular + child) (a child)



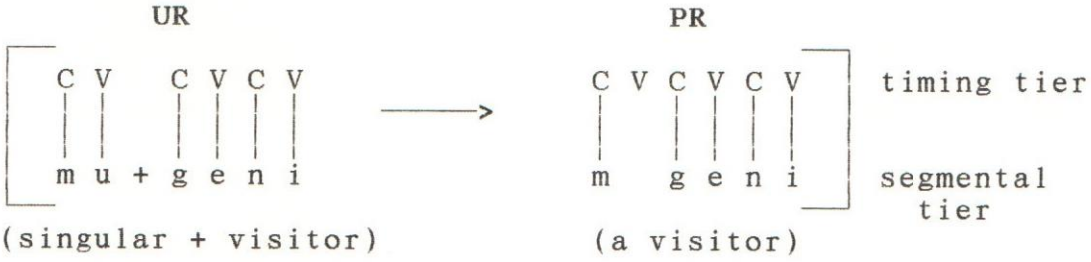
The motivation for the glide formation process in these dialects is that the rules of the language prevent two dissimilar vowels from being adjacent to each other in the phonetic representation. Of great significance in data 19 is the observation that though the high vowel of the prefix is not realized phonetically the V - timing slot with which it is associated on the timing tier does not disappear. For compensatory purposes this 'hanging' slot is reassociated with the next vowel on the segmental tier which is then coarticulated along with a lengtheme hence spanning the domain of two timing units.

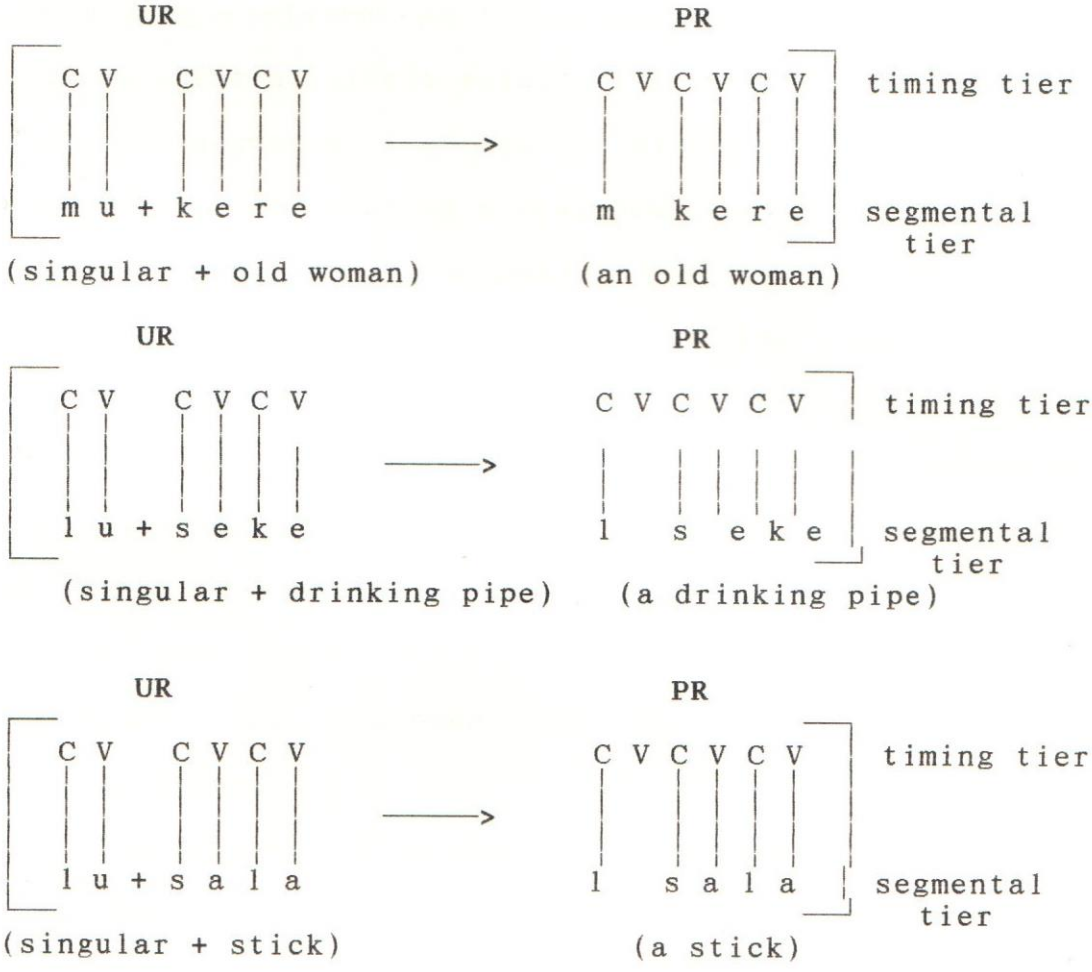
It is worth noting that, as attested to by data 19, the glides realized in the phonetic output after derivation are not left unassociated but are linked to the C - timing slots immediately to the left. The explanation for this linking is that when the dissociated prefix high vowel bears the feature [+back] it combines with the preceeding consonant as secondary labialization. If, however, the prefix high vowel is [-back] then

it is realized along with the preceeding consonant as secondary palatalization. Of great significance here, again, is the fact that although glides, which originally were absent, have been introduced in the phonetic output extra C - timing units are not introduced on the timing tier, nor are any of the original V - timing units deleted. This evidences the **stability** and **independence** of the timing tier, that is, the length tier does not necessarily behave in unison with the segmental tier.

Another process of compensatory lengthening worth mentioning is evident in Lulogooli. This is the process of **consonant gemination.** In this dialect there is a certain vowel - assimilation process affecting nominal prefixes which results in consonant gemination. The high-back vowel of the singular class markers /mu-/ and /lu-/ is completely assimilated and not usually phonetically realized in casual speech. If the prefix is affixed to a root beginning with a syllabic consonant sound then a lengtheme is realized along with the initial /m/ or /l/ of the prefix in compensation:

Data 20: Lulogooli



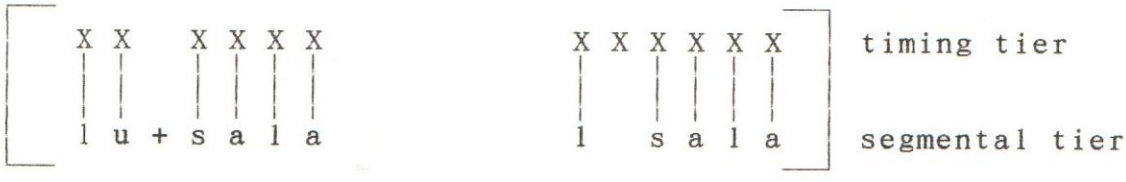


The initial consonants in the above derivations are simultaneously associated with two positions on the timing tier in the phonetic output, meaning that the duration of their articulation is equivalent to that of two positions instead of the normal one. The convincing argument is that whereas one of the elements on the segmental tier has been completely assimilated, resulting in a reduction in the number of segmental elements, all the timing positions on the timing tier are retained; this points to the **stability** and **autonomy** of the timing tier from the segmental tier.

One problem, however, arises from the autosegmental representation depicted in 20: both a **C** and a **V** are associated

with a single element on the segmental tier after derivation. This represent a surfeit structure since there is cross-linking of the autosegmental tier and the segmental tier. Whereas VV or CC positions representing a lengtheme should be associated with a single element on the segmental tier (or two elements on the segmental tier linked to one unit on the timing tier in the manner illustrated in data 19 above) two different units - C and V - are associated with the same segmental element. Moreover, the representation of length by two identical positions VV or CC on the timing tier also represent a surfeit structure in relation to the OCP which require that all contiguous identical autosegments be collapsed into each other in the phonetic representation.

This problem can be overcome if the CV tier is substituted by the SKELETAL TIER which has as its constituents a set of pure positions represented by Xs. The last example given in 20 would thus look like this:



In this representation no surfiet structure arises since the [l] element is linked only to pure positions. This argument is highlighted in section 6.2. below under the specificational problems associated with a CV tiered autosegmental representation.

4.4. AUTOSEGMENTALITY

The evidence for the autonomy of length adduced from data 17, 18 and 19 can be interpreted in the following simple terms: when the vowel of the nominal prefix or tense morpheme is not realized in the phonetic output or is realized as a non-syllabic glide its V - timing unit is not lost but is inherited by the succeeding vowel which becomes simultaneously associated with two V - slots and hence has virtually the duration of two vowels in the phonetic representation; when, on the other hand, two vowels coalesce and reduce the number of elements on the segmental tier the original two V - timing units are simultaneously associated with the emergent single segmental element.

This evidence overwhelmingly justifies the treatment of length as an autosegment. The timing tier, which reflects the timing (duration or length) of an utterance, is not in any way affected by segmental variation. Segmental processes like complete vowel assimilation (data 17), vowel coalescence (data 18), and glide formation (data 19) take place independently while leaving the timing units in their original position. The assimilation or change of a segment, or the reduction in the number of elements on the segmental tier, may at best only elicit, by delinking and linking conventions, compensation from the timing tier which remains stable. Again, as can be observed from data 19, the introduction of new [-syllabic] elements on the segmental tier does not lead to the introduction of extra C - timing units on the timing tier. By defying these segmental processes length proves itself to be stable and, in principle, **autonomous** from the segmental organization of speech. This

behaviour is typical of an autosegment.

In section 1.8 it was noted that among the claims put forward in in AP is that autosegments have to be defined in terms of units which are larger than single segment - sized units. Ideally, one timing unit on the timing tier should be associated with a single element on the segmental tier. However, in the representation of length two timing units are associated with a single element on the adjacent tier. Conversely, two elements on the segmental tier can be associated with a single position on the timing tier. These multiple associations only take place in words in which phonemic length is evident and at syllable boundaries. Techncally, this implies that length spans a domain which is larger than that of individual segments (the domain of syllables), enabling it to be defined in metrical terms.

It can also be observed from data 17, 18 and 19 that length can also be defined in morphosyntactic terms (c.f. 2.4). This is due to the fact that grammatical length is constrained to occur at morphemic and word boundaries. Furthermore, the occurance of length at these boundaries is subject to another condition - that in the underlying representation the contiguous elements are both [+syll] (note here that liquids such as /l/ and nasals such as /m/ can be [+syll]. See consonant gemination in 4.3. above). Length, therefore, like tone, is proved to be an autosegment: it is phonemic and constrained to occur in specific positions in an utterance (c.f.4.2; 4.4); it is stable and autonomous from the segmentals of language (4.3); and it can be defined in both metrical and morphosyntactic terms (4.3; 4.4.).

CHAPTER FIVE

5.0. SUMMARY AND CONCLUSION

5.1. SUMMARY

This work was an attempt to investigate the nature and functions of the prosodic features of tone and length in the Luluyia dialects of Lubukusu and Lulogooli. The first part of the study sought to establish whether the features of tone and length in these dialects are phonemic and whether they are constrained to occur in any specifiable patterns. The second part of the study grappled with the issue of whether these features can be treated as autosegments which can, consequently, be adequately handled within the multi-tiered framework of Autosegmental Phonology.

From the discussion presented in this study it is clear that the thesis of the prosodic school that various components of speech do not lend themselves to analysis into discrete segments is based upon practical and valid premises. The centrality of the phoneme as the basic building block of language in a universal theory of speech synthesis, short of being thrown out of the window, is seriously questioned. Consequently the SPE edifice, which incorporates the Absolute Slicing Hypothesis, that is, the claim that speech can be exhaustively sliced into discrete segments which consist of unordered bundles of features which are linearly ordered (c.f.1.8.), has to be reconsidered to give prosodic phenomena their due albeit much neglected importance in speech analysis.

In chapters 3 and 4 it was noted that speech functions not only by virtue of lineal phoneme ordering but also by courtesy

of the coarticulation of seperate prosodic activities - the tonal activity and the timing or length activity (among others, c.f.2.3.). These activities are just as significant as the segmental activity in speech production and reflect the action of various articulatory parameters made possible by the complex human vocal tract physiological and general neurological development.

In phonological analysis the significance of these activities (that is, the tonal and timing activities) is best recognized when they are represented formally as complex arrays of (in principle) independent tiers within the multi-tiered framework of autosegmental phonology. The supremacy of such a multiple-tiered model is given as twofold: first, the significant contribution of each activity towards overall speech effectiveness is clearly underlined. Secondly, the use of association lines which indicate the coregistration of adjacent units clearly account for the notion of simultaneity in time between different tiers.

5.2. CONCLUSION

From the discussion on tonology and length it can be discerned that in the dialects under study tone and length are phonemic or contrastive. These features can be used distinctively to signal meaning contrasts between various minimal pairs. For this reason tones should not be marked by diacritic marks [ ] for high tone and [ ] for low tone, nor should length be marked by double dots [:] after segments. Such markings indicate the peripheral status of these features or their affiliation to

consonants and vowels whereas in fact they should be given their due phonemic and phonological recognition in phonological representations. As argued out in the relevant chapters tone and length are autonomous from the segmentals, are best phonetically represented on independent tiers of activity, and are constrained by certain prosodic processes to occur in specifiable patterns.

The choice of lexical tone and length, for instance, is wholly dependent upon speaker-intention just as much as the choice and order of segmental phonemes. Grammatical length as reflected in the discussion of compensatory lengthening (c.f.4.3.), on the other hand, is dependent on phonological environment just as much as the realizations of segmental phonemes are phonetically conditioned. A simplified model of speech in communication based upon the findings of this study is illustrated in the diagram below:

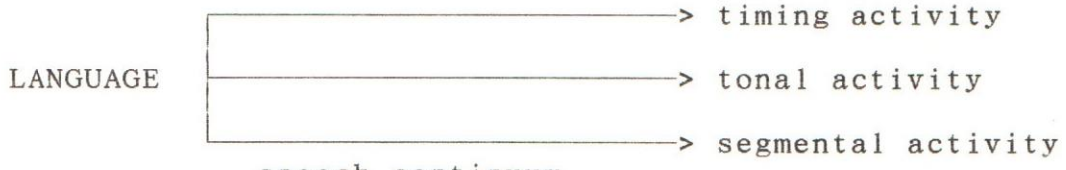


Diagram (vi): An autosegmental model of speech in communication

The hypotheses presented as a basis for this study (c.f.1.4.) are thus positively supported. First, tone and length in Lubukusu and Lulogooli have been found to function phonemically and to be constrained to occur in specifiable patterns. Secondly, these features have been found to have the characteristics of autosegments: they function autonomously from the segmental make-up of speech and are manifested on syllables, consequently definable in metrical terms; the syllable has in

fact been found to be the hub of the organization of phonological representations which is pivotal in the expression of prosodic processes. Moreover, grammatical length (that is, length that is a result of phonological derivational processes) is evident at stem and word boundaries, making length further definable in morphosyntactic terms. Thirdly, by giving tone and length due phonemic and phonological recognition in phonological representations these features are most appropriately handled within the multi-tiered framework of autosegmental phonology. This, however, is not without the specificational problems highlighted in 5.2. below.

In a nutshell, Autosegmental Phonology has revolutionalized the nature of the organization of phonological representations. Speech, rather than be seen as a monotonous repetition of segmental phonemes in unilinear organization, is seen as a complex assortment of parallel but complementary phonological activities. The skeletal CV tier makes possible the exploitation of a wide array of options available to the speaker, such as selection of phonemes, tonemes and lengthemes, on a phonological and functional basis. It is thus without error to state that Luluyia language is itself an epitome of the complex inventiveness of the Baluyia people. The tone with which a word is spoken, and the duration of each syllable within a lexical item or morphosyntactic unit, is a systematic bastion that burstles with meaning in everyday speech communication amongst these peoples.

5.3. RECOMMENDATIONS

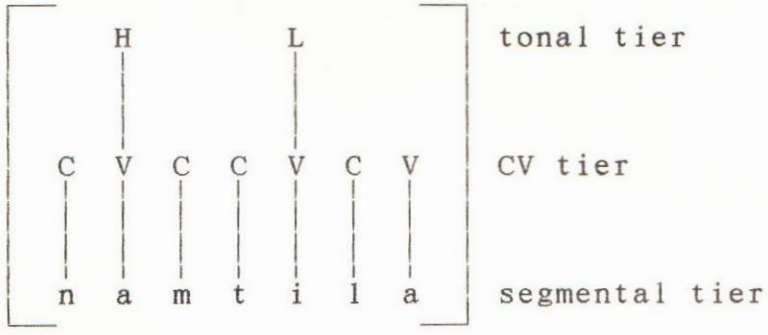
Several observations and recommendations can be made in the light of the discussions presented in this study. First, it is worth noting that several specificational problems have been identified in the framework of a multi-tiered autosegmental approach to the nature of the organization of phonological representations. These problems mainly relate to the association between tiers and to the OCP as a universal autosegmental constraint.

5.3.1. The 'hanging slot' problem

In the formal autosegmental representation tones are associated with [+syllabic] or V elements on the segmental tier, leaving [-syllabic] or C elements 'hanging'. This formalism only assumes that tones spread onto [-syllabic] elements as well but this is not formally notated. Tones are not locked within single segment sized domains but spread over whole syllables in natural speech (chapter 3). A maximal syllable, for instance, has a tone that spreads from the onset to the coda (both represented by Cs on the autosegmental tier) but with a relatively more prominent medial peak (represented by V).

It is thus rather misleading to link tones to vowels while acknowledging that they are basically attributes of whole syllables. One weakness of leaving the C slots hanging is that it is problematic to determine the tones with which medial C elements are to be associated. In the Lubukusu exemplification below it is not easy to determine whether the Cs representing [m] and [t] should be linked to H or to L on the tonal tier, or

whether the C of [m] should be associated with H while that of [t] with L:



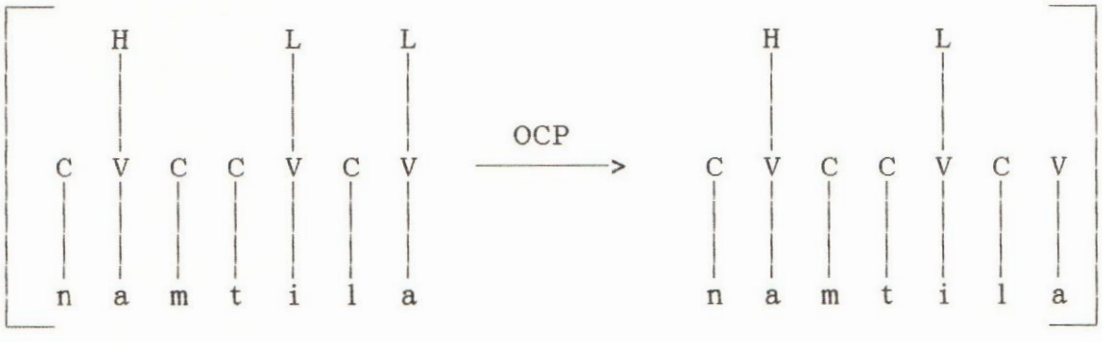
(I caught him)

To circumvent this problem hanging C positions should be linked to the tonal tier according to syllable structure rules in the following manner:

(i) Each C element should be linked to the nearest H or L to its right provided the sequence of segments resulting thereof does not violate any language specific rule;

(ii) If after applying (i) any C element remains hanging it should be linked to the nearest H or L to its left.

The application of the above rules to the example given would result in the following associations:



Before the application of the OCP no C element to the right of a V position can be linked to the same H or L as the V since

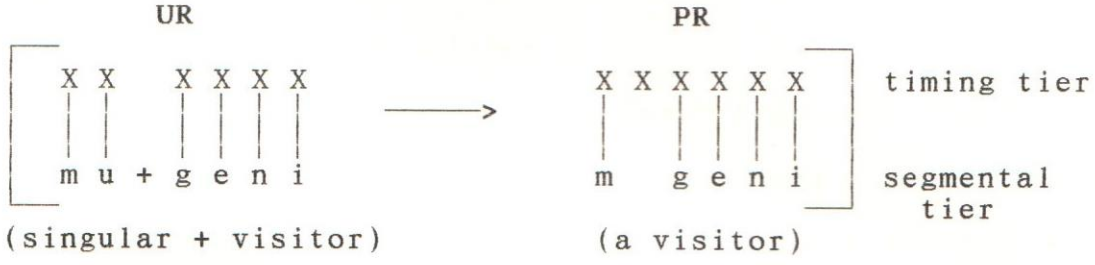
Luluyia syllabification rules allow for only the formation of open syllables. These rules make possible the intermarriage between autosegmental notations and hierarchical syllable structure representations, thus opening up the combination of Autosegmental and Metrical Phonology as an area in which further insightful research is needed.

5.3.2. The Cross-linking Problem

Autosegmental Phonology utilizes the notion of a CV tier which makes possible multiple associations between different phonological tiers. Among the universal conditions for relating the CV tier to the segmental tier is the convention that V positions are linked to [+syllabic] segments (or syllable nuclei) and C positions to [-syllabic] segments (c.f.2.4.). This convention falls short of constituting a truely universal theory of association. This is because the consonant germination process in Lulogooli discussed in 4.3. results in the association of the single syllabic consonant /m/ (and /l/, c.f. data 20) with non-identical CV positions on the timing tier; this **cross-linking** contravenes the position that lengthemes are represented by double C slots (CC) or double V slots (VV) on the timing tier.

This problem can be avoided if the skeleton is specified in terms of pure positions. Rather than view the skeletal tier as consisting of Cs and Vs it could be seen as consisting of pure positions represented by Xs. Such an idea has fortunately been presented by Kaye and Lowenstamm (1985) and Levin (1983) and is currently recievivg extensive treatment by most phonologists working within a multidimensional framework.

In such an approach the first example in data 20 [mgeni] ('visitor'), which has the underlying form /mugeni/, could be handled in the following way:



Such a representation solves the controversy of associating both C and V timing units to consonantal segments on the segmental tier. The skeletal tier as a set of pure positions mediates between various phonological tiers and thus uncontroversially unifies a truely multidimensional representation.

5.3.3. The Problem of the OCP

In its strongest form the Obligatory Contour Principle (OCP) as a universal constraint prohibits any two identical autosegments from being adjacent to each other in the phonetic representation (c.f.2.4.). The OCP dissimilates all contiguous identical elements on all tiers. In the representation of length, however, two identical VV timing units on the timing or length tier have to remain adjacent to each other in the phonetic representation. What this means is that the association between the length tier and the segmental tier defies the OCP.

Despite having been restated in a moderate version as Mauseen's rule - that at the phonetic level any two identical autosegments must be collapsed into each other - the representation of length is still problematic since, during a

derivation, the 'collapsing process' only takes place on the segmental tier, leaving intact contiguous identical positions on the CV timing tier. The representation of the skeletal tier as a set of pure timing positions represented by Xs does not alleviate this problem either.

The logical conclusion to be drawn from this observation is that in a multi-tiered phonological representation of length the length or timing tier should be treated as a DEFAULT TIER in relation to the OCP. The CV timing tier (or the X-tier if the skeleton is taken as a set of pure timing positions) is OPAQUE and does not yield to the constraint exacted by Mauseen's rule.

5.4. SUGGESTIONS FOR FURTHER STUDY

The techniques of automatic speech recognition and analysis are yet to be fully developed. Instrumental problems are severe (c.f.1.5) and specificational problems (such as those raised in 5.2. above) not fully established in speech coding, synthesis and representation due to variability of human speech. A consideration of the points raised in this study could be pivotal in the development of a unified theory of multidimensional phonology in which all linguistically significant speech elements are accorded legitimate recognition in the system of language, specified in the phonetic representation, and adequately accounted for in both phonological and functional terms.

Of significance to note here, perhaps, is the fact that research into the full contribution of prosodies in a truely universal theory of speech coding and synthesis is long overdue. Indeed, the area of acoustic phonetics with instrumentally

backed-up data in other Luluyia dialects and, by extension, other Kenyan and African languages, is a maiden and interesting research field for prospective linguistic scientists.

APPENDICES

APPENDIX I: PILOTING

A pilot study was conducted to test the reliability of the elicitation instrument. Four subjects were randomly selected for this purpose in the following manner: 2 subjects from Bungoma, and 2 subjects from Vihiga. The interview schedule (c.f. appendix II), which was the elicitation instrument, was subsequently applied orally to this sample. The subjects were requested to repeat their responses for authentification

Subjects 1 and 2 were Lubukusu speakers and subjects 3 and 4 were Luloogoli speakers. Asked to respond to the first question, which was the elicitation instrument for tone, the subjects responded in the following manner:

SUBJECTS	RESPONSES	
1.	Engila	(a road)
	Engila	(s/he enters)
	Libimba	(the thatch)
	Libimba	(a swelling)
2.	Kamaru	(ears)
	Kamaru	(banana leaves)
	*Monya	(whisper)
	Monyaka	(drizzle)
3.	Sama	([dog's] bark)
	Sama	(sprinkle)
	Deka	(get married)
	Deka	(cook)

4.		Inda	(stomach)
		Inda	(louse)
		Kubimba	(thatch [verb])
		Kubimba	(swell)

When asked to respond to the second question which was the elicitation instrument for the feature of length the subjects responded in the following manner (note that starred responses are erroneous in as far as this study is concerned):

SUBJECTS		RESPONSE	
1.		Bhola	(rot)
		Bhoola	(say)
		Enda	(stomach)
		Endaa	(wing)
2.		Kamandu	(rubbish)
		Kamaandu	(dry ugali)
		Khula	(grow)
		Khuula	(uproot)
3.		Tula	(get out)
		Tuula	(remove one's load)
		Sinya	(fed up with)
		Siinya	(uproot, e.g. potatoes)
4.	*	Heliza	(get pregnant)
		Haaliza	(give him/her)
		Ilitu	(ear)
		Iliitu	(leaf)

The reliability of the elicitation instrument can be discerned from an examination of the responses given in the pilot

study. Out of the 32 responses from the four subjects interviewed only 2 responses were erroneous. This means that 30 out of 32 responses were correct. The percentage of the correct responses can be computed in the following way:

$$\frac{30 \times 100}{32}$$

Thus,

$$\frac{3000}{32} = \frac{1500}{16} = 93.75$$

The elicitation instrument was therefore 94% reliable.

APPENDIX II : INTERVIEW SCHEDULE

This interview schedule was conducted orally and the responses of respondents tape-recorded as data. It was administered to thirty-six subjects who were stratified into two different groups as follows:

(i) Literate subjects

(ii) Non-literate or Semi-literate subjects

(i) Literate subjects

The schedule was first administered to eighteen literate subjects in the following way: nine subjects were selected from among Lubukusu dialect speakers in Bungoma and nine from LuLogooli dialect speakers in Vihiga. The criteria for literacy was that the subjects must have had either secondary or post-secondary education, preferably university students or graduates. First, the respondents had to be made aware that some words may be structurally similar but that such words may convey two or more different meanings.

(a) Elicitation for Tone

There are some words which seem to be the same but are different just because of the way we pronounce them. I have the following words. Listen to them:

1. (a) [liru]
   (b) [liru]

2. (a) [endzala]
   (b) [endzala]

Repeat 1. (a) [liru] means 'an ear'
   (b) [liru] means 'a banana leaf'

2. (a) [endzala] means 'finger'
   (b) [endzala] means 'hunger'

Now think of as many other such cases as you can. I will come back after seven days to hear the cases that you will have got.

(b) Elicitation for Length

There are some words which seem to be the same but are different just because we delay the pronunciation of a part of one of them. I have the following words. Listen to them:

1. (a) [ta]
   (b) [ta:]

2. (a) [enda]
   (b) [enda:]

Repeat 1. (a) [ta] means 'no'
   (b) [ta:] means 'fetch'

2. (a) [enda] means 'louse'
   (b) [enda:] means 'wing'

Now think of as many other such cases as you can. I will come back after seven days to hear what you will have got.

(ii) Non-literate or Semi-literate subjects

After the schedule had been administered to literate respondents it was then administered to eighteen non-literate or semi-literate subjects in the following way: nine subjects were be selected from among Lubukusu dialect speakers in Bungoma and nine from Lulogooli dialect speakers in Vihiga. The mode of adminstration was purely oral. Subjects were given a range of up to seven days within which to collect as many responses as possible. The responses were tape - recorded as data.

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