AN EXAMINATION OF THE TONE SYSTEM OF FUR

AND ITS FUNCTION IN GRAMMAR

by

GEORGIANNA NOEL

Presented to the Faculty of the Graduate School of

The University of Texas at Arlington in Partial Fulfillment

of the Requirements

for the Degree of

MASTER OF ARTS IN LINGUISTICS

THE UNIVERSITY OF TEXAS AT ARLINGTON

AUGUST 2008

DEDICATION

To Scott and to my parents, for traveling with me down this long and winding road. Thanks for seeing the light at the end of the tunnel, even when I could not.

ACKNOWLEDGEMENTS

First, I would like to thank my committee chair, Dr. Jerold A. Edmondson, who studied Fur alongside me and convinced me that I was capable of this research. I would also like to thank Dr. Donald A. Burquest and Dr. Laurel Smith Stvan for their support, critique and encouragement. I thank my husband, Scott Noel, for putting up with me during this long process and for the insight he contributed. Finally, I must thank "M", the subject of this research who gave so willingly of her time to help me understand the Fur language.

July 15, 2008

ABSTRACT

AN EXAMINATION OF THE TONE SYSTEM OF FUR

AND ITS FUNCTION IN GRAMMAR

Georgianna Noel, M.A.

The University of Texas at Arlington, 2008

Supervising Professor: Jerold A. Edmondson

This research into the tonal system of Fur and its grammatical functions began with several basic assumptions. These assumptions were based on the excellent prior research by Jakobi (1989), and Waag and Kutsch Lojenga (2000). These assumptions were:

1. Fur is a register tone language with two tones L and H. Contours on LH and HL are possible.
2. Tone makes lexical distinctions in Fur as exemplified by examples such as:

   'desert' *úrì*

   'sheep' *úri*
3. Tone also functions in the grammar of Fur. Tone is used to differentiate the nominative and locative forms of nouns and the attributive and predicate forms of adjectives.

The purpose of the research was to take this knowledge and study two aspects of the Fur language in greater detail. These three objectives were as follows:

1. A reexamination of the tone system to determine if Jernudd's claim (1983) of a three tone system was possible.
2. An investigation of two previously known functions of tone in Fur, that of tone change in the formation of locatives, and tonal difference between attributive and predicate forms of nouns, in light of the results of the new evaluation of the tone system produced by the first objective.
3. A study of a new function of tone in Fur grammar discovered during this research, namely a tonal difference in [±human] objects of verbs based on their semantic roles.

Through elicitation of data from Subject A, a native speaker of Fur residing in Arlington, Texas, and analysis of the data using F_0 Pitch Trajectory Plots, the aforementioned topics are investigated.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

1.1 The Fur Language

The Fur language is spoken by about 3,000,000 people in the Darfur area of Western Sudan and Eastern Chad. The map below defines the area in which Fur is spoken.

Figure 1.1 Map of Fur Language Area

Fur has alternately been known by the following names: For, Fora, Fordunga, Furawi, Furakang, Forta, Forok, Konjara, Kungara, Yerge, Onage, Korra, Kadirgi, Kurka, Dala and Lali . The subject of this research referred to it as *Fur* [fur], or *Bele Fur* 'Fur Language' (Bele is borrowed from Arabic). Many Fur speakers are also fluent in Arabic, and Fur has many Arabic loan words.

1.2 Nilo-Saharan Languages

Fur belongs to the Nilo-Saharan language group. The Nilo-Saharan Language group was first identified by Joseph Greenberg in 1963. As suggested by the name, Nilo-Saharan is primarily a family of the African interior, including the greater Nile basin and its tributaries as well as the central Sahara desert. The languages are mainly spoken in the northern parts of the Chari and Nile rivers, north of where the two tributaries of the Nile meet. However the members of the family are far-reaching, extending across 17 countries (see map). The largest part of Nilo-Saharan's major subfamilies are found in Sudan.

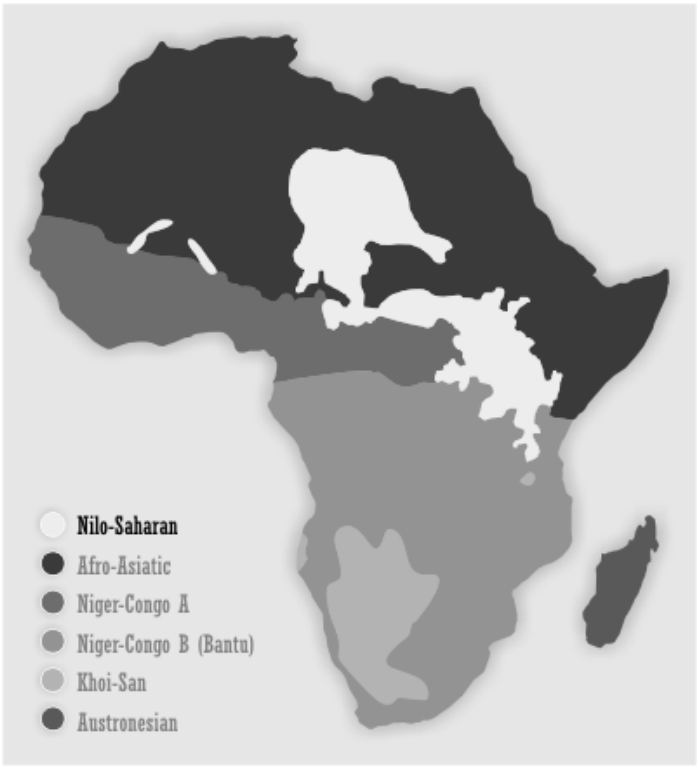

Figure 1.2 Map of Nilo-Saharan Language Area

In his construction of Nilo-Saharan, Christopher Ehret (2001) classified the Nilo-Saharan Languages as follows:

- Koman languages
- Sudanic languages
- Central Sudanic languages
- North Sudanic languages
- Kunama language
- Saharo-Sahelian languages
- Saharan languages
- Sahelian languages
- Fur languages
- Trans-Sahel languages
- Western Sahelian languages
- Songhay languages
- Maban languages
- Eastern Sahelian languages
- Astaboran languages
- Nara language (= Barea)
- Western Astaboran languages
- Nubian languages
- Taman languages
- Kir-Abbaian languages
- Jebel languages
- Eastern Jebel languages (= Tabi)
- Berta language
- Kir languages
- Nuba Hills (= Temein) (including Nyimang)
- Daju languages
- Surma-Nilotic languages
- Surmic languages
- Nilotic languages
- Rub languages (= Kuliak, Teuso) (Ik et al.)

The Fur language group includes three languages: Fur (Sudan), Amdang (Chad), Mimi (Chad).

1.3 Research Objective

The objective of this research was to reexamine and define the tone system of Fur, and to describe the role of tonal polarity in grammatical constructions. Three major grammatical structures were examined: predicate and attributive adjectives; nouns and their locative forms; and the effect of [±human] subjects and objects on the tone of the verb.

Jernudd (1983) suggested that Fur had three tones: high, low and mid, although both Jakobi and Kutsch Lojenga and Waag propose a two tone system with Jernudd's 'mid' as a surface realization of either a high or low tone This research supports Jernudd's suggestion and used pitch vector analysis to make the case for the three tone system. The study of tonal polarity in grammatical construction reveals the extensive use of tonal polarity in Fur, while also providing support for the three tone system.

1.4 Research Method

The sole subject of this research was Subject A, a native speaker of Fur, currently residing in Arlington, Texas. Darfur has been an area that has been plagued by increasing governmental instability and civil war since 1979. It is currently the focus of much attention for its ever increasing human rights crisis. As a result, there are many Fur refugees living in the United States. Subject A has learned English and is largely self-taught.

The potential disadvantages of using only one subject are clear: there is no basis for comparison or confirmation. However, the objective was not to develop a complete grammar of the Fur language, but to engage in a focused study of the incredibly complex and unique tonal system of Fur. In light of this very focus, intensive work with a single speaker had the advantages of providing invaluable one-on-one time for repetition and verification.

The tones were analyzed using F_0 trajectory plots and vector analysis. Using vector analysis for determining tones involves mathematical calculation of the slope (or vector) of the tone, which is the movement of the pitch over time. This is not a new idea and in fact the possibility for the necessity of just such analysis was first raised by Pike (1948).

1.4.1 Previous Research on the Fur Language

There is little available research on the Fur language. *A Fur Grammar*, by Angelika Jakobi (1989) is a systematic overview of the entire language, including Phonology, Syntax, Morphophonemics and Morphology. A paper, *The Sounds and Tones of Fur* by Contance Kutsch Lojenga and Christine Waag (2004) is an in depth analysis of Fur phonology.

Jakobi's excellent overview of the language provides several examples of the grammatical function of tone, and Kutsch Lojenga and Waag mention the use of tone in grammar briefly, but this topic was not the primary objective of the research. The important role that tone plays in Fur grammar has never been fully investigated. It was this gap that provided the impetus for the current research.

1.5 Tone in Nilo-Saharan Languages

Because the emphasis of the study is on tone, and there are only two published works on Fur, a broader investigation into the Nilo-Saharan family's tonal system was necessary. This investigation found numerous examples of Nilo-Saharan languages with three tone systems similar to that proposed in this research:

Three tones are commonly found in Nilotic languages (which are in the same phylum as Fur) according to Albert Remijsen and Caguor Adong Manyang (2007).

A study presented by C.A. Creider at the First Nilo-Saharan Linguistic Colloquium (1980) on the tonal systems of Southern Nilotic Languages in the Rift Valley Group, which include Kipsikiis, Nandi, Markweta, Tuken, and Keyo, show that most of these languages have three or four surface tones, and that all have three underlying tonemes, H, L, F.

1.5.1 Research on Tonal Polarity

According to Goldsmith (1995) tonal polarity refers to a process by which the tone of a morphophonemic segment is invariably different than the preceding tone. In Fur, according to current research, the idea of polarity takes a different shape. It presumes a tonal change to the "opposite" tone (i.e. H to L in a two tone system). This has been called 'tone reversal'.

Cahill (2004), in his study of Kɔnni, puts forward the idea that it is not always the preceding tone that effects a tone in a polarity relationship, and that is it even possible to have a situation where the tones is floating and the manifested tone is assigned based on grammatical considerations.

1.6 The Language Inventory

The following is a description of the consonants and vowels system of Fur. The analysis of Subjects A's consonants corresponded precisely with the consonants presented by Waag and Kutsch Lojenga (2004).

1.6.1 The Consonants

Fur has 18 consonants. The consonants are listed in Table 1.1 below:

Table 1.1 Consonants

	Bilabial	Alveolar	Palatal	Velar	Glottal
Voiceless Stops	p	t		k	
Voiced Stops	b	d	dz	g	
Voiceless Fricatives		s			h
Voiced Fricatives		z			
Nasal Sonorants	m	n	ɲ	ŋ	
Oral Sonorants	w	l,r	y		

The phoneme /p/ is alternatively pronounced /f/ and /pf/ by Subject A. This variation is also documented by Kutsch Lojenga and Waag, and Jakobi. According to Kutsch Lojenga and Waag, native speakers are not aware of the alterations, and Subject A would frequently say a word three times in a row with the three different phonetic variants. Kutsch Lojenga and Waag chose to use the phoneme /p/, while Jakobi opted for /f/. This study has favored the opinion of Kutsch Lojenga and Waag, based on the fact that Subject A also pronounced words beginning with [f] in English with a [p] or [pf] more often than any other variant. Also, as Kutsch Lojenga and Waag point out, when asked the name of their language, the answer of native speakers is most often [poor].

1.6.2 The Vowels

Jakobi and Waag and Kutsch Lojenga have contrasting opinions on the Fur vowel system. The sounds produced by Subject A did not align entirely with either system. Subject A's vowel system is not as complex as that proposed by Kutsch Lojenga and Waag (which involves eight vowels and ATR harmony). According to analysis of Subject A's vowels, Fur has a five vowel

system which is in keeping with Jakobi's research, although there is a slight difference in the inventory.

The vowels Jakobi presents are as follows:

[a] [e] [i] [o] [u]

Kutsch Lojenga and Waag present an eight-vowel contrast with ATR harmony. Given their large corpus of data, multiple speakers, and in-depth study of this particular topic, the data in this research cannot and does not attempt to question this proposal. However, for the purposes of this research, the details of the vowel inventory were not in focus. Therefore, in this study, a five vowel system that corresponds to the vowels produced by Subject A will be used. The vowel system produced by plotting Subject A's vowels is shown below with examples of the vowel in each position in the word: initial, medial and final.

An analysis of Subject A's vowels, using vowel formant plots, produced a five vowel system like Jakobi, with certain differences. Rather than [e] Subject A's vowel was lower in height, more resembling [ɛ] and Subject A also did not produce [o], but a [ɔ]. Therefore Subject A did not show ATR harmony but did produce some of the +ATR vowels. This vowel system that combines +ATR and –ATR vowels without contrast and may be simply a distinction of this particular speaker.

Table 1.2 Vowels

	Word Initial	Word Medial	Word Final
[a]	aar (firewood)	alankwe (woman)	appa (big)
[ɛ]	ɛllɛ (village)	kwɛde (boy)	dakkɛ (sticky)
[ɨ]	itti (small)	biis (manure)	jitti (ugly)
[ɔ]	ɔrra (dove)	ngɔra (hill)	rɔɔ (river)
[u]	utu (fire)	kulle (fast)	bagu (garden)

1.6.3 Representation of Vowels and Consonants

For consonants Jakobi, and Kutsch Lojenga and Waag, use a simple orthography based for the most part on a phonetic rendering of the transcription. This paper uses the same orthography almost entirely except where noted below. The table below does not indicate the tone of the word. The tonal system will be described in detail in Chapter 2.

Table 1.3 Consonant Representation

Phoneme	Orthographic Representation	Example	
p	p	piti	bed
b	b	bagu	garden
m	m	madine	city
w	w	kwede	boy
t	t	tong	house
d	d	doonga	hand
s	s	sikka	sharp
z	z	zaab	teeth
n	n	nima	shadow
l	l	lolo	no
r	r	rei	farm
j	j	jaara	jaara
ɲ	ny[1]	nyandam	fishhook
y	y	yaanga	woman
k	k	kuu	cows
g	g	gurag	bird sp.
ŋ	ng	ngora	hill
h	h	hilla	that (deictic)

For the vowels, the following representation has been chosen based on the desire to keep the orthography as simple as possible.

[1] Lojenga and Waag chose to use the IP symbols ŋ and ɲ, but in the interest of creating a simple writing system, these phones will be represented by *ng* and *ny* respectively. This is common in the orthography of many languages containing these sounds.

Table 1.4 Vowel Representation

a	a	aar	firewood
ɛ	e	elle	village
i	i	itti	small
ɔ	o	roo	well
u	u	rus	rice

1.6.4 The Tones

This study proposes a three tone system for Fur—high, mid and low. The tonal analysis that led to this conclusion is detailed in Chapter 2.

1.6.5 Tonal Polarity in Fur

Although this analysis is a departure from previous research on Fur, the presentation of tonal polarity in the grammatical function of Fur is unveiled in the subsequent chapters and it only serves to strengthen the argument for the existence of the mid tones. This type of polarity is manifested in the following manner:

$$X \rightarrow X^{*}/ \text{ [Grammatical Function A]}$$

for example

$$L \rightarrow M/ \text{ [forming locative from a noun]}$$

Fur exhibits a phenomenon of tonal polarity in its grammar that is fascinating in its own right while also giving credence to the three tone system because of the systematic polarity relationships between M and L as well as and M and H.

CHAPTER 2

REEXAMINING THE TONE SYSTEM USING F_0 TRAJECTORY PLOTS

2.1 Previous Research on Fur Tones

Previous research has analyzed Fur to have two underlying tones, L (low) and H (high), with contours of LH and HL on a single vowel possible. This tone system is presented by both Jakobi and Kutsch Lojenga and Waag. However, Jernudd (1983), proposed a three tone system: low, mid and high. His analysis was based on a collection of only 39 words, and no in-depth analysis was undertaken. Jakobi considered Jernudd's mid tone to be a realization of either a low or high toneme, rather than a separate tone.

The 'mid' realization of a high or low tone appeared so often in an initial study on the grammatical functions of tone and the role of tonal polarity that it became necessary to undertake a focused examination of the tone system itself in order to continue with research on tonal polarity in grammar.

This study used a method of pitch trajectory analysis to determine if there are two tonemes with multiple realizations due to environmental factors, or if there are indeed additional separate tones. The tones were analyzed using F_0 trajectory plots, which visually presented the pitch trajectory of lexical items and allowed for comparison of their gradients.

Each word was repeated by the informant three to four times. The sound files were then analyzed by software program PRAAT. PRAAT has the capability to show the pitch of the sounds as shown in Figure 2.1 where the lines on the bottom half of the Figure shows the pitch.

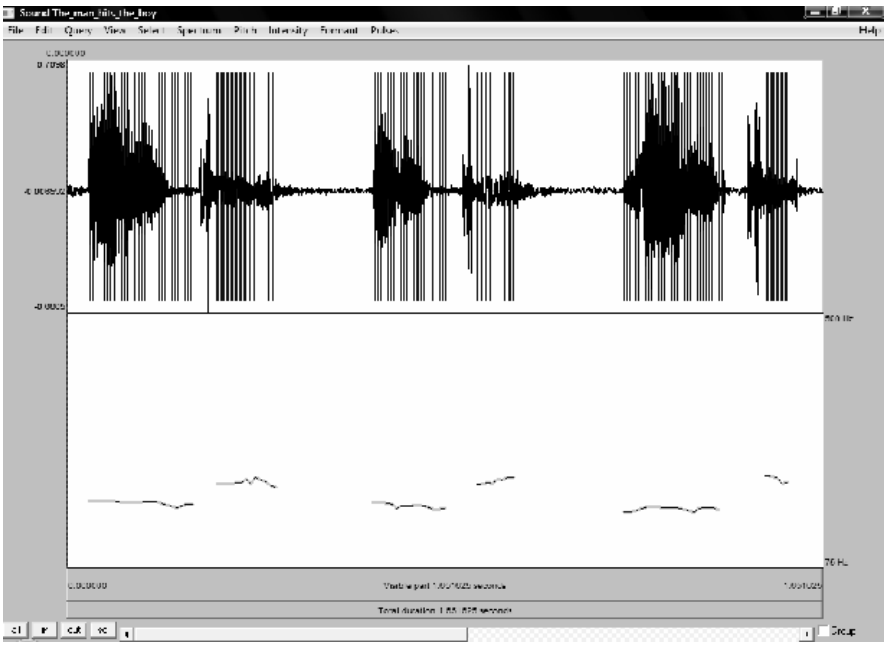

Figure 2.1 Three Repetitions of a Lexical Item in PRAAT

In PRAAT the pitch values can be extracted about every 10 milliseconds for each repetition of a word (the frequency in Hertz vs. time in seconds) as follows:

Time_s	**F0_Hz**
0.050813	186.568807
0.060813	186.580276
0.070813	186.740223
0.080813	186.915151
0.090813	186.718141
0.100813	186.309487
0.110813	185.825723
0.120813	184.287499
0.130812	183.864481
0.140813	183.758791
0.150813	183.842537
0.160813	184.328948

Multiple pitch listings for repetitions of the word were then averaged for duration and pitch height using the program COMP, which also converts frequency in Hertz to semitones. The tone could then be plotted in Excel using a *tone space* (pitch range for tone trajectories) of 12 semitones or one octave, which gives the truest analysis of the contours of the tone of a human voice, according to Ross et al. (1986), and Traunmiller & Eriksson (1995). For Subject A, the tone space encompassed the range 40 to 52 semitones. This method allowed analysis of the tones in quantitative terms, which provide a level of exactness that ears alone could not produce. By removing idiosyncracies and keeping comonalities between repetitions, COMP produces a reliable and verifiable pitch vector.

Nolan (2003) did a study of Hertz scales versus what he refers to as Psycho-Acoustic scales in which he includes semitones. Nolan's claim is that each speaker has a personal "tessitura" or personal pitch range and that equivalent tones will differ in magnitudevbut share the same pitch span. Through testing speakers' imitation of utterances by speakers with a different personal pitch range from their own, Nolan discovered that Psycho-Acoustic scales, such as semitones, produce the smallest replication error when comparing the utterances of speakers with different personal pitch ranges.

2.2 Tone in Minimal Environments

The first step was an examination of tone in minimal environments. The most useful segmental example of which various tone shapes can be is *day*. The tones and definitions of the four according to Kutsch Lojenga and Waag are listed below:

day 'oil'

dáy 'he-goat'

dây 'lalob tree'

dăy 'ant'

The first important step that must be taken before proceeding is a reevaluation of the tone bearing units in Fur. As can be seen above, the lexical item *day* has been analyzed as

having one tone bearing unit with a combination of low high on the single vowel possible. However, the study of a number of words like *day* leads to a different perspective.

CVV is a common sequence in Fur. Some examples of lexical items with a CVV segmental pattern (tones unmarked) are:

[dua] 'eagle' and 'headpad'

[kui] 'neck' and 'rain'

[pie] 'rabbit' and 'lie'

The difference in analysis in this research resides in the area of words ending in *uy* and *ay*. The distinctness of the syllables in words like *day*, and *kuy* (as per Waag and Kutsch Lojenga) led to a new transcription of these words as [dei] and [kui] with both vowels as tone bearing units. In addition, although *dǎy* is also listed by Kutsch Lojenga and Waag as 'grass', Subject A's pronunciation did not match the other four. In Subject A's speech, the word for grass is [dai]. Analysis of [dai] turned out to give significant insight into tone-bearing units, particularly in reference to [dei] which is at the core of the new tone inventory proposal.

The figures below, which are the PRAAT pitch plots of *dei* 'oil' and *dai* 'grass' reveal a distinct difference in syllabicity between *dei* and *dai*.

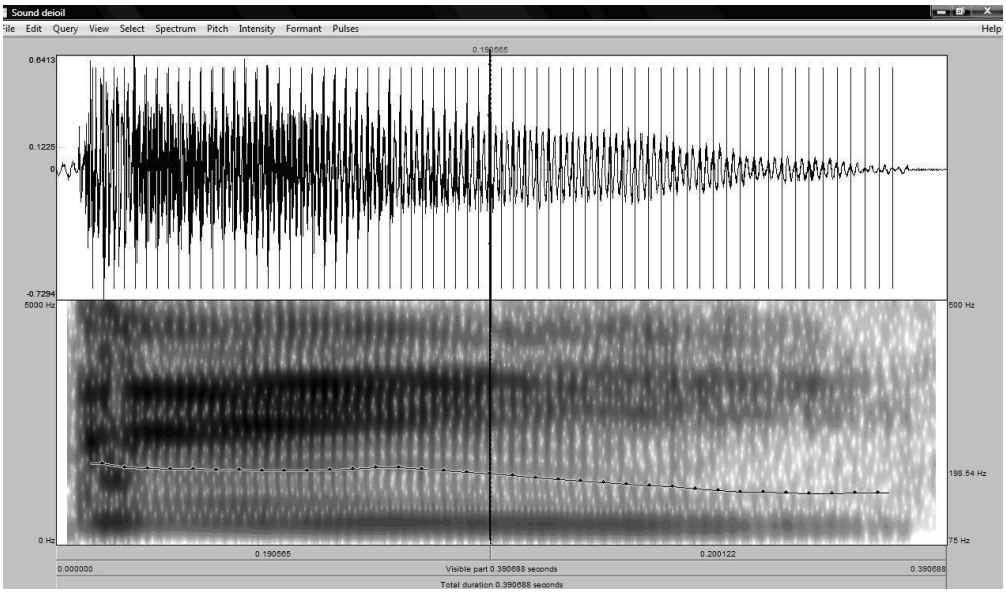

Figure 2.2 PRAAT Waveform, Pitch Plot and Spectrogram of *dei* 'oil'

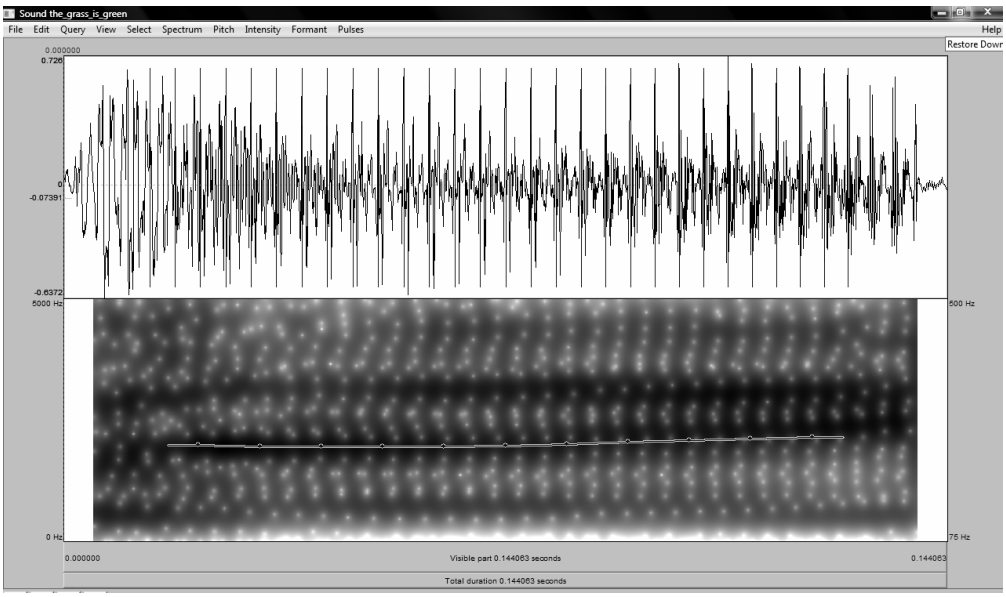

Figure 2.3 PRAAT Waveform, Pitch Plot and Spectrogram of *dai* 'grass'

Viewing a spectrogram of *dei* 'oil' shows the change in formant trajectory at the syllable break (191 msec), which is marked by a vertical line. This corresponds directly to the tonal change that is visible in the pitch trajectory plot. The distinct formant change in the spectrogram that corresponds with the syllable break in the trajectory plot is true of all the variants of *dei*. However, the spectrogram of *dai* shows no distinct change across the spectrogram.

In actuality the duration of *dei* is more than twice as long as that of *dai* as can be seen clearly in Figure 2.4 below. It can also be seen that *dei* is equal in length to a two syllable CVCV word, *dari* 'porridge'. These factors suggest that while *dei* is indeed two syllables, *dai* is only one.

An important factor to note is that, in many of the following figures, the initial consonant of the lexical items has been excised from the F_0 trajectory plots in order to make the vowel vector more easily recognized. In cases where the lexical item has a mid consonant which is voiced and obscures the clarity of section of the slope, the section of the slope which represents these consonants has been marked on the plot.

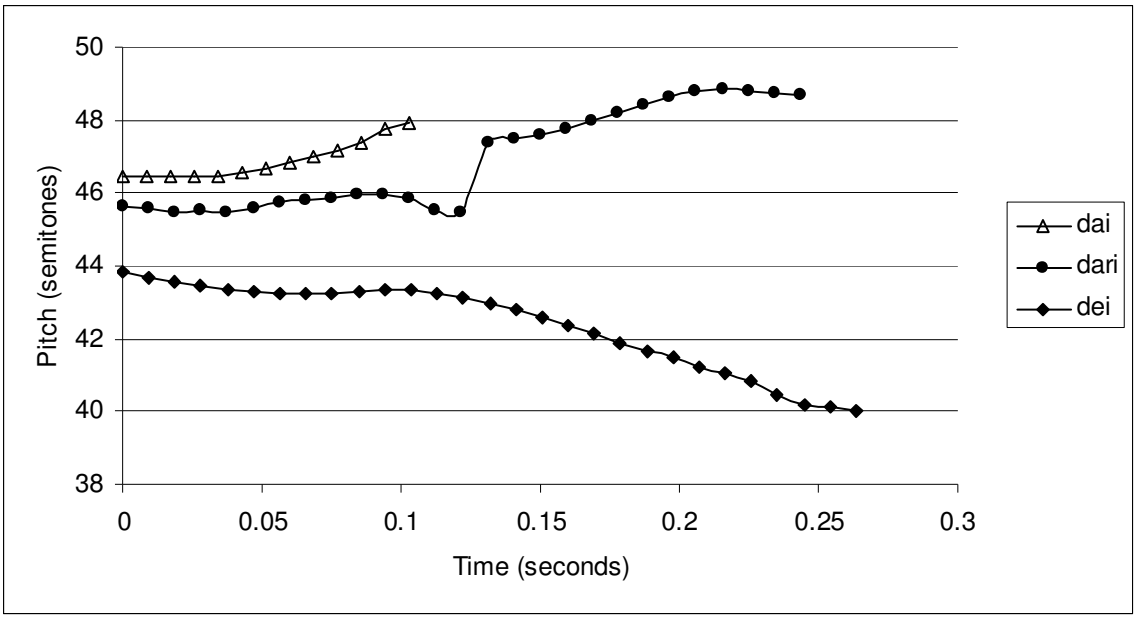

Figure 2.4 Pitch Trajectories of *dai* 'grass, *dei* 'oil' and *dari* 'porridge'

2.3 Vowel Plots and Tone Bearing Units

In addition to the evidence visible in the F_0 trajectories and spectrograms, there is support for this idea provided by examining the vowel formants. The figure below shows the [e] vowel from the first syllable, and the [i] vowel from the second syllable plotted on an acoustic vowel plot which has become the standard in experimental phonetics, as opposed to impressionistic phonetics.

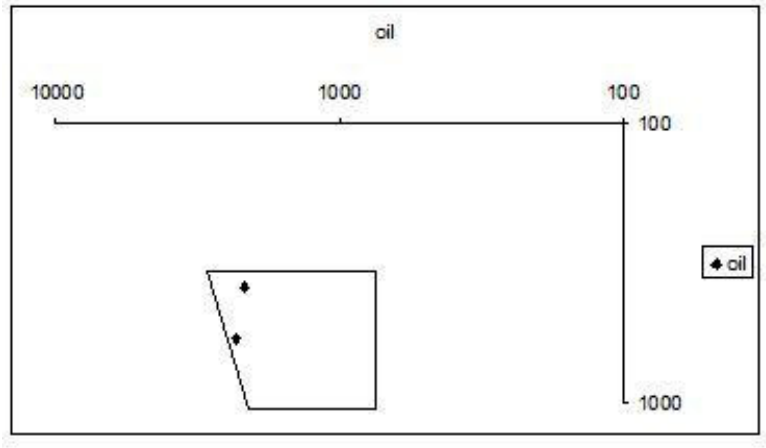

Figure 2.5 Vowel Plot of [e] and [i] in [dei]

2.4 The Pitch Vector Method

Before continuing the discussion of the tone inventory of Fur, it is necessary to introduce the idea of tone gradients that is central to the analysis of tone in this work. Determining tone values by ear can be extremely difficult. Therefore the method preferred in this research is examining the gradients of the tones to determine how many tones there are and their individual features.

Vowel duration at times can be quite short and, therefore, it can be difficult to be certain about the precise nature of tone values. Clearly multiple speakers is usually the answer, but in lieu of other Fur consultants, one can also examine multiple examples by one speaker using a constant and verifiable procedure. In order to establish a verifiable procedure for determining if a tone is high, mid or low, pitch vectors of multiple repetitions were analyzed and a threshold boundary for each tone was developed.

In Excel, two points on a pitch trajectory that marks the beginning and the end of a syllable were chosen. The figure below includes these two points on the tone plot. It is the slope between these two tones that is being numerically determined.

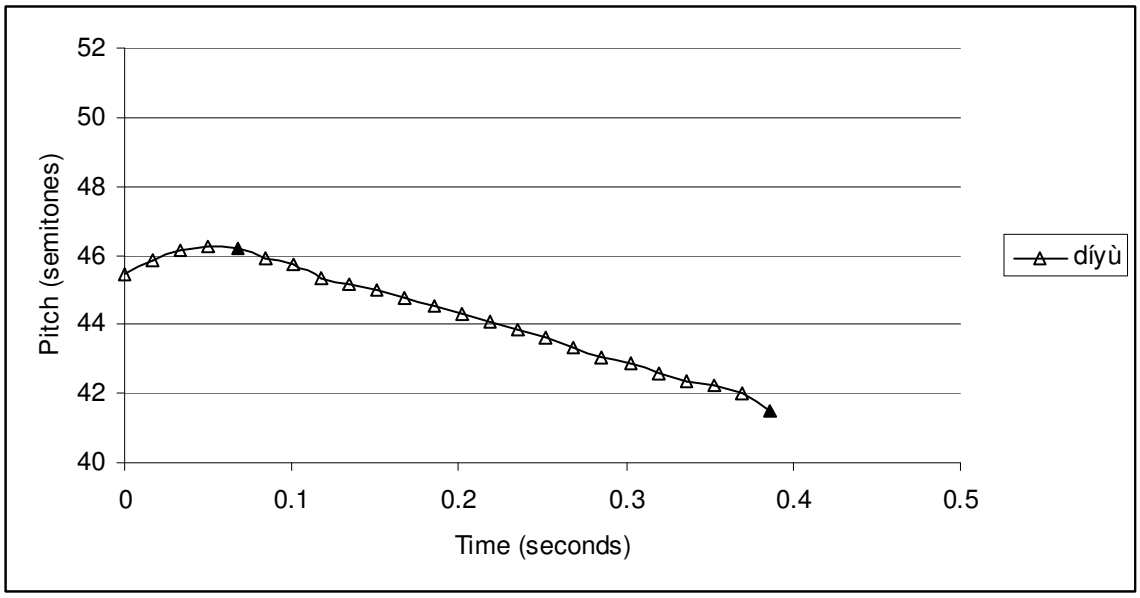

Figure 2.6 Pitch Trajectory of *díyù* 'goat'

The pitch vector is calculated by dividing the *rise* (or pitch change) by the *run* (or time in seconds).

The data points highlighted below correspond to the marked distance in Figure 2.6.

0	45.48
0.0168	45.85
0.0336	46.15
0.0504	46.25
0.0672	46.2
0.084	45.93
0.1008	45.72
0.1176	45.33
0.1344	45.14
0.1512	44.97
0.168	44.77
0.1848	44.56
0.2016	44.31
0.2184	44.09
0.2352	43.87
0.252	43.61
0.2688	43.33
0.2856	43.06
0.3024	42.87
0.3192	42.58
0.3359	42.36
0.3527	42.24
0.3695	42.03
0.3863	41.48

Rise: 41.48- 46.2= -4.72 (The negative value indicates that the “rise” is actually a downward slope.)

Run: 0.3863-0.0672= 0.3191

Rise/Run: -14.7916

Therefore, the downward slope, or vector, of this tone is -14.79 semitones/second.

In some instances, the pitch is extremely variable across the trajectory, moving up and down in small amounts very frequently, as shown below. In this case, the vector for each section of upward or downward sloping trajectory is calculated to avoid a skewing of results. The dark lines indicate where the trajectory varies from a positive to a negative slope.

0.0859	47.64
0.0982	47.5
0.1105	47.4
0.1228	47.37
0.135	47.38
0.1473	47.38
0.1596	47.41
0.1719	47.45
0.1841	47.45
0.1964	47.45
0.2087	47.45
0.221	47.45
0.2332	47.45
0.2455	47.43
0.2578	47.34
0.2701	47.28
0.2823	47.28

2.4.1 Establishing Trajectory Boundaries

After analyzing the pitch trajectories of many words, a range for each pitch vector in semitones/second was developed in order to classify a tone. It was determined that the vector of each tone could be as shown in the table below.

Table 2.1 Trajectory Boundaries

High Tone (Rising)	Mid Tone (Level)	Low Tone (Falling)
≥1 semitone/decisecond	≤1/-1 semitones/decisecond	≥-1 semitones/decisecond

2.5 Analyzing the Tones of *dei*

Having established the trajectory boundaries of tones, and the tone bearing units of *dei* attention can be given to the nature of the tones in the four lexical items *dei*.

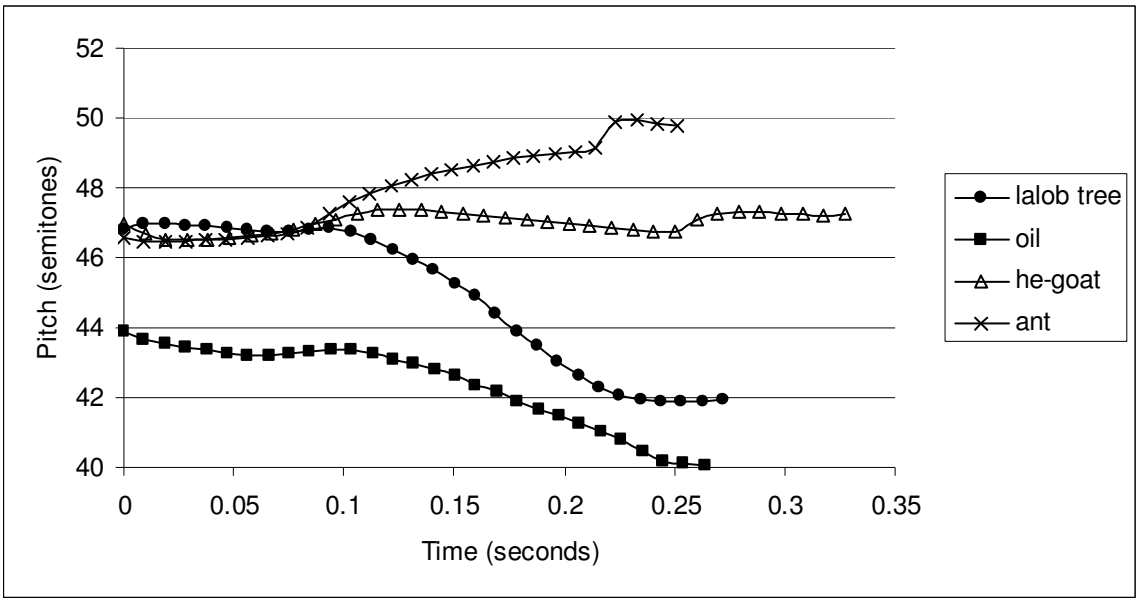

Figure 2.7 Pitch Trajectories of Four Tonal Variants of [dei]

These four words were elicited from Subject A by providing her with the English prompts and asking her to produce it in Fur. Then using PRAAT and COMP as described above, the following F_0 trajectory plots represent Subject A's tone value for the four different pitch shapes of the segmental string *dei*. Time in seconds on the x-axis is plotted against pitch in semitones on

the y-axis. In these four tonally different versions of *dei* each vowel is measurable in terms of time and pitch measured in semitones. The F_0 trajectory plot in Figure 2.7 above shows clearly that the onset time of the second syllable is virtually identical for each example. The tone values of each word, and the corresponding vectors, are as follows:

'lalob tree'	*deì*	(-0.06, -3.28)
'he-goat'	*dei*	(0.28, -0.04)
'ant'	*deí*	(0.21, 1.72)
'oil'	*deì*	(-0.09, -2.08)

Prior research would have considered the second syllable tone of 'he goat' to be merely a surface realization of either the low or high tone (which are represented, it might be assumed by pitch shapes which move upwards or downwards in trajectory.) But, the key question is why there is a difference. These items were elicited in isolation; there is no external factor that might suppress the rise in tone, or raise the low pitch to a more neutral vector. This research will suggest that it is not merely a variant of a toneme but in fact a distinct tone.

In addition, it is necessary to consider the first syllable of the four items. The vectors of 'oil', 'lalob tree', 'he goat' and 'ant' show very little change in trajectory, cf. table above. They appear to fulfill the requirements of a "mid" or level tone.

As previously mentioned, Jernudd (1983) suggested that Fur possessed three tones: high, low and mid. The vector values in the above quadruple for the segment string *dei* shows the existence of Jernudd's proposed mid tone. Moreover, a significant factor, as noted previously, is that three tones are commonly found in Nilotic languages according to Albert Remijsen and Caguor Adong Manyang (2007).

There are additional minimal pairs which further establish the mid tone. In the examples that follow, the duration between the enlarged, square data points indicates the part of the vector that corresponds to the vowel.

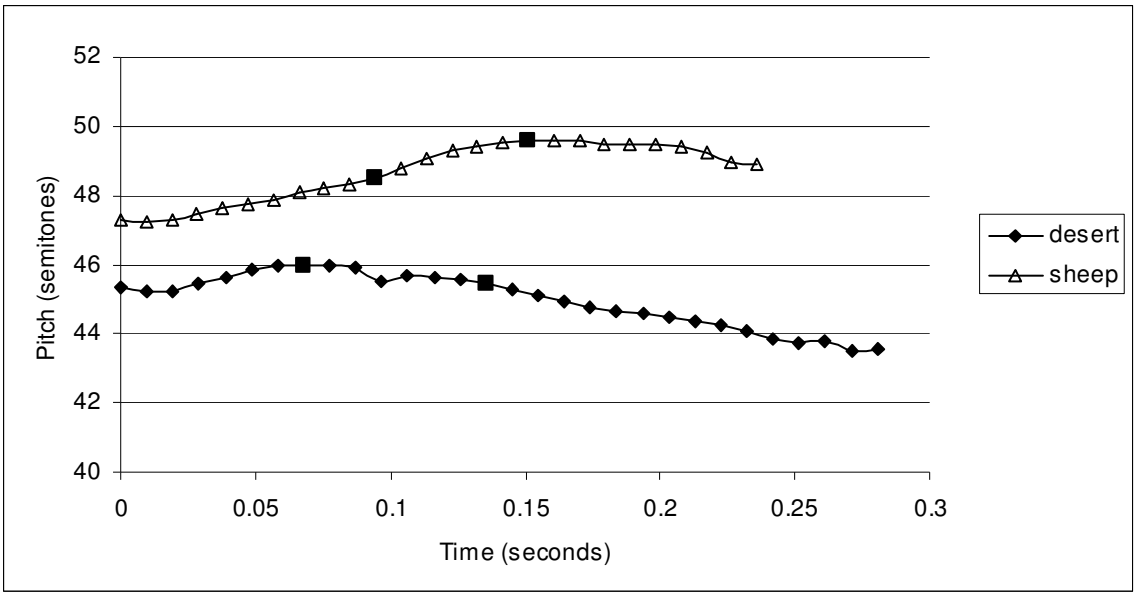

Figure 2.8 Pitch Trajectory of 'desert' and 'sheep'

'desert' *úrì* (1.01,-1.2) 'sheep' *úri* (1.1, -0.8)

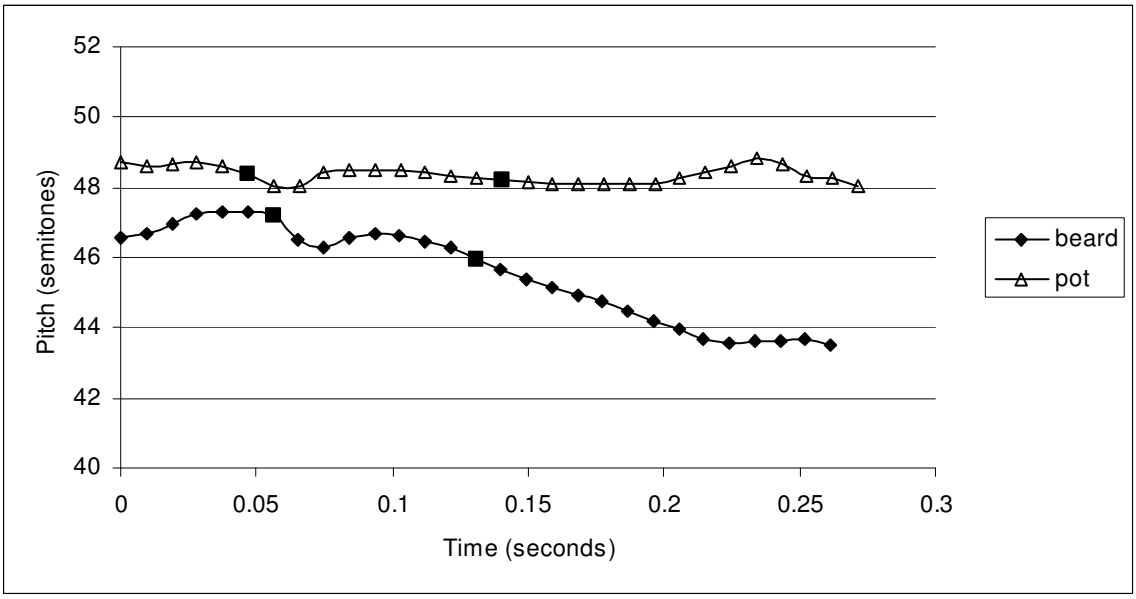

Figure 2.9 Pitch Trajectory of 'beard' and 'pot'

'beard' *purò* (-0.09, -1.87) 'pot' *puro* (-0.77, -0.25)

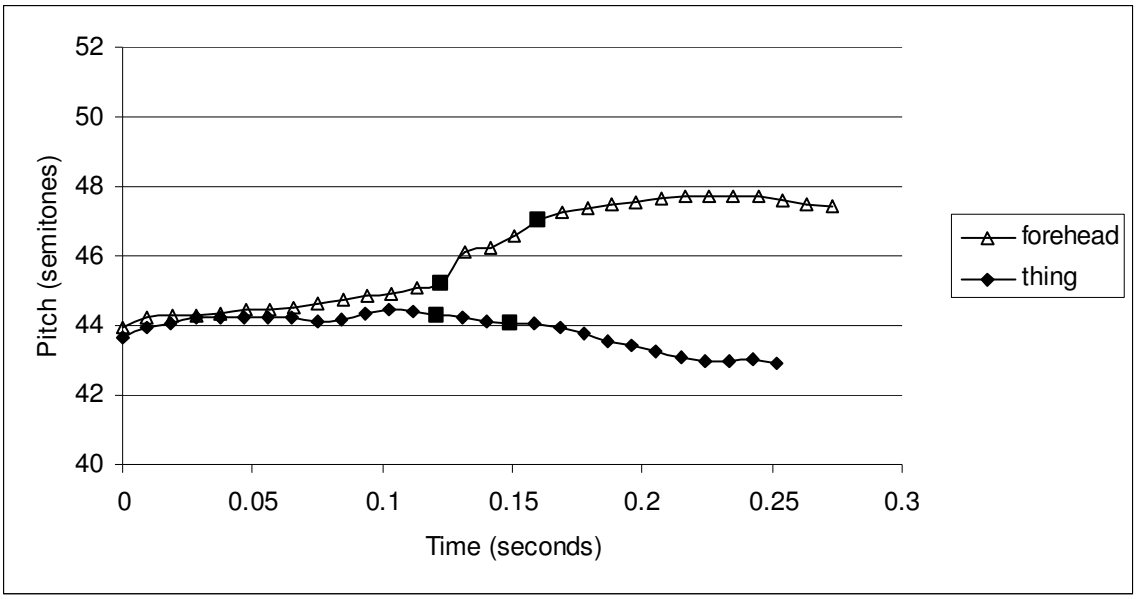

Figure 2.10 Pitch Trajectory of 'forehead' and 'thing'

'forehead' *ári* (1.01, 0.37) 'thing' *arì* (0.5,-1.2)

2.6 The New Tone System

The new tone system has three underlying tones, low, mid and high. These tones are characterized by their vectors as described in Section 2.4.

2.6.1 Low Tone

Low tone is characterized by a falling trajectory with a rate of decline greater than 1 semitone/decisecond. Both syllables of *pààl* in Figure 2.11 below are examples of falling tone.

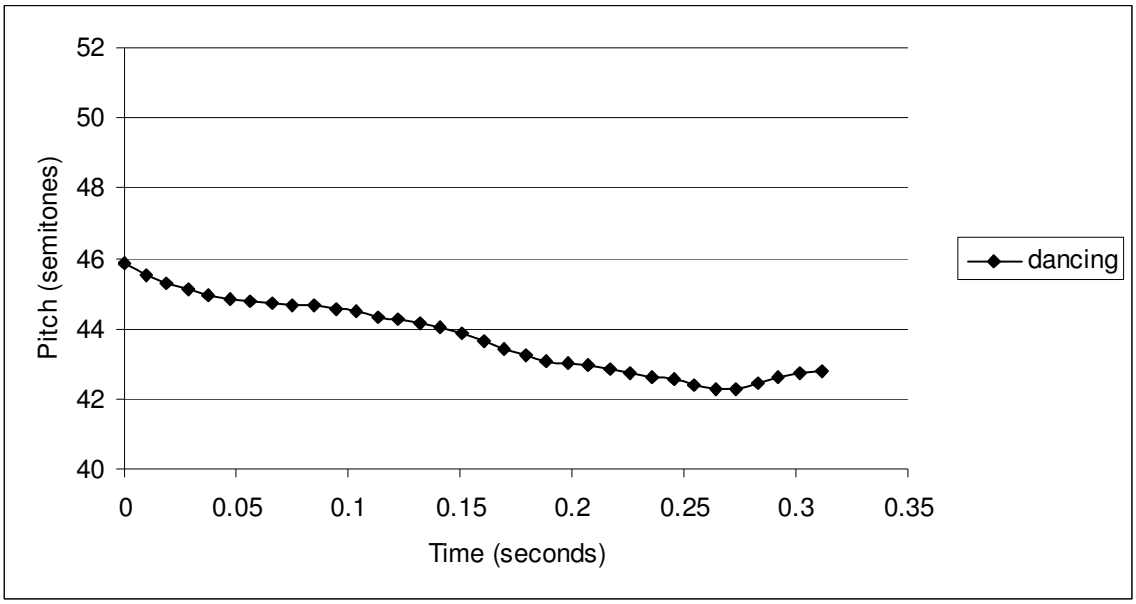

Figure 2.11 Pitch Trajectory for *pààl* 'dancing'

2.6.2 Mid Tone

Mid tone is characterized by very little rise or fall of the frequency over time. Both syllables of *elle* are examples of mid tones.

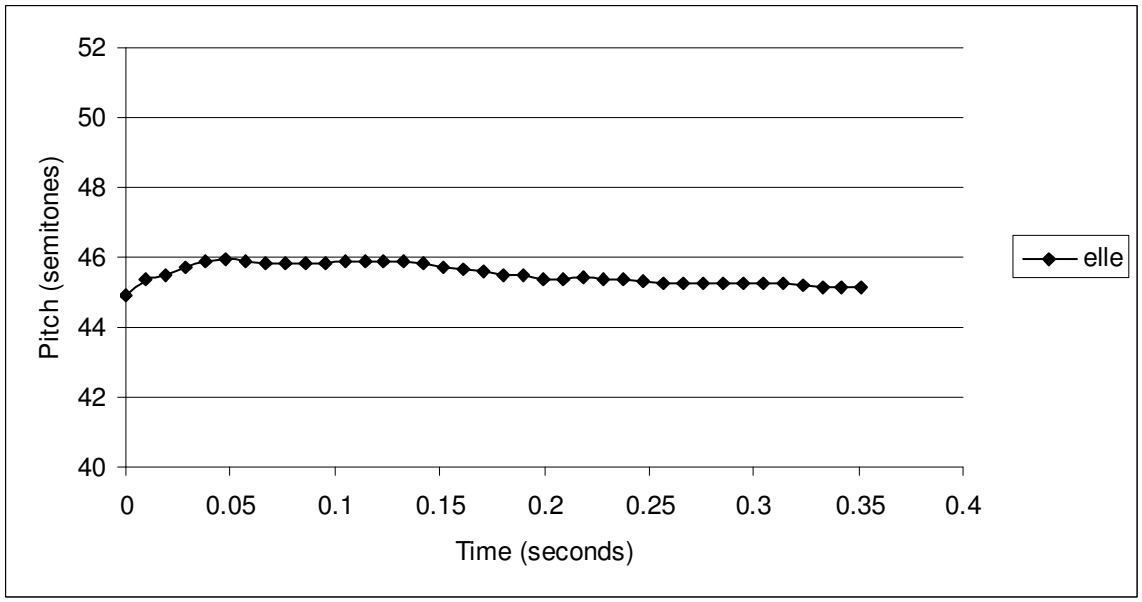

Figure 2.12 Pitch Trajectory for *elle* 'village'

Piri shows a mid tone at a higher pitch level:

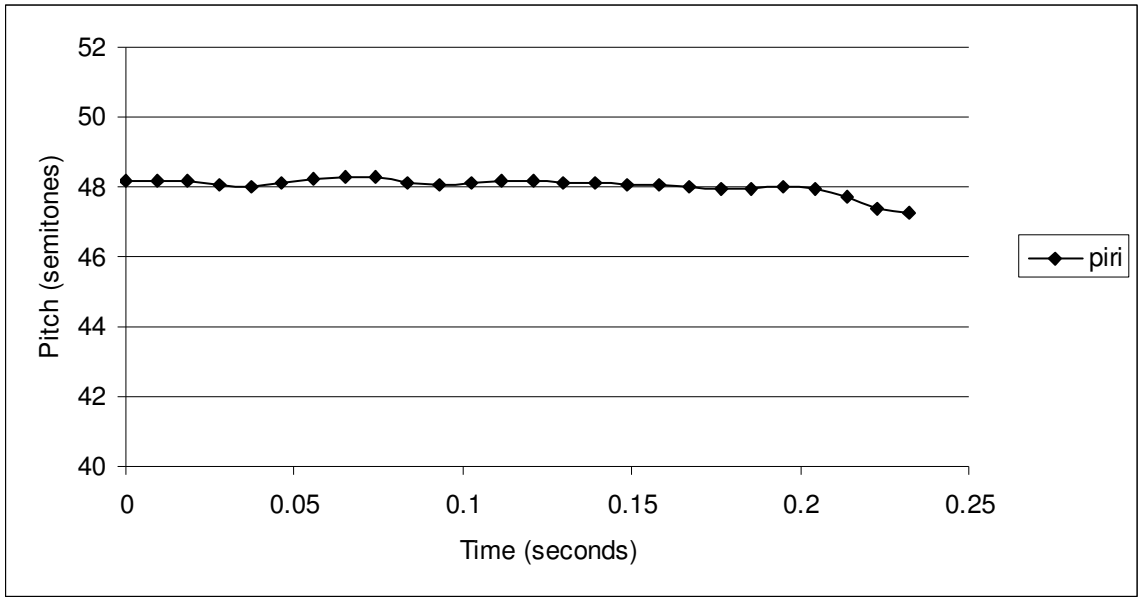

Figure 2.13 Pitch Trajectory for *piri* 'leg'

2.6.3 High Tone

High tone is characterized by a rise in trajectory of greater than or equal to 1 semitone/decisecond.

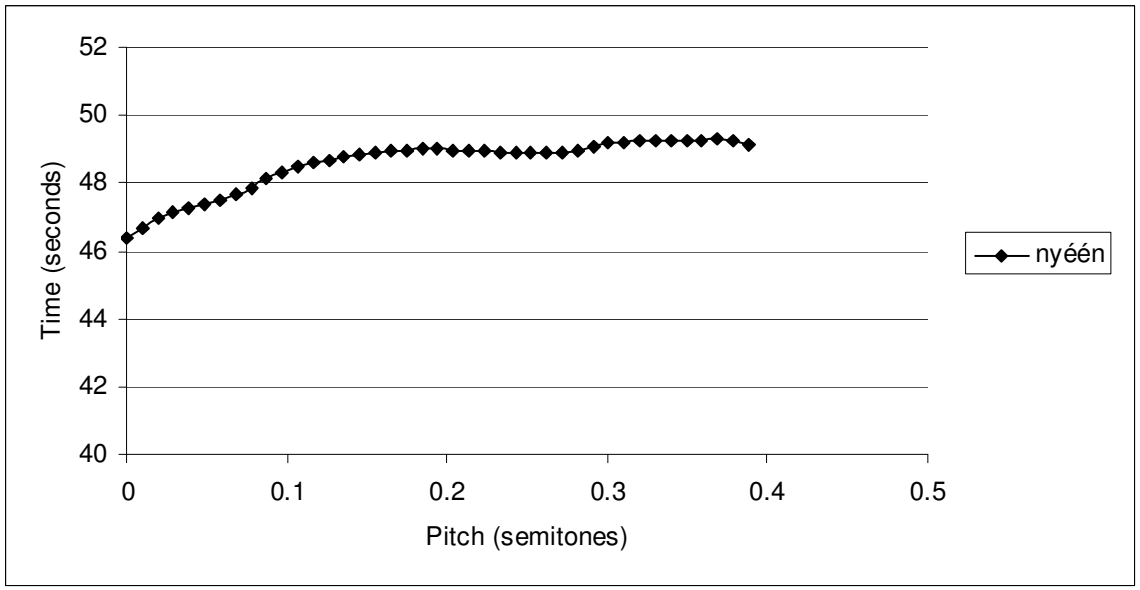

Figure 2.14 Pitch Trajectory for *nyéén* 'scorpion'

2.6.4 Representation of Tones

H tones will be marked with an acute accent: á

L tones will be marked with a grave accent: à

M tones will be unmarked: a

Sequences of LH and HL on a single tone-bearing unit are possible, but will not be of concern in this paper.

CHAPTER 3

LOCATIVES

3.1 Current Understanding of Locatives

Unlike many SOV languages, Fur has no postpositions to indicate location. Locatives are indicated by a tonal change on the noun that is to be marked as in the locative—a modulatory change of the pitch trajectory rather than an additive strategy.

According to Jakobi's research, this tonal change involves a reversal of tone from H-L or L-H in a one-syllable word, and a change of this nature in the second syllable of a two syllable word. Some examples taken from Jakobi were:

tón 'house'

tòn 'in the house'

bagù 'garden'

bagú 'in the garden'

Lojenga and Waag provide other examples of this in their paper on Fur tones and sounds:

roo 'well'

roó 'at the well'

korò 'water'

koró 'in the water'

Given the proposal of a third tone—a mid tone—as indicated in the previous chapter attention must paid to the pattern of tonal change in locatives; and the w ay the three tones of

Fur are manifested in locative constructions; that is to say the notion of polarity is more complex when there are high, low, an d mid tones in play.

Data for locatives was elicited in sentence pairs. To elicit the nouns, sentences with the noun as subject, or object were elicited, a procedure established by Jakobi, and corroborated in this research, that there is no tonal variation between the subject and object forms of a noun.

The locatives were also elicited in sentences. Some examples of the kinds of sentence pairs that were presented to Subject for translation into Fur are as follows:

The sun makes a shadow.

I am standing in the shadow.

The well is empty.

The dog is at the well.

One reason for eliciting data in sentences has been established—namely, to avoid any disturbance of the tonal data from assimilatory or down-drift forces engendered by the location of a test NP in a sentence. An additional reason for eliciting the data in sentences was to avoid any misunderstanding on the part of Subject A. Within a sentence, the idea of "in the shadow" versus "shadow" was much clearer to Subject A than simply asking for the word and prepositional phrase independently. This is not surprising since the locatives are represented by tone, not a preposition word as they are in English.

The analysis of tone supported Jakobi's original analysis of tone reversal, which is now being referred to as *polarity*. The key difference lies in the patterns of reversal that exist when the mid tone is taken into consideration. Another discovery that was made was the effect of various constellations of tone categories in the locative form as well as which syllable in a polysyllabic context undergoes the tonal change. A detailed description of these concepts follows.

3.2 Polarity Relationships

There are two distinct polarity patterns that occur between nouns and their locatives.

a) There is a polar relationship between H and M: H tone in the noun form becomes M in the locative, or M in the noun becomes H in the locative.

b) There is a polar relationship between L and M: L tone in the noun form becomes M in the locative, or M in the noun becomes L in the locative.

Although proponents of the two tone theory might argue that this relationship shows only a "leveling" of the L or H tones that could be caused by environmental factors, the data in the following examples show that there is no substantive evidence that the tone change is produced by assimilatory processes.

3.2..1 H-M Polarity

Consider the example of *bagu* 'garden' shown below:

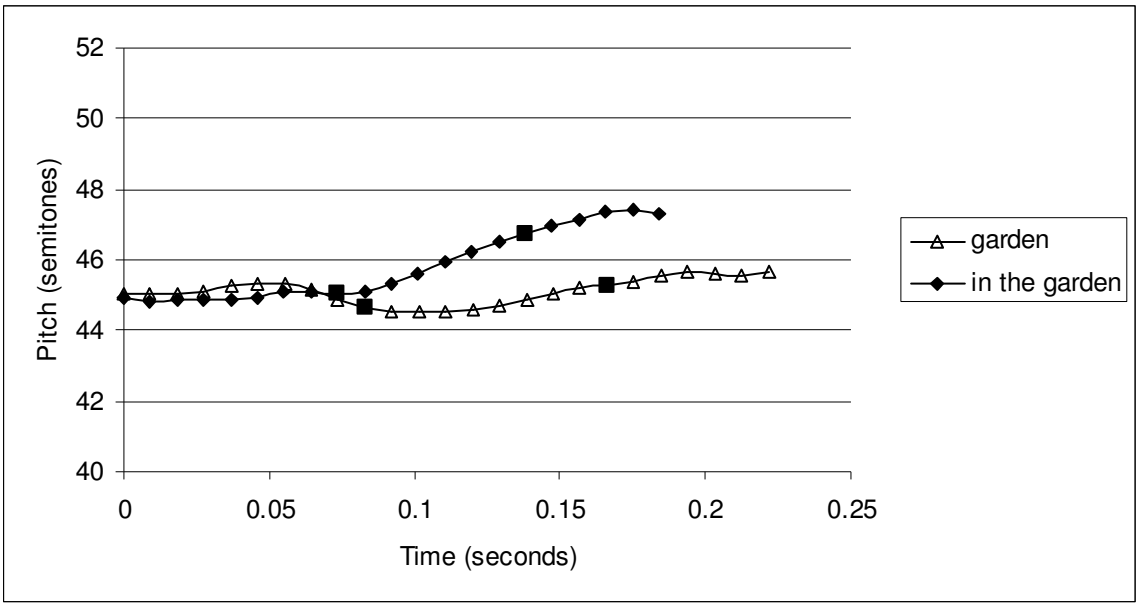

Figure 3.1 Comparison of Nominative and Locative Tones of *bagu* 'garden'

Syllables:	ba	gu	
NOM Tone:	M	M	(-0.44, -0.68)
LOC Tone:	M	H	(0.17, 1.29)

a. *bagu jàmmáìl*

garden beautiful

The garden is beautiful'

b. *kwedè. bagú kè*[2]

boy garden is

'The boy is in the garden.

The first detail to note is that neither placement in the sentence, nor preceding, or following constituents with tone appears to have any influence on the tonal change. Both sentences show the tone on the first syllable of the word to be M. Both sentence a and sentence b are immediately followed by a low tone. And though *bagú* in sentence b is closer to the end of the sentence, its tone is clearly higher (H as compared to M).

Also significant in this example when establishing the existence of a separate mid tone is that the trajectories of both the H and M tones are rising. Therefore, any argument that that the relationship is actually H to L must confront the tone vector value in *bagu*; the second syllable is realized with a less steep realization than a low tone at only -0.68 semitones/decisecond. In essence if the M tone in this example were identified as L, then there would be no tone change at all, which does not agree with the vector evidence, nor does it match Subject A's judgment about the two words *bagu* and *bagú*, which is that they are not identical (in pitch).

Another example of the affinity of H to M is found in the word *dai* 'grass'. As was discussed and evidenced in Chapter 1, *dai* is a diphthong with only one TBU. Notice that the polarity relationship between H and M is present again, but in this instance the H tone is in the noun and becomes M in the locative.

[2] The verb *ke* only appears in sentences where location is indicated. Its meaning is therefore something like "is located".

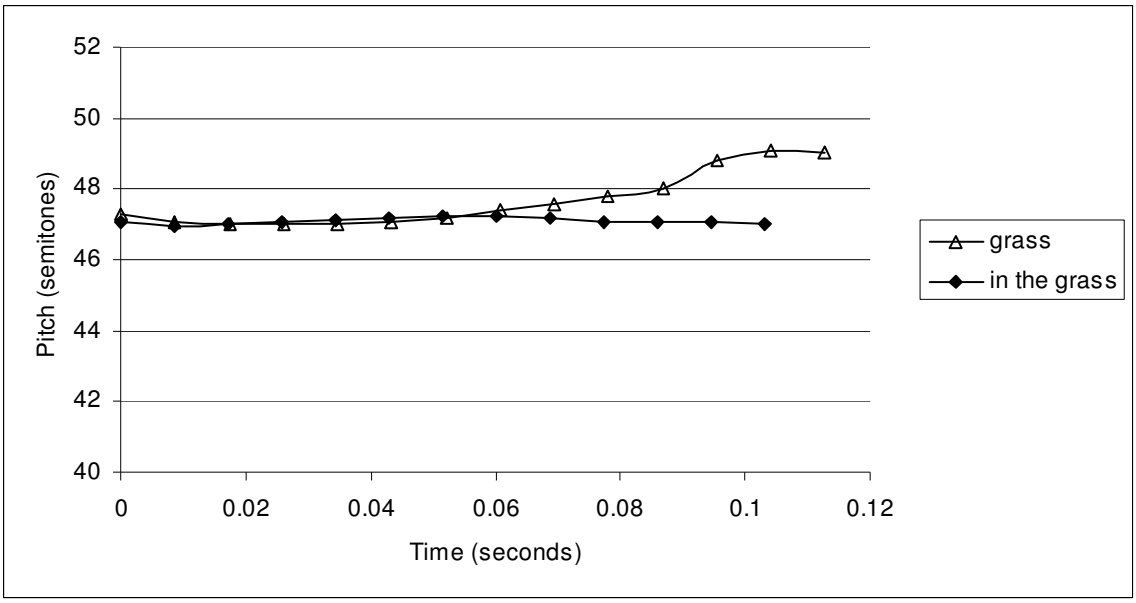

Figure 3.2 Comparison of Nominative and Locative Tones of *dai* 'grass'

Syllables: dai

NOM Tone: H

LOC Tone: M

a. *dáí*[3] *kìrro*

grass green

'The grass is green.'

b. *núng dai ndìo*[4]*-kè*

snake grass is

'A snake is in the grass.'

There are many more examples of H and M polar affinity. However, the change does not always occur on the first syllable. The examples below show the action of H and M polarity on the first syllable of locatives.

[3] In order to avoid confusion with the unmarked mid tone, both vowels will be marked with the H tone although *dai* is monosyllabic.

[4] *ndio*, which means 'space inside' is used in combination with the verb *ke* with certain nouns, like *dai*. Some nouns use no spatial indicator at all, as is seen in *bagu*.

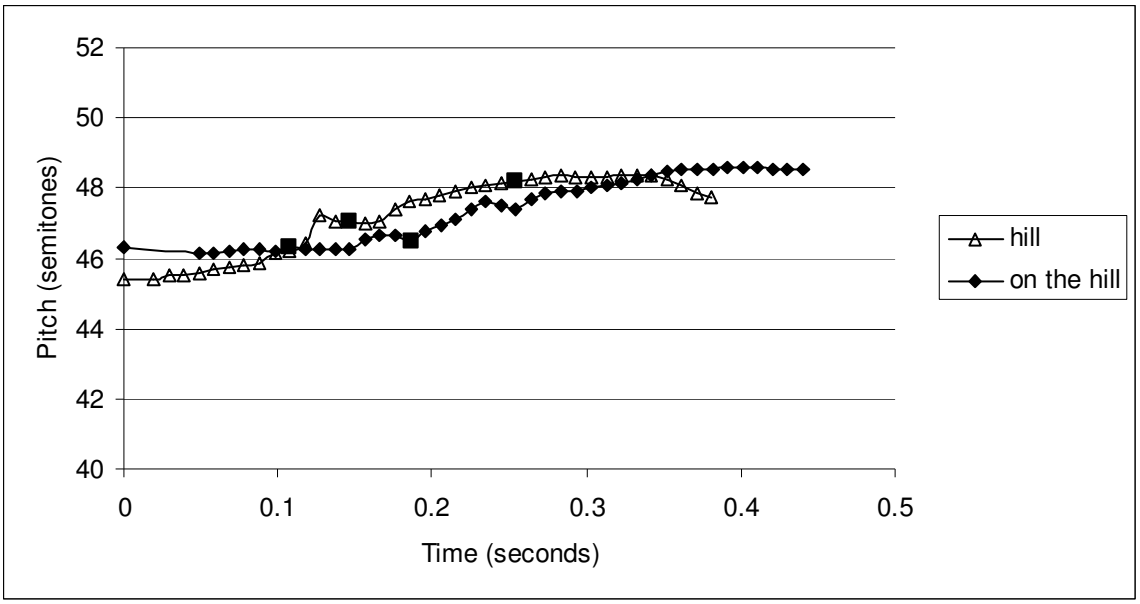

Figure 3.3 Comparison of Nominative and Locative Tones of *ngora* 'hill'

Syllables: ngo- ra

NOM Tone: M H (0.75, 1.08)

LOC Tone: M M (-0.47, 0.51)

a. *ngóra kurrá*

hill tall

'The hill is high'.

b. *duwo ngora-ng iri*[5]*-ke*.

man hill is

'The man is on the hill.

[5] *iri* is similar to *ndio*. It means 'space above'.

3.2.2. L-M Polarity

Polarity between L and M is evident in *dute* 'pot':

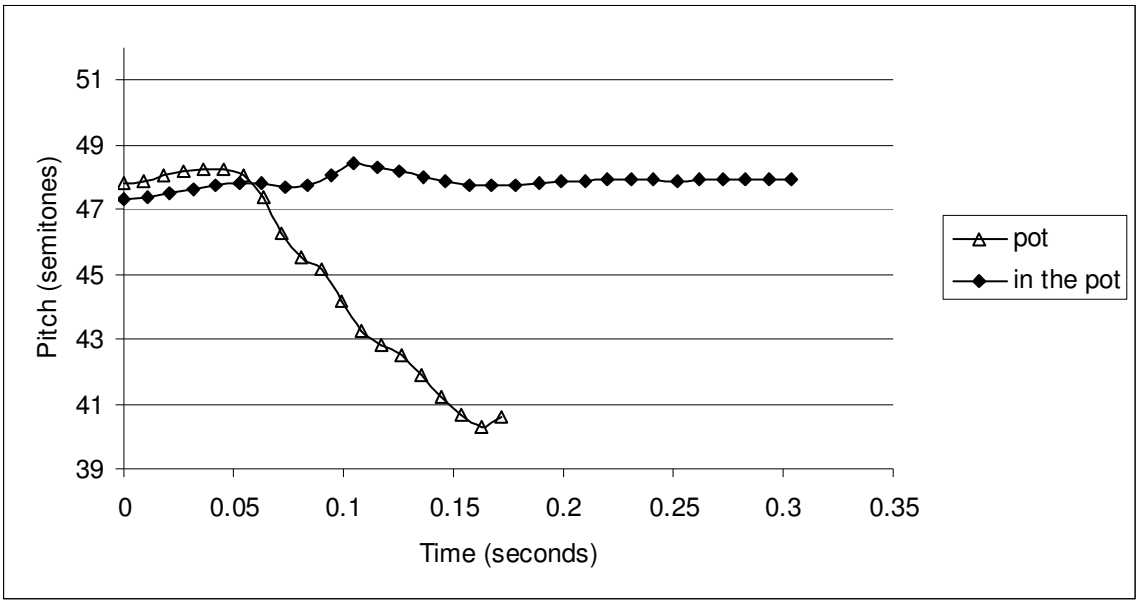

Figure 3.4 Comparison of Nominative and Locative Tones of *dute* 'pot'

	Syllables:	du-	te
	NOM Tone:	M	L
	LOC Tone:	M	M

a. dutè àppā

pot big

'The pot is big.'

b. dute-ng ndìo-kè

rice pot inside is

'The rice is in the pot.'

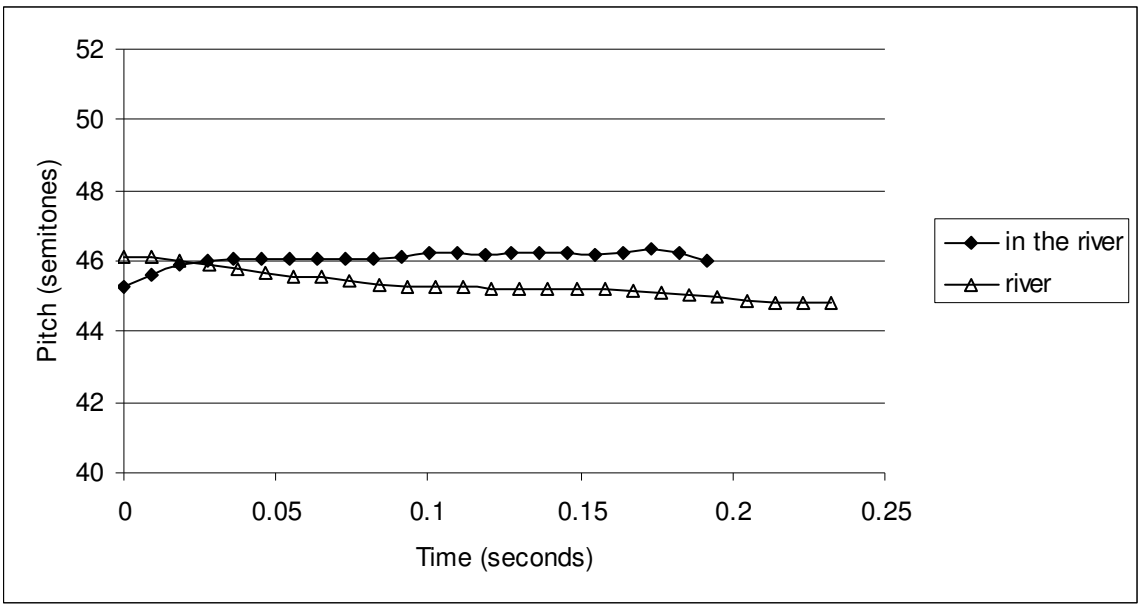

Figure 3.5 Comparison of Nominative and Locative Tones of *baw* 'river'

Syllables: baw

NOM Tone: L

LOC Tone: M

a. *bàw itti*

river small

'The river is small.'

b. *timsa baw kè*

crocodile river is

'The crocodile is in the river'

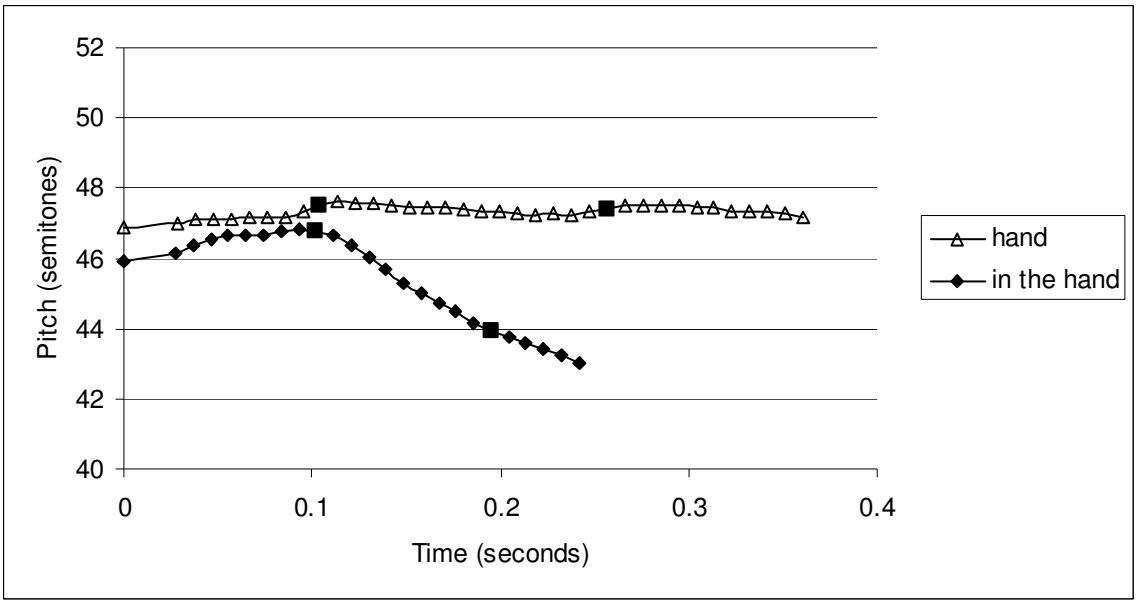

Figure 3.6 Comparison of Nominative and Locative Tones of *donga* 'hand'

Syllables: do- nga

NOM Tone: M M (0.59, -0.23)

LOC Tone: M L (0.88, -1.88)

a. *dōngā fùllò*

hand dry

'The hand is dry.'

b. *galam dóngà kè*

pencil hand is

'The pencil is in the hand.'

First syllable M and L polarity also occurs. In *nima* 'shadow', the first syllable changes from a mid to a low pitch shape.

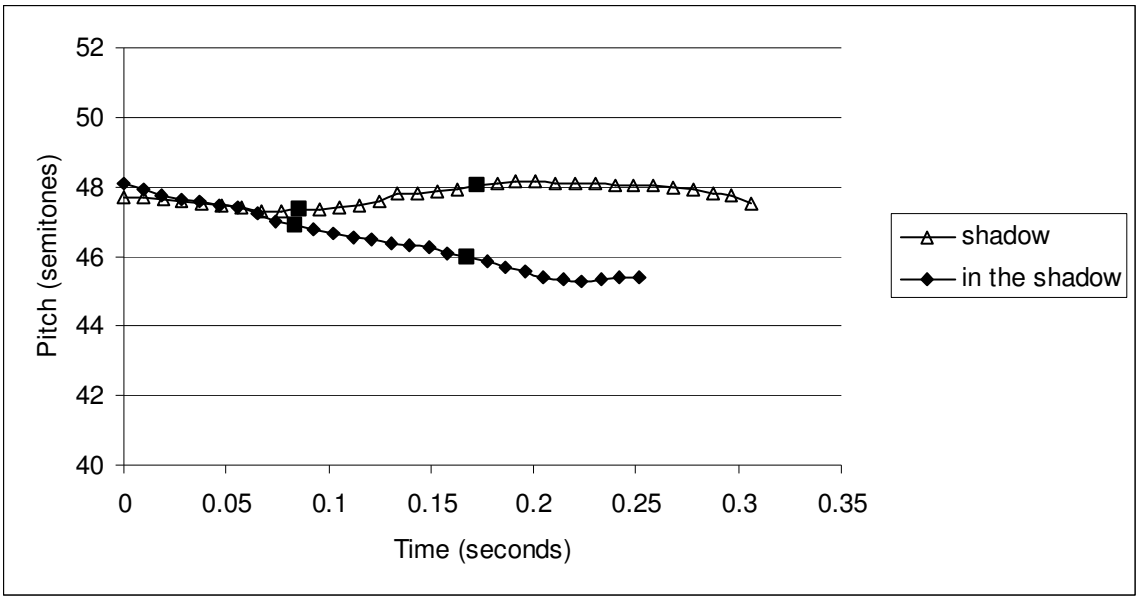

Figure 3.7 Comparison of Nominative and Locative Tones of *nima* 'shadow'

Syllables:	ni-	ma
NOM Tone:	M	M (-0.41. -0.44)
LOC Tone:	L	M (-1.43, -0.61)

a. *dulé nima-s pì*

tree shadow make

'The tree makes a shadow.'

b. *Kā kūrù nìma àìng.*

I tree shadow am

'I am in the shadow of the tree.'

3.2.3 Further Examples of Tone Change

The following pairs were also elicited:

'water'	kòro
'in the water'	koro
'desert'	uri
'in the desert'	ùri

‘well’	roo
‘at the well’	róó
‘fire’	utu
‘on the fire’	utù
‘shelter ‘	dirbò
‘under the shelter’	dirbo

3.3 The Motivation for Polar Tone Change

Why the tone change occurs on varying syllables cannot be determined as yet from the data, however the reason for M tones moving to either H or L can be clearly laid out.

When an M tone is high in the tone space, it becomes L, such as in *donga* ‘hand’, where the mid tone trajectory in the predicate is at almost 48 semitones which is at near the top of Subject A’s normal tone range.

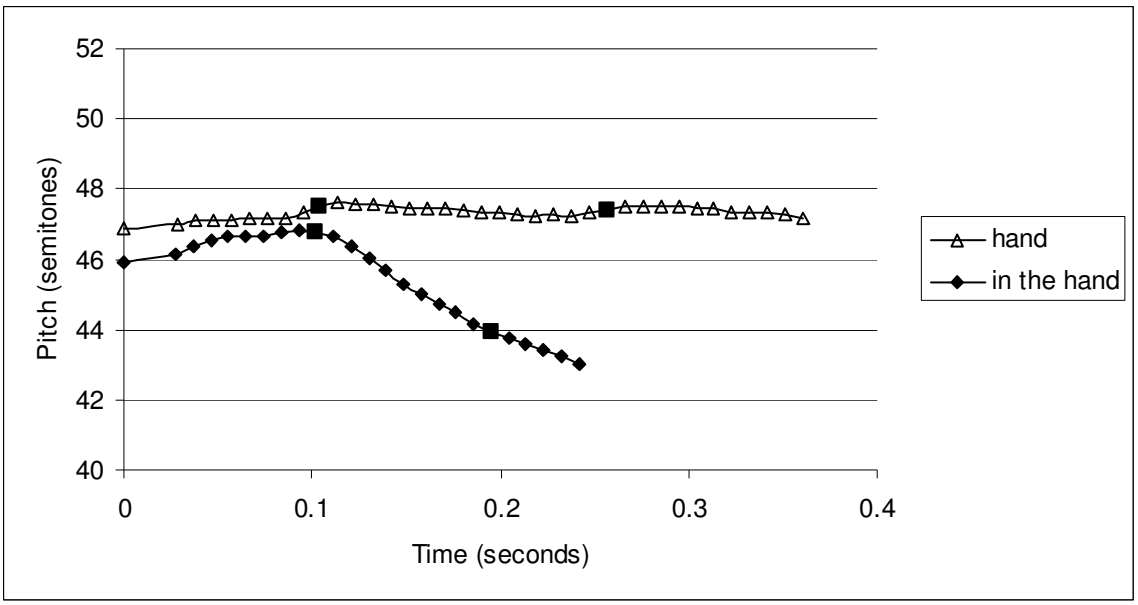

Figure 3.8 Comparison of Nominative and Locative Tones of *donga* ‘hand’

If a mid tone trajectory is, relatively speaking, low in the tone space, it will change to a higher tone trajectory, as in bagu ‘garden’ where the mid in the nominative form is lower in the tone space (45 semitones).

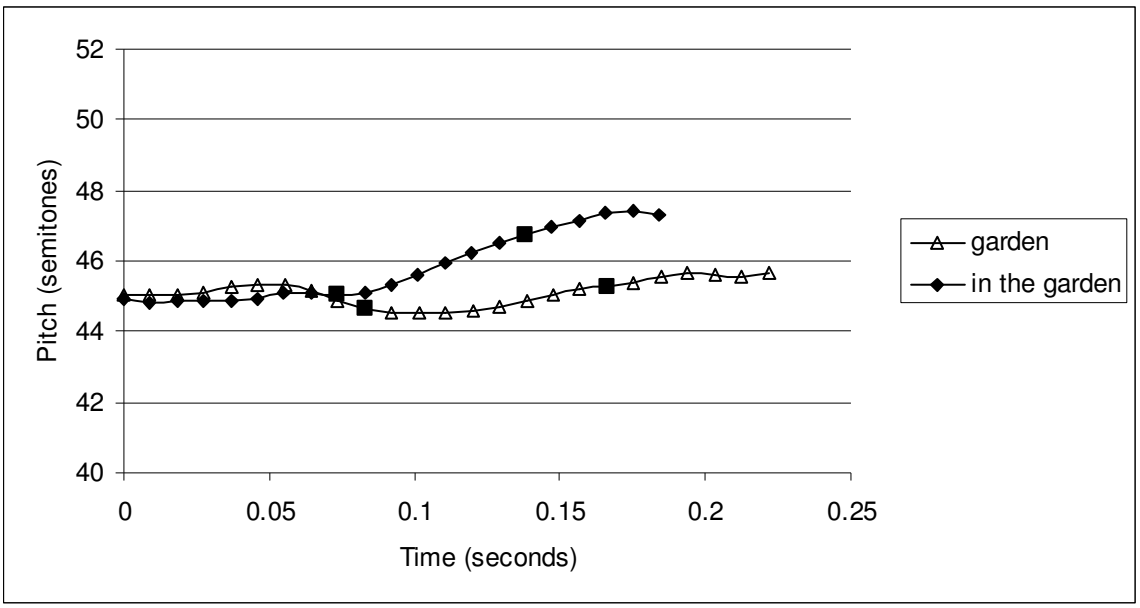

Figure 3.9 Comparison of Nominative and Locative Tones of bagu 'garden'

This pattern is borne out in all the examples in the chapter, which shows that there is a consistent rule governed system on tonal polarity for locatives.

CHAPTER 4

ATTRIBUTIVE AND PREDICATIVE ADJECTIVES

4.1 Tonal Polarity in Adjectives

The second grammatical function of tone that will be examined is the tonal polarity which distinguishes the predicative forms of adjectives form the attributive forms. The difference in tone between attributive and predicative forms of adjectives was first noticed by students in a Field Methods class at the University of Texas at Arlington where Fur was being studied and Subject A was the informant.

The understanding of the tone values of these adjective forms at that time was that a "reversal" of the tone on the second syllable of a two-syllable predicate adjective will occur when it is used as an attributive, as shown below:

a. *Kìtàb kírró*

book green

'The book is green.'

b. *Kìtàb kírrò júwò*

book green new

'A new green book.'

At that time there was no clear understanding of what tone was underlying in each adjective, only that the second syllable appeared to change from L to H, or H to L on the second syllable. With the establis hment of a mid tone, and the notion of tonal po larity with no underlying

tone having been established, this first look at the relationship between an adjective in these two roles required a more in-depth analysis.[6]

The approach employed to elicit data for comparison of the two adjective roles was to ask for complete sentences for each adjective role. The concern was that simply asking for the difference between 'the book is green' and 'a green book' might be confusing to a speaker with a yet imperfect knowledge of English and to whom the rules of English grammar are unknown. The objective of this study was to collect data from a natural environment where the attributive adjective was being used as the subject of a complete sentence. Therefore pairs of sentences such as the following were elicited:

The book is green.

The green book is on the table.

The bird is red.

The red bird is singing.

The Fur data was elicited by giving the subject cues in English. The sentence with the predicative adjective was elicited first, followed immediately by the sentence with the same adjective in an attributive position. The goal was to capture the changes in tone in as natural an environment as is possible when doing data elicitation. Rather than focusing purely on the phrase desired, the phrase was captured within an entire sentence. As a result, features such as tonal down-drift were taken into consideration and the tones examined relative to the entire sentence rather than in isolation, which could lead to artefactual analysis.

The trajectory plot analysis of Fur adjectives in attributive and predicate positions yielded intriguing results that both reinforced the existence of the mid tone as well as the concept of polarity that is not determined by a preceding tone.

The significant difference between the findings in this research and the previous account about attributive and predicate adjectives in Fur is that the tonal change in two syllable words can

[6] One is tempted to assume that the nominative form is the model and the locative form is the change form but that has not yet been established.

take place on the first or the second syllable. Take for example the adjective *pukka*[7] 'red' which is plotted below:

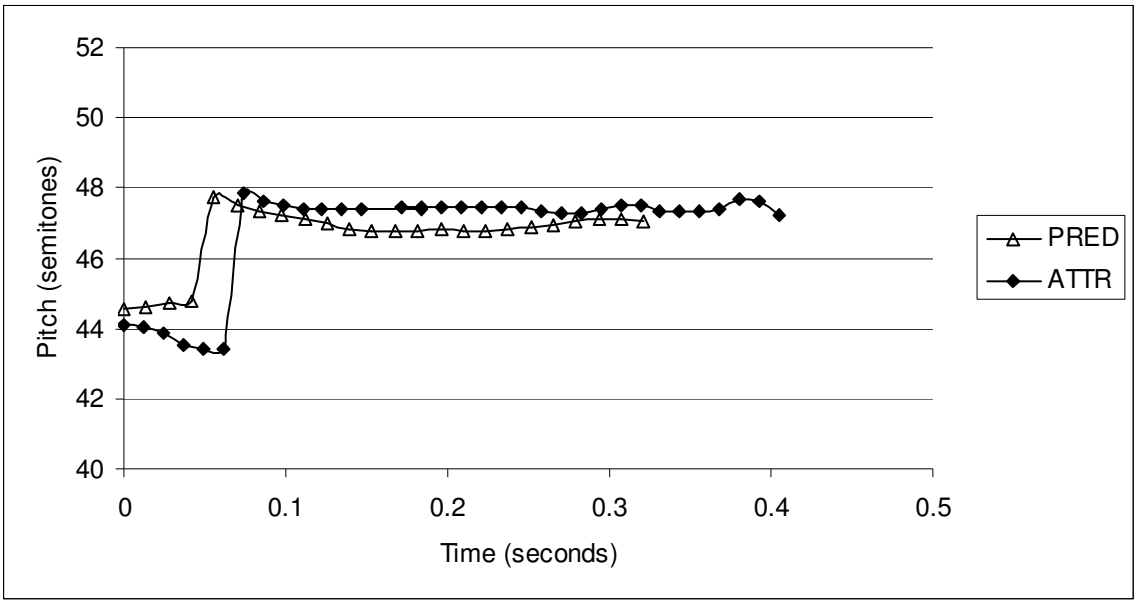

Figure 4.1 Comparison of Predicative and Attributive Tones of *pukka* 'red'

Syllables:	puk-	ka
PRED tone:	M	M
ATTR tone:	L	M

The tones of the adjectives were not only studied throughout their trajectory plots but also in the sentential environment from which they were extracted.

a. *díyà pukka*

bird red

'The bird is red.'

b. *díyà pùkka kònàs pì*

bird red song sing

'The red bird is singing a song.'

[7] Because there is no evidence to support either the predicative or attributive forms as underlying, the lexical items are being presented without tone when discussed in general, rather than role specific terms.

In sentence final position in sentence a the tones are M-M. There is a pitch difference in the two mid tones, the second tone being considerable higher in pitch. In the attributive position, shown in example b, the first syllable changes from M to L, while the second syllable remains the same. Two important conclusions can be drawn from this comparison. Firstly, the relative height of the second-syllable mid tone of *pukka* in the sentence final predicate position suggests that there is no confounding down-drift effect skewing the tonal analysis, as it is only slightly lower than the second-syllable mid of the attributive form. Secondly, the change from M to L on the first syllable reinforces the existence of M as an independent tone.

After analyzing further examples of predicate and attributive adjectives, a clear pattern of tonal change emerged. Like the locatives discussed in Chapter 3, there is a pattern of polar affinity that occur in attributive and predicative adjectives, which is L-M polarity. No examples of H-M polarity were found.

4.1.1 Examples of L-M Polarity

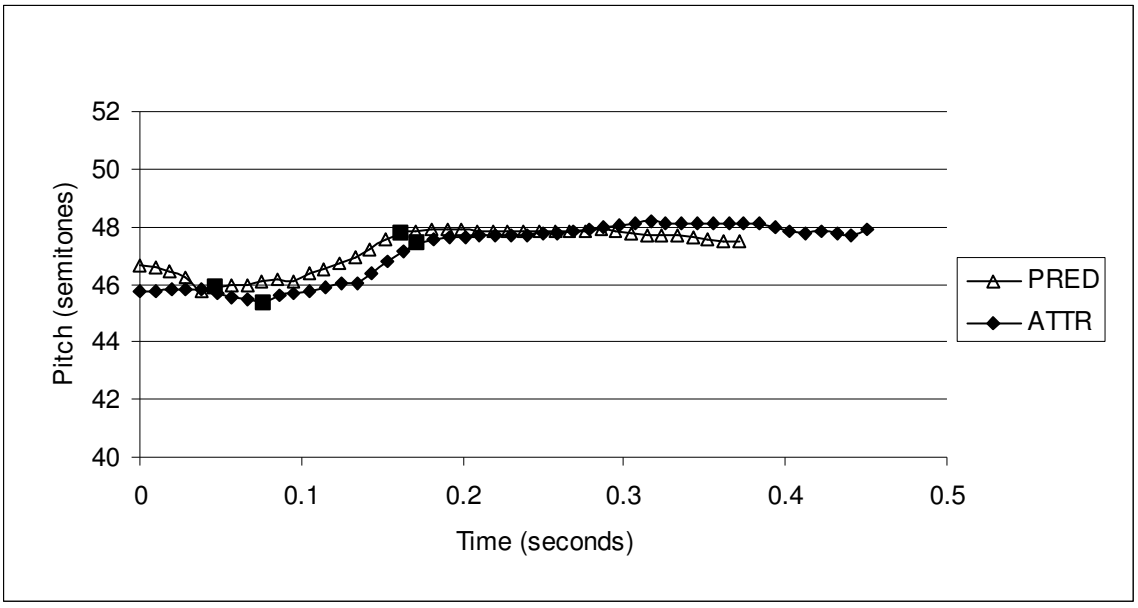

Figure 4.2 Comparison of Predicative and Attributive Tones of *kirro* 'green'

Syllables: kir- ro

PRED tone: L M

ATTR tone: M M

a. *Kitàb kìrro*

book green

'The book is green.

b. *Kìtàb kirro tèrèbésang ìri kè*

book green table space above is

'The green book is on the table.'

In the case of *kirro*, the first tone changes from L to M. Although this change may not be easily perceived in Figure 4.2., but the pitch vectors indicate a clear difference: The pitch vector of the first tone of the predicative form has a value of 24.17, while the pitch vector of the first tone of the attributive form is -4.32. Notice that both have negative trajectories, which militates against the idea that it is actually a L to H shift.

In *kirro*, the tone on the second syllable remains constant, regardless of sentential position. This suggests that there is no tonal down-drift from sentence final position in the sentence responsible for tone change. In addition, the word preceding *kirro* is the unchanged in each sentence, so there is no down-drift effect from the preceding tone.

The following examples of L-M polarity were also carefully examined in sentential context like *kirro* to ensure that no confounding features were producing inaccurate results.

The following examples show that the polar change in tone can occur in either the first or the second syllable of the word. In the words that follow, the tone change takes place on the second syllable, unlike in *pukka* and *kirro*.

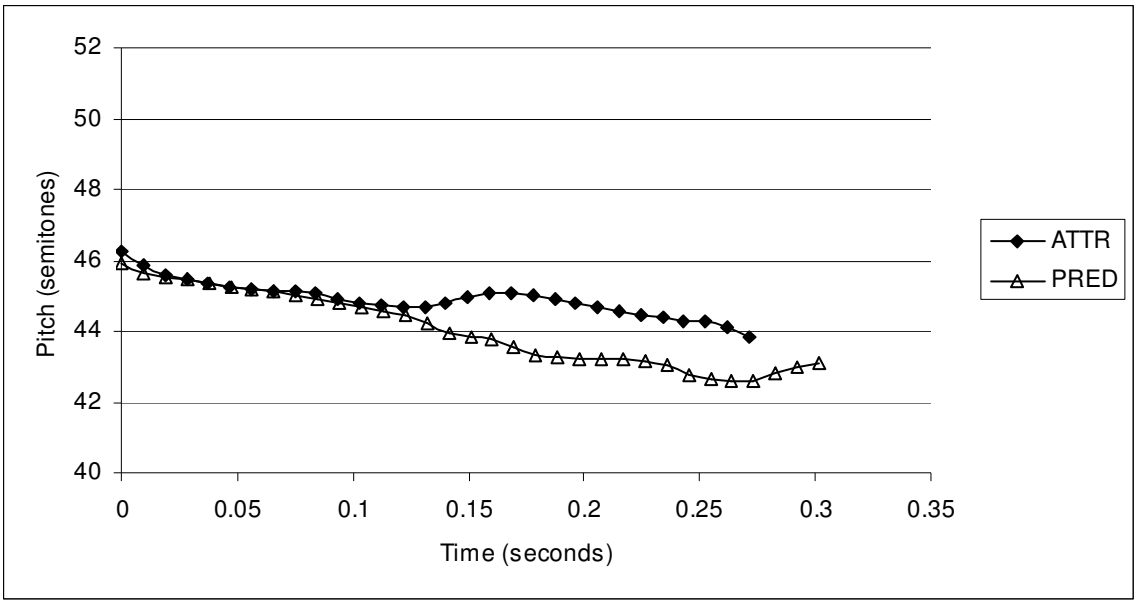

Figure 4.3 Comparison of Predicative and Attributive Tones of *toi* 'old'

Syllables:	to-	i
PRED tone:	L	L
ATTR tone:	L	M

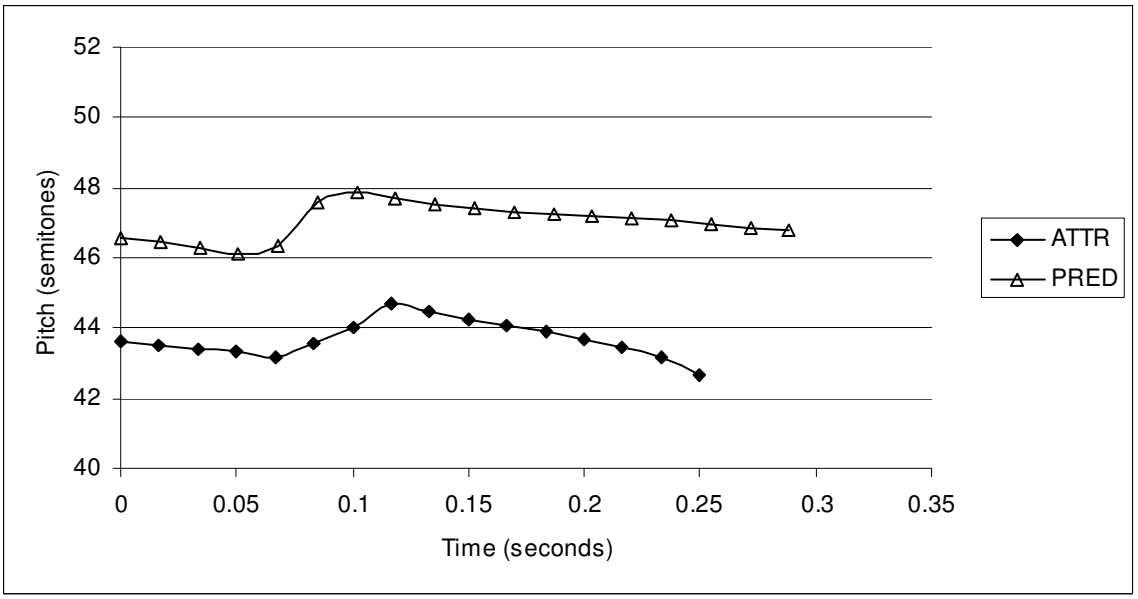

Figure 4.4 Comparison of the Predicative and Attributive Tones of *jitti* 'ugly'

Syllables:	jit-	ti
PRED tone:	L	M
ATTR tone:	L	L

The similarity to the locatives is clear, although there were no examples with high tones in the data collected. However, the occurrence once again of L-M polarity is more evidence for the existence of a M tone.

CHAPTER 5

THE EFFECT OF THE FEATURE [HUMAN] ON TONE

5.1 Thematic Roles and [±human] Direct Objects

One significant new discovery made during this research is that there is a tone change on the verb indicating whether the object arguments are human or non-human. In this chapter, the tonal change in verbs with human and non-human objects in the roles of Patient and Stimulus are explored. The discovery of this phenomenon was serendipitous. As often happens when one is seeking to generalize a discovery, many environments must be explored to determine if there might be more exemplars of grammatical tone change. The fact that Fur has no overt third person object pronouns such as *him*, *her* or *it* led this investigator to probe if the feature human or non-human could play a role in the morphosyntax of the language.

5.2 The Effect of [±human] Direct Objects on Verbs

The effect of [±human] on direct objects showed a pattern of tonal change that was dependent on the semantic role of the NP object. While a tonal polarity change was the target and occurred on verbs with [±human] Patients, there was no polarity evident on [±human] Stimuli. The motivation for this difference is not clear.

5.2.1 [±human] Patients

In the case of [±human] Patients, the second syllable of the accompanying verb undergoes the tone change. Although it poses a 'chicken and egg' paradox to decide which form of the verb is underlying, this research posits that the more-commonly appearing non-human tones change to form the less-commonly appearing [+human] tone form. Essentially, the decision is based on frequency: As there are many more non-human than human

objects in any language, it doesn't seem far-fetched to choose the non-human tonal pattern as the underlying form. In the verb *duja* 'to put down', in the example below, the tone changes from L to H for the human object. 'To put down' indicates a change in state of the object. Thus the role of Patient is assigned to the verb 'duja'.

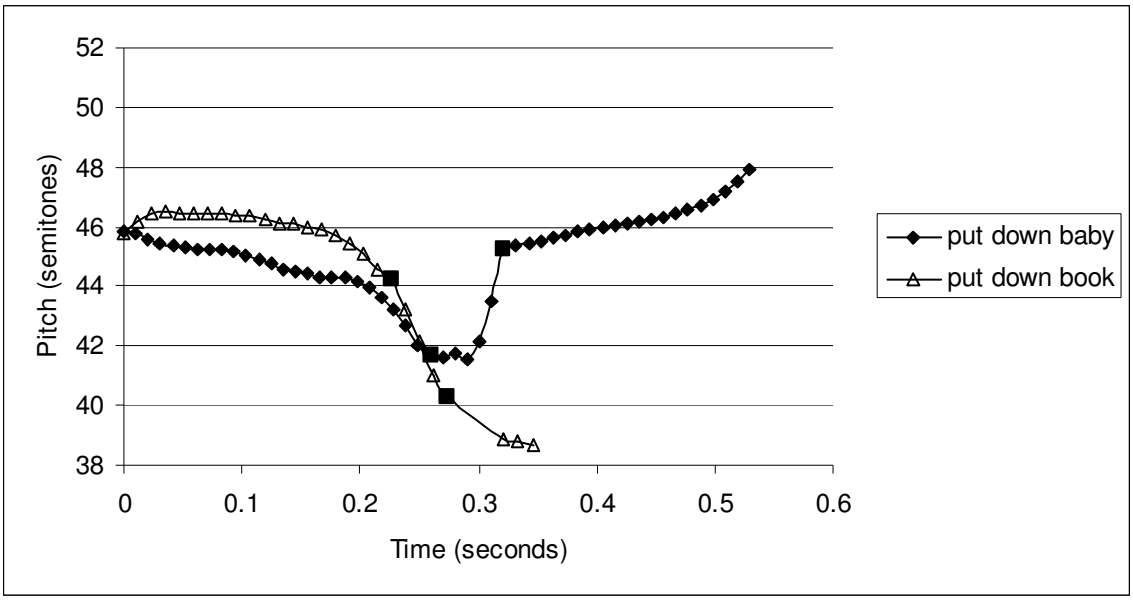

Figure 5.1 Pitch Trajectories of *duja* 'to put down' with [±human] Objects

Verb Syllables:	du-	ja
Non-Human Tone:	L	L
Human Tone:	L	H

a. *duwó kitàb dùjà*

man book puts down

'The man puts down the book.'

b. *duwó kwe dùjá*

man baby puts down

'The man puts down the baby.'

To ensure that the difference was not a distinction based on a [±animate], as opposed to the more restricted [±human], feature of the objects, sentences using *kwedè* 'boy' and *ásà* 'dog'

as object in the same sentence were tested. Below is a plot of the verb l*adi* 'to hit' with these two objects. It is clear that the same verb change occurs between 'dog' and 'boy'; therefore, [±human] is required for the change to occur.

The physical effect on the object of 'to hit', like *duja* 'to put down' leads to the conclusion that the theta role of the object of *ladi* is that of Patient.

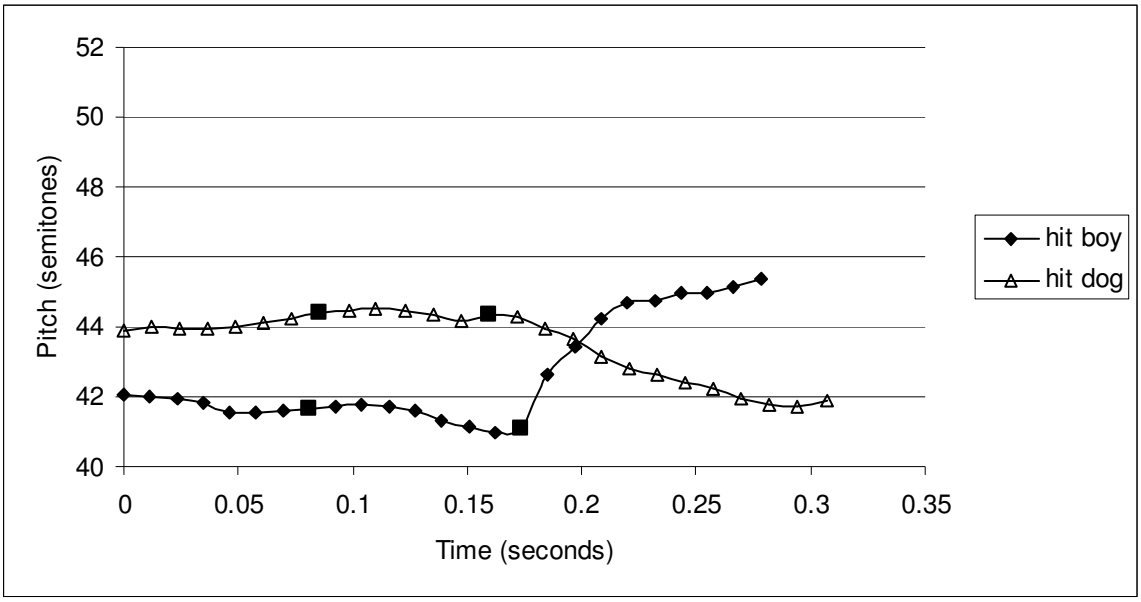

Figure 5.2 Pitch Trajectories of *ladi* 'to hit' with [±human] Objects

Verb Syllables:	jel-	di
Non-Human Tone:	M	L
Human Tone:	M	H

a. *ji ásà ladì*
you dog hit
'you hit the dog.'

b. *ji kwedè ladí*
you boy hit
'You hit the boy.'

A final example of a verb which takes an object with a semantic role of Patient is the verb *bawa* 'to take':

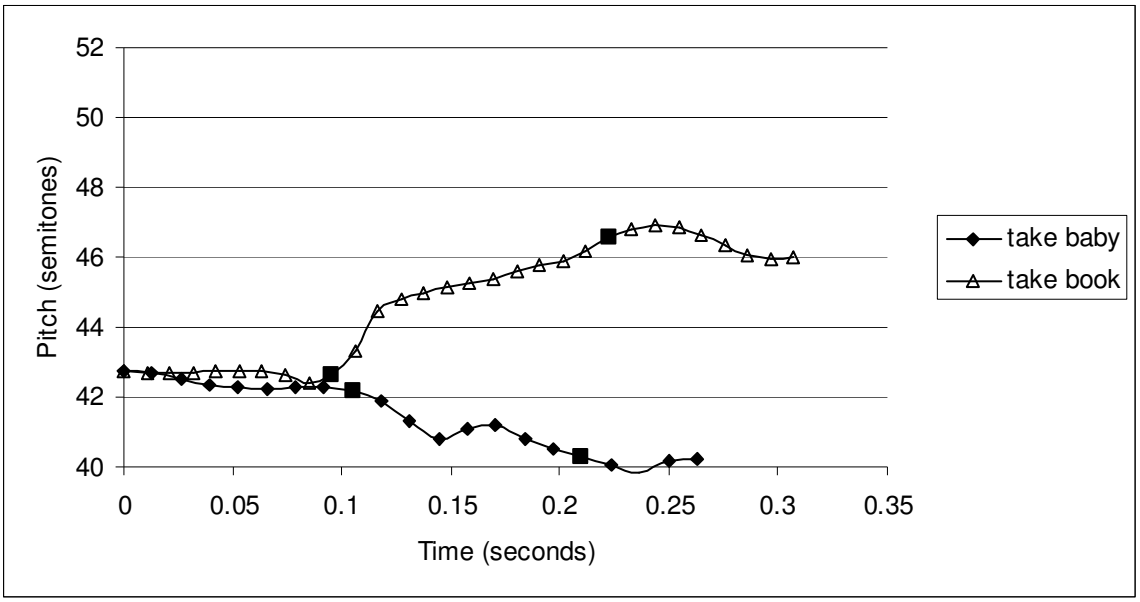

Figure 5.3 Pitch Trajectories of *bawa* 'to take' with [±human] Objects

Verb Syllables:	ba-	wa	
Non-Human Tone:	M	H	(-0.09, 1.33)
Human Tone:	M	L	(-0.55, -1.12)

a. *álánkwè kitàb bawá*

woman book take

'The woman takes the book.'

b. *álánkwè kwe bawà*

woman baby takes

'The woman takes the baby.'

Having seen this pattern of tonal change, the obvious question was what might have caused such a change to develop. The reason for such a tone change on the verb is adumbrated by the following example, according to Subject A.

ji ∅ *jeldì*

you it hit

'The man hit it.'

In this case without an overt 3rd person pronoun, we can, nevertheless, see how the tone on the verb tells us if the object pronoun is human or non-human. Subject A claimed that all of the examples given could have the object covert. This gives a clear motivation to the [±human] tonal change; the verb is the target of tone change because pronominal objects have zero realization and they are not present to be marked for the feature [human].

5.2.2. [+human] Stimuli

Whereas [±human] Patients show a distinct tone reversal, there is a different tonal change manifested in verbs which assign the theta role of Stimuli to the object. Consider the verb jitti 'to hate':

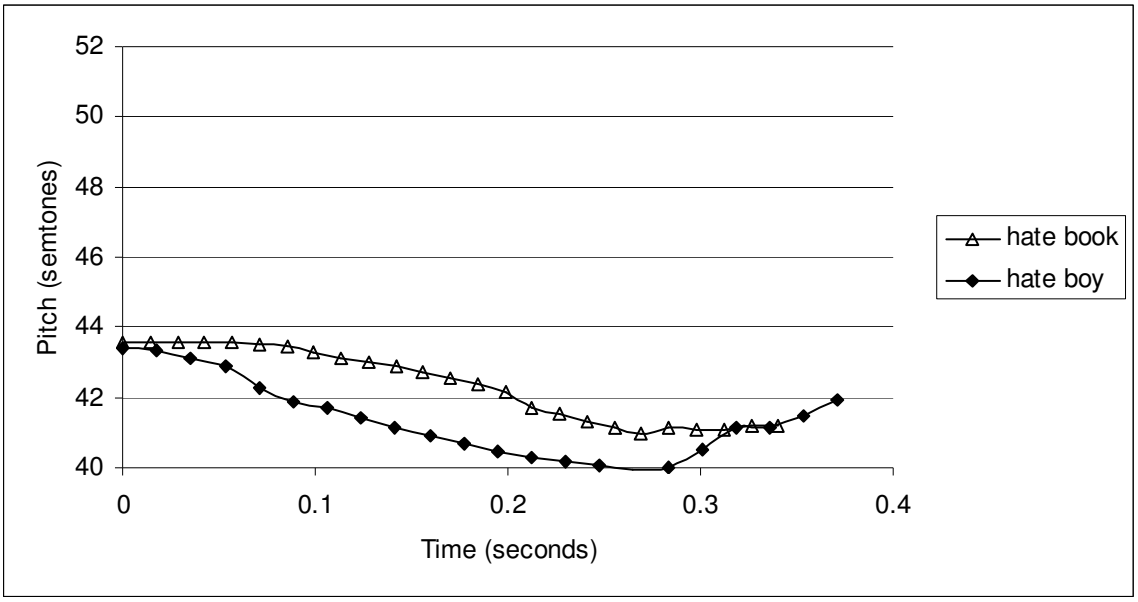

Figure 5.4: Pitch Trajectories of *jitti* 'to hate' with [±human] Objects

a. *Kā kitàb jìttì*

I book hate

'I hate the book.'

b. *Kā kwedè jìttì*

I boy hate

'The man hates the boy.'

Again a slight lowering of pitch across the whole verb for the human Stimulus occurs. The upward trajectory at the end of the [+human] vector appears to be artefactual. Upon seeing this lowering of pitch recurring and noting that it is more significant in value than the slight pitch change between verbs when human and non-human agents are compared. A final example with the same lowered pitch in the verb with a human object in pitch forced a consideration of this lowering of pitch; was it an actual tone change or simply a pitch modulation? If downstep is assumed, then the relationship between the sentences with the verb jìttì would be as follows:

a. Kā kwedè jìttì

'I hate the boy.'

b. Kā kitàb jì↓ttì↓

'I hate the book.'

This tonal change hold true for the verb kwel 'to love':

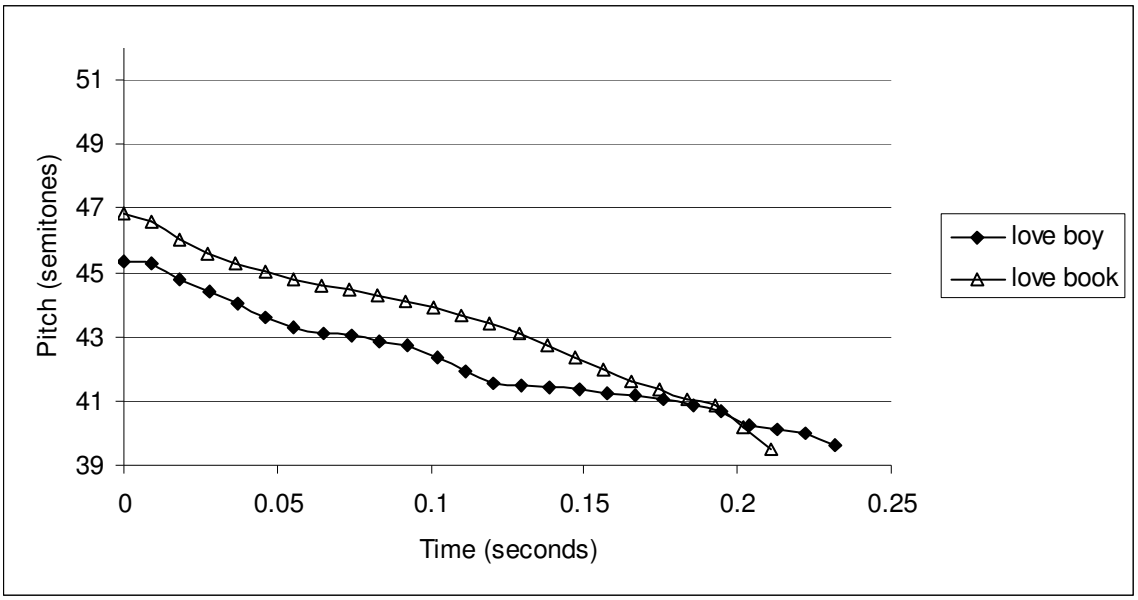

Figure 5.5 Pitch Trajectories of *kwel* 'to love' with [±human] Objects

a. *duwó kitàb kwè*l

man book love

'The man loves the book.'

b. *duwó kwedè kwè*ɬl

man boy love

'The man loves the boy.'

The chart below shows how *jura* 'to touch', shows no contour change, only a minimal pitch variation, in keeping with verbs like *kwel* 'to love' and *jitti* 'to hate'. This reinforces that it is indeed the theta roles and not simply action or non-action verbs that are causing the change. 'To touch' would be considered an action verb, but because it causes no change in state to its object, that object is assigned the role of Stimuli.

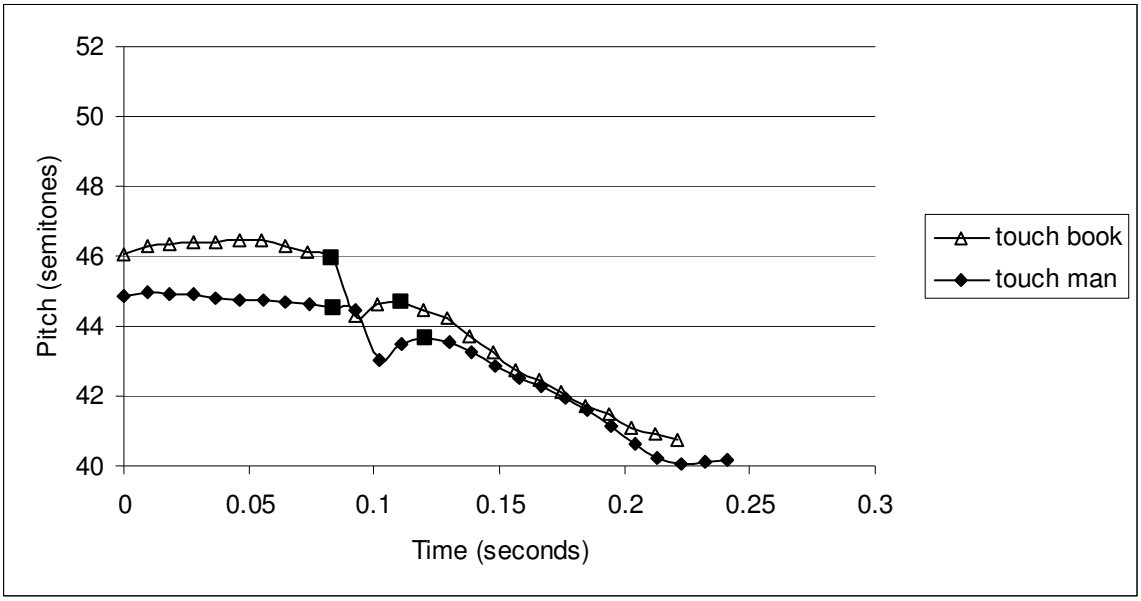

Figure 5.6 Pitch Trajectories of *jura* 'to touch' with [±human] Objects

a. *Kā kitàb jūrà*

I book touch

'I touch the book.'

b. *Kā duwó jūˈràˈ*

I man touch

'I touch the man.'

In the following example, *junga* 'to shout at' shows the same effect as the previous verbs with [±human] Stimuli.

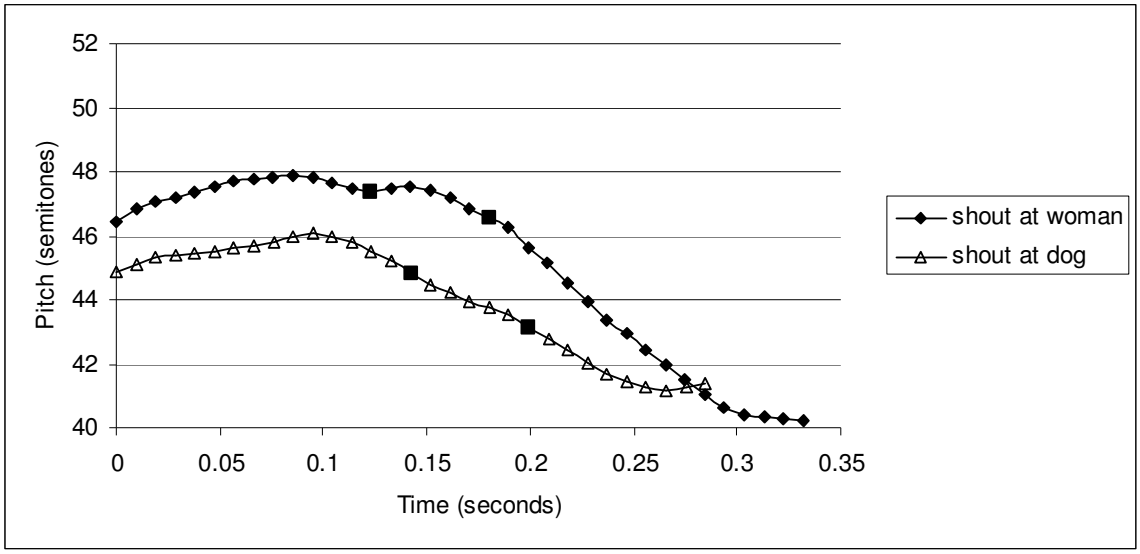

Figure 5.7 Pitch Trajectories of *junga* 'to shout at' with [±human] Objects

jûngà [-human] jûngá [+human]

A downstep, though visually clear, is a far less acoustically perceivable change, which is difficult to understand in terms of tone acting as a marker for human or non-human object pronoun that is lacking in the grammar, as we have established above. However, clearly from the plots such lowering is indeed present for verb tone with [±human] in Fur. Therefore this particular use of tonal polarity in the grammar has produced a question: Why does polarity not occur in the verbs which assign a Direct Object Stimulus? This is a topic worthy of future investigation.

CHAPTER 6

CONCLUSION

6.1 Research Purpose and Process

This research into the tonal system of Fur and its grammatical functions began with several basic assumptions. These assumptions were based on the excellent prior research by Jakobi (1989), and Waag and Kutsch Lojenga (2000). These assumptions were:

1. Fur is a register tone language with two tones L and H. Contours of LH and HL are possible.
2. Tone makes lexical distinctions in Fur as exemplified by examples such as:

   'desert' *úrì*

   'sheep' *úri*
3. Tone also functions in the grammar of Fur. Tone is used to differentiate the nominative and locative forms of nouns and the attributive and predicate forms of adjectives.

The purpose of the research was to take this knowledge and study two aspects of the Fur language in greater detail. These three objectives were as follows:

1. A reexamination of the tone system to determine if Jernudd's claim (1983) of a three tone system was possible.
2. An investigation of two previously known functions of tone in Fur, that of tone change in the formation of locatives, and tonal difference between attributive and predicate forms of nouns, in light of the results of the new evaluation of the tone system produced by the first objective.
3. A study of a new function of tone in Fur grammar discovered during this research, namely a tonal difference in [±human] objects of verbs based on their semantic roles.

Through elicitation of data from Subject A, a native speaker of Fur residing in Arlington, Texas, and analysis of the data using F_0 Pitch Trajectory Plots, the aforementioned topics are investigated.

Analysis of tones in this study was undertaken using F_0 Pitch Trajectory Plots. Thresholds for the pitch vectors (the fall or rise of the pitch over time) of tones were established, so that those tones that were 'level' could be distinguished from the previously recognized H and L tones of the language. The thresholds determined in this research considered tones between -1 and 1 semitones/decisecond to be level tones. The range was generally from +/-0.05 to +/- 0.7 for mid tones. High tones were found to range from 1.1 to 2.5 semitones and low tones from -1.1 to -4.2 semitones.

6.2 Results

The study of tone in Fur using the Fo trajectory method yielded very intriguing results. A summation of these results follows below.

6.2.1. A Three Tone System

The examination of the tones of Fur using the pitch plot method supported Jernudd's belief in a three tone system. Examples of these three tones can be seen in the plot of four tone shapes of the lexical item *dei*.

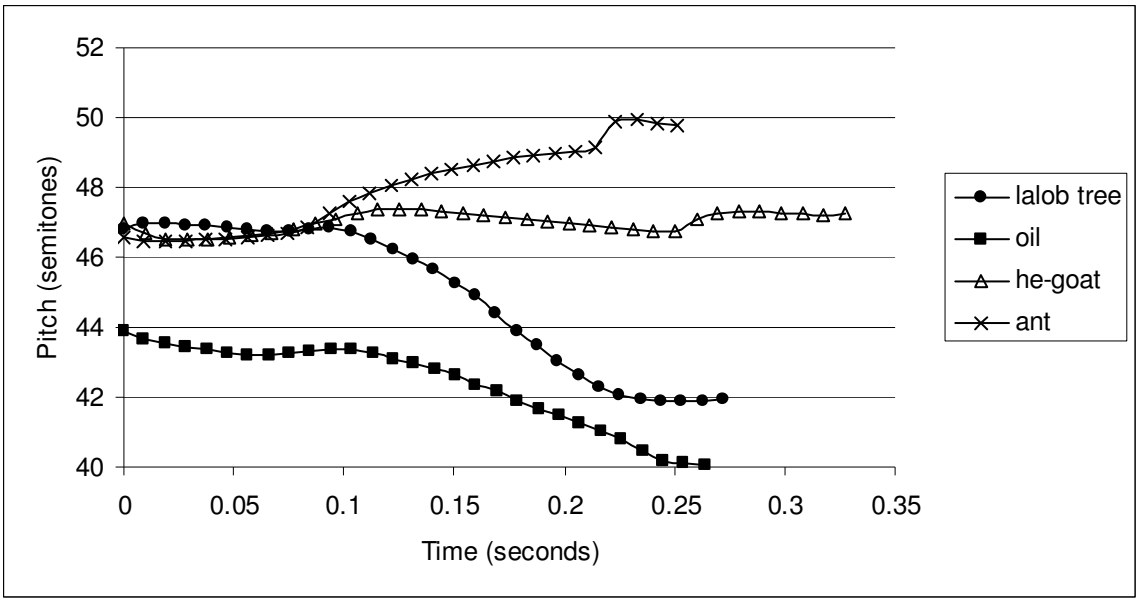

Figure 6.1 Pitch Trajectories of Four Tonal Variants of [dei]

Using the prescribed pitch thresholds for tone, these four lexical items exhibit tone as follows (mid tone is unmarked):

‘lalob tree’ *deì* (-0.06, -3.28)

‘he-goat’ *dei* (0.28, -0.04)

‘ant’ *deí* (0.21, 1.72)

‘oil’ *deì* (-0.09, -2.08)

Other minimal sets support the existence of a mid tone:

‘desert’ úrì

‘sheep’ úri

‘beard’ purò

‘pot’ puro

This accumulation of data and its analysis along with the belief of Subject A that there are indeed three different tones in Fur led to the conclusion that Jernudd’s proposal was best motivated and that a three tone system in Fur has the strongest empirical support.

6.2.2 Tonal Polarity Relationships in Grammar

Through three particular grammatical structures we see tonal polarity functioning in Fur.

a) Nominative v. Locative Forms of Nouns

b) Attributive v. Predicative Forms of Adjectives

c) Verbs with [±human] Patients of Verbs

We see consistently across all of these grammatical structures a tonal polarity relationship between the two forms.

6.2.2.1 Nominative v. Locative Forms of Nouns

There are two distinct polarity patterns that occur between nouns and their locatives. This change can occur on either the first or second syllable of the word.

a) There is a polar relationship between H and M: H tone in the noun form becomes M in the locative, or M in the noun becomes H in the locative.

a. *bagu jàmmáìl*

garden beautiful

'The garden is beautiful'

b. *kwedè bagú kè*

boy garden is

'The boy is in the garden.

b) There is a polar affinity between L and M: L tone in the noun form becomes M in the locative, or M in the noun becomes L in the locative.

a. *dáí kìrro*

grass green

'The grass is green.'

b. *núng dai ndìo-kè*

snake grass is

'A snake is in the grass.

What was additionally discovered about the two types of tone change was that when an M tone is high in the tone space, it becomes L, and when the M tone is low in the tone space in becomes a H. This type of polarity keeps the pitch within normal values for the subject. This rule of change was consistent across all examples.

6.2.2.2 Attributive v. Predicative Adjectives

In Fur is that the tonal change in two syllable words also takes place on the first or second syllable, much like the locatives already discussed. The data gathered showed only one polarity relationship—L-M polarity. In addition examples of both L to M and M to L change were found. The example below shows a L to M tone change on the first syllable of the adjective *kirro* 'green':

a. *Kitàb kìrro*
   book green
   'The book is green.'

b. *Kìtàb kirro tèrèbésang ìri kè*
   book green table space above is
   'The green book is on the table.'

6.2.2.3 The Feature [human] and Verbs

Two patterns of tonal change on verbs were found when comparing human and non-human direct objects in the roles of Patient and Stimulus

Verbs which assign the role of Patient to their direct objects undergo a tonal change in the second syllable. Again we see a polar relationship between the two forms.

a. *duwó ásà ladì*
   man dog hit
   'The man hits the dog.'

b. *duwó kwedè ladí*

man boy hit

'The man hits the boy.'

The motivation for a tone change on the verb is clarified by the following example which, according to Subject A, is correct in Fur.

duwó ∅ ladì

man it hit

'The man hit it.'

In this case we can see how the tone on the verb tells us if the object pronoun is human or non-human just as 'it' and 'him/her' do in English.

Although the expectation was that all verbs would show the same tonal change, this was not the case. Verbs where the Direct Object is assigned the role Stimuli, because no physical effect is made on the NP object have a tonal change, but it is is a much more subtle change—tonal downstep.

a. duwó kitàb kwèl

man book love

'The man loves the book.'

b. duwó kwedè *kwè*ꜜl

man boy love

'The man loves the boy.'

The reason for this difference remains an unsolved problem still that will require more speakers and insights to solve.

6.3 Summary

This research has reevaluated and redefined the Fur tone system using the F_0 Trajectory System and shown the importance of the tonal polarity values in multiples grammatical structures in Fur. There are likely many more examples of this phenomenon in Fur. This initial examination

of the grammatical function of tone, particularly focusing on the tonal polarity relationships between forms is a step towards understanding a small part of the complex language that is Fur.

The findings of this research could impact the study of tones in many languages. Using Pitch Vector Analysis could prove to be a more powerful and precise tool for tonal research in other languages, not only in establishing the tonemes of a language, but also in determining the limiting threshold of tonal variation or deviation in a context,

In addition, the evidence of a type tonal polarity that is not caused by surrounding tones supports a relatively new understanding of polarity which could also significantly influence the understanding of the function of tone in grammar.

REFERENCES

Beaton, A. C.1968. A Grammar of the Fur Language Linguistic Monograph Series, No. 1. Khartoum: Sudan Research Unit, Faculty of Arts, University of Khartoum.

Bender, Lionel, 1997. The Nilo-Saharan Languages: A Comparative Essay. München.

Burquest, Don, 1993. Phonological Analysis: A Functional Approach. The Summer Institute of Linguistics: Dallas, Texas.

Creider, C.A. 1980. The Tonal system of Proto-Kalenjin. Proceedings of the First Nilo-Saharan Linguistics Colloquium, Leiden, September 8-10, 1980. Foris Publications: Dorderedcht Holland/Cinnaminson – USA.

Ehret, Christopher, 2001. A Historical-Comparative Reconstruction of Nilo-Saharan. Köln.

Greenberg, Joseph 1963. The Languages of Africa (International Journal of American Linguistics 29.1). Bloomington, IN: Indiana University Press.

Jakobi, Angelika,1989. A Fur Grammar. Buske Verlag: Hamburg.

Jernudd, Bjoärn H., 1983. “Phonetic Notes on Tone and Quantity in the For Language” in:Nilo-Saharan Language Studies, ed. by M. Lionel Bender. East Lansing, Michigan: African Studies Center, University of Michigan. pp. 80-86.

Kutsch Lojenga, Constance and Christine Waag, 2004. "The Sounds and Tones of Fur", in Occasional Papers in the Study of Sudanese Languages No. 9. Entebbe: SIL-Sudan 2004.

Nolan, Francis, 2003. Proceedings of the 15th International Congress on the Phonetic Sciences Barcelona, 771-74, ISBN 1-876346-48-5.

Pickett. J.M., 1999. Acoustics of Speech Communication. Allyn and Bacon. Needham, Heights, MA.

Pike, K. Tone, 1948. Ann Arbor: University of Michigan Press.

Ross, Elliott D, Jerold A. Edmondson and G. Burton Seibert, 1986. The effect of affect on various acoustic measures of prosody in tone and non-tone languages: a comparison.
based on computer analysis of voice. Journal of Phonetics 14.2.283-302.

Traunmüller, Hartmut and Anders Eriksson. 1995. The frequency range of the voice fundamental in the speech of male and female adults. Institutionen för lingvistik, Stockholms universitet, S-106 91 Stockholm, Sweden

Yip, Moira. Tone, 2002. Cambridge Textbooks in Linguistics. Cambridge University Press, Cambridge, UK.

BIOGRAPHICAL INFORMATION

Georgianna received a BA in French and a BFA in Modern Dance from Texas Christian University. Her broad array of interests and experiences include choreography and directing for a musical theatre company, and work in the community with children on the Autism Spectrum. Georgianna grew up in Nairobi, Kenya therefore another research project she has been involved in is the study of Sheng,a Swahili based patois spoken by the younger generations in Kenya. Georgianna teaches English to Speakers of Other Languages at The University of Dallas.