

## XXXI. LINGUISTICS\*

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### RESEARCH OBJECTIVES

There have been two main traditions in the study of language in modern times. The first is the tradition of "universal" or "philosophical grammar," which flourished in the seventeenth and eighteenth centuries in intimate connection with philosophy and speculative psychology. The second is the tradition of modern linguistics, a nineteenth and twentieth century phenomenon that was also closely interwoven with the philosophy, psychology, and anthropology of its day. Philosophical grammar was concerned with general, universal principles of language structure; it attempted to ground these principles in a theory of mental processes, and to illustrate them with detailed study of particular languages. By modern standards, the work lacked care and attention to detail, and the conclusions that were reached, though often highly insightful, were deficient in empirical support and sharpness of formulation. In comparison, modern nineteenth and twentieth century linguistics has achieved a much higher standard of rigor, and has accumulated linguistic data of an incomparably greater scope and variety. It has been limited, however, by a much narrower interpretation of the purposes and goals of linguistic science. It has eschewed theory construction in favor of elaboration of methods of analysis, and it has not been concerned with linguistic universals – often, in fact, it has denied that there are, in any significant sense, genuine and deep universal principles that constrain the form and use of human language.

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The work in linguistics at the Massachusetts Institute of Technology represents, in a sense, a synthesis of these two major traditions. In terms of its general goals and even many of its specific hypotheses, this work has a very classical flavor. But in the range and reliability of evidence and precision of formulation, this work accepts and attempts to surpass the standards of modern structuralism.

For classical linguistics, a central property of human language is what we can call its "creative" aspect, that is, its unboundedness and freedom from stimulus control. Under ordinary circumstances, what a person says is not determined by the stimuli that impinge on him or by identifiable physiological states, to any significant degree. The unboundedness of normal language is evident from the fact that almost every linguistic utterance produced and understood is quite new, not similar in any physically defined sense to those that have been produced in the past experience of the language user, and not conforming to familiar or memorized patterns, in any meaningful sense of the notion "pattern." Nor are these utterances "generalizations" from past experience, in any sense of "generalization" known to psychology or philosophy. Nor can language use be described in terms of "habits" or "repertoires of responses." In recognizing these facts, philosophical grammar was entirely correct and to the point.

To account for this creative aspect of normal language use, we must attribute to the language user knowledge of a certain organized system of rules that establish a sound-meaning relation for an infinite class of sentences. This knowledge is, of course, quite unconscious, but it is nonetheless perfectly real. Thus it is quite likely that no one reading this report has ever seen, heard, or produced the sentence

- (1) What disturbed John was being disregarded by everyone.

Yet every reader will understand that the sentence may be roughly paraphrased by either (2) or (3):

- (2) Everyone was disregarding the thing that disturbed John.
- (3) The fact that everyone was disregarding him disturbed John.

Thus sentence (1) is ambiguous, its possible interpretations being (2) or (3). If the word "our" is inserted in (1), giving (4), the sentence is unambiguous.

- (4) What disturbed John was our being disregarded by everyone.

The interpretation of (4) can only be along the lines of (3), with "him" replaced by "us." Or, to choose an example from a totally different sphere of language, speakers of English would know that the plural of the word *dap* is *daps*, whereas that of *linch* is *linches* (with *es* rather than *s*), in spite of the fact that most of the speakers would neither know the meanings of these words nor have heard them before.

A speaker of English has knowledge of these facts and numerous others without having been exposed to these sentences or to any explicit "teaching." He has mastered a system of rules that determine both the phonetic form of sentences (1)-(4) and their various semantic interpretations. The first task of the linguist who is investigating the structure of English is to try to determine this system of rules, the system that is called the "generative grammar of English." This generative grammar has in some manner internalized by every speaker of English; it determines the pairing of sound and meaning for an indefinitely large range of possible sentences. It is this internalized generative grammar that makes possible the normal, "creative" use of language.

The discovery of the generative grammar of English, and other languages, is, however, only the first task that faces the linguist. To the extent that such grammars have been developed and validated, the linguist can then turn to the question of how they are put to use, by the speaker or hearer, in normal conversation, in literature, in internal monologue, and so on. Furthermore, he can turn to the basic problem of classical linguistics: What are the universal principles that limit the form of such generative grammars? Clearly, there must be universal principles with a very narrow and limiting character. If this were not true, it would be impossible for the child, presented with

scattered samples of a language for an extremely short period, to determine for himself the generative grammar of this language. But this is a task that normal humans accomplish with great facility. This indicates that they must approach the task forearmed with highly specific advance knowledge (obviously, unconscious) of the possible form that a generative grammar must assume. To put it loosely, although the child cannot "know" in advance whether the language to which he is exposed is English, Chinese, and so on, he must "know" that it is a "human language" of a highly special sort, which can only vary in very restricted ways. The problem of "universal grammar," now, as in the seventeenth century, is to determine the principles that limit the variety of human language and make possible the acquisition of language. To the extent that such principles can be formulated and validated, we gain insight of an unparalleled kind into the innately determined character of human mental processes.

We feel that recent work, much of it carried out at M. I. T., makes it possible to formulate a fairly precise theory of universal grammar in this sense, a theory which is, furthermore, reasonably well supported by substantial empirical evidence from a variety of languages. The major goal of our research, then, is to sharpen and deepen the theory of generative grammar, and to use it as a basis for the study of cognitive processes.

Since many of the problems of language lie in the area in which several disciplines overlap, an adequate and exhaustive treatment of language demands close cooperation of linguistics with other sciences. The inquiry into the structural principles of human language suggests a comparison of these principles with those of other sign systems, which, in turn, leads naturally to the elaboration of a general theory of signs, semiotics. Here linguistics touches upon problems that have been studied by philosophy. Other problems of interest to logicians – and also to mathematicians – are touched upon in the studies devoted to the formal features of a general theory of language. The study of language in its poetic function brings linguistics into contact with the theory and history of literature. The social function of language cannot be properly illuminated without the help of anthropologists and sociologists. The problems that are common to linguistics and the theory of communication, the psychology of language, the acoustics and physiology of speech, and the study of language disturbances are too well known to need further comment here. The exploration of these interdisciplinary problems, a major objective of this group, will be of benefit not only to linguistics; it is certain to provide workers in the other fields with stimulating insight and new methods of attack, as well as to suggest to them new problems for investigation and fruitful reformulations of questions that have been asked for a long time.

M. Halle, N. A. Chomsky

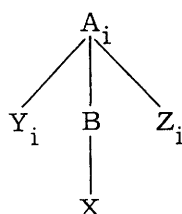
#### A. CONJUNCTIVE STACKS AND DISJUNCTIVE SEQUENCES IN LANGUAGE CHANGE

As an introduction, we shall first consider two independently defined but related formal operations on phrase-structure grammars. (We define operations in the strict sense of mapping a grammar  $G$  into a new grammar  $G'$  that differs from  $G$  in a determinate manner.) We shall define these operations to cover the case of context-free grammars initially, although subsequently we shall extend them in a natural way to context-sensitive grammars. These particular operations are of interest in that there is some evidence that in conjunction they may serve as a formal model for certain kinds of historical changes in the base component of a grammar.

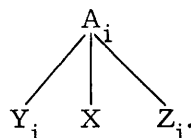
The first operation is simply that of rule deletion (formally speaking, deleting the  $i^{\text{th}}$  rule from the  $j^{\text{th}}$  grammar). It is obvious that, in general, the result of this

operation is to modify the generative capacity of the grammar, and perhaps also to reduce the stock of nonterminals if there were no other rules besides the deleted one that expanded a certain symbol.

The second operation we call truncation. This consists of modifying a grammar from which a rule has been deleted as follows: Suppose we delete a rule of the form  $B \rightarrow X$ , where the symbol  $B$  appears on the right-hand side of the rules  $A_1 \rightarrow Y_1 B Z_1$ ,  $A_2 \rightarrow Y_2 B Z_2$ ,  $\dots$ ,  $A_n \rightarrow Y_n B Z_n$ . Then the truncated grammar will contain the rules  $A_1 \rightarrow Y_1 \left\{ \begin{array}{c} X \\ B \end{array} \right\} Z_1$ ,  $A_2 \rightarrow Y_2 \left\{ \begin{array}{c} X \\ B \end{array} \right\} Z_2$ ,  $\dots$ ,  $A_n \rightarrow Y_n \left\{ \begin{array}{c} X \\ B \end{array} \right\} Z_n$ . In terms of trees, truncation takes us from structures of the form



to structures of the form



Note that rule deletion with truncation does not change the weak generative capacity of the grammar, and does not necessarily remove from the grammar the nonterminal to the left of the arrow in the deleted rule.

The combined effect of these operations is to change the labelled bracketing of certain terminal sequences generated by the grammar (to wit: the string  $X$  is no longer dominated by  $B$ ). Now there may be various kinds of data which indicate that the structural description of strings has been changed through time in this manner. For example, suppose we have a transformation performing some operation on all strings dominated by  $B$ , and through time we observe that the string  $X$  ceases to undergo this rule. Then we might conclude that deletion of the rule  $B \rightarrow X$  with subsequent truncation had occurred. I think that a case can be made for deletion and truncation in the change in modal and auxiliary systems between Old English and Middle English, although the data have a rather different structure than that mentioned above. The point for the time being is that of seeing what predictions one might make concerning change if one takes deletion and truncation as a possible formal model.

It has been noted in the previous literature on generative grammar that one frequently finds the right-hand side of rules organizing themselves in conjunctive

sequences (sequences of the form  $\left. \begin{matrix} B_1 \\ B_2 \\ \vdots \\ B_n \end{matrix} \right\}$ ); or, as it has been traditionally formulated, one

finds systems of rules which are collapsible by the bracket notation. That one frequently finds systems of rules so collapsible is evidence that the bracket notation is to play a significant part in the general notion of simplicity of a grammar. Notice that the effect of truncation and deletion is to form a conjunctive sequence where there was none, or, more accurately, to add an extra term to any existing conjunctive sequence including a conjunctive sequence of one term. In this sense, rule deletion and truncation have the effect of materially simplifying the grammar in certain respects, which is what one might well expect of a process of historical change. (Alternatively, one might demand this as a consequence of any model of historical change, although it is necessary to be careful here, as a simplification in one part of the grammar could result in greater complication in another.) In fact, if it can be shown that deletion and truncation will serve as a model of change, one could 'explain' such a model on synchronic grounds in terms of a preference on the part of the language learner to organize rules conjunctively. (Clearly, one has to explain all changes on synchronic grounds anyhow, as no greater confusion arises than that from thinking of changes as entities or processes existing sui generis.)

Thus, there is a relation between deletion and truncation and conjunctive sequences. And we might then proceed to see if there is not some analogous relation between these operations and disjunctive sequences (sequences of the form  $(a_1)(a_2)\dots(a_n)$ ). What one finds is that one does get disjunctive sequences when these operations are applied to sets of rules of a certain kind. Let us define a conjunctive stack to be a set of rules of the form:

$$\begin{array}{l}
 A \longrightarrow a \left\{ \begin{matrix} B_1 \\ B_2 \\ \vdots \\ B_k \end{matrix} \right\} \\
 B_1 \longrightarrow b_1 \left\{ \begin{matrix} B_2 \\ \vdots \\ B_k \end{matrix} \right\} \\
 \vdots \\
 B_i \longrightarrow b_i \left\{ \begin{matrix} B_{i-1} \\ \vdots \\ B_k \end{matrix} \right\} \\
 \vdots \\
 B_k \longrightarrow b_k
 \end{array}$$

For working purposes, let us deal with the particular stack

- (1) (1a)  $A \longrightarrow a \left\{ \begin{array}{c} B \\ C \\ D \end{array} \right\}$   
 (1b)  $B \longrightarrow b \left\{ \begin{array}{c} C \\ D \end{array} \right\}$   
 (1c)  $C \longrightarrow c D$   
 (1d)  $D \longrightarrow d.$

Note, first, that the weak generative capacity of a conjunctive stack is a set of strings collapsible by the parenthesis notation to the string  $a(b_1)(b_2)\dots(b_{k-1})b_k$ ; likewise, the set of rules (1) generates  $a(b)(c)d$ .

Suppose that we delete rule (1b) and truncate; we then get the following:

- (2) (2a)  $A \longrightarrow a \left\{ \begin{array}{c} b \left\{ \begin{array}{c} C \\ D \end{array} \right\} \\ C \\ D \end{array} \right\}$   
 (2b)  $C \longrightarrow c D$   
 (2c)  $D \longrightarrow d$

And by the conventions for collapsing according to the bracket and parenthesis notations, rule (2a) is written as (2a)'.

$$(2a)' \quad A \longrightarrow a(b) \left\{ \begin{array}{c} C \\ D \end{array} \right\}$$

Repeated deletion of (1c) and (1d) with truncation reduces the system of rules (1) to the single rule (3).

$$(3) \quad A \longrightarrow a(b)(c) d$$

We have seen, then, that application of the operations of deletion and truncation to conjunctive stacks yields rules collapsible by the parenthesis notation. The interest of this lies in the evidence that the system of rules for Old English modals and auxiliaries, which system preceded the modern rule  $Aux \rightarrow Tns (M)(have+en)(be+ing) V$ , looked in essential respects like a conjunctive stack. And one can argue further for the changed constituent structure of certain strings, which would result from deletion and truncation, on the basis of certain changes in the transformational component for which there is abundant evidence.

It is not my purpose here to present or support in detail this analysis of the change in auxiliary system from Old English to Middle English. (This the author has done

elsewhere.<sup>1</sup>) Briefly, however, one can make the case that the Old English predecessors of modern modals and auxiliaries each appeared as a main verb in its own sentence as in Modern German, and that, as in German, there was a transformation of Verb Final moving the verbs in subordinate clauses to the end of their clauses.<sup>2</sup> The options for choosing the various elements of the modals and auxiliaries in the embedded sentences produces a structure that has all of the essential properties of a conjunctive stack. One can then argue that the loss of the rule of Verb Final from Old English to Middle English no longer required that modals and auxiliaries be main verbs in deep structure, for there was no longer a rule that applied to them requiring them to have that analysis. Thus a reanalysis was possible, and some facts from Middle English indicate that such reanalysis followed the pattern predicted by the model of deletion and truncation.

As remarked above, my purpose in this report is not to detail any particular historical change, but to suggest, for the purposes of further research, a possible model for change which produces good results in at least one case. There has been nothing said, thus far, concerning phonology and what predictions one would make, in this case, if one adopted a model such as that suggested here. We shall conclude with some remarks on this subject.

We must first define the operations of rule deletion and truncation for the class of context-sensitive grammars. The first notion carries over directly, but it is not so clear how one ought to define truncation, especially as one deals with complexes of features instead of unanalyzed nonterminals in the context-sensitive rules of phonology. One needs data in order to see how to proceed in this case.

Two cases in which the notions of truncation and deletion might apply suggest themselves. The first case is that in which these operations apply to the symbol on the right of the arrow in a rule of phonology, and the second is that in which the operations apply to the context of the rule. For example, in the first case we might have at one stage two rules in the phonology of the form

$$\begin{aligned} A &\longrightarrow B / \text{ \_\_\_\_\_\_ } C \\ B &\longrightarrow D / \text{ \_\_\_\_\_\_ } C E \end{aligned}$$

By a process of truncation and deletion of the second rule, we would then have

$$A \longrightarrow D / \text{ \_\_\_\_\_\_ } C(E).$$

One would predict from such an account that the distribution of forms in the second stage would differ from that in the first by virtue of the disjunctive ordering of the collapsed rules in the second stage.

For an example of deletion and truncation operating in the environment of rules, we might consider the system

$$\begin{array}{l} A \rightarrow B / \text{_____} \left\{ \begin{array}{l} D \\ C \end{array} \right\} \\ C \rightarrow \emptyset, \end{array}$$

where the second is a late rule of the grammar. We might then find at a later stage the two rules becoming disjunctively ordered and collapsed as

$$A \rightarrow B / \text{_____} (D).$$

In general, then, one might look for instances of the operation of deletion and truncation in phonology by considering the historical versions of certain synchronic rules which involve disjunctive ordering.

J. P. Kimball

#### References

1. J. P. Kimball, "Conjunctive Stacks and Disjunctive Order in English Diachrony," Massachusetts Institute of Technology, 1967 (unpublished).
2. J. R. Ross, "Auxiliaries as Main Verbs," Massachusetts Institute of Technology, 1967 (unpublished).

#### B. TONE IN EWE

Traditional analyses of Ewe tone (Westermann,<sup>1</sup> Berry,<sup>2</sup> Welmers<sup>3</sup>) have set up three levels of tonemes: High, Mid, and Low, and two compound, or kinetic, tonemes: Rising and Falling. Ansre<sup>4</sup> recognized that the low-mid distinction was allotonic, and postulated four tonemes: High, Non-high, Rising and Falling; later, Ansre<sup>5</sup> reduced this to three by the tacit omission of the falling tone. Taking Ansre's<sup>6</sup> analysis further, it seems to me that with a number of relatively minor exceptions<sup>7</sup> all of the phonetic tones of Ewe can be predicted by rule from knowledge of the underlying form of each lexical item, provided this includes the location of "high tone" (+H) or accent.

This is clearly true for the level tones, less obviously so for the kinetic tones. I would claim, however, that in the underlying form of Ewe words there is no rising or falling tone. Phonetically, kinetic tones arise from sequences of vowels which may either be present in the lexical entries or arise from the insertion of a vowel or vowels by rule. The former case is exemplified by nouns with phonetically rising tone; the latter, by verbs that assume rising or falling tone in certain environments.

As the consonant system of Ewe interacts closely with the tonal system, I shall give a partial feature specification of the "phonemes."





Note: 1. I have no evidence whether gb, kp should be treated as labialized velars or velarized labials. This is irrelevant for tone anyhow.

2. r, l are in complementary distribution: r occurs after a consonant with the feature [+coronal], l occurs elsewhere.<sup>8</sup>

|                        |                     |
|------------------------|---------------------|
| e. g. , trè - calabash | gblò - speak        |
| dzrè - quarrel         | klò - knee          |
| yrá - bless            | mlò - sit           |
| nyré - sharpen etc.    | ló - crocodile etc. |

3. This distribution of r/l is the major justification for assigning ny and y the feature [+coronal].

4. w, γ are in complementary distribution: w occurs before vowels with the feature [+rounded], γ occurs elsewhere.

|                   |                  |
|-------------------|------------------|
| e. g. , wù - beat | γí - white       |
| wó - they         | γé - borrow      |
| wò - do           | γá - scrape etc. |

The underlying canonical form of Ewe words is

$$(V) C \left( \begin{array}{l} +son \\ -voc \\ -nas \end{array} \right) V (V)^9$$

Hereafter, the possibility of a postconsonantal sonorant will be ignored, as it plays no role in the tonal system. Note that the vast majority of items, including all verbs, have short underlying vowels. By convention, the unmarked tone is  $\begin{bmatrix} -High \\ -Low \end{bmatrix}$ . Any vowel, whether in the lexicon or introduced by rule, which is not marked otherwise is presumed to have these features. In general, only the last vowel may be marked [+H] in the lexicon, although in a few cases of polysyllables other vowels may need to be marked. A word-initial vowel may never be marked.

If we consider the following examples:

- 1 mè yì<sup>10</sup> - I went
- 2 me vá - I came
- 3 ame vá - a person came
- 4 me kpó àmè - I saw a person
- 5 me bu wó - I respect them
- 6 mè bù wò - I respect you

it is clear that besides the marking convention mentioned above, we need a rule applying to non-high tone vowels to turn them low sentence-finally and before another low tone:

$$I \quad \left[ \begin{array}{l} V \\ -H \end{array} \right] \rightarrow [+L] / \text{---} \left\{ \begin{array}{l} \# \\ [+L] \end{array} \right\}$$

There are, however, some extensions to this generalization which depend on

- a. the class of consonant before and/or after the vowel
- b. the grammatical class of the item in which the vowel appears, and also of the item following
- c. the syntactic environment.

In nouns, Rule I must be extended to all cases in which the noun has initial  $\begin{bmatrix} -\text{son} \\ +\text{voice} \end{bmatrix}$  when it always has low tone. Thus

|        |       |          |    |        |              |
|--------|-------|----------|----|--------|--------------|
| 7      | dà    | - snake  | -- | dà lá  | - the snake  |
| 8      | hà    | - pig    | -- | hà lá  | - the pig    |
| 9      | βùú   | - drum   | -- | βù lá  | - the drum   |
| 10     | d èví | - child  |    |        |              |
| cf. 11 | f ù   | - sea    | -- | f u lá | - the sea    |
| 12     | kpò   | - stick  | -- | kpo lá | - the stick  |
| 13     | toó   | - mortar | -- | to lá  | - the mortar |
| 14     | nyì   | - cow    | -- | nyi lá | - the cow    |
| 15     | γè    | - sun    | -- | γe lá  | - the sun    |
| 16     | nuú   | - mouth  | -- | nu lá  | - the mouth  |
| 17     | kofí  | - Kofi   |    |        |              |

II  $\begin{bmatrix} V \\ -H \end{bmatrix} \rightarrow [+L] / \begin{bmatrix} +\text{voice} \\ -\text{son} \\ +\text{noun} \end{bmatrix} \text{--- (C V)}$

In nouns with an initial vowel (nearly always /a/) this vowel remains low except before a sonorant consonant followed by a non-low tone.

|        |        |              |  |  |  |
|--------|--------|--------------|--|--|--|
| 18     | alé    | - sheep      |  |  |  |
|        | ame lá | - the person |  |  |  |
| cf. 19 | àmè    | - person     |  |  |  |
|        | átí    | - tree       |  |  |  |
|        | àhà    | - wine       |  |  |  |
|        | àhà lá | - the wine   |  |  |  |

III  $\begin{bmatrix} V \\ -H \end{bmatrix} \rightarrow [+L] / \text{---} \begin{bmatrix} -\text{son} \\ +\text{noun} \end{bmatrix} V$

In verbs, the class of the initial consonant is irrelevant, and the tone remains low as predicted by Rule I and also in all cases except the following:

- a. when the initial consonant of the item immediately following the verb is a sonorant, in which case the tone of the verb assimilates to mid before mid or high tone.

|        |                      |                         |
|--------|----------------------|-------------------------|
| 20     | mè gbè kútsétsé á wó | - I plucked the fruits  |
| but 21 | me gbè aṅutí á wó    | - I plucked the oranges |

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- 22 wó wò kúnú – they performed a funeral  
 but 23 má a du nú – I shall eat (thing)  
 24 mè fì kpo lá – I stole the stick  
 but 25 me fì yí lá – I stole the cutlass

If the item immediately following the verb is an adverb, the unmarked mid tone occurs before any class of consonant followed by a vowel on a non-low tone.

- 26 é tsi kábá – he grew fast  
 27 me zɔ hlóyíhlóyí – I walked clumsily  
 cf. 28 mè wù kesé lá – I killed the monkey

b. when the verb is followed by another verb and is not preceded by a low tone, the tone of the first verb remains mid before mid or high.

- 29 àtí hǎǎ mu dze m'ó á mè – a tree also fell in the road  
 30 é da nú du kló àgbà w'ó mè – he cooked food, ate, and washed the dishes  
 31 kofí xa zɔ vá kp'ó ame gǎ lá à – did Kofi come to see the great man?  
 cf. 32 yàwò xa zɔ vá kp'ó ame gǎ lá à – did Yawo come to see the great man?

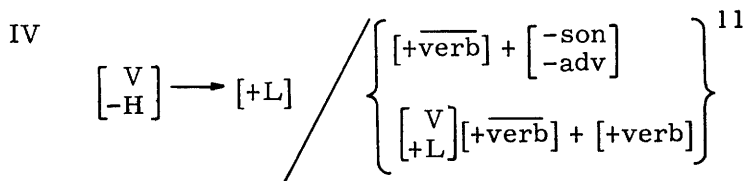
(Note that the class of items including /xa/ here, the so-called "verbal augments," behave tonally exactly like verbs).

c. when the verb is followed by the marker of the present continuous /m/ and is not preceded by low tone.

- 33 dèví á w'ó n'ò kpé da m' – the children were throwing stones  
 cf. 34 w'ó lè hà dzi m' á z' – they are singing a song now

Note that (c) is a special case of (b) inasmuch as the full marker of the present continuous is the discontinuous /le...m/ which will itself have the feature [+verb].

The rules for non-high tone verbs can then be formulated to produce the following schema:



There is a further set of conditions under which non-high tone vowels become low even before non-low tone vowels.

1) In the imperative singular, if the verb is non-high tone, the tone of the vowel of this verb and of all succeeding vowels is low, until a high tone is reached.

- 35 wù lǎklè lá – kill the leopard!  
 cf. 36 w'ó wu lǎkle lá – they killed the leopard  
 37 gbè àṅ utí á w'ó – pluck the oranges

cf. 38 me gbe aṅ utí á wó – I plucked the oranges

Note that this rule applies only if the non-high tone imperative verb is initial; contrast:

39 nò ànyí – sit down!

and 40 vâ nɔ anyí – come and sit down!

In 40 /vâ/ comes from underlying /vá/ (cf. Rule 11) and the following verb /nɔ/, although imperative, remains mid.

2) After a small set of items including /fífílàà/ – "now," /ɔ̀è/ – verbal emphazier, and maybe one or two others, followed by a pronoun subject, the tone of the vowel of the pronoun and the tone of all succeeding vowels is low until a high tone is reached.

41 me zɔ kpóókpóó – I walked quietly

but 42 ɔ̀è mè zò kpóókpóó – I did walk quietly

43 me vá ɔ́ó – I came and arrived

but 44 fífílàà mè vá ɔ́ó – just now I came and arrived

cf. 45 fífílàà ame vá ɔ́ó – just now a person came and arrived

3) There is also a set of nominals which have the same effect when head of a noun phrase: e. g., /gèdèè/ – "many," /àhòsì/ – "widow," /yàwò/ – "proper name," etc. All these items are inherently non-high tone, but not all non-high tone items appear to belong to this class.

31 kofí xa zɔ vá...

but 32 yàwò xà zò vá...

46 mɔ́ zɔla ɲe ɲeé – groaning traveller

but 47 àhòsì ɲè ɲeé – groaning widow

and 48 ame ɲe ɲeé – groaning person (/àmè/ in citation)

We may formulate these cases in the schema:

$$V \quad \left[ \begin{array}{c} V \\ -H \end{array} \right] \rightarrow [+L] \quad \left\{ \begin{array}{c} \# [ \\ V \\ \left[ \begin{array}{c} V \\ +X \end{array} \right] \end{array} \right\} C \left( \left[ \begin{array}{c} V \\ -H \end{array} \right] C \right)^* \text{ ———}$$

where the feature complex  $\left[ \begin{array}{c} +X \\ +low \end{array} \right]$  is ascribed to pronouns in the environment after /fífílàà/, etc; and the subclass of nouns is so marked in the lexicon.

It would be possible to ascribe this same feature [X] to the imperative case, as well; but I am not convinced that this is the same phenomenon, and doing so would exclude an argument for the ordering of subsequent rules (Rules 11 and 12) below. The imperative examples can probably be ultimately related to one of the rules of derivational

morphology which states that a compound whose first element is a non-high tone verb has low tone throughout until a high tone is reached:

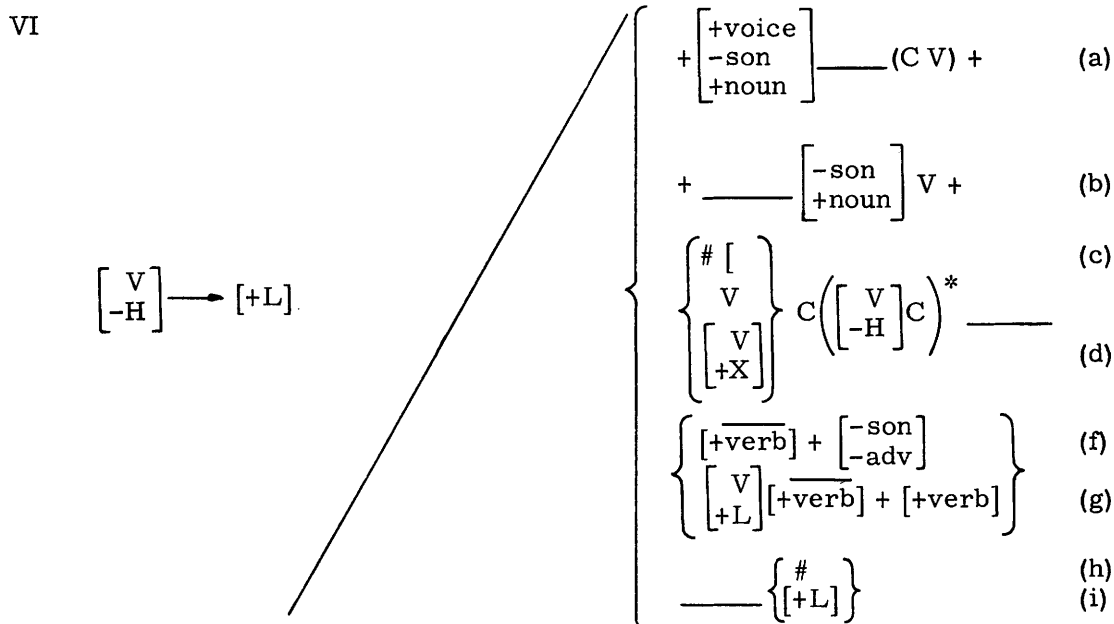
e.g., /dù-àmè-tsà-tó/ - "tarantula" Literally: "bite-person-go about-tell"

/dù-àmè-dzi-hlũí/ - "centipede" Literally: "bite-person-heaven-thunders"

(Note that /dzi/ contains an underlying high tone.) cf. Ansre.<sup>12</sup>

Note that Rule V must precede Rule IV, as the low tone specified in the environment of the latter may arise from the former.

We may now conflate schemata I-V to produce:



This schema accounts for the majority of the tonal phenomena in Ewe.<sup>13</sup> There are, however, other rules, most of which have to precede this one, one of which is unordered, and two of which must follow.

Rule VI(a) states that nouns beginning with a voiced nonsonorant are invariably low tone. There is, however, at least one exception:

49 é lè dɔ wɔ m̄ - he is working

50 é lè dà wù m̄ - he is killing a snake

Those nouns whose underlying form is +voice C V V<sup>14</sup> become mid in this environment, those whose underlying form is +voice C V become low. (Note also the reaction of this on the tone of the verb.)

There is an independently motivated rule which deletes the high-tone (second) vowel of nouns and demonstratives in specific environments; first, before high tone<sup>15</sup>:

|                              |                            |
|------------------------------|----------------------------|
| 51 d̄ɔ́ <sup>16</sup> - work | -- d̄ɔ́ lá - the work      |
| zèé - pot                    | -- zè lá - the pot         |
| toó - mortar                 | -- to lá - the mortar etc. |

(The forms underlying dòó, zèé and toó are /dɔɔ, zee, too/ with the second vowel marked [+H] redundantly, and the unmarked first vowel remaining mid unless marked low by Rule VI).

Second, in all compounds:

- 52 dèé - palm + àhà - wine → dehaá - palm-wine  
 (cf. fn. 18)  
 gbǎǎ - goat + àtsú - male → gbǎtsu - he-goat

The environment of this rule can therefore be extended to the case in which the object noun precedes the main verb as in examples 49 and 50 (in fact, in the continuous construction with /m̄/ or /ḡé/). So we have:

$$\text{VII} \quad V \rightarrow \phi^{17} / C V \left[ \begin{array}{l} \overline{+noun} \\ \overline{+DEM} \end{array} \right] \left\{ \begin{array}{l} (C) \left[ \begin{array}{l} V \\ +H \end{array} \right] \\ +YZ \text{ (i. e., in compounds)} \\ [+verb] \\ \text{VP} \end{array} \right\}$$

As it stands, however, Rule VII merely equates /dà/ and /dòó/, with the result that both 49 and 50 would end up with low tone on the noun and the verb. To avoid this, nouns of the form exemplified by /dòó/ are marked as exceptions to Rule VI in the particular syntactic environment specified.

Readjustment Rule I

$$V \rightarrow [-\text{Rule VI}] / C \left[ \overline{+noun} \right] V + \left[ \overline{+verb} \right] \text{VP}$$

Hence the derivation of sentences 49 and 50 is

|               |                                       |           |
|---------------|---------------------------------------|-----------|
| é le da wu m̄ | é le dɔɔ wɔ m̄                        |           |
|               | (with all tones [-Low] by convention) |           |
| "             | é le dɔ wɔ m̄                         | (by VII)  |
| é le dà wu m̄ | "                                     | (by VIa)  |
| é lè dà wu m̄ | é lè dɔ wɔ m̄                         | (by VI f) |
| é lè dà wù m̄ | "                                     | (by VI g) |

(where ditto marks indicate that the rule was inapplicable)

High-tone verbs preceding an object noun whose tone is non-low change this high tone to falling.

- 53 kpó - to see -- é kpóò kpé - he saw a stone  
 54 dí - to look for -- mí a dí ì tú - we shall look for a gun  
 55 wódí ì fya lá - they looked for the chief

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- cf. 56 kpó dèví á dá – look for the child  
 57 me dí bé é vá – I want him to come

$$\text{VIII} \quad \phi \rightarrow V/C \begin{bmatrix} V \\ +H \\ +\text{verb} \end{bmatrix} \text{---} + C \begin{bmatrix} V \\ -L \\ +\text{noun} \end{bmatrix}$$

This rule must precede VI as the inserted vowel, which is  $\begin{bmatrix} -\text{High} \\ -\text{Low} \end{bmatrix}$  by convention, remains mid or becomes low, determined by the class of the following consonant: i. e., mid before a sonorant, low otherwise. Thus in the following examples:

- 58 é kpóó ńó – he saw a worm  
 59 e kpóò só – he saw a horse

we get /kpóò/ in 59 by rule VI<sub>f</sub>, and /kpóó/ in 58 by convention.

There are three rules needed to assign the correct tone to various particles. The first of these assigns the tone of the preceding verb to the continuous-aspect particle /a/ (which has an alternant /na/).

- 60 me dzó ná gà èvè mè – I arrive at two o'clock  
 61 fya mé fo a nuú lè hà mè ò – the chief does not speak in public  
 62 mè yì nà àsì mè gbèsíàgbè – I go to market every day

$$\text{IX} \quad (n)a \rightarrow [aH] / C \begin{bmatrix} V \\ +\text{verb} \\ aH \end{bmatrix} \text{---} \begin{matrix} \text{continuous} \\ \text{aspect} \end{matrix}$$

The second assigns high tone to the future tense particle /a/ between two non-high tones, and before noninitial serial verbs,<sup>19</sup> and leaves it unmarked elsewhere.

- 63 ma à zù kesé – I shall become a monkey  
 64 wó à lè tsi, á du nú, á há mló anyí – they will bathe eat and lie down  
 65 wó má a go dà fufù ò – they won't cook fufu again

$$\text{X} \quad \begin{matrix} a \\ \text{future} \end{matrix} \rightarrow [+H] / \left\{ \begin{matrix} [-H] \text{---} [-H] \\ \# \text{---} \end{matrix} \right. \text{(i. e., before serial verbs)} \}$$

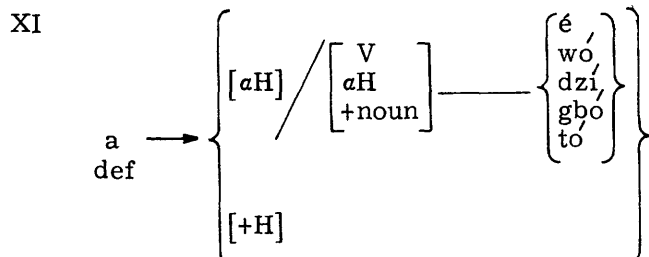
The third specifies the tone of the enclitic article /a/ which assimilates to the tone of the preceding noun before five items:

- /é/ – a nominal emphazier  
 /wó/ – the plural marker

and three postpositions: /dzí, gbó, tó/,  
 and becomes high elsewhere.<sup>20</sup>



- 66 àvò à é kofí tɔ́ dzò è — it was the cloth Kofi set fire to  
 67 xɔ́ a wó kátáá mù — all the houses fell down  
 68 è vî á tsì — his child has grown  
 69 takú yíí èvè nò kplɔ́ a dzí — there were two white scarves on the table



All of these three rules, IX, X, XI, must precede VI as the non-high tone vowels introduced appear either as mid or low, as predicted. It is also necessary to assume that the sequence "verb + a" is itself a verb, and that the sequence "noun + a" is itself a noun. Presumably, syntactic evidence for this will be forthcoming.

Next, we have two rules applying to individual items that have further environmental restrictions than those elaborated in VI. The first applies to the copula /le/ which assumes low tone both under the conditions specified in VI and whenever preceded by a low tone at all — irrespective of the following environment.

- 70 gá lè wó sí — they have money  
 cf. 71 gá lá le wó sí — they have the money  
 or 72 g̀lì mu énumáké — a wall suddenly fell down

XII le → [+L] / [+L]

As the preceding low tone in the environment of this rule may arise from Rule VI<sub>d</sub>, but if /le/ is not in this environment it is subject to Rule VI<sub>f</sub> just as any other verb. Rule XII must be incorporated as a special case between VI<sub>d</sub> and VI<sub>f</sub>.<sup>21</sup>

The second special case is the repetitive /ga/. This has traditionally been treated as a particle, but should probably be regarded as a defective verb. Its tonal behavior obeys Rule VI, except when it follows a future marker, in which case its tone is invariably mid. To account for this, we merely need to insert a readjustment rule making /ga/ an exception to Rule VI in this environment; the mid tone will then appear by convention.

- 73 wó má a ga dà fufù ò — they won't cook fufu again  
 74 mí má a ga wò à ò gbèdé ò — we shall never fight again  
 75 nyè mé gà lè tsìtsì m̀ ò — I'm not growing any more  
 in which last example /ga/ has been assigned low tone by Rule VI.

Readjustment Rule II

ga → [-Rule VI] / future \_\_\_\_\_

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The initial vowel of nouns of the form: V C V (V(CV(V))), which is always underlyingly non-high, becomes high after a possessive.

- |    |            |              |                    |                   |
|----|------------|--------------|--------------------|-------------------|
| 76 | à d`áá     | - sugar-cane | -- wò á d`áá       | - your sugar-cane |
| 77 | à z`íí     | - egg        | -- míá f é á z`íí  | - our egg         |
| 78 | àmì        | - oil        | -- dàdà f é à m`ì  | - mother's oil    |
| 79 | áf` ɔ kpaá | - shoe       | -- nyè á f` ɔ kpaá | - my shoe         |

XIII V → [+H] / Possessive + [+noun] C V (V(C V(V)))

Similarly, one subclass of nouns, whose initial consonant is a voiced nonsonorant and has a double vowel in the stem, changes this vowel to a short high-tone vowel after the possessive.

- |        |         |         |               |            |
|--------|---------|---------|---------------|------------|
| 80     | à b`ò`ó | - arm   | -- wò á b`ó   | - your arm |
| 81     | gb`ò`ó  | - goat  | -- nyè gb`ó   | - my goat  |
| 82     | zèé     | - pot   | -- míá f é zé | - our pot  |
| cf. 83 | g`ò`ó   | - gourd | -- nyèé g`ó   | - my gourd |
| 84     | dòó     | - hole  | -- é f é dòó  | - his hole |

As a long vowel already containing a high tone becomes simply a high vowel, this is best treated as a deletion rule.

XIV V → φ / Possessive + (V) [-son, +voice] [+noun] [+H]

Note that the underlying form of "my" is /nyèé/ which becomes /nyè/ by Rule VII (cf. also example 75). Hence Rules XIII and XIV must precede Rule VII or we should be unable to generate 79, as well as both 81 and 83.

In relative clauses, the second vowel of a noun of the form V C V, where the consonant is a sonorant, becomes high tone. This rule applies to no other class of noun.

- |        |                                   |  |
|--------|-----------------------------------|--|
| 85     | amé si kp`ó` dá lá lá né vá w`ù`  | - let him who saw the snake come and kill it |
| 86     | w`ó` w`ò` kúnú ná amé si w`ó` ... | - they buried the people who ...             |
| cf. 87 | ame w`ó` y`ì` à f` é              | - the people went home                       |

XV V → [+H] / V [+son] [+noun] / Relative

Note that this rule must precede VI or the tone of the initial vowel would become low instead of remaining mid.

An unordered rule inserts a low tone at the end of any sentence, irrespective of subordination or coordination, in which there is an overt marker (wh-word) of the interrogative.

- 88 àfí kaá ne gblẽ dèví á dó. — where did you leave the child?  
 89 àfí kaá ne gblẽ dèví á do háfí vá le ye dú m. — where did you leave the child  
 before you came to dance?  
 90 núdudu kaa wó flè éye wó ká ná mí kpó. — which food did they buy and  
 prepare for us before?  
 (kaá = "which")

XVI  $\phi \rightarrow [+L] / X \text{ Interrog } Y [+son] \_\_\_\_\_ \#$

As the falling tone in these examples is short, I have merely inserted a low tone after the final sonorant (no sentence or word can end in a nonsonorant) rather than insert a copy of this final sonorant on a low tone and then shorten it. No importance attaches to this abbreviatory mechanism.

Finally, we have two rules applying to high-tone verbs in the imperative.

A high-tone verb beginning with a voiced consonant becomes rising in the imperative.

- 91 vá — to come — -- vää — come!  
 92 ná — to give — -- nää gà kofí — give the money to Kofi!

XVII  $\phi \rightarrow \left[ \begin{array}{c} V \\ +L \end{array} \right] / \# \left[ \begin{array}{c} +\text{voice} \\ C \end{array} \right] [+verb] \left[ \begin{array}{c} V \\ +H \end{array} \right] (V) +$

The optional vowel in the environment of Rule XVII has to be included in case the verb has already undergone Rule VIII. Thus, if a verb begins with a voiced consonant, is followed by an object noun with a non-low tone vowel and is in the imperative, it will be subject to both Rules VIII and XVII. In this case the resultant tone is the expected rise-fall:

- 93 dì í tú á — look for the gun!

where /dí/ — "to look for" has become /dí̀/ by VIII and finally /dì í̀/ by XVII.<sup>22</sup>

Note that the possibility of the vowel of one verb meeting the structural description of both of these rules, and acquiring the features of each, precludes conflating the rules in any way. Moreover, for reasons stated, VIII must precede VI, whereas, if we are to account for 40 (/vâ nɔ anyí/), where the imperative /nɔ/ is non-low after /vâ/, presumably because /vâ/ is underlying high /vá/, without having recourse to the use of ad hoc features, XVII must follow VI.

As it stands, Rule XVII is a little too powerful; for instance, /vá/ — "to come" in:

- 94 vâ lyá àtí — come climb the tree

becomes low instead of the expected rising tone. It is accordingly necessary to insert a further rule before XVII, stating that before another verb in the imperative, a high-tone verb with initial voiced consonant becomes low not rising.

XVIII  $\left[ \begin{array}{c} V \\ +H \end{array} \right] \rightarrow [+L] / \# \left[ \begin{array}{c} +\text{voice} \\ C \end{array} \right] [+verb] + [+verb]$

These rules are sufficient to deal with virtually all of the nonderivational tonal phenomena of Ewe. There are, of course, remaining problems, where I cannot account entirely for the data, and a number of items whose underlying form is dubious; but in general the rules as re-ordered below will generate the correct tonal shape of Ewe sentences.

Marking convention: Unmarked tone  $\longrightarrow$   $\begin{bmatrix} -\text{High} \\ -\text{Low} \end{bmatrix}$

Readjustment rules: 1)  $V \longrightarrow [-\text{Rule 10}] / C [+ \overline{\text{noun}}] V + [+ \text{verb}] \Big]_{\text{VP}}$

2)  $ga \longrightarrow [-\text{Rule 10}] / \text{future } \underline{\hspace{1cm}}$

Tonal rules:

1)  $V \longrightarrow [+ \text{High}] / \text{Possessive} + [+ \overline{\text{noun}}] C V (V(CV(V)))$  (XIII)

2)  $V \longrightarrow \phi / \text{Possessive} + (V) \begin{bmatrix} -\text{son} \\ +\text{voice} \end{bmatrix} [+ \overline{\text{noun}}]_p \begin{bmatrix} V \\ +\text{High} \end{bmatrix}$  (XIV)

3)  $V \longrightarrow \phi / C V \begin{bmatrix} +\overline{\text{noun}} \\ +\text{dem} \end{bmatrix} \left\{ \begin{array}{l} (C) \begin{bmatrix} V \\ +\text{High} \end{bmatrix} \\ + Y Z \text{ (i. e., in compounds)} \\ [+ \text{verb}] \\ \text{VP} \end{array} \right\}$  (VII)

4)  $\phi \longrightarrow V / C \begin{bmatrix} V \\ +\text{High} \\ +\text{verb} \end{bmatrix} \underline{\hspace{1cm}} + C \begin{bmatrix} V \\ -\text{Low} \\ +\text{noun} \end{bmatrix}$  (VIII)

5)  $(n)a \longrightarrow [a \text{High}] / C \begin{bmatrix} V \\ +\text{verb} \\ a \text{High} \end{bmatrix} \underline{\hspace{1cm}} \text{continuous aspect}$  (IX)

6)  $a \text{ (future)} \longrightarrow [+ \text{High}] / \left\{ \begin{array}{l} [-\text{High}] \underline{\hspace{1cm}} [-\text{High}] \\ \# \underline{\hspace{1cm}} \text{ (i. e., before serial verbs)} \end{array} \right\}$  (X)

7)  $a \text{ (def)} \longrightarrow \left\{ \begin{array}{l} [a \text{High}] / \begin{bmatrix} V \\ a \text{High} \\ +\text{noun} \end{bmatrix} \underline{\hspace{1cm}} \left\{ \begin{array}{l} \acute{e} \\ w\acute{o} \\ dz\acute{i} \\ gb\acute{o} \\ t\acute{o} \end{array} \right\} \\ [+ \text{High}] \end{array} \right\}$

8)  $V \longrightarrow [+ \text{High}] / V \begin{bmatrix} C \\ +\text{son} \end{bmatrix} [+ \overline{\text{noun}}] / \text{Relative}$  (XV)

- 9)  $\phi \rightarrow [+Low] / X \text{ Interrogative } Y [+son] \text{ \_\_\_\_\_\_ } \#$  (XVI)
- 10)  $\left[ \begin{array}{c} V \\ -High \end{array} \right] \rightarrow [+Low]$
- 11)  $\left[ \begin{array}{c} V \\ +High \end{array} \right] \rightarrow [+Low] / \# \left[ \begin{array}{c} C \\ +voice \end{array} \right] [+verb] + [+verb]$  (XVIII)
- 12)  $\phi \rightarrow \left[ \begin{array}{c} V \\ +Low \end{array} \right] / \# \left[ \begin{array}{c} C \\ +voice \end{array} \right] [+verb] \left[ \begin{array}{c} V \\ +High \end{array} \right] (V)$  (XVII)
- (a)  $\left[ \begin{array}{c} +voice \\ -son \\ +noun \end{array} \right] \text{ \_\_\_\_\_\_ } (C V)$
- (b)  $\left[ \begin{array}{c} -son \\ +noun \end{array} \right] V$
- (c)  $\# \left[ \begin{array}{c} V \\ +X \end{array} \right] C \left( \left[ \begin{array}{c} V \\ -High \end{array} \right] C \right)^*$
- (d) (VI)
- (e)  $[+Low] le$
- (f)  $[+verb] + \left[ \begin{array}{c} -son \\ -adv \end{array} \right]$
- (g)  $\left[ \begin{array}{c} V \\ +Low \end{array} \right] [+verb] + [+verb]$
- (h)  $\#$
- (i)  $\left[ \begin{array}{c} +Low \end{array} \right]$

I am greatly indebted to Professor Morris Halle for his unstinting help and criticism in the preparation of this report.

N. V. Smith

#### Footnotes and References

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2. J. Berry, The Pronunciation of Ewe (Heffer's, Cambridge, 1951).
3. W. E. Welmers and G. Ansre, "A Start in Ewe" (Preliminary edition - mimeographed, 1960).
4. G. Ansre, "The Tonal Structure of Ewe," *Hartford Studies in Linguistics*, I., 1961.
5. G. Ansre, "The Grammatical Units of Ewe," Ph.D. Thesis, University of London, 1966.
6. Most of the analysis is based either on Ansre's written material or on data acquired in discussions with him. I would like to acknowledge here our many pleasant hours of collaboration.
7. For instance, /éye/ - "and" is always high-mid; the second tone never becomes low under any circumstances. There are a few other similarly fixed items that could be listed in the lexicon.

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8. A similar phenomenon obtains in the distantly related language Dan (Ewe is in the Kwa sub-group of Niger-Congo, Dan is in the Mande sub-group), although the situation after palatal consonants in Dan is obscure. cf. 1. Bearth and H. Zemp, "The Phonology of Dan (Santa)," J. A. L. VI(i), 1967, pp. 14, 28.
9. Polysyllables, other than disyllables with an initial (V), are relatively infrequent; their structure is a repetition of monosyllables of the above-mentioned pattern. Pre-consonantal nasal consonants come from underlying nasal + vowel sequences.
10. ´ = High tone; ` = Low tone; Mid tone is unmarked. Falling and rising tone are represented by a sequence of vowels each with its own tone.
11. This fails to account for: /nyéé dzì dzè émé/ – I was relieved, where we should expect /dze/ on mid tone. Note that we do get mid before /e/: /àvùv` le é wɔ́ m'/ – he feels cold. I do not understand what is going on here.
12. G. Ansre, "The Tonal Structure of Ewe," op. cit., p. 44.
13. As indicated, this schema can be further generalized to include some examples of compounding; but this is outside the scope of the present discussion.
14. Remember that phonetically rising tones in nouns come from an underlying sequence of vowels. In fact, all nouns of the form (V)CVV are redundantly marked [+H] on the last vowel.
15. There are further restrictions on this rule: e. g., the deletion does not occur before the high-tone negative marker /mé/, but these are ignored.
16. Some dialects are reported (Welmers and Ansre, p. 62) to have a distinction between long and short rises. For these a low-level shortening rule triggered by a lexical feature would be necessary (possibly the same feature that is needed in Rule XIV).
17. For greater generality, it may be necessary to rephrase this rule as  $V \rightarrow [-H]$  (rather than zero), with a later deletion rule; as in some cases the vowel remains long: e. g., /kaá + é/ → kaaé.
18. Some form of this readjustment rule will be needed, anyhow, to account for the tone of the compound /dehaá/ cited in 52, and also for some cases of genitival tonal perturbation. These cases are ignored here.
19. When sentences with the same subject are coordinated, the output is this subject followed by a series of verb (phrase)s with no conjunctions, but with any tense markers repeated throughout.
20. /a/ is in partial free variation with /lá/ which is invariably high tone.
21. Note, however, examples such as: /...éye wò le wó sí/ – "... and it's theirs." /wò/ (the reflex of /é/ – "he, she, it" in subordinate clauses) is tonally transparent as a left environment, though it is tonally opaque as a right environment: cf. /àtí sì wò tsó lá vá fò è/ – "the tree he felled struck him."
22. There will also have to be a low-level shortening rule after XVII, as the vowel of /dì í/ is double, not triple, length.