

AN OPTIMALITY-THEORETIC ACCOUNT OF
SOME ASPECTS OF CHITONGA PHONOLOGY

WINFRED MKOCHI

BACHELOR OF EDUCATION (UNIVERSITY OF MALAWI)

CHANCELLOR COLLEGE

DECEMBER, 2004

MAL

THE

458

MK0

2004

AN OPTIMALITY-THEORETIC ACCOUNT OF SOME ASPECTS OF CHITONGA PHONOLOGY

WINFRED MKOCHI

BACHELOR OF EDUCATION (UNIVERSITY OF MALAWI)



A THESIS SUBMITTED TO THE FACULTY OF HUMANITIES, UNIVERSITY OF
MALAWI, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE
DEGREE OF MASTER OF ARTS IN PURE LINGUISTICS

CHANCELLOR COLLEGE

DECEMBER 2004

DECLARATIONS

I certify that the work contained in this thesis is my own and has never been presented for any award at this university or elsewhere. Acknowledgement has been given wherever other people's work has been used.

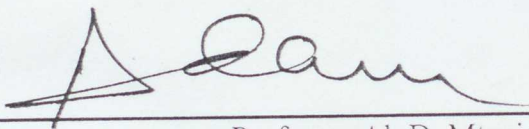


Winfred Mkochi

DATE: 14-06-05

We certify that this thesis has been submitted to the University of Malawi with our approval, as a fulfillment of the requirements for the degree of Master of Arts in Pure Linguistics.

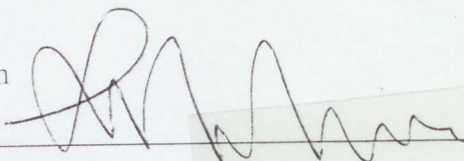
Supervisor:



Professor Al D. Mtenje

DATE: 10-06-2005

Head, Department of English



Mr. Bright Molande

Date 13-06-2005



241620
MAL
THE
458
MKO
2004

34/219

DEDICATION

To my wife, Pilirani.

ABSTRACT

Among others, the two available analyses of Bantu syllable onsets in the literature, namely the consonant cluster and the single segment approaches, are discussed. The phonology of Chitonga seems to favour an analysis that does not permit clusters of segments of the form CC (consonant clusters), VV (vowel clusters) or GG (glide clusters). In the light of this analysis, the sound inventory of Chitonga has been identified and the featural structure of the sounds and their phonotactics examined. Selected aspects such as segment sequences, aspiration of prenasalized voiceless consonants, consonant insertions, final vowel deletion, etc., are discussed within the framework of Optimality Theory (OT), as developed by Prince and Smolensky (1991, 1993) and revised and extended by others (Goedemans 1996, Downing 1996c, McCarthy and Prince 1999, among others). The single segment analysis adopted for Chitonga implies that Syntagmatic Principles of OT which govern the pattern of consonant clusters play no role in the syllable onsets of this language. This thesis suggests that although the theory has the power to explain most of the facts, there are signs that some of its tenets such as exclusion of constraints which are language specific, and constraints on the generation of the input, could be challenged and are thus in need of further research.

TABLE OF CONTENTS

DEDICATION	i
ABSTRACT	ii
TABLE OF CONTENTS	iii
ACKNOWLEDGEMENTS	iv
CHAPTER ONE: INTRODUCTION	1
1.0 Introduction	1
1.1 The Chitonga Language	1
1.2 Rationale	1
1.3 Previous Works	2
1.4 Language overview	3
1.4.1 The Chitonga Sound Inventory	3
1.4.2 A Note on Tone	5
1.4.3 The Chitonga Verb	5
1.5 Organization of the Thesis	12
CHAPTER TWO: THEORETICAL PERSPECTIVE	14
2.1 Theoretical Perspectives of the Syllable	14
2.2 Theoretical Framework	16
2.2.1 Outline of Optimality Theory	18
CHAPTER THREE: THE CHITONGA SYLLABLE STRUCTURE AND ITS PROCESSES	21
3.1 The Consonant Cluster Analysis	21
3.2 The Single Segment Analysis	24
3.3 Bisyllabic/Bimoraic Minimality Condition in Bantu	30
CHAPTER FOUR: THEORETICAL APPLICATION	34
CHAPTER FIVE: SUMMARY AND CONCLUSION	44
References	46

ACKNOWLEDGEMENTS

The presentation of the material in this study has benefited greatly from inspiration, advice, guidance, suggestions and criticisms by my supervisor, Professor Al Mtenje (Yewu ukongwa, vipandu vije kutali!). I thank all the good people from the Department of African Languages and Linguistics and the English Department for their moral support and various other ways. Dr. E. Kayambazinthu (Associate Professor) for spending her time proof reading and making important observations at the time I thought everything was well and over. Associate Professor P.J. Kishindo, Head of African Languages and Linguistics, for his numerous forms of support, including moral and academic nourishment and also for reading, editing and making important observations which have seen this thesis look the way it is now. I also thank him for giving me time to study. Dr. Laura Downing for her encouragement and for warning me against becoming complacent of the tradition. I should also thank the participants who used to gather, listen, grill and grind some of my ideas in one of the rooms of Chancellor College. Mr. H.K. Chabwera of Chancellor College Library for helping me to reach for some forgotten work written in/on Chitonga. My officemate Mr. D. Akambadi for bearing with my noise about Optimality wherever we were. My wife, Pilirani Galuwapananji, and my daughter, Tamanda Naliyeni Mkochi, for behaving during the entire period I was working on this paper, including those two months we ate grass. Finally, and quite important, I thank Chancellor College for financial support.

I am sometimes unnecessarily stubborn and impatient, such that all the errors and half-truths that persist in this work are utterly children of the stubbornness in me, and not of my supervisor, nor any of the persons mentioned above.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

The aim of this thesis is to demonstrate how Optimality Theory (OT), one of the recent theories in linguistics, can account for phonological facts in Chitonga. To achieve this goal, the study identifies a sound inventory and examines the pattern of sound sequencing in Chitonga syllables. The study also shows an extent to which principles of OT provide insight into the featural structure of Chitonga sounds and their sequencing.

1.1 The Chitonga Language

Chitonga, the language on which the present study is based, is mostly spoken in Nkhata-Bay, a district in Northern Malawi that covers 4089km², with a population of 164,761 people, and the language is mostly spoken by 118,114 households (1998 population census, National Statistical Office, Zomba).

The language belongs to the Bantu group of languages of Africa classified by Guthrie (1947) as belonging to 'Zone N Group 10' together with neighbouring Chichewa and Tumbuka languages. Bryan (1959) puts Chitonga in the same group with Tumbuka where Chichewa is excluded. In colonial literature, the language is considered a dialect of Tumbuka.

1.2 Rationale

This study is part of a larger programme of current linguistic theory whose main goal is to characterize the grammar that enables humans to produce and understand utterances they have never heard before. And this has to be coupled with the fact that children learn

their first language within a very short period of time and with very limited data from their environments. The general assumption has been that much of this knowledge is inborn, that is, all children are born with some of the principles and they need to learn just a little bit from their surrounding. The goals of linguistics today, therefore, are twofold: to characterise those principles which children are born with (universal principles), and those which vary from one language to another language (parameters - a possible range of variations that have to be learned/set by children). The programme is thus carried out in such a way that the structure of all the languages of the world has to be studied so that universal principles and possible variations are determined (Chomsky 1964, 1965, 1981; Hornstein and Lightfoot 1981; Ruwet 1973; etc.). The present study is just one step towards that goal. It utilizes one of the current linguistic theories, Optimality Theory, developed by Prince and Smolensky (1991, 1993) and extended by others (cf. Goedemans 1996, Downing 1996a, McCarthy and Prince 1999, among others), and shows how its insights can account for syllable structure in Chitonga.

1.3 Previous Works

As Mphande (2000) and Vail (1972) also note, a few books have been written on and in Chitonga, most of which are not available now. People who are very old now remember having read *Mkwele*, *Chiswamsangu*, *Marko*, *Mcapu*, *Nthanu*, and others. What is known of the works that are written in Chitonga are Chirwa (1932), *Mcapu wa Chitonga* (n.a) (1932), *The Bible in Chitonga* (1986) and Mphande (2000). None of these works is linguistically important. There are also material that is written in English about Chitonga, and these should also be mentioned for their cultural and historical importance for the language and its speakers, some of which may not be available or may not have full bibliographical information. These are MacAlpine (1905), Mary Tew (1950), Monica Wilson (1958), Jaap van Velsen (1959, 1964), Banda (1985), Soko (1985), Mphande (1998), and Msosa (1999). Perhaps the earliest study that can be called a linguistic pursuit is that which was done by Turner (1952, *Tumbuka-Tonga-English Dictionary*). Even recently, not much has been done to understand the structure of Chitonga, despite numerous interesting patterns it displays. Serious linguistic studies on this language have

been done by Mtenje (1994/95, 2004). Perhaps to this list we can add Mkochi (2001) and other undergraduate dissertations available in language departments at Chancellor College, University of Malawi.

As can be seen from this survey, very little has been published on Chitonga phonology and this justifies the pursuit of this study.

1.4 Language Overview

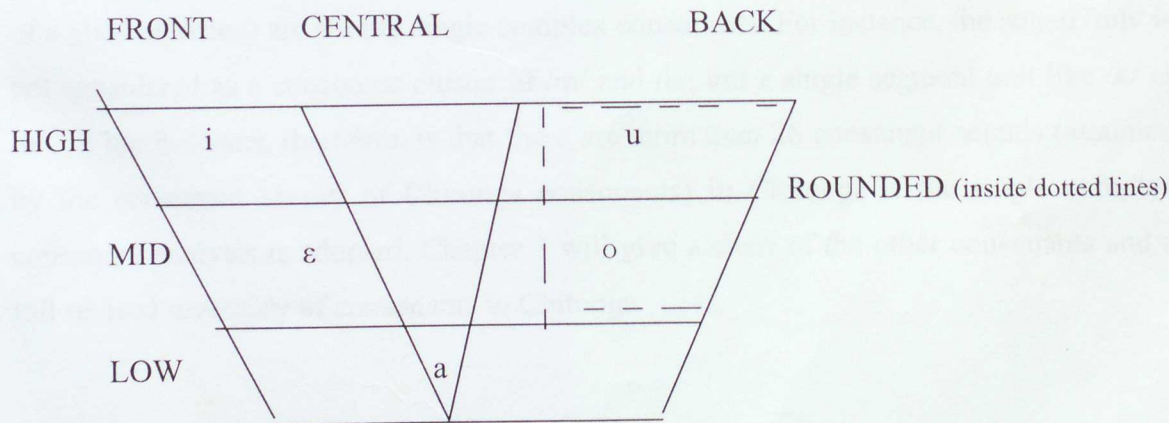
1.4.1 The Chitonga Sound Inventory

Chitonga has five phonemic vowels namely, *a*, *ε*, *i*, *o* and *u*, and they are all short vowels. Long phonemic vowels are encountered in limited and unpredictable cases as seen in the following contrasting words:

- | | | |
|-----|----------------------------------|---------------------------------|
| (1) | nkhu:li ‘nudeness’ | nxhuli ‘fondness for good food’ |
| | zele:za ‘ignore’ | zeleza ‘fool’ |
| | mbu:na ‘type of fish’ | mbuna ‘pit’ |
| | fu: βa ‘fail to be cooked fully’ | fuβa ‘fire stone’ |

The five vowels are classified and represented diagrammatically as follows:

(2) Chitonga Vowels



The following chart shows Chitonga consonants.

(3) Chitonga Consonants

		BILABIAL	LABIO-DENTAL	ALVEOLAR	PALATAL	VELAR	GLOTAL	LAB. VELAR
STOP	+voice	b		d	ɟ	g		
	-voice	p		t	c	k		
	asp.	p ^h		t ^h	c ^h	k ^h		
NASAL		m		n	ɲ	ŋ		
FRICATIVE	+voice	β	v	z		ɣ	ɦ	
	-voice		f	s				
GLIDE					y			w
LATERAL (approximant)				l				

Adapted from Doke (1967)

The table shows that Chitonga does not have alveolar affricates /dz/ and /ts/. The sound /c/ and its voiced partner are phonetically palatal stops (mediopalatal stop, as Heffner [1950:153] calls it) and not affricates (cf. Doke 1967:30; Vail 1972:6; Bryan 1959:x). Therefore, it is assumed that there are no affricate sounds in this language. Following Goyvaerts (1980, 1986) and Banda (2001), who have argued against consonant clusters in Bantu, the present study shows and assumes that all onsets in Chitonga (with the position of a glide clarified) are simply single complex consonants. For instance, the sound /mb/ is not considered as a consonant cluster of /m/ and /b/, but a single segment unit like /k/ or /p/. What it means, therefore, is that there are more than 26 consonant sounds (assumed by the consonant cluster of Chitonga consonants) in Chitonga if the single complex consonant analysis is adopted. Chapter 3 will give a chart of the other consonants and a full revised inventory of consonants in Chitonga.

1.4.2 A Note on Tone

This study is limited to segmental phonology. However, since Chitonga is a tonal language some brief notes on Chitonga tone are provided without getting into detailed description of its tonal system. According to Mtenje (2004), there are two level tones in Chitonga namely, high (´) and low (not marked). Contour tones (rising, ˇ, and falling, ˘) are only attested as a combination of these two level tones on long vowels. Tone in nouns cannot be predicted because any vowel can have any level tone underlyingly. In verbs, however, verb roots are either completely low-toned or bear only one high tone per root.

The high tone in verbs is usually on the penultimate syllable which is usually lengthened. Mtenje (2004) exemplifies Low and high tone verbs in Chitonga as follows:

a. Low tone verbs

- Viina-dance
- Sambiizya – teach
- Leleesya – see/look

b. High tone verbs

- čimbiíya - run
- khumbiíla - admire
- beéya – belsh

The above examples show that low-toned verbs (a) have Low tones on all syllables while high-toned verbs (b) have only one high tone per root and this appears on penultimate syllable when the verbs are in a citation form. When these verbs occur in phrase-medial positions, the high tone surfaces on the final syllable of the verb and the penultimate syllable is short and low-toned as seen in the following examples:

- | | | |
|----|---------------------|----------------|
| c. | cimbiyá ukóongwa | -run a lot |
| | khumbilá munthikazi | admire a woman |
| | beyá ukóongwa | -belch a lot |

1.4.3 The Chitonga Verb

Like other Bantu languages, Chitonga expresses many grammatical processes by means

of the morphology of the verb. Among these are both subject and object agreement. The subject agreement affix (SA) is obligatory, while the object affix (OA) is optional:

(4) βaná βa-lim-a mūnda.¹

Children SA-till-fv garden

‘The children have tilled a garden.’

(5) βaná βa-u-lím-a mūnda.

Children SA-OA-till-fv garden

‘The children have tilled (it) a garden.’

The SA and the OA show person, number and noun class gender of the subject and object, respectively. The verb morphology may also display various concatenations of stem forming suffixes with two allomorphic variants whose occurrence is determined by vowel harmony as in most Bantu languages (cf. Mtenje 1985, Katamba 1984, etc, for details). These suffixes yield passives, causatives and applied/dative constructions. The passive suffix is -ek-/-ik-; it is -ek- when the verb root vowel is either e or o, and -ik- for the rest (a, i, u). The following sentences exemplify this:

(6) a. Tamandá wa-ngu-wonj-á mbeβa.

Tamanda SA-past-catch-fv mice

‘Tamanda caught mice.’

b. Mbeβa zi-ngu-wónj-ék-a ndí Tamanda.

Mice SA-past-catch-pass-fv by Tamanda

‘The mice were caught by Tamanda’

¹ The present perfect and the present progressive tense in Chitonga are marked by tone (cf. Mtenje 1994/95; 2004). Further details on the Chitonga verb can be found in Mkochi (2001).

(7) a. Musambizyi wa-ngu-púm-á ßána.

teacher SA-past-hit-fv children

‘The teacher hit the children.’

b. ßána ßa-ngu-púm-ík-a ndí musambizyi

Children SA-hit-pass-fv by teacher

‘The children were hit by the teacher.’

The causative suffix is -esy-/-isy-, the form again being determined by vowel harmony; it is -esy- when the vowel of the verb root is either e or o, and -isy- for the rest (a, i, u).

Examples (5) and (6) show causative verb complexes as used in sentences:

(8) a. Musambizyi wa-ngu-púm-á ßána.

teacher SA-past-hit-fv children

‘The teacher hit the children.’

b. Musambizyi wa-ngu-púm-ísy-a ßána.

teacher SA-past-hit-caus-fv children

‘The teacher caused the children to be hit.’

(9) a. Tamanda wa-pemb-a mötu.

Tamanda SA-kindle-fv fire

‘Tamanda has made fire.’

b. Tamanda wa-pemb-esy-a mötu.

Tamanda SA-kindle-caus-fv fire

‘Tamanda has caused the fire to be made.’

Perhaps the applicative suffix is the most interesting, phonologically. It is a vowel -i/-e, the form once again being determined by vowel harmony. As can be seen from the table below, the vowel is -i- after stems whose root vowel is i, a, u, and -e after stems whose

root vowel is e or o.

(10) The applicative suffix

a. jal-a	Close-fv
b. jal-i-a	Close-appl-fv
a. samb-a	Bathe-fv
b. samb-i-a	Bathe-appl-fv
a. bik-a	Cook-fv
b. bik-i-a	Cook-appl-fv
a. kumb-a	Dig-fv
b. kumb-i-a	Dig-appl-fv
a. wonj-a	Catch-fv
b. *wonj-e-a	Catch-appl-fv
c. wonj-e:	Catch-appl
a. wotch-a	Roast-fv
b. *wotch-e-a	Roast-appl-fv
c. wotch-e:	Roast-appl
a. met-a	Shave-fv
b. *met-e-a	Shave-appl-fv
c. met-e:	Shave-appl
a. sem-a	Carve-fv
b. *sem-e-a	Carve-appl-fv
c. sem-e:	Carve-appl

The table shows that there is vowel harmony in Chitonga which determines the applied form. The asterisk, however, indicates that although the b-verbs are morphologically and semantically correct, they are ungrammatical because they are not attested in Chitonga. There is a tendency in Chitonga to delete the vowel a whenever it follows a mid vowel.

The following sentences vindicate the observation:

- (11) a. Joni wa-ngu-jál-á botolu.
 John SA-past-close-fv bottle
 'John closed a bottle.'
- b. Joni wa-ngu-jál-í-a chibakasa botolu
 John SA-past-close-appl-fv bottle
 'John closed a bottle with a top.'
- (12) a. Tamanda wa-ngu-kúmb-á chimbuzi.
 Tamanda SA-past-dig-fv pit latrine
 'Tamanda dug a pit latrine.'
- b. Tamanda wa-ngu-kúmb-í-a ßána chimbuzi.
 Tamanda SA-past-dig-appl-fv
 'Tamanda dug a pit latrine for children.'
- (13) a. Joni wa-ngu-wonj-á mbeßa.
 John SA-past-catch mice
 'John caught mice.'
- b. *Joni wa-ngu-wonj-e-a ßana mbeßa
 John SA-past-catch-appl-fv mice
 'John caught mice for children.'
- c. Joni wa-ngu- wónj-é: ßána mbeßa.
 John SA-past-catch-appl-fv mice
 'John caught mice for children.'

- (14)
- a. Joni wa-ngu-sém-á ngoza.
John SA-past-carve-fv statue
'John carved a statue.'
 - b. *Joni wa-ngu-sem-e-a βana ngoza.
John SA-past-carve-appl-fv statue
'John carved a statue for children.'
 - c. Joni wa-ngu-sém-é: βāna ngoza.
John SA-past-carve-appl-fv statue
'John carved a statue for children.'

Thus the phonetic forms of wonj-a, sem-a, wotch-a, met-a and pemb-a in the applied form are as follows: wonj-e:, sem-e:, wotch-e:, met-e: and pemb-e:.

Having discussed vowel harmony and final vowel deletion in Chitonga, we can now turn to a rule of /l/ insertion to break vowel clusters between vowel-final verbs and the vowel of the applied extension.

(15) Vowel-final verb roots and the applicative extension (CVCV roots)²

a. sani-a 'find-fv'
b. *sani-i-a 'find-appl-fv'
c. sani-l-i-a 'find-l- appl-fv'
a. li-a 'cry-fv'
b. *li-i-a 'cry-appl-fv'
c. li-l-i-a 'cry-l-appl-fv'
a. mbati-a 'stagger-fv'
b. *mbati-i-a 'stagger-appl-fv'
c. mbati-l-i-a 'stagger-l-appl-fv'

² The last five rows contain roots which underlyingly end in mid vowel plus a but that the [a] deletion rule after mid vowel for applicatives in (13-14) has applied.

a. pu-a 'pound-fv'
b. *pu-i-a 'pound-appl-fv'
c. pu-l-i-a 'pound-l-appl-fv'
a. ndele: 'move'
b. *ndele-e 'move-appl'
c. ndele-l-e: 'move-l-appl'
a. pende: 'be lame'
b. *pende-e 'be lame-appl'
c. pende-l-e: 'be lame-l-appl'
a. to: 'take'
b. *to-e 'take-appl'
c. to-l-e: 'take-l-appl'
a. domo: 'cut'
b. *domo-e 'cut-appl'
c. domo-l-e: 'cut-l-appl'
a. gong'o: 'hit'
b. *gong'o-e hit-appl
c. gong'o-l-e: 'hit-l-appl'

The asterisk shows that although the applied verbs (b's) are morphologically and semantically appropriate, they are not attested in Chitonga as b-sentences in (16) and (17) indicate. As seen in the c-forms above, Chitonga inserts a liquid /l/ between the verb roots final vowel and the applied vowel in order to avoid vowel clustering. We further illustrate this below.

16. a. Joni wa-ngu-sání-a ndaláma
 John SA-past-find-fv money
 'John found money.'

- b. *Joni wa-ngu-sani-i-a βana ndalama.

John SA-past-find-appl-fv money

'John found money for the children.'

c. Joni wa-ngu-sání-l-i-a ßána ndaláma.

John SA-past-l-appl-fv children money

'John found money for children.'

17.a. Joni wa-ngu-góng'ó: mwăna.

John SA-past-hit child

'John hit the child.'

b. *John wa-ngu-gong'o-e kamiti mwana.

John SA-past-hit-appl stick child

'John hit the child with a stick.'

c. Joni wa-ngu-góng'ó-l-e: kamíti mwăna.

John SA-past-hit-l-appl stick child

'John hit a child with a stick'

l-insertion in Chitonga, as well as in some Bantu languages, is a general phonological process. Other operations such as the causative and the passive, whose suffix vowels make a boundary with a vowel in vowel-final roots also require liquid insertion to avoid vowel clustering.³

1.5 Organization of the Thesis

This chapter has discussed general facts about the thesis and Chitonga language. To achieve the goals stated earlier, Chapter 2 of this thesis discusses theoretical perspectives

³ Whether an l is inserted or deleted is debatable. For the present study, as Chapter 3 shows, either a glide or a liquid is inserted depending on the context. This does not rule out the possibility that the position that an epenthetic glide or liquid occupies could be already specified for everything but a feature, hence it is not

of the syllable and the theoretical frameworks that have directed phonological research. At the end, this chapter gives an outline of Optimality Theory. Chapter 3 examines two available analyses of the Bantu syllable structure, the consonant cluster and the single segment. Adopting the single segment analysis, the chapter shows that Chitonga has 33 consonant sounds. The chapter also shows that certain phonological requirements bring changes on the featural structure and sequences of sound segments. Finally, the chapter also tackles the issue of word minimality condition in Bantu. In Chapter 4, an attempt is made to account for some phonological facts in the framework of Optimality Theory. Chapter Five provides a summary and a conclusion of the thesis.

deletion or insertion of a segment but a feature. Furthermore, in OT, what matters is not whether an *l* is deleted or not. What matters is whether the input and the output are identical or not.

CHAPTER TWO

THEORETICAL PERSPECTIVE

This chapter discusses theoretical perspectives of the syllable and the theoretical frameworks that have directed phonological thinking. At the end, the chapter gives an outline of Optimality Theory.

2.1 Theoretical Perspectives of the Syllable

As cited by Goldsmith (1990:104), a clear and influential discussion of the syllable is found earlier in Hocket (1955) and Pike's discussions in various places (for example Pike and Pike 1947). With the appearance of work by Kahn (1976), it was clear that the syllable could not be overlooked by phonological theory. The syllable needed to be recognized as a unit (see Durand 1990, Kenstowicz and Kisseberth 1979). As simple illustrations of this claim, consider the following statements:

- (a) Every Mazateco morpheme in its full form consists of bisyllabic sequences (Pike and Pike 1947).
- (b) In Polish, stress is penultimate in words of more than one syllable, but monosyllables are stressed (Durand 1990: 198).
- (c) Chichewa requires that a verb consist of at least two surface syllables (Hyman and Mtenje 1995).

Traditionally, there have been two views regarding the nature of the syllable. The first, which is called a *sonority* view, is illustrated in Bloomfield's *Language*:

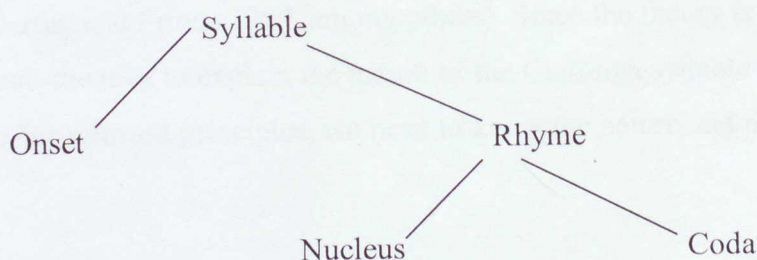
In any succession of sounds, some strike the ear more forcibly than others; differences of *sonority* play a great part in the transition effects of vowels and vowel-like sounds. ... In any succession of phonemes there will thus be an up-and-down of sonority. ... Evidently some of the phonemes are more sonorous than the phonemes (or the silence) which immediately precede or follow. ... Any such phoneme is a *crest of sonority* or a *syllabic*; the other phonemes are *nonsyllabic*. ... An

utterance is said to have as many *syllables* (or *natural syllables*) as it has syllabics. The ups-and-downs of *syllabification* play an important part in the phonetic structure of all languages. (Bloomfield, 1933: 120–1).

The second view of the syllable is based on a syntactic approach (Harris 1951; Haugen 1956a). It is built on the assumption that the syllable is a constituent definable in familiar phrase-structure terms like a sentence. For example, Harris (1951: 151) places the segments of Yokuts into two categories, labelling one 'C', the other 'V' to represent the consonants and the vowels. The Yokuts word, he suggests, can always be analysed as a sequence of zero or more occurrences of the pattern CV or CVC.

Work on the phrase-structure of the syllable has concluded that the syllable (σ) is a phonological unit composed of zero or more consonants, followed by a vowel, and ending with a shorter string of zero or more consonants. These three parts of the syllable have been referred to as the *Onset* (O), the *Nucleus* (N) (also known as the *Peak*), and the *Coda* (C), respectively (see 18). The nucleus and the coda form a unit called the *Rhyme* (R) (also called the *Core*). The following figure illustrates the phrase structure of a syllable.

(18)



For Bantu syllables, three analyses have been suggested. The first two (which are termed consonant cluster analysis and single segment analysis in the present study) assume that canonical Bantu syllables have no Codas (e.g. Mtenje 1980, 1986; Greenberg 1983: 3, etc.). These shall be elaborated in the following chapter. Using the single segment analysis, the present work shows the inviolability of the principle of sonority and the insignificance of other principles in Bantu phonological undertakings.

One other analysis, which is not considered in this study since it does not directly affect the issues being discussed, deals with Pre-NC lengthening languages (i.e. those languages where a vowel becomes longer before a Nasal-Consonant Cluster) (Downing 2004). This analysis proposes that the Codas cannot be completely ruled out in Bantu words, because certain phonological evidence in Pre-NC lengthening (Pre-NCL) languages points towards such an analysis: that is to say, a Nasal in such a position is syllabified in a Coda to which the lengthened vowel belongs. With evidence drawn from Jita (a language spoken in Tanzania), Downing shows that an NC sequence is a heterosyllabic cluster, not a unit segment, and that a long vowel shares a mora with the following nasal.

2.2 Theoretical Framework

During the past forty years, phonological theory has undergone several major developments. These have made available theoretical tools with which researchers have attempted to account for problems that older theories were unable to handle in a satisfactory way. The analysis of the syllable has also been affected by these theoretical developments. In the present study, we adopt Optimality Theory, as developed by Prince and Smolensky (1991, 1993) and revised and extended by others (cf. Goedemans 1996, Downing 1996c, McCarthy and Prince 1999, among others). Since the theory is wide, we outline only relevant sub-theories to explain the nature of the Chitonga syllable structure. But before we identify the relevant principles, we need to know the nature and purpose of linguistic pursuits.

The main goal of linguistic theory today is to link linguistic explanation to the problem of how children can attain mastery of their native language; the goal is to show how this process takes place (Hornstein and Lightfoot, 1981: 9). This corresponds with the highest level of linguistic success, what Chomsky calls *explanatory adequacy*. In this approach, a linguistic explanation should account for the problem of how, within a very short period of time, a child masters a language on the basis of degenerate and deficient data. In fact this has developed into a new field of study, theoretical psycholinguistics, which is

concerned with learnability theories.

In the evolution of generative phonological theory, research towards this goal can be divided into phases. The following are the frameworks that have directed phonological research.

The first phase was characterised by the theory articulated in the SPE (*The Sound Pattern of English*) where Chomsky and Halle (1968) set out what was later to be referred to as the standard theory of phonology. This work argued that phonological representations are organised into linear strings of segments which comprised unordered bundles of distinctive features. Chomsky and Halle also made available the notions of underlying versus surface representations (parallel to the notions of deep and surface structures in syntax) and proposed a series of extrinsically ordered rules which derived surface representations from abstract or remote representations. The SPE's main preoccupation was the postulation of rule types and their interaction. Adopting and modifying the notion of Distinctive Features (taken from Jakobson), although they attempted to build a theory without the notion of a syllable, Chomsky and Halle were also able to capture significant generalizations and their work took a revolutionary step forward in understanding the nature of the sound systems of natural languages. The view that sounds are linearly arranged was challenged in the 1970's paving the way for the second phase which we will term the period of phonological representations.

In the mid 1970s, Autosegmental Phonology, was made explicit by Goldsmith (1976). Unlike SPE, Autosegmental Phonology (AP) recognized that phonological representations are multidimensional in nature. These representations are made up of a skeletal core to which a number of independent sets of levels or tiers may be linked. AP also spelt out that independent universal principles and language-specific rules combine in order to determine how melody units are associated with slots on the skeletal tier. The linkage of the levels is facilitated by a more general principle, the Universal Association Convention which states that "when unassociated vowels and tones appear on the same side of an association, they will be automatically associated in a one-to-one, radiating

outward from the association line" (Goldsmith 1990:14).

The theory also postulated a Well-formedness Condition which guarantees that such linkages do not cross association lines. One of the major insights of AP was the assumption that the tiers were to be treated as autonomous. In other words, the rules that introduce organizational changes on one tier need not necessarily affect other tiers (cf. Moto 1989, Mtenje 1986 for summaries). AP contributes to the present work the insight that in Chitonga and perhaps in Bantu syllable onsets in general, there is a single C-node that can dominate a single consonant or a glide.

The third (and present) phase in phonological theory can be termed the phase of Constraints or Principles as represented by Optimality Theory. This framework has been shown in various works to offer a better account of the development of language in children. The theory has also offered solutions to old problems such as language change, behaviour of borrowed words, second language acquisition, natural language perception, natural language production, computational modelling of language, etc. (Archangeli 1997:30-32).

2.2.1 Outline of Optimality Theory

Like in Chomskyan Transformational Generative Grammar, Optimality Theory proposes inputs and outputs and a relation between the two. All languages of the world are said to have access to the same set of universal conditions/constraints which are ranked differently from one language to another language. The relation between input and output is mediated by two formal mechanisms, *GEN* and *EVAL*.

GEN (for *Generator*) creates linguistic objects and notes their faithfulness relations to the input under consideration. *EVAL* (for *Evaluator*) uses the language's constraint hierarchy to select the best candidate(s) for a given input from among the candidates produced by *GEN*. The constraint hierarchy for a language is its own particular ranking of *CON*, the *universal set of constraints* (Archangeli 1997: 13)

The fact that “all languages have access to exactly the same set of constraints” is the formal means by which universals are encoded. Perhaps the most important claim that the theory makes is that “any constraint may end up being violated in some language: the potential for being violated is a result of the position of a constraint in a particular language's hierarchy, rather than a property of the constraint itself.” (Archangeli 1997:15, citing McCarthy and Prince 1994). Each ranking characterizes the distinctive patterns between and among languages and leads to variation between them.

For first language acquisition, it means acquiring the critical constraint rankings of that language. Since constraints interact, it is reasonable to assume that evidence for a particular ranking of constraints is not always noticed by the learner, so some constraints are ranked incorrectly, to be re-ranked when further information is available. This predicts specific stages that a child might go through, each of which would reflect the incorrect dominance of some universal constraint. This prediction is quite different from that of a rule-based model, in which a learner might incorrectly learn a language-particular rule, which in itself may have little claim to universality (Archangeli 1997:31).

Under OT, language change through time means the re-ranking of the constraints. A common view of the cause of language change is that change occurs when there is imperfect transmission from one generation to the next. Combining these claims implies that constraints can only be re-ranked when the evidence for a particular ranking is not very robust. In this way the theory of Optimality makes clear predictions both about the effects of change and about the type of change that might occur (Archangeli 1997:31).

The major strength of OT is captured when we consider the following problem in syntax where the constraints are assumed to be inviolable:

The inviolable principles of syntax have proved themselves to be problematic in that inviolability has been purchased at the cost of a variety of types of hedges. ... some principles are parameterized, holding in one way in one language and in another way in another language. ... the prevailing belief about constraints - that they are inviolable - resulted in a continuing frustration with their role in grammar, for it is exceedingly difficult to find a constraint that is never violated.

(Archangeli 1997: 26-27)

This last observation also justifies the choice of the model in the present study. The theory recognizes the fact that principles can be violated.

This chapter has discussed three issues: the early theoretical perspectives of the syllable, theoretical ideas that have directed research in phonology and an outline and justification for adopting Optimality Theory in the present work. Among others, the following chapter discusses some analyses of Bantu syllable-onset structures and it assumes the syllable structure for Chitonga as essentially V, CV, GV or CGV, where a glide (G) is dominated by either a C- or V- node (mora).

CHAPTER THREE

THE CHITONGA SYLLABLE STRUCTURE AND ITS PROCESSES

This chapter examines the two available analyses of the Bantu syllable structure in general and also argues that the single segment analysis is the favoured analysis for Chitonga. Both of the analyses (the single segment and the consonant cluster), as discussed earlier in Chapter 2, assume that canonical Bantu syllables have no Codas (e.g. Mtenje 1980, 1986; Greenberg 1983: 3, etc.). The central point that the chapter makes is that certain phonological requirements bring changes on the featural structure and sequences of sound segments. The chapter will also tackle the issue of word minimality conditions in Bantu in the light of the Chitonga syllable patterns discussed. We review below the two analyses of syllable structures and show how Chitonga fits in.

3.1 The Consonant Cluster Analysis

This analysis suggests that the Bantu syllable allows a maximum of three consonants in the Onset position. These consonants can be predicted in their order of occurrence. Consider the Onsets of the following Chitonga words⁴:

- | | | |
|------|--------------------------------------|---------------------------|
| (19) | mbwĩ.ta 'miss' | mu.swa.swa 'footsteps' |
| | ŋk ^h wǎ.pa 'armpits' | li.zwa.zwa 'torn clothes' |
| | u.ŋgwé.lu 'light' | a.zé.lé.za 'fools' |
| | mbwa.mbwa.nt ^h a 'shiver' | mu.tó.ndó.ni 'lizard' |
| | li.kó.ndwa 'happiness' | gwé.βa.ni 'type of grass' |
| | mwá: 'stone' | myǎ.ti 'jokes' |
| | fwí.ti 'sorcerer' | |

⁴ We assume that all vowels in Chitonga are short. So whenever a, e, i, o, and u are used in the following discussion, they should be understood as such.

kú.vwa 'to listen'

u.lyá.lya 'dishonesty'

In a three-consonant cluster of Bantu syllables in general, the first consonant is usually a nasal, the second an oral stop or fricative and the third a glide as in *mbw* or *nsw* in *mbwita* 'miss' and *nswaswa* (Chichewa) 'footsteps' (cf. Mtenje 1980, Vail 1972:15). In a two-consonant cluster, the first consonant is an obstruent or a nasal followed by a glide, or a nasal followed by an oral stop or a fricative.

(20) Bantu consonant cluster

C	C	C
		Stop
	Nasal}+	Fricative
		Affricate
		Glide
	Stop	
Nasal}+	Fricative }+	Glide
	Affricate	

In Chitonga, however, in the spirit of the cluster analysis, Nasal-Fricative clusters are not allowed. Compare the following Standard Chichewa and Chitonga words. It will be noticed that Chitonga uses similar words but deletes the nasal before the fricative (see (21) below).

(21) Chitonga does not allow Nasal+Fricative clusters

CHICHEWA

nsima 'hard porridge'

nsato 'python'

nsomba 'fish'

nsalu 'cloth'

CHITONGA

sima

sato

somba

salu

The fact which was noted in the introductory chapter, that Chitonga does not have affricates, can be explained as follows: Affricates are featurally [-cont][+cont] (such as stop+fricative), and Chitonga does not allow such antagonistic features within a sound segment or in a sequence of consonants or vowels. Thus Chitonga consonant clusters can be diagrammatically represented as follows:

(22) Tonga consonant cluster

C	C	C
		Stop e.g. mp ^h ǎ.ka ‘boundary’
	Nasal} +	nc ^h ítu ‘work’
	Obstruent, incl. nasals}+	Glide e.g. mwá: ‘stone’
Nasal} +	Stop+	{glide e.g. vu.ngwa ‘wing’
		e.g. Ꞥc ^h wǎ ‘ideophone-falling into throat’

A prenasalised voiceless stop is always aspirated in Chitonga as is the case in several other Bantu languages (cf. Vail 1972:17). Consider the pre-nasalized voiceless stops in (23):

(23) Prenasalized voiceless stops are always aspirated

Mp ^h ako ‘cave’	*mpako	
mp ^h apo ‘blood child’	*mpapo	mapapo ‘kidneys’
Nt _h anga ‘agemate’	*ntanga	
nt ^h énda ‘disease’	*ntenda	matenda ‘diseases’
ñc ^h ító ‘work’	*ñcito	
nt ^h ówa ‘way’	*ntowa	
ŋk ^h ǎno ‘crab’	*ŋkano	
ŋk ^h umba ‘pig’	*ŋkumba	

munt^hu 'person' *muntu

3.2 The Single Segment Analysis

The single segment analysis views "what is usually perceived as a combination of consonant sounds in Bantu languages as a single phoneme" (cf. Banda 2001, citing Goyvaerts 1980, 1986; Banda 1995). Mtenje (1986: 79), working within the theory of Autosegmental Representation, reduces the triconsonantal cluster to a biconsonantal representation. He says: "... in terms of representation within an autosegmental model we need only a maximum of two C-positions to cover all cases of consonant sequences. This is because in autosegmental terms, affricates and prenasalized consonants are dominated by a single C-node." In the single segment analysis, it is shown that this is not only the case in Autosegmental Representation. The autosegmental model is one of the most plausible models in phonology and it could simplify several issues not yet resolved in phonology (Archangeli 1997:25). What is represented as CC in consonant cluster analysis is simply a single complex C dominated by a single C node in Chitonga.* Serious recent arguments to show that there are no consonant clusters in Chitonga or Bantu languages have not been accessed. But suffices it to say that even proponents of consonant cluster analysis have not provided valid reasons as to why /mb/ and /ng/ are categorised as consonant clusters but not affricates /ts/ and /dz/. As Banda (2001:19-20) observes, the assumption of CC here is not descriptive of a native speaker's knowledge of language. Native speakers of Bantu languages perceive such 'consonant clusters' like /mb/, /ng/, etc., as single phonemes just like any other sounds (cf. Hubbard 1995a, 1995b who gives empirical evidence from Runyambo and Luganda). This kind of analysis is also mentioned in Mtenje (1986:79, citing personal communication with Goldsmith and Halle).

The next step should be to clarify the position of the glide in the Single Segment Analysis. Traditionally, a glide has been defined as 'not consonant not vowel'. Durand's (1990:17) argument that the glide is underlyingly a vowel cluster or a diphthong will be adopted for the reasons that follow. Durand shows that the glide /y/ could not be a third

consonant in consonant clusters. According to the context in which /y/ is used, he suggests that /y/ should be treated either as the reflex of a single vocalic unit (e.g. a long unrounded back vowel which is converted to [yu:] on the surface of words such as *mew*, *lieu*, *view*, *new*, *hew* or as a rising diphthong /iu:/. In either analysis "we are dealing with a unit which is not part of the consonantal (CC) margin of a syllable but part of its vocalic core".

Durand (1990: 17) argues that in English, [m, n, l v, h] do not appear in word initial clusters⁵ - with the exception of 'music', 'nuisance', 'lieu', 'view', and 'hue'. Durand shows that since these words accept this clustering, then /y/ indeed is not a consonant. "Note that our analysis should also be extended to the /y/ which we have listed as a possible third C slot ... since it only occurs before /u/."

Another argument to show that a glide is not a third consonant in a cluster is very clear in Ntcheu-Chichewa dialect (Mtenje 1986). Mtenje (1986: 51, 52) shows that in Chichewa, there is a rule called Glide Formation or vowel desyllabification. In this instance, a high vowel is changed into a glide when it is followed by another vowel. The second vowel in turn gets lengthened. Examine the following data:

(24)	mu+a+bwela	mwa:bwela ⁶	'You have come'
	i+a+bwela	ya:bwela	'It has come'
	i+o+kongola	yo:kongola	'beautiful (object)'
	ku+ipa	kwi:pa	'to be bad'
	ku+enda	kwe:nda	'to walk'

Phonology is mainly concerned with the surface form. As such, while we accept that there is clear evidence in (24) that the glide is derived, it could not be realized at the surface level as a vocalic nucleus. The fact is that there is a glide formed to break the VV cluster. Sometimes a glide is inserted (epenthetic glide) as we see in the following

⁵ In Chitonga and most Bantu languages prenasalized consonants do appear word initially and the nasal is neither tone-bearing nor syllabic. For example, *mbohóli* 'potato', *mbeβa* 'mice', *ndeū* 'a fight', etc.

example words from Chitonga. A glide is inserted between a vowel-final verb root and the final vowel.

(25) Glide insertion in Chitonga

INPUT	OUTPUT
(a) zu-a “undress-fv”	zu-w-a
(b) sani-a “find-fv”	sani-y-a
(c) li-a “cry-fv”	li-y-a
(d) si-a “leave-fv”	si-y-a
(e) pu-a “pound-fv”	pu-w-a

Both derived and epenthetic glides seem to have a vocalic core in the underlying form or input form. However, consider the following words from Chitonga and their applicative counterparts:

(26) Epenthetic and phonemic glides behave differently

NONAPPLIED WORD	APPLIED WORD
(a) bay-a “kill”	bay-i-ya “kill for”
(b) luw-a “forget”	luw-i-ya “forget for”
(c) kwi-y-a “get angry”	kwi-y-i-ya “get angry for”
(d) chay-a “hit”	chay-i-ya “hit for”
(e) zuw-a “undress”	zu-l-i-ya “undress for”
(f) sani-y-a “find”	sani-l-i-ya “find for”
(g) li-y-a “cry”	li-l-i-ya “cry for”
(h) si-ya “leave”	si-l-i-ya “leave with”
(i) puw-a “pound”	pu-l-i-ya “pound”

Note that the glide in the nonapplied words (e) - (i) is epenthetic (compare with (25)). It

⁶ The glide is either w or y depending on the rounding of the initial vowel.

disappears when an applied vowel /i/ is attached because the rules that determine the insertion of either a glide or a liquid look into the same verb stem input for their structural description. For example, in the derivation of *sani-ya*, the input [*sani-a*] satisfied its structural description. In the derivation of the applied form *sani-l-i-ya*, the same input [*sani-a*] plus the applied morpheme *i* before the final vowel *a* (thus *sani-i-a*) satisfied the structural description for a liquid /l/ to be inserted. What determines whether it is a liquid that is inserted instead of a glide is nothing but the height of the vowels. As it can be noticed from the above examples and various other tables where insertion of a glide or a liquid is illustrated, a liquid is inserted where both the vowels have the same height, but when they differ in terms of height a glide is inserted. Thus the glides which appear to be deleted in (26e-i) when no VV violations would occur are not in the literal sense deleted because they do not form part of the input for l-insertion.

Contrastively, a glide of the verb roots in (26a-d) is never affected when the applied morpheme *i* is attached, even when the height of the vowel clusters satisfies the structural description for the liquid /l/ to be inserted. This is an indication that this type of glide is phonemic rather than derived.

At this point, it is tempting to conclude that it is a derived glide (derived from a vocalic nucleus) that has been wrongly assumed as a third consonant in consonant cluster analysis. But the fact remain that derived and phonemic glides are phonetically the same. Perhaps the point that can be proposed, in defence of the single segment analysis, is that a glide should be realised as such, as has been the case in traditional grammar, "not vowel not consonant". But, in the present study, a glide's own node in the representation of sound segments cannot be proposed because there seem not to be enough evidence. As diphthongs have been viewed in English, it can be speculated, however, that a glide that is formed in (24) occupies the position of a high vowel /i/ or /u/. Where a glide was viewed as a third consonant in the C-cluster, therefore, and where a glide was claimed to be formed, it can be argued that a glide is dominated by a V-node, since, it has already been shown, the glides are underlyingly vocalic.

It can be concluded, therefore, that a glide occupies a V-node. But a problem can arise when the position that an epenthetic liquid occupies is considered. There seem to be a unanimous agreement that a liquid is a true consonant that cannot be dominated by a V-node, and by extension an epenthetic glide can be viewed as such. (There is also a possibility that sonorants can be dominated fully or partially by moras.)

Autosegmental Theory revealed that each and every syllable has C and V-nodes. Since both the glide and the liquid break a vowel cluster, it can be claimed that an epenthetic glide goes straight into the C-node. There seem to be no problem with a segment that is “not vowel not consonant” to be dominated by either a C- or a V-node.

It will be assumed in this study, therefore, that sound sequences of the form CC, VV and GG do not exist in Chitonga and the following syllable structures are adopted: V, CV, GV, and CGV. This sounds obvious, but it can be appreciated when the size of the literature that emphasised a glide as a third or second consonant dominated by C-node is examined.

At this point in time, a full chart of consonants in Chitonga, in the spirit of single segment analysis, is necessary:

Two or more generalizations can be made from the table. First, only stops are prenasalized. Second, all prenasalized voiceless stops are aspirated. The voiced partner of the sound ɲC^h is misrepresented as a mere stop in Doke (1967). This sound, represented here as $/\text{ɲJ}/$, is actually one of the prenasalised consonants rightly recognised as a unit segment and identified by one phonetic symbol in phonetic alphabets.

3.3 Bisyllabic/Bimoraic Minimality Condition in Bantu

Let us now discuss the Chitonga syllable structure in terms of bisyllabic or bimoraic minimality conditions. As cited in Hyman and Mtenje (1999), it has been agreed generally that the minimal number of syllables or moras (vowel positions) in Bantu words is two. (cf. also Myers 1987; Karneva 1990; Mutaka and Hyman 1990; Downing 1996). For instance, Chichewa requires that a verb (or any surface word) consist of at least two syllables. The imperative is normally expressed by the bare verb stem. The following Chichewa verbs, for instance, have bisyllabic stems:

28. me.nyá 'hit!'
 te.nga 'take!'
 phi.ka 'cook!'
 su.nga 'keep!'
 se.ka 'laugh!'

The following monosyllabic words in Chichewa, however, will always attach $/i/$ in the imperative mood.

- (29) -pha i-pha 'kill!'
 -dya i-dya 'eat!'
 -gwa i-gwa 'fall!'
 -swa i-swa 'break!'
 -phwa i-phwa 'get dry!'

Like in Chichewa, the imperative in Chitonga is normally expressed by a bare verb stem with a final vowel /a/. Monosyllabic verbs will always attach a prefix /i/ (see (33)) when in use.

- (30)
- | | |
|-------|------------------|
| -swa | i-swa 'break' |
| -lya | i-lya 'eat' |
| -phwa | i-phwa 'get dry' |
| -fwa | i-fwa 'die' |
| -wa | i-wa 'fall' |

This satisfies the bisyllabic minimality condition. However, there are in this language several surface monosyllabic words which do not take any prefix in the imperative:

- (31)
- | | |
|------------|----------------|
| <i>to:</i> | 'take' |
| <i>ko:</i> | 'catch' |
| <i>po:</i> | 'get cold' |
| <i>me:</i> | 'grow' |
| <i>pe:</i> | 'get subdued'. |

(31) shows all these verbs have a mid vowel as their final vowel. It was shown in Chapter One that all these verbs are mid-vowel-final, and the assumption is that all mid-vowel-final roots delete the final vowel /a/. This means that in the input the monosyllabic words are bisyllabic and they also surface with long vowels, hence they are bimoraic. This is what is expected if the bisyllabicity/bimoraicity condition has to be satisfied.

The reduplicant is bimoraic as well (only stems are copied):

- (32)
- | | |
|--------|--------------------------------|
| ku-kó: | kukó:ko: 'to catch repeatedly' |
| ku-tó: | kutó:to: 'to take repeatedly' |
| ku-mé: | kumé:me:, 'to grow repeatedly' |
| etc. | |

Some nouns are also bimoraic in Chitonga:

- (33) mba: 'fire burns'
nja: 'hunger'
mwá: 'stone'
bó: 'faeces'
gá: 'charcoal'
bé: 'breast'
ba: 'porridge'.

And when they are reduplicated, the reduplicant is also bimoraic:

- (34) Ngwa-mba:mbá: 'he is of fire burns'
Ndi-mwá:mwâ: 'she is very beautiful'
Mba-bó:bô: 'they are full of faeces'
Mba-bé:bê: 'they are fond of women'

We see, therefore, that the bisyllabic or bimoraic minimality condition is inviolable in Chitonga and Bantu in general.

This chapter has discussed several phonological facts that require theoretical explanation. Two available analyses of the Bantu syllable structure have been examined. Having argued for the single segment analysis, that excludes clusters of segments of the form CC (consonant clusters), VV (vowel clusters) or GG (glide clusters) in Chitonga, the chapter has shown that Chitonga has 34 consonant sounds (against the 26 if CC cluster is assumed). It has also shown that certain phonological requirements bring changes on the featural structure and sequences of sound segments. Only stops can be prenasalised, the prenasalised voiceless stops are always aspirated, and the final vowel /a/ of verb stems always gets deleted when it follows mid-vowel-final roots instead of inserting a glide or a liquid to break such a cluster as it is done in similar situations. It has also tackled briefly

the issue of word minimality condition in Bantu where it has been shown that the bisyllabic/bimoraic minimality condition is never violated in Chitonga. The following chapter, therefore, lists some of these facts and it demonstrates the capacity of Optimality Theory to capture the generalizations.

CHAPTER FOUR

THEORETICAL APPLICATION

An adequate characterization of Chitonga grammar should include the following facts:

(I) Chitonga consonant inventory does not include affricates found in its neighbouring languages such as Chichewa.

(II) Only stops are prenasalised.

(III) Voiceless stops are aspirated when prenasalised.

(IV) Chitonga does not allow segment clusters such as GG (glide+glide), CC or VV.

(V) The final vowel /a/ of verb stems gets deleted when it follows mid-vowel-final roots instead of inserting a glide or a liquid. This results into certain imperative or infinitive verbs in Chitonga, unlike most Bantu languages, ending in /e/ or /o/ as final vowels.

We will show how OT principles can account for these facts.

Since it is assumed in this study that Chitonga does not fit in well with similar sound clusters/sequences (i.e. VV, CC, GG), Syntagmatic Constraints (constraints governing sequences of sounds) are seen to play a minimal role in the phonology of this language. The relevant principles governing Chitonga consonant inventory and the syllable structure, therefore, should belong to FAITHFULNESS and Paradigmatic families. These are outlined below:

(35) SYNTAGMATIC CONSTRAINTS: These require particular featural properties of sequences of segments. For example, a syntagmatic constraint may require identity of the

place features of sequences/clusters of consonants (cf. Pulleyblank 1997).

(36) **PARADIGMATIC CONSTRAINTS**: one feature imposes a condition on another feature within the same speech sound. These are of two types, *sympathetic* and *antagonistic* (Archangeli and Pulleyblank 1994).

Sympathetic Feature F must appear when feature G appears.

Antagonistic Feature F must not appear when feature G appears.

(37) **FAITHFULNESS CONSTRAINTS**: Pronounce everything as is. That is, the input and the output are identical (no epenthesis, deletion or featural alteration) (cf. Archangeli 1997).

To this list we can also add the general principle of *COMPLEX.

(38) ***COMPLEX**: Syllables have at most one consonant at an edge (cf. Hammond 1997) (to be adapted).

We now turn to a discussion of how the Chitonga consonant inventory and syllable structure facts listed above can be accounted for in the light of the principles of Optimality Theory. To begin with, an examination of large numbers of inventories demonstrates that the selection of consonants is not haphazard. Both across languages and within languages, regular patterns emerge. At issue, therefore, is how to express such patterns (Pulleyblank 1997:76).

In Optimality Theory, whether some segment is included in the inventory of a given language depends fully on the nature of the constraint ranking of the language in question. That is, the inventory derives from the way that constraints on output forms interact with freely chosen input feature combinations (Prince and Smolensky 1993;). Consider, for example, feature cooccurrence conditions of *continuancy* in an affricate. "Some sounds are produced by a stop closure followed immediately by a slow release of

the closure characteristic of a fricative. These sounds are called **affricates**” (Fromkin and Rodman 1978:75). Relevant to the discussion is the feature continuant. Chitonga does not have affricates because it does not allow antagonistic cooccurrence of features [+continuant] and [-continuant] in a single sound segment. This is why the Standard Chichewa word *tso.no* ‘now’ (cf. Mtenje 1980, 1986 on consonant clusters) will be realized as *sóno* in Chitonga. Below are similar instances:

STANDARD CHICHEWA	CHITONGA	GLOSS
tso.ka	so.ka	misfortune
tse.mbwe	se.mbwi	goose bumps
fa.tsa.ni	fwa.sa.ni	be patient
dzi.na	zi.na	name
dzi.βa	zi.βa	know
ma.dzu.lo	ma.zu.lo	evening
i.dza	i.za	come

In another sense, an affricate can be considered as a consonant cluster, hence violating *COMPLEX which seems to be highly ranked in Chitonga as it will be shown later. Three constraints are proposed below. The first one (a) is an antagonistic constraint that excludes affricate sounds in Chitonga inventory, thus ranked above FAITH. Constraints (b) and (c) ensures that it is a ‘stop’ part that is abandoned as we see in (39).

- a. +CONT/-CONT: A segment unit with opposing features in terms of continuancy is excluded from the inventory.
- a. FAITH[+CONT]: A continuant in the input surfaces in the output.
- b. FAITH[-CONT]: A stop in the input surfaces in the output.

Figure (39) below illustrates the above discussion in the manner common to most work in Optimality Theory.

(39) Affricates are not found in Chitonga inventory

tsó.no	+CONT/- CONT	FAITH[+CONT]	FAITH[-CONT]
(a) tsó.no	*!		
(b) tó.no		*!	
(c) ⇒só.no			*

The figure is called a **tableau**; the constraints are ranked across the top, going from highest ranked on the left to lowest ranked on the right. Solid lines between constraints indicate crucial rankings while dashed lines indicate that the ranking is not (or not yet) crucial. In this example, for instance, it is crucial that FAITH[-CONT] be subordinate to +CONT/-CONT. The top left-hand cell shows the input representation (e.g. *tsó.no*) for which candidates are being considered. Candidates show up in the leftmost column, with the optimal candidate indicated by the symbol '⇒'. The optimal candidate is the one with the lowest violations. Violations are indicated by asterisks (*), and an exclamation mark highlights each "fatal" violation, i.e. the violation that eliminates a candidate completely.⁷ Shaded areas indicate constraints that are irrelevant due to the violation of a high ranked constraint. Thus candidate (39a) is disqualified because it violates the high ranked +CONT/-CONT. Candidate (b) satisfies +CONT/-CONT, but it is unacceptable as it violates another high ranked constraint FAITH[+CONT]. Candidate (c) is opted since it satisfies both the highly ranked constraints and violates the low ranked FAITH[-CONT] which can be tolerated.

The same antagonistic constraint also explains why all prenasalised sounds in Chitonga are stops (see (21) for more examples). Principally, all nasals must not be continuant (Pulleyblank 1997:76). Corollary, two paradigmatic constraints can be invoked at this point. The first one (a) ensures that a prenasal feature cannot cooccur with the feature

⁷ Given that GEN creates an infinite set of candidates, only those which are critical to the point being made are given.

continuant. This is ranked above FAITH[PRENAS] (b). The result of this fact is that Chitonga does not exhibit prenasalised fricatives. As it was shown in (21), prenasalised sounds like /ns/ surface as simply /s/. For instance, the Chichewa word *nsima* ‘hard porridge’ will surface as *síma* in Chitonga.

- a. PRENAS/CONT: A prenasalised consonant must not be continuant.
- b. FAITH[PRENAS] A prenasalised segment unit in the input must appear identical in the output.

(40) Only stops can be prenasalised

nsi.ma	PRENAS/CONT	FAITH[PRENAS]
Nsíma	*!	
⇒síma		*

The candidate *nsíma* is non-optimal because it violates the highly ranked PRENAS/CONT which prevents continuants such as fricatives from being prenasalised. The second candidate (*síma*) is chosen as it satisfies PRENAS/CONT and it violates the low ranked FAITH[PRENAS] which requires a prenasalised segment unit in the input to appear identical in the output.

The ranking hierarchy can be represented as follows:

Chitonga: PRENAS/CONT>> FAITH[PRENAS]
Chichewa: FAITH[PRENAS]>> PRENAS/CONT

We can also invoke a *sympathetic* paradigmatic constraint that makes sure that all prenasalised voiceless stops are aspirated in Chitonga (see (23) for more examples). It makes one speculate whether a nasal is intrinsically aspirated. There are other cases where nasality forces the voicing of a following consonant (cf. Katamba 1989:88-89). Drawing from the principles of Optimality Theory and the aforementioned assumptions we can explain why prenasalized voiceless stops are always aspirated in some Bantu

languages. The feature *nasal* forces aspiration and not voicing, maybe because FAITH[VOICE] is ranked above FAITH[ASPIRATION]. The following constraints can be invoked at this moment which show that (a) and (b) are ranked above FAITH[ASP].

- a. PRENAS/ASP: prenasalised voiceless stops must be aspirated.
- b. FAITH[VOICE]: The input and the output must be identical in terms of voicing.
- c. FAITH[ASP]: The input and the output must be identical in terms of aspiration.

This can be diagrammatically represented as follows:

(41) Voiceless prenasalised stops are always aspirated

mu.ntu	PRENAS/ASP	FAITH[VOICE]	FAITH[ASP]]
a. muntu	*!		
b. $\Rightarrow$ munt ^h u			*
c. mundu		*!	

Candidate (a) is disqualified because it violates the highly ranked constraint PRENAS/ASP which requires all prenasalised consonants to be aspirated. Candidate (b) is optimal because it satisfies PRENAS/ASP and violates the low ranked FAITH[ASP] which requires identity of the input and the output in terms of aspiration. The third candidate⁸ is also unacceptable because it violates another highly ranked voicing constraint which requires the input and the output to be identical in terms of voicing (FAITH[VOICE]).

The principles of OT also ought to provide an insight into why Chitonga does not allow segment clusters such as CC, GG, or VV. The principle of *COMPLEX (in 38) will be adapted as below.

8. This is a possible word in Chiyao, a Bantu language spoken in some parts of Southern Malawi.

*COMPLEX: There should be no segment clusters like CC, VV or GG.

This principle prevents segments of the same nature like consonants from clustering in any environment. In Chitonga, such cases arise where vowels are juxtaposed such that something has to be done to preserve the highly ranked *COMPLEX. For example, when an input such as *to-esya* ‘cause to take’ is given, a glide or a liquid is inserted to break such a cluster (see (15) for details).

But this is not being FAITHFUL to ‘consonant’ (FAITHC, defined below). Optimality Theory predicts that a consonant is inserted instead of deleting one of the vowels because FaithV, defined below, is ranked above FAITHC.

- a. FAITHC: The output must be identical to the input in terms of consonants.
- b. FAITHV: The output must be identical to the input in terms of vowels.

*COMPLEX, FAITHV>>FAITHC

(42) Vowel clusters are not allowed in Chitonga

to-esy-a	*COMPLEX	FAITHV	FAITHC
a. $\Rightarrow$ to.le.sya			*
b. to.e.sya	*!		
c. to.sya/te.sya		*!	

Candidate (a) is optimal because it satisfies the high ranked constraint *COMPLEX which excludes cluster forms like CC, VV, or GG. It also satisfies the high ranked FAITHV which prevents deletion of vowels, but it violates the low ranked FAITHC which can be tolerated. The second and the third candidates violate the high ranked *COMPLEX and FAITHV which cannot be tolerated, hence they are unacceptable.

The following discussion, however, contradicts this ranking as it independently shows that FAITHC is ranked above FAITHV.

Each and every verb in imperative form or in infinitive form in Chitonga, as in most Bantu languages, has a final vowel /a/. We can propose that there is a constraint called FINALITY (Since this does not seem to be a universal constraint, perhaps it should be considered as a language-specific or language family constraint). When the final vowel, however, follows any mid vowel it is deleted (see (10) for more examples). This entails that mid vowel-final verb roots and the applied suffix variant *-e* will not be followed by the final vowel as is the case in the rest of infinitives.

It seems the deletion of the final vowel is syntagmatically induced - "certain types of sequences are simply impossible in some languages - and the only way to respect such possibility is the deletion of a segment" (Pulleyblank, 1997: 72). The incompatibility of the mid vowel and the final vowel /a/ arises from their differences in terms of height. As we see in the following discussion, I link this problem to a family of constraints called IDENTICAL CLUSTER CONSTRAINTS (ICC - adapted).

ICC: The featural properties of sequences of vowels must be identical.

And in terms of the constraint we are proposing, we can call the constraint ICC (HEIGHT). ICC (HEIGHT) (defined below) is ranked above FINALITY and it can be tentatively assumed that it is also ranked above FAITHV since the deletion of a vowel is involved. This can be hierarchically represented as follows:

ICC (HEIGHT) >> FAITHV, FINALITY

ICC (HEIGHT): A sequence of vowels must be identical in height.

FINALITY: All infinitives have final vowel a.

(43) Mid vowel deletes low final vowel

sompho-a	ICC (HEIGHT)	FAITHC	FAITHV	FINALITY
somphoa	*!			
⇒sompho			*	*
somphola		*!		

The first candidate is unacceptable since it violates the high ranked ICC (HEIGHT) which requires that a sequence of vowels must be identical in terms of height. The second candidate is optimal because the mid vowel has deleted the low vowel, solving the problem of incompatibility of the vowel sequence. It also violates the tolerable low ranked FAITHV and FINALITY which resist the deletion of vowels as well as a final vowel. The third candidate is unacceptable because it violates the high ranked FAITHC although it satisfies FAITHV.

The preceding tableau shows that a vowel (fv) has to be deleted, instead of inserting a glide or a liquid. In this case, it is tempting to conclude that FAITHC is ranked above FAITHV. But (42) independently showed that FAITHV is ranked above FAITHC. This contradiction can be solved if we propose a constraint in the input that prohibits vowels that are incompatible in terms of height to cluster. Thus ICC (HEIGHT) is a constraint for the correct input that excludes mid + non-mid vowel clusters (as in **sompho-a*). This requires further research as it violates one of the tenets of OT which rules out any constraints on the input.

Another alternative would be to approach the problem diachronically. Since most Bantu languages have a non-mid vowel /a/ as a final vowel, it is possible that Chitonga once satisfied the condition but lost it with the passage of time. The lengthening of the final mid-vowel vindicates this claim. Gradually this type of verbs (mid-vowel-final) became lexicalised. Further research is also necessary to justify this possibly controversial position.

Implications for Language Learning

This section proceeds from the main goal of linguistics today as cited in (1.2). Optimality Theory has to predict how children learn their first language within a very short period of time and with very limited data from their environments. The goal is to show how the process takes place. For the acquisition of Chitonga, OT shows that the child does not learn the biologically endowed universal set of constraints. Instead, the child learns the critical constraint ranking of Chitonga. For instance, to learn the right form *mu.nt^hu* out of the many freely generated forms such as *mu.ntu* and *mu.ndu* in (41), the child does not acquire the already biologically endowed constraints PRENAS/ASP, FAITH[ASP] and FAITH[VOICE]. To produce the correct form *mu.nt^hu*, the child needs to learn that PRENAS/ASP is ranked above both FAITH[ASP] and FAITH[VOICE] in the constraint ranking hierarchy of Chitonga.

OT also makes important generalizations as regards errors that children learning Chitonga make. Children may be heard producing Chitonga words *munt^hu*, *mant^ha* as *muntu*, *manta*. This type of error is systematic and follows some specific principles: the assumption is that the constraints PRENAS/ASP and FAITH[ASP] are incorrectly ranked, and the correct forms are attained when the constraints are re-ranked later when there is enough evidence from the environment. This prediction is different from that of the traditional generative grammar where a learner incorrectly learns a language-particular rule, which has little claim to universality.

This chapter set off by listing some of the facts observed in Chitonga, which Optimality Theory has shown to have the capacity to account for. However, as it has been noted by others, the theory needs to formally accommodate the fact that certain constraints are language-specific and that constraints on the input cannot be completely ruled out (cf. Mtenje 2002, Golston 1996, respectively, for arguments along the same lines). At the end, the chapter discussed implications of OT insights for a child learning Chitonga. The following chapter provides a general summary and a conclusion.

CHAPTER FIVE

SUMMARY AND CONCLUSION

In this study we have presented selected aspects of Chitonga phonology and how Optimality Theory accounts for each of them. In this chapter we summarize these findings by chapter. Chapter one discussed general issues about Chitonga language and the thesis. Chapter 2 discussed the theoretical perspectives of the syllable and the theoretical frameworks that have directed phonological thinking before we outlined Optimality Theory.

In Chapter 3, two available analyses of the Bantu syllable structure were examined. Having argued for the single segment analysis, that excludes clusters of segments of the form CC (consonant clusters), VV (vowel clusters) or GG (glide clusters) in Chitonga, the thesis showed that Chitonga has 33 consonant sounds (against the traditional 27 assumed by consonant cluster analysis). Affricate sounds present in other neighbouring languages such as Chichewa are not part of the Chitonga consonant inventory.

We also showed (Chapters 1 and 3) that certain phonological requirements bring changes to the featural structure and sequences of sound segments. An observation was made that only stops can be prenasalised, the prenasalised voiceless stops are always aspirated, and the final vowel /a/ of verb stems always gets deleted when it follows mid-vowel-final roots instead of inserting a glide or a liquid to break such a cluster as it is done in similar situations. This results into certain imperative or infinitive verbs in Chitonga, unlike in most Bantu languages, ending in /e/ or /o/. The thesis also briefly tackled the issue of word minimality conditions in Bantu where it was shown that the bisyllabic/bimoraic minimality condition is never violated in Chitonga.

The thesis also demonstrated the different behaviours of phonemic and derived glides when they satisfy the structural description for a phonological rule to apply. This debate

consolidated the point made by Durand (1990) that it is a derived glide (derived from a vocalic nucleus) that has been wrongly assumed as a third consonant in the consonant cluster analysis. Perhaps further research in Bantu languages could be more revealing than we have done in the present study.

The thesis also discussed the position that a glide occupies in the theory of representations. We showed that as diphthongs have been viewed in English, derived glides (including the third C in a consonant cluster analysis) are dominated by a V-node. But we raised a problem of the position that an epenthetic liquid occupies. There seems to be a general consensus that a liquid is a true consonant that cannot be dominated by a V-node, and by extension an epenthetic glide also ought to be viewed as such. Following insights from Autosegmental Theory that each and every syllable has C and V-nodes, the present study showed that an epenthetic glide goes straight into the C-node based on the fact that both glides and liquids break up vowel clusters. This conception of glides helps us to clarify certain phonological issues.

In Chapter 4, an attempt was made to account for the observed phonological facts within the framework of Optimality Theory.

Explaining the phonological issues in this framework, the data from Chitonga (and perhaps from Bantu languages) show that although the theory has the power to explain most of the facts, there are signs that some of its tenets can be challenged. For instance, using data from Chitonga, the study has hinted that there could be constraints on the generation of the input, and that some constraints could be language or language family specific, which is contrary to a general belief in OT (cf. Golston 1996, Mtenje 2002, respectively, for arguments along the same lines). The data from Chitonga calls for a modification of the theory in order to accommodate these observations. Perhaps related to this is the fact that the theory should be better constrained to avoid attributing every problem that arises with data from certain languages to a new constraint (claimed to be inviolable) that has never been proposed before. In other words, there has to be a mechanism for the theory to separate language-specific from universal constraints.

References

- Archangeli, Diana (1997) "Optimality Theory: An introduction to linguistics in the 1990s," in Diana Archangeli and D. Terence Langendoen (eds.) *Optimality Theory: An Overview*. Massachusetts, Oxford: Blackwell Publishers, pp. 1-32.
- Archangeli, Diana and Douglas Pulleyblank (1994) *Grounded Phonology*. Cambridge, Mass.: MIT Press.
- Banda, Felix (1995) "The 'Meaning-to-Grammar Hypothesis' of Zambian English: Implications for Classroom English Instruction in a Multilingual Context." Doctoral thesis, Free University, Brussels.
- Banda, Felix (2001) "Towards an integrated orthography of Zambian languages," in Felix Banda (ed.), *Language Across Borders*. Cape Town: The Centre for Advanced Studies of African Society, pp. 9-25.
- Banda, Joseph T.K. (1985) "proverbs in Tonga-proverbe N.M3574O" Unpublished.
- Bloomfield, L. (1933) *Language*. New York: Holt.
- Bryan, M.A. (1959) *The Bantu Languages of Africa*. London, New York, Capetown: Oxford University Press.
- Chirwa, Filemon K. (1932) *Nthanu za Chitonga*, Livingstonia Mission.
- Chomsky, N. (1964) *Current Issues in Linguistic mTheory*. The Hague, Paris: Mouton.
- Chomsky, N. (1965) *Aspects of the Theory of Syntax*. Cambridge, Mass.: MIT Press.
- Chomsky, N. (1981) *Lectures on Government and Binding*. Dordrecht: Foris.

Chomsky, N. and Halle, M. (1968) *The Sound Pattern of English*. New York: Harper and Row.

Doke, C.M. (1967) *The Southern Bantu Languages*. London: Dawsons of Pall Mall.

Downing, Laura (1996) *The Tonal Phonology of Jita*. Munich: LINCOM EUROPA.

Downing, Laura (1996c) "On the prosodic misalignment of onsetless syllable," *Natural Language and Linguistic Theory* 16, pp. 1-52.

Downing, Laura J. (2004) "Complex consonants or complex sequences? NCs and affricates in Bantu Languages," Paper presented at seminar organized by The Centre for Language Studies and the Department of English, Chancellor College, University of Malawi, Zomba, 1st April 2004.

Durand, Jacques (1990) *Generative and Non-Linear Phonology*. London and New York: Longman.

Fromkin, Victoria and Robert Rodman (1978) *An Introduction to Language*. New York: Holt, Rinehart and Winston.

Goedemans, R. (1996) "An Optimality account of context sensitivity in quantity insensitive languages," *The Linguistic Review* 13, pp. 33-48.

Goldsmith, John (1976) "Autosegmental phonology." Unpublished Ph.D dissertation, MIT. Reproduced by Indiana University Linguistics Club.

Goldsmith, John (1990) *Autosegmental and Metrical Phonology*. Cambridge, Mass.: Basil Blackwell.

Golston, Christopher (1996) "Direct Optimality Theory: Representation as pure markedness," *Language* 72, pp. 713-748.

Goyvaerts, D.L. (1980) "Some aspects of Logo phonology and morphology," *Brussels Papers in Linguistics* 4: 44. University of Antwerp

Goyvaerts, D.L. (1986) "Language and history in Central Africa." *Antwerp Papers in Linguistics*, 44. University of Antwerp.

Greenberg, Joseph H. (1983) "Some aerial characteristics of African Languages," in Ivan R. Dihoff (ed.), *Current Approaches to African Linguistics* (vol. 1). Dordrecht, Cinnaminson: Foris Publications. Pp. 3-21.

Guthrie, Malcom (1947) *The Classification of the Bantu Languages*. London, New York, Toronto: Oxford University Press.

Hammond, Michael (1997) "Optimality theory and prosody," in Diana Archangeli and D. Terence Langendoen (eds.) *Optimality Theory: An Overview*. Massachusetts, Oxford: Blackwell Publishers, pp. 33-58.

Harris, Zellig (1951) *Methods in structural linguistics*. Chicago: University of Chicago Press.

Haugen, Einar (1956) "The syllable in linguistic description," in M. Halle, H.G. Lunt, H. MacLean, and C.H. Van Schooneveld (eds.) *For Roman Jakobson*. The Hague: Mouton.

Heffner, R-M.S. (1950) *General Phonetics*. Wisconsin: The University of Wisconsin Press.

Hockett, Charles (1955) "A manual of phonology," *International Journal of American Linguistics* 21(4), part 1. memoir 11.

Hornstein, N. and D. Lightfoot (eds.) (1981) 'Introduction', *Explanation in Linguistics*. London, New York: Longman. Pp. 9-31.

Hubbard, Kathleen (1995a) "Prenasalised consonants' and syllable timing: evidence from Runyambo and Luganda," *Phonology* 12, pp. 235-256.

Hubbard, Kathleen (1995b) "Toward a theory of phonological and phonetic timing: Evidence from Bantu," in Bruce Connell and Amalia Arvaniti (eds.) *Papers in Laboratory phonology and phonetic evidence*. Cambridge: Cambridge University Press, 168-187.

Hyman, Larry and Al Mtenje (1999) "Prosodic morphology and tone: the case of Chichewa," in René Kager, Harry Van De Hulst and Wim Zonneveld (eds.) *The Prosody-Morphology Interface*. Cambridge: Cambridge University Press. pp. 90-133.

Kahn, Daniel (1976) "Syllable Based Generalizations in English Phonology". PhD dissertation, MIT, New York: Garland Press.

Kanerva, Jonni (1990) "Focussing on phonological phrases in Chichewa," in Sharon Inkelas and Draga Zec (eds.), *The Phonology-Syntax Connection*. Chicago: Cambridge University Press, pp. 145-161.

Katamba, Francis (1984) "A Non-linear Analysis of Vowel Harmony in Luganda." *Journal of Linguistics* 2, pp. 257-276.

Katamba, Francis (1989) *An Introduction to Phonology*. London, New York: Longman.

Kenstowicz, Michael and Charles Kisseberth (1979) *Generative Phonology: Description and Theory*. New York, San Francisco, London: Academic Press.

MacAlpine, A.G. (1905) "Tonga beliefs and customs," *Aurora* 8, Livingstonia Mission.

Mazgu Ghaku Chiuta, The Bible in Chitonga (Malawi) (c) (1986), United Bible Societies, UBS-EPF 1987-5M-D53.

Mcapu wa Chitonga (n.a) (1932).

McCarthy, J. and A. Prince (1994) "The emergence of the unmarked: Optimality in prosodic morphology," *Proceedings of the North East Linguistic Society* 24, pp. 333-379.

McCarthy, J. and A. Prince (1999) "Faithfulness and identity in prosodic morphology," in Kager, R., H. Van der Hulst and W. Zonneveld (eds.) *The Prosody-Morphology Interface*. Cambridge: Cambridge University Press. Pp. 218-309.

Mkochi, Winfred (2001) "Applicative construction in Malawian Tonga." B.Ed. dissertation, University of Malawi, Chancellor College, Zomba.

Moto, Franscis (1989) "Phonology of the Bantu Lexicon." Ph.D Thesis. University College London.

Mphande, David K. (1998) "On the use of Tonga myths, folktales and proverbs in moral education," Ph.D., university of Malawi.

Mphande, David K (2000) *Nthanthi za Chitonga Zakusambizgiya ndi Kutauliya*. Blantyre: CLAIM/MABUKU.

Msosa, W. (1999) "Fishery culture and origins of the Tonga people of Lake Malawi." In H. Kawanabe, G.W. Couter and A.C. Roosevelt (eds.) *Ancient Lakes: Their Cultural and Biological Diversity*. Belgium: Kenobi Publications, pp. 271-280.

Mtenje, Al (1980) "Aspects of Chichewa derivational phonology and syllable structure constraints." M.A. Thesis, Southern Illinois University, Edwardville, Illinois.

Mtenje, Al (1985) "Arguments for an Autosegmental analysis of Chichewa vowel harmony." *Lingua* 66, pp. 21-52.

Mtenje, Al (1986) "Issues in the non-linear phonology of Chichewa." PhD dissertation, University College London.

Mtenje, Al (1994/95) "Tone in Malawian Tonga," *Journal of Humanities*, 8/9, pp. 65-72.

Mtenje, Al (2002) "An Optimality-theoretic account of Ciyao verbal reduplication." Paper generously given to me by the author. To appear in Proceedings of ACAL 33.

Mtenje, Al (2004) "Alignment theory and prosody in Malawian Citonga." To appear in *Linguistic Analysis*.

Mutaka, N. and Larry M. Hyman (1990) "Syllables and morpheme integrity in Kinande reduplication," *Phonology* 7, pp. 73-119.

Myers, Scott (1987) "Tone and the structure of words in Shona." Ph.D dissertation, University of Massachusetts, Amherst.

Pike, Kenneth and Eunice Victoria Pike (1947) "Immediate constituents of mazateco syllables," *International Journal of American Linguistics* 13: 78-91.

Prince, Alan S. and Paul Smolensky (1991) "Optimality," Talk presented at Arizona Phonology Conference 3, University of Arizona, Tucson.

Prince, Alan S. and Paul Smolensky (1993) *Optimality Theory: Constraint Interaction in Generative Grammar*, RuCCs Technical Report NO. 2, Rutgers University Centre for Cognitive Science, Piscataway, N.J.

- Pulleyblank, Douglas (1997) "Optimality theory and Features" in Diana Archangeli and D. Terence Langendoen (eds.) *Optimality Theory: An Overview*. Massachusetts, Oxford: Blackwell Publishers, pp. 59-101.
- Ruwet, Nicholas (1973) *An Introduction to Generative Grammar*. Amsterdam, London: North-Holland Publishing Company.
- Soko, B.J. (1985) "Tonga proverbs", Unpublished collection.
- Tew, Mary (1950) *The Peoples of the Lake Nyasa Region*. Passim.
- Turner, Y. (1952) *Tumbuka-Tonga-English Dictionary*. Blantyre: Hetherwick Press
- Vail, Hazen Leroy (1972) "Aspects of the Tumbuka Verb." Unpublished. PhD. Thesis, University of Wisconsin.
- Velsen, Jaap van (1959) "Notes on the history of the lakeside Tonga of Nyasaland," *African Studies*, XVIII, No. 3, pp. 105-117.
- Velsen, Jaap van (1959) "The missionary factor among the lakeside Tonga of Nyasaland," *Rhodes-Livingstone Journal*, XXVI, pp. 1-22.
- Velsen, Jaap van (1964) *The Politics of Kinship: A study in Social Manipulation among the Lakeside Tonga of Nyasaland*. Manchester University Press.
- Wilson, Monica (1958) *The Peoples of the Tanganyika-Nyasa Corridor*. Cape Town. Passim.