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VOWEL COALESCENCE AND TONAL MERGER IN CHAGGA (OLD MOSHI): A NATURAL GENERATIVE APPROACH[1]

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The first section of this paper is a discussion of the vowel coalescence process of Chagga (Old Moshi dialect). Vowel coalescence processes interact with tone rules in an interesting way. I discuss the analysis of Chagga tone which was done by Nurse and Philippson [1977]. In section 2 I discuss some problems with their analysis and suggest revisions within the Transformational Generative framework. In section 3 I offer an alternative analysis which follows the constraints on grammars imposed by Natural Generative Phonology, showing that by treating the problem morphotonemically, problems inherent to the more abstract analysis can be avoided.

1. Vowel Sandhi

An understanding of the system of vowel sandhi in Chagga is critical to an understanding of its tense system. Vowel initial tense markers merge so completely with preceding vowel final subject markers that one must reconstruct the entire paradigm before the tense markers become discernable. We will see, for example, that the verbs in several tense paradigms are rendered segmentally ambiguous as a result of vowel coalescence, as the following examples show:

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[1]The data used in this paper are representative of Old Moshi, one of the Central Kilimanjaro groups of Chagga dialects. I would like to express many thanks to Mrs. Helen Mariki for her invaluable assistance and cooperation. Thanks also goes to Prof. Larry Hyman, whose seminar on Bantu Tonology served as impetus for this work. A special note of thanks and appreciation to Prof. Paul Schachter for having worked patiently with me while preparing an earlier draft of the paper. Thanks also to Prof. Thomas Hinnebusch who made comments on an earlier draft, and finally thanks to Prof. Russell Schuh whose comments contributed to the final version of this paper.

(1) /ˊlù-á-kúdìkà šìdì/[2] → [lókúdìkà šídì]
we-rec pst-carry chairs
'we carried the chairs (this morning)'

(2) /ˊlú-è-kúdìkà šìdì/ → [lókúdìkà šìdì]
we-fut-carry chairs
'we will carry the chairs'

Most of the data which are relevant to this study are found in the Bantu verbal, which consists of a subject pronominal concord, a tense marker and a verb stem. Coalescence in this environment results from the juxtaposition of a pronoun agreement morpheme and a vowel initial tense marker

(3) /nú-é-dèdá/ → [nódédà] 'you will speak'
you-fut-speak

(4) /wá-é-dèdá/ → [wédédà] 'they will speak'
they-fut-speak

Coalescence also takes place between the stems of the associative morpheme and their pronominal agreement forms, as shown in Appendix I, no. 7. As the vowels which actually occur in these environments are exhaustive, there are sequences which are possible but which do not occur. Therefore the rules which have been formulated here to account for such sequences are actually predictions about them. The vowel sequences which actually occur are listed below:

a + a = a	e + i = e	u + a = o
a + e = e		u + e = o
i + a = ya		u + u = u
i + e = e		

Many of the sandhi rules in Chagga are not unlike vowel coalescence

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[2]Chagga has two tones at the underlying level, H and L. The conventions I will use for marking tones are as follows:

ˊ = H
ˋ = L
ˈ = D (downstepped H)
ˆ = falling
ˇ = rising

rules which are commonly found in languages. The first process to be discussed, palatal glide formation, involves two separate rules. *Palatal Glide Formation* forms y from the high front vowel, /i/, before a vowel which is [+back, +low], /a/.

Rule (1) Palatal Glide Formation

$$i \rightarrow y \; / \left\{ \begin{matrix} C \\ \# \end{matrix} \right\} \_\_ \; a$$

Examples of *Palatal Glide Formation* are found when subject agreement markers for classes 4 and 9 (i), 7 (ki), and 8 (ši) combine with the associative morpheme / -a /:

Class 9	i	+ a	→	ya
Class 7	ki	+ a	→	kya
Class 8	ši	+ a	→	ša[3]

Closely related to *Palatal Glide Formation* is *Palatal Glide Insertion*, a morpho-phonemic rule which inserts a palatal glide between /i/ and any non-high vowel in infinitives:

Rule (2) Palatal Glide Insertion

$$\emptyset \rightarrow y \; / \; X \quad \underset{\left[\begin{matrix} +high \\ -back \end{matrix}\right]}{V} \_\_\_\_ \underset{[-high]}{V}$$

[+infinitive marker]

Examples:

i + adanya	→	[iyadanya]	'to listen'
i + oloka	→	[iyoloka]	'to fall'
i + ende	→	[iyende]	'to bring'

By this analysis no rule ordering is required, if the general principle that morphophonemic rules precede phonological rules is assumed (Hooper [1976]).

1.1. Fusion. The fusion process represents the heart of the sandhi process in Chagga. Two adjacent vowels will merge to become a single vowel

[3]The palatal glide y is deleted when it is preceded by a palatal or velar consonant.

segment. The simplest rule of this type involves identical underlying vowels:

Rule (3) $\quad V + V \rightarrow V$
$\qquad\quad [\alpha f] \quad [\alpha f] \quad [\alpha f]$

Examples of this process are found in the recent past paradigm and among nominals:

ná-à-dèdá	→	[nádèdá]	'he spoke'
he-rec pst-speak			
wù-úkì	→	[wúkì]	'honey'
Cl 11 pro-noun root			

The second part of this process involves the coalescence of unlike vowels. The following are examples of the types of sequences that are coalesced.

lú-é-dèdá	→	[lódédà]	'we will speak'
we-fut-speak			
lú-à-dèdá	→	[lódèdà]	'we spoke'
we-rec pst-speak			
ná-é-dèdá	→	[nédédà]	'he will speak'
he-fut-speak			
ngí-é-dèdá	→	[ngédédà]	'I will speak'
I-fut-speak			

The feature of roundness is significant in these rules. When one or both of the underlying vowels are round, the coalesced vowel is round. Otherwise the vowel is non-round. A possible formalization is given below (the two vowels in each rule must not be identical; this could be handled by conditions on the rules or by ordering these rules after rule 3):

Rule (4) $\quad V + V \rightarrow V$
$\qquad\quad [-rd] \quad [-rd] \quad \begin{bmatrix} -high \\ -low \\ -rd \end{bmatrix}$

Rule (5) $\quad V + V \rightarrow V$
$\qquad\quad [\alpha rd] \quad [\beta rd] \quad \begin{bmatrix} -high \\ -low \\ +rd \end{bmatrix}$

Condition: alpha or beta must be [+ round].

These rules can be further collapsed as follows:

Rule (4, 5') $\begin{matrix} V \\ [\alpha round] \end{matrix} + \begin{matrix} V \\ [\beta round] \end{matrix} \rightarrow \begin{matrix} V \\ \begin{bmatrix} -high \\ -low \\ \gamma round \\ \gamma back \end{bmatrix} \end{matrix}$

Condition:[4] (a) if α and $\beta = -$, $\gamma = -$

(b) elsewhere $\gamma = +$

In summary, there are two basic strategies for coalescing vowels in Chagga. The first strategy, *palatal glide formation*, is used when the high front vowel [i] is found before [a]. Its morphophonemic correlate inserts a palatal glide between [i] and any non-high vowel in infinitives. The second strategy, *fusion*, is used to coalesce vowels to which the palatal glide formation rules are not applicable. The coalescence of unlike vowels depends on the feature [round]. If at least one of the input vowels is [round], then the resultant vowel is the mid-round vowel o. Otherwise, the coalesced vowel is the mid-non-round vowel e.

After having taken a brief look at the vowel coalescence process in Chagga (Old Moshi), I would be the first to admit that the problem of vowel

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[4] An interesting sideline note is the problem that such a rule poses for the formalism. Intuitively, the process seems simple enough, and can be summarized as follows (remembering that these are only non-identical vowels, identical vowels being treated under Rule 3, sec. 1.1):

(a) any two non-round vowels will coalesce to [e].

(b) two vowels will coalesce to [o] if at least one vowel is [+round]

Part (b) poses the challenge, where either of the underlying vowels may be [+round] in order for the coalesced vowel to be [+round]. The problem is to have the rule express the optional presence of [+round] on either vowel. One might suggest that this be handled by a neighborhood rule, as shown below:

$V \rightarrow \begin{bmatrix} -high \\ -low \\ +round \end{bmatrix} \; / \; [+round]$

This rule would not be satisfying as it is not reflective of the coalescing process which takes place here. What I did was essentially to avoid handling the optionality of placement of [+round] by generating the [o] segment elsewhere.

coalescence exceeds the boundary of a paper of this nature. One very interesting problem, for example, which was not resolved in this paper has to do with the environments in which vowel coalescence processes are apparently blocked. Vowel coalescence rules do not operate in several environments:

-between tense marker and verb
-between agreement marker and adjective

I would speculate that this restriction has to do with the fact that verbs in Proto-Bantu were consonant initial. Since adjectives in Bantu generally derive from verbs, the same would apply to adjectives. Whatever the reason for these restrictions, it should be known that the rules discussed above would have to be restricted from applying in these environments.

2. Tonal Sandhi

Chagga is a tonal language which exhibits both grammatical and lexical tone. Lexically there are two tones, H and L. When adjacent vowels are in a syntactic environment which allows coalescence, there are four tonal sequences possible:

H + H
L + L
H + L
L + H

When vowels whose tones are identical coalesce, the resultant vowel bears that tone:

H + H → H
L + L → L

Underlying vowels with non-identical tones might be expected to give rise to complex tones, as shown below:

H + L → V̂
L + H → V̌

There are, however, no falling and rising tones resulting from vowel coal-

escence in surface structures.

2.1. The analysis of Nurse and Philippson. Before proceeding further to discuss the analysis that I am proposing of the tonal sandhi process, I will present relevant portions of Nurse and Philippson [1977].[5] Nurse and Philippson claim the existence of falling and rising tones at an intermediary point in the derivation, as the following derivations from their paper show:

(5) /tsí-:ná/ → tsîná → [tsína] 'four (cl 10)'
/á-á-mè-lí-à wù-úkì/ → ámèlyá wǔkì → [àmélyà wúkì...]'he has eaten honey'

They argue that these abstract tones are responsible for the surface tonal phenomena. I quote from their paper (p. 53):

> "L + H gives a H on the following syllable, which will then be downstepped if immediately preceded by another H . ... H + L gives a H which *does not* shift and remains on the syllable itself, the following syllable will then bear a low tone."

Two tone rules are basic to their analysis, *Tone Shift* and *Tone Polarity*. *Tone Shift* moves all deep structure tones rightward by one syllable. Nurse and Philippson explain the rule as follows:

> "OM(Old Moshi), like other Bantu languages in East Africa, has a tone shift, which means that PB(Proto-Bantu) tones are realized on the syllable immediately following that for which they are posited in PB. In other words, the phonetic tone on any syllable will always to some extent depend on the underlying tone of the previous syllable." [1977:52]

As *Tone Shift* moves all deep structure tones rightward, Nurse and Philippson must provide rules to account for the tones on initial syllables. In

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[5]In this section, I rely heavily on the analysis of tones in Chagga put forth in Nurse and Philippson [1977]. I realize that objections could be raised about the validity of the postulated underlying tones in their paper. The scope of this paper is not such that it is possible to undertake a complete reanalysis of the tonal system; however, in section 3 I discuss an alternative approach using a limited amount of data. There I discuss the feasibility of treating the tonal system of Chagga within the framework of Natural Generative Phonology. In the remainder of this section, however, I assume the validity of the underlying tones and tone rules that were postulated by Nurse and Philippson.

addition, they need rules to account for the complex tones which obtain sentence finally.[6] With regard to sentence initial tones, they claim that in some instances, the stabilizer nǐ can account for sentence initial high tones:[7]

(6) /nǐ lù-lé-hùRà màRùhú/ → [ǹlúlèhúRà màRùhǔ] 'we bought bananas'

The stabilizer nǐ that they posit in sentence initial position never surfaces in the speech of my consultant. For all practical purposes, this is like claiming that a floating H tone exists in the deep structure of some verb paradigms. When the effects of a floating H are not found on an initial syllable, a floating L must be posited to account for the sentence initial L which results after *Tone Shift* has applied.

The second tone rule which is needed in the Nurse/Philippson analysis is *Tonal Polarity*.[8] This rule changes a verb stem-initial H to L if a H tense marker or object marker precedes it.

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[6]In the Nurse/Philippson analysis, the tone being shifted merges with the underlying sentence-final tone, as follows:

/ˊ + CV̀# / → [CV̀#]
/ˋ + CV̀# / → [CV̀#]
/ˊ + CV̀# / → [CV̂#]
/ˋ + CV̀# / → [CV̌#]

[7]The R here represents a slightly retroflexed tap.

[8]They state the *Tonal Polarity* Rule as follows: "If the class prefix preceding the stem carries an underlying L (i.e. classes 1, 4, 9), then the stem itself will be H. If the underlying tone of the prefix is H (as in the other classes), then the stem will be low" (p.62). Referring specifically to verbs, they say: "It may be seen in 3.3.4 that several of the pre-stem tense markers end in a H. Similarly, most of the object markers listed in 3.4.5 are H. When H's from either of these two series immediately precede a H in the first syllable of the verb stem, then the latter is realized as L" (p.67).

(7) /'lù-ké-dédà/ (habitual)
we-hab-speak

'lù-ké-dèdà tonal polarity

[lúkèdédà] tone shift

Earlier it was mentioned that the coalescence of vowels with differing tones produces altered tones. These phenomena are treated as a part of *Tone Shift* in the analysis of Nurse and Philippson, which gives the impression that tone shifting causes tonal simplification. They claim that L + H effects a H on the following syllable, which is then downstepped if it follows a H . Their having written the rule in this manner is a consequence of having claimed that the tonal simplification process is a part of *Tone Shift*. We will see subsequently that it is possible, in fact desirable, to separate this process from *Tone Shift*. In the case of a H + L sequence, N/P claim that it also yields a H but that this H *does not shift*. It remains on the syllable itself, and the following syllable then bears a low tone. We have numerous examples to show that this formulation is not correct. The future paradigm provides one such example:

(8) /'lú-è-sànjà màRùhù/[9] 'we will wash bananas'

The structure which would be generated by the Nurse/Philippson analysis follows:

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[9]The data being analyzed here have expressed objects (see Appendix II). Disyllabic transitive verbs with unexpressed objects have almost identical variants to those of transitive verbs with expressed objects. They differ in one respect. In the recent past paradigm, transitive verbs with unexpressed objects take a H tone on the final syllable:

lósànjá 'we washed (something)'

lómàrìsá 'we finished'

lóhàdìmá 'we forgot'

lósèká 'we laughed'

Notice that intransitive verbs do not take such a tone:

lódèdà 'we spoke'

lócà 'we came'

*lósànjà màRùhù

The correct surface structure corresponding to (8) is [lósánjà màRùhù] Looking at Appendix II, we find that a similar situation obtains in the future paradigm of the verbs -iwa, -ambuya, -kudika, and -deda · Among transitive verbs in very fast speech sometimes the initial H of the verb stem cannot be heard. However, in deliberate speech this H is always heard (see -ambuya). Notice that given the Nurse/Philippson analysis of H + L sequences, *Tone Shift* must be prevented from operating on a H just in case that H resulted from the coalescence of H + L.

In summary, I have three major objections to the Nurse/Philippson treatment of these data. Firstly, it requires that abstract underlying tone assignments be posited for all surface tones of Chagga. Secondly, I find it difficult to believe that *Tone Shift* is part of the grammar of contemporary speakers of this language. The third objection is simply that in some cases the application of their rules produces the wrong output.

2.2. An alternative to the Nurse/Philippson analysis. In this section, I will discuss further the vowels which result from coalescence rules and their interaction with the tone rules of Nurse and Philippson. I suggest changes within the Transformational Generative model which might be made to correct their analysis.

The first tone rule that will be considered is *Tonal Polarity*, which changes a verb stem-initial H to L if a H tense marker or object marker precedes it. In example (9) below, the H tense marker which serves as input to *Tonal Polarity* is also one of the vowels that is affected by *Vowel Sandhi*:

(9) /'lù-á-dédà/ 'we spoke (recent past)'

I have given the variant in the paradigm which would be used with transitive verbs with expressed objects (D L (L)). In a more complete account of the verbal variants, it would be necessary to incorporate this H as a part of the morphotonemic pattern of these verbs:

D (L) L $_{\begin{matrix}[+\text{trans},+\text{object}]\\[-\text{trans}]\end{matrix}}$

D (L) H $_{[+\text{trans},-\text{object}]}$

Vowel Sandhi, if applied first, would change the tone immediately preceding the verb stem to rising:

'lǒ-dédà vowel sandhi

Tonal Polarity would apply, changing the verb stem-initial H to L :

'lǒdèdà

Tone Shift would apply to produce:

[lódèdà]

The analysis of Nurse and Philippson assumes the existence of rising and falling tones (from vowel coalescence) at an intermediary level in the derivation. I would like to suggest another analysis which does not require the positing of abstract tonemes. This analysis would not combine *Tonal Simplification* with the tone shifting process, as did Nurse and Philippson. Rather, *Tonal Simplification* will be considered part of the vowel coalescence process. I have thus rewritten the rules for tonal simplification as sandhi rules, which would need to be included among the vowel coalescence rules given earlier. One way in which this analysis differs from that of Nurse and Philippson is that it derives the surface forms directly from the underlying ones:

H + H simplifies to H
L + L " L
L + H " $\left\{\begin{matrix} D/H\_\_\_ \\ H/L\_\_\_ \end{matrix}\right\}$
H + L " H

Tonal Polarity may now be altered so that it changes an initial H on a verb stem to L after a tense marker or pronoun which is either H or D (downstepped H). This does not affect the generalization that I made initially, except insofar as it expresses the relationship between L + H and H tones in a more direct way. The generalization can now be expressed in more surface terms than was possible under the alternative analysis. Another advantage of this formulation is that it groups together two tones which seem to make up a class in this language, H and D . In feature termin-

ology, both could be represented as [+H]. Tonal simplification rules also reflect this class, i.e. all sequences with at least one H simplify to [+H].

The second tone rule which interacts with vowel coalescence rules is ***Tone Shift***, which moves underlying tones rightward. Our interest in ***Tone Shift*** stems from its operation over coalesced or "derived" vowels. According to the analysis of Nurse and Philippson, coalesced segments provide exceptions to the tone shifting process. I show below that by separating tonal simplification from ***Tone Shift*** , and by including it as a part of vowel coalescence, a more correct analysis of the data can be given. Furthermore, it will be shown that this analysis makes certain generalizations about the language which would be otherwise obscured.

Nurse and Philippson [1977:53] make the following statements about the effects of ***Tone Shift*** on complex tones:

> "H + H and L + L behave exactly like single H and L respectively."
>
> "L + H gives a H on the following syllable, which will be downstepped if immediately preceded by another H ."
>
> "H + L gives a H which ***does not*** shift, remaining on the syllable itself, the following syllable will then bear a low tone."

These rules are interesting in that they claim that both L + H and H + L simplify to H . In order to make this generalization hold, they must add a condition to the tone shift rule so that the [H] which results from H + L sequences is exempt from shifting. Let's consider data with H + L sequences, deriving them using the Nurse/Philippson rules:

(10)	/'lú-è-dédà/ we-fut-speak	
	lô	coalescence
	ló	simplification
	*lódèdâ	tone shift cf. correct [lódédà]
(11)	/'ngí-è-sànjà/ I-fut-wash	
	ngê	coalescence
	ngé	simplification
	*ngésànjà	tone shift cf. correct [ngésánjà]

Notice that the surface structures that would be derived given the rules of Nurse and Philippson are wrong. The H which results from H + L does not render the following tone L. Even if the following tone were low, as the Nurse/Philippson rule would predict, this formulation would be inherently problematic, since tone shift would have to be prevented from operating in just this case, necessitating the use of a diacritic feature. One possible formulation would be to mark the H which results from H + L as [+H̋L] and then *Tone Shift* would be made sensitive to [+H̋L], being rendered inoperable just in those cases where [+H̋L] is present in the string.

Given that the data support a generalization which is somewhat different from that made by Nurse and Philippson, I would like to suggest another formulation of the rule governing the coalescence of H + L:

> H + L simplify to H, without exception; *Tone Shift* then applies to effect the correct surface structures.

Derivations given the new formulation are shown below:

(10')	/'lú-è-dédà/	
	lóè	coalescence
	'lódèdà	tonal polarity
	[lódédà]	tone shift
(11')	/'ngí-è-sànjà/	
	'ngé	coalescence
		simplification
	[ngésánjà]	tone shift

One wonders what prompted the complicated statement made by Nurse and Philippson. I would venture to guess that they felt that H + L and L + H should not both simplify to an identical H. They must have wanted to show that the two complex tones contrast in some way. It will be shown that this is the case, without such a complicated statement of the facts.

Turning to L + H sequences and the Nurse/Philippson statement about them, they can be summarized as follows: L-H sequences are also an exception to *Tone Shift*, shifting as H rather than the expected L-H. This H is claimed to become downstepped if immediately preceded by another H. Again, the justification for including this process as a part of *Tone Shift*

is unclear. In the analysis that I am proposing, the simplification of L + H (like that of H + L) is a part of *Vowel Coalescence*. In this way the rules which merge segments would simultaneously merge the suprasegments. With this reformulation, a generalization is possible. The tonal simplification of sequences with opposing values is always [+H]. That this is the case is interesting in that it suggests that [+H] is stronger that [+L] in Chagga. This is reminiscent of the suggestion of Stevick [1969] about Bantu tone systems, that H's are marked in contrast to unmarked L's.

Below, I show derivations to compare the two analyses. Example (12) shows the derivation of a string in the recent past.

(12) /ˈɪù-á-dédà/ (recent past)
we-pst-speak

dèdà	polarization
ˈɪǒdèdà	coalescence
[ɪódèdà]	tone shift

Revised analysis:

(12') /ˈɪù-á-dédà/

dèdà	polarization
ˈɪo̞dèdà	coalescence
[ɪódèdà]	tone shift

Comparing (12) with (12'), we find that the major respect in which the analysis being proposed is different is that it produces the simplified toneme directly from the underlying vowel sequences rather than via the abstract intermediary rising and falling tones. Another way in which this analysis is different is that the tones which result from vowel coalescence are no longer exceptions to *Tone Shift*. They are simplified by the vowel coalescence rules and are subsequently shifted by *Tone Shift*.

Given the revised formulation of the tonal simplification process, we can see a general tendency of tones to merge under sandhi in the direction of the marked H tone. It is interesting to contrast this with the tendancy of vowel segments to merge becoming intermediate vowels (e and o).

At this point, I would like to say a few words about the interaction between tone rules and vowel coalescence rules with respect to whether or

not ordering is required. Assuming that morphophonemic rules operate before phonological rules, this principle will dictate the order of application of both *Tonal Polarity* and *Vowel Coalescence* with respect to *Tone Shift*. Both *Tonal Polarity* and *Vowel Coalescence*, being morphophonemic, will apply before *Tone Shift*. The principle makes the correct predictions, as the following derivations show:

(13) /'lú-è-sànjà/
we-fut-wash

'lósànjà	coalescence
[lósánjà]	shift
*lósànjà	polarization

(14) /'lù-á-dédà/ (recent past)

'lù-á-dèdà	polarization
lú-à-dédà	shift
*lódédà	coalescence
'lù-á-dèdà	polarization
'lɔ́dèdà	coalescence
[lódɛ́dà]	shift

Since *Vowel Coalescence* is ordered before *Tone Shift*, the generalization can be made that *Tone Shift* shifts underlying as well as derived tones. This generalization would not have been possible by the analysis of Nurse and Philippson, in which the tonal simplification process was formulated as a part of *Tone Shift*.

3. A Morphotonemic Approach to Verb Variation

The analysis proposed by Nurse and Philippson to account for the tonal system of Chagga is a possible analysis under the theory of Transformational Generative Grammar, which allows totally abstract underlying segments. It is generally agreed that the set of possible grammars for a given language must be constrained so that those grammars which represent the tacit knowledge of speakers would be the preferred ones. It has been shown that the generative power of the TG model is too strong. That is, grammars constructed within the model may not represent the kind of competence that

speakers use in producing utterances in their language. Such grammars imply that totally abstract deep structure constructs and corresponding "abstract" rules, as well as rule ordering statements, are within the realm of human linguistic competence. In many cases, these theoretical entities are not disconfirmable.

Because of the problems which ensue, a body of literature has come about in which linguists have made various attempts at constraining the set of possible grammars for a given corpus of data. Arguments have been given within the TG model against fully abstract morphophonemics, extrinsic rule ordering and the unconstrained use of diacritic features. Venneman [1971, 1973] argues that even stronger constraints should be placed on grammars. Thus, the *Strong Naturalness Condition*, which puts restrictions on abstract segments, and the *True Generalization Condition* and the *No-Ordering Principle,* which constrain abstract rules, are basic tenets of the alternative approach to phonology which Vennemann and, following him, Joan (Hooper) Bybee advocate.

It is within the context of arguments like these that I would like to suggest that an analysis that does not make use of rule ordering and which constrains abstractness is preferred. Natural Generative Phonology is such a theory. By following the constraints of NGP, the analysis which I propose below eliminates some of the problems which are inherent to the Nurse/Philippson analysis. I show that relevant generalizations are brought to light which would not have been possible otherwise. Given the scope of this paper, it is not possible to give a total reformulation of the tonal system of Chagga. Thus, I would like to offer this paper as a sample of what this type of analysis has to offer.

The stimulus for this discussion comes from the tone shifting process. The most basic question which can be raised about this rule is whether it can justifiably be said to represent a synchronic process of the language. The relation between the tones of Chagga and those of Proto-Bantu is clear enough and should not be overlooked, especially in view of the historical relationship which exists between them. Nurse/Philippson must pay the cost however, of claiming that this historical process represents a productive synchronic rule of Chagga grammar. In order to maintain such a claim, they

must set up unconstrained underlying tone assignments on morphemes. Since ***Tone Shift*** moves the underlying tones on all morphemes rightward by one syllable, it follows that no morpheme at the level of surface structure will possess the tone which was assigned to it at the underlying level. Thus, the first problem posed by ***Tone Shift*** is that it requires that all morphemes of Chagga be assigned abstract tones at the level of deep structure.

A second place where abstractness is created in their analysis is in sentence initial position. Since ***Tone Shift*** moves underlying tones rightward, it becomes necessary to account for sentence and word initial tones. Nurse and Philippson account for sentence initial H tones by attributing the tone to the copular form ní , which, according to them, is deleted at the level of surface structure, as the following example shows (p.54):

(15) /ní lù-lé-hùRà màRùhú/
we-pst-buy bananas
ǸlúlèhúRà màRùhǔ 'we bought bananas'

The initial syllable of the surface sentence might just as well have been transcribed by [l] because, in fact, there is no contrast between [l] and [ll]. What they want to say, however, is that whenever the initial syllable of a sentence in surface structure is H , that H can be accounted for by the presence of ní in the deep structure. In all other cases, sentence initial syllables will be L . This is tantamount to claiming that floating H and L tones are found in pre-sentential positions throughout the language. Since these tones are never produced, it is difficult, if not impossible, to confirm such a hypothesis directly.

A final problem is that which results from the vowel coalescence process. Nurse and Philippson treat the tonal simplification which accompanies vowel coalescence as a part of the tone shifting process, to which these tones are exceptions. If, as they define it, ***Tone Shift*** is designed to shift underlying tones rightward, it follows that "derived" vowels would be problematic.

In summary, there are three areas which are problematic for the abstract analysis put forth by Nurse and Philippson: ***Tone Shift*** , with its inherent problems; the abstract floating tones that must be posited at the deep

structure level in pre-sentential position; and the problems which coalesced vowels pose for *Tone Shift*.

One of the aims of the Natural Generative Grammar model adopted here is to place constraints on grammars so that it will be possible to choose between the possible grammars of a language. NGG constrains grammars by minimizing abstractness. Since in Chagga the tonal variants of verbs seem not to be phonologically conditioned, this is a natural place to look in trying to find an alternative to the Nurse Philippson analysis. I will show in what follows that by handling the variation of verbs as a morphophonemic problem, many relevant generalizations about the language are revealed which were not possible under the more abstract analysis.

The most striking difference between the abstract analysis and that which I am proposing here is that the tonal variation on verbs is handled morphotonemically. Below, I would like to discuss the variation found on disyllabic and trisyllabic transitive verbs in order to show the feasibility of an NGG type analysis for these data. For example, the verbs -sanja 'wash' and -ambuya 'look at', which were assigned underlying L tones in the analysis of Nurse and Philippson, have the following variants:

L	L	(L)	present perfect
D	L	(L)	recent past
H	L	(L)	past habitual future

In the analysis being proposed here, these verbs may also be assigned L tones underlyingly, as this tonal variant is found in surface structures in the present and perfect paradigms. The Strong Naturalness Condition of Vennemann [1971] constrains against positing underlying allomorphs which are totally abstract (from Hooper [1976]):

(a) The underlying forms of nonalternating morphemes are identical to their phonetic representations.

(b) For alternating forms (a morpheme with one or more allomorphs), one of the allomorphs is listed in the lexicon in its phonetic representation and the others are derived from it.

A pattern much like that found for L is found for verbs which have a H tone in the underlying structure (in the Nurse/Philippson analysis, the initial syllables of this group are H and therefore the verbs are classified as H—see below). This is the pattern of verbs such as -iwa 'steal', -kudika 'carry', -deda 'speak', and -dumbuo 'cut':

L	H	(L)	present
			perfect
D	L	(L)	recent past
H	L	(L)	past [10]
			habitual
			future

As the morphotonemic patterns of the two groups differ only in present and perfect tense, I will assign to each verb the underlying pattern that is found in the present and perfect tenses. The underlying tones of these verbs would then be as follows:

-sànjà	'wash'	-ìwá	'steal'
-àmbùyà	'look at'	-dèdá	'talk'
		-kùdíkà	'carry'
		-dùmbúò	'cut'

Given this approach to the surface variation among verbs, the underlying representations of verbs are in some cases different from those postulated by Nurse and Philippson. In those cases where they differ, there is a direct relationship between them (the Nurse/Philippson deep structure assignments are leftward by one), as is shown below:

THE ABSTRACT ANALYSIS		THE PRESENT ANALYSIS	
-sànjà	-íwà	-sànjà	-ìwá
-àmbùyà	-dédà	-àmbùyà	-dèdá
	-kúdìkà		-kùdíkà
	-dúmbùò		-dùmbúò

[10] Notice that the variants of the latter two groups are identical to those found for /L/ verbs.

By both analyses these verbs are grouped alike. In the abstract analysis, H verbs are assigned the H L (L) variant underlyingly. It is interesting to note that the variant which is considered underlying by the Nurse/Philippson analysis is that variant which is found in the past, habitual, and future tenses. Among L verbs however, the underlying variants correspond to those of the present and perfect tenses. Given the hypothesis proposed here, the deep structure variants always correspond to those found in the present and perfect tenses. As it is common to find that the present variant represents the basic or unmarked verb form, the generalization could be made that the deep structure of verb stems is represented in surface structure by the present tense pattern.

The underlying representations of pronoun agreement morphemes and tense markers are also different from those that were postulated by Nurse and Philippson. In surface structures, pronouns seem to exhibit morphotonemic variation:

PRO → [+H] (in all tenses except perfect)
[+L] (in perfect)

By the Nurse/Philippson analysis, pronouns could not be assigned an underlying tone. Under *Tone Shift*, pronouns, being sentence initial, received the floating tones that they posited in pre-sentential position. The underlying tones of tense markers in the present analysis are as follows:

present	Ø	past	lè
recent past	à	future	é
habitual	kè	perfect	amé

Returning now to the discussion of the morphotonemic variants of the verbs themselves, several interesting generalizations are possible:

1) The underlying tonal patterns on H and L disyllabic verb stems always correspond to those of the surface variant which is found in present tense.
2) There are only two morphotonemic variants of H and L verbs:

D L (L) recent past
H L L elsewhere

These two statements can account for the variants only of disyllabic H and L verbs. One might question the relevance of these generalizations as they represent only two tonal verb types, H and L. If, however, we take into account the tonal restrictions on verb stems, we find that these data are indeed representative. Nurse and Philippson say the following about these restrictions (p.67):

> "Verb stems may of course be mono- or poly-syllabic. Monosyllabic stems are either L or H phonologically.... Polysyllables behave in a similar way—however many syllables a stem has, it is only the first which is distinctive in that it may be H or L, the following syllables being all L." [These generalizations all apply to underlying stems.]

By the present analysis, the generalizations they make would have to be restated in terms of surface structure. Thus, it would be the second syllable which is distinctive. Given this generalization, the following tone sequences are not found:

*HH	*LLH	*HHL
*HL	*HLL	
*HHH	*HLH	

The tonal sequences which are found are as follows:

H	L
LH	LL
LHL	LLL

We can see that the sample of data that was presented here omits only monosyllabic verbs.

Given the above analysis, the complex morphotonemic variation in Chagga verbs has been reduced to one underlying form and two variants. The morphotonemic approach can account for the tonal variation within the Chagga verbal in a rather straightforward way.

It can easily by seen why this problem cannot be handled as a straight phonological one. We can see that given an approach which first of all admits of morphotonemic variation in this environment, certain generalizations are possible. Apparently, the variation which is found on verbs in Chagga obtains as a result of the interaction between the morphotonemic rules of the language and the tones which are lexically assigned. This phenomenon compares with what has been found in other Bantu languages, in which verbs

and nouns have been shown to exhibit morphophonemic and/or morphotonemic variation (cf. Bennett [1976] and Asongwed and Hyman [1976]).

I am claiming that this analysis is preferable because it does not require abstract underlying tones on morphemes. Neither does it require the abstract floating tones which were needed in the Nurse/Philippson analysis. In fact, this is a significant respect in which the two analyses differ. The analysis of Nurse and Philippson had a three-pronged strategy as an approach to the tonal phenomena within the verb phrase:

1) Abstract deep structure tone assignments and abstract floating tones;
2) abstract phonological rules to alter the abstract deep structure tones;
3) tone melody statements in the lexicon to account for what could not be accounted for by abstract deep structures and phonological rules.

All of these strategies were eliminated by the analysis being proposed here. The abstract underlying tones assigned to verb stems were replaced by setting up morphotonemic tonal variants in the lexicon. The abstract floating tones were eliminated by assigning tone directly to the pronominal agreement morphemes. ***Tone Shift*** and ***Tonal Polarity*** were unnecessary as there were no longer totally abstract deep structure tones on which they were operable. Finally, a combination of all of these strategies made it unnecessary to include tonal melodies in the grammar.

Often the NGP analysis is found to be more complex, but in this case this is not so. The morphotonemic analysis seems in fact more straightforward, requiring only morphotonemic variants in the lexicon and morphotonemic rules to derive the correct surface structures. In the sense that less apparatus is needed, the proposed analysis is simpler. One might ask whether simplicity is an adequate criterion in choosing between possible grammars, if it means, for example, counting features. Simplicity does seem important insofar as it expresses the extent to which the proposed grammar can adequately express the competence of native speakers. The existence of a rule like ***Tone Shift***, while it may be considered simple by some criteria, would have to be questioned from the standpoint of its being able to represent the kind of knowledge that speakers use in generating structures of

their language. Since morphotonemic and morphophonemic variation is quite commonly found in language, it seems not unreasonable to consider it plausible from a psychological standpoint. *Tone Shift*, on the other hand, has been attested to as a diachronic process in Bantu, but it is questionable as representing a synchronic process of Chagga or any other Bantu language. I would like to suggest that the type of analysis being argued for here is more simple and moreover more feasible as a process which speakers have internalized and use in the generation of their language.

APPENDIX I — Underlying Tones and Morphotonemic Patterns

Subject Pronouns		Tense Markers	
ngi	'I'	future	-é-
nu	'you'	past	-lè-
na	'he, she'	present	∅
lu	'we'	rec. past	-à-
mu	'you pl.'	imperfect	-e-
wa	'they'	habitual	-kè-
		perfective	-àmé-

VERB PARADIGMS (-dèdá 'speak')

I. Future	II. Present
ngédédà	ngídèdá
nódédà	núdèdá
nédédà	nádèdá
lódédà	lúdèdá
módédà	múdèdá
wédédà	wádèdá

III. Past

ngílèdédà
núlèdédà
nálèdédà
lúlèdédà
múlèdédà
wálèdédà

IV. Rec. Past

ngádèdà
nódèdà
nádèdà
lódèdà
módèdà
wádèdà

V. Habitual

ngíkèdédà
núkèdédà
nákèdédà
lúkèdédà
múkèdédà
wákèdédà

VI. Perfective

ngàmédèdâ
òmédèdâ
àmédèdâ
lòmédèdâ
mòmédèdâ
wàmédèdâ

VII. Associative Morphemes

Cl. 1	(u)	+	a	=	o
Cl. 2	(wa)	+	a	=	wa
Cl. 3	(fa)	+	a	=	fo
Cl. 4	(i)	+	a	=	ya
Cl. 5	(li)	+	a	=	lya
Cl. 6	(ha)	+	a	=	ha
Cl. 7	(ki)	+	a	=	kya
Cl. 8	(ši)	+	a	=	ša
Cl. 9	(i)	+	a	=	ya
Cl. 10	(ŧsi)	+	a	=	ŧsa
Cl. 11	(u)	+	a	=	wo

APPENDIX II — Sample Paradigms of Mono-, Di- and Tri-syllabic Verbs

	1. -sànjà 'wash'	2. -íwà 'steal'
pres.	lúsànjà*	lúìwá màRùhù*
past	lúlèsánjà	lúlèíwà màRùhù
rec. past	lósànjá**	lólwà máRùhù
fut.	lósánjà	lóíwà màRùhù /lóíwa
hab.	lúkèsánjà	lúkèíwà màRùhù
perf.	lòmésánjà	lòmélwá màRùhù

	3. -àmbùyà 'look at'	4. -kùdíkà 'carry'
pres.	lúàmbùyà màRùhù	lúkùdíkà šìdì*
past	lúlèámbùyà màRùhù	lúlèkúdíkà šìdì
rec. past	lóámbùyà màRùhù	lókúdìkà šídì
fut.	lóàmbùyà màRùhù /lóámbùyà	lókúdìkà šìdì
hab.	lúkèámbùyà màRùhù	lúkèkúdíkà šìdì
perf.	lòméàmbùyà màRùhù	lòmékùdíkà šìdì

	5. -lyà 'eat'	6. -cá 'come'
pres.	lúùlyà ***	lúùcà
past	lúlèlyá	lúlècá
rec. past	lôlyâ	lóócà
fut.	lôlyâ	lóòcâ
hab.	lúkèlyá	lúkècá
perf.	lòmélyà	lòmécà

	7. -dèdá 'speak'
pres.	lúdèdá
past	lúlèdédà
rec. past	lódédà
fut.	lódédà
hab.	lúkèdédà
perf.	lòmédèdá

*lu 'we' maRuhu 'bananas' šidi 'chairs'

**see footnote 9

***compensatory lengthening on monosyllabic verbs

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