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THE INTERACTION OF SEGMENTAL AND TONAL LEVELS: THE CASE OF [ɯ] IN TEMNE*

Julie F. Nemer
Fourah Bay College, University of Sierra Leone

and

Keith Wm. Mountford
Heidelberg College

Temne is a West Atlantic Mel language, spoken in northern Sierra Leone, which has both phonemic and morphological tone. This paper explores the interaction between tonal and segmental levels through the investigation of segmental rules of insertion and deletion and through verbal inflections and derivations. The paper shows that tonal patterns on Temne verbs are not additive, unlike the segmental portions of the verbs, and that the tones on verbs must be viewed as almost totally independent of the component morphemes of the verb. In the process, the paper argues for the analysis of [ɯ] as an underlying vowel and for the analysis of pronouns as noncliticized morphemes, which means that Temne has redundant subject markers in certain types of sentences. Both of these are issues which various authors have taken opposing stances on in the literature.

1. Introduction

Temne is a West Atlantic Mel language spoken in northern Sierra Leone.[1]

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[1]There are five dialects of Temne: Western, the most widely spoken dialect, found in the westernmost part of Sierra Leone; Yoni, spoken to the east of Western Temne; Bombali, spoken to northeast of Yoni; Western Kunike, spoken to the east of Yoni: and Eastern or Deep Kunike, which is spoken to the east of Western Kunike [Dalby 1962]. Schlenker [1861] worked on Western Temne;

Although it has phonemic and morphological tone, only two accounts of the language, Dalby [1966] and Wilson [1968], deal with tone to any extent. Some accounts mention tone but do not mark it (as in Wilson [1961] and Thomas [1916]), and others do not mention tone at all (as in Scott [1956] and Coleman [1967]). While most accounts mention processes which affect consonants and vowels (such as assimilation, deletion, insertion, and coalescence), even those analyses which include tonal phenomena do not deal with the interaction of non-tonal processes with tonal processes.

This paper will explore this interaction between tonal and segmental levels using as an example the processes of insertion and deletion affecting the Temne high back unrounded vowel [ɯ] . This vowel has a controversial status in the phonological literature on Temne. It has been analyzed by various scholars as a semi-vowel, as the syllabic variant of a non-syllabic consonant, and as an anaptyctic vowel in polysyllabic stems while being underlying in monosyllabic ones. The first part of this paper will therefore establish the status of [ɯ] as a normal vowel having the same properties as other Temne vowels and will also establish it as an underlying vowel in at least some instances. Once the status of [ɯ] as a normal Temne vowel has been established we will discuss the interactions of segmental and tonal levels that deletion and insertion of this vowel bring about. Such interaction between vowels and tones raises the question of how tones are to be represented underlyingly. These phenomena present problems especially for an analysis which assumes underlying tone to be the property of syllables or of single segments, i.e. part of the feature matrix of a vowel. As will be shown, to resolve such problems and reach a clearer understanding of what happens to a tone when the segment which bears it is deleted or inserted it will be necessary to assume that tone is the property of larger underlying sequences, i.e. morphemes or words.

Thomas [1916] probably also worked on Western Temne. It is not clear which dialects Sumner [1922] and Scott [1956] were working on. Wilson [1961] was working on Western Temne and Dalby [1966] was working on Yoni. This analysis is based on Western Temne.

2. Review and Discussion of Previous Analyses of [ɯ]

In order to understand the problem of the status of [ɯ] it is necessary to see how this vowel has been analyzed in the past: Schlenker [1861:xvii] describes it as "an imperfect vowel sound", which he contrasts with normal vowel sounds; Scott [1956:8] considers it to be a semi-vowel; Dalby [1966:7] appears to treat it as an allophonic reflex of a non-syllabic consonant in the environments in (1).

(1) CC → CɯC (where C ≠ ŋ, h, w, y)
Cy → Cɯy
Cŋ(C) → Cɯŋ(C)
ŋŋ(C) → ŋɯŋ(C)
VCCV → VCɯCV (usually)

For Dalby, [ɯ] therefore is everywhere derived, and one is left in doubt as to whether it is a vowel at all. Lastly, Wilson [1961:3-4] analyzes [ɯ] as inserted in concord elements, between the final consonant of a word and the initial consonant of the next word, and between the second and third consonants of a polysyllabic stem. Wilson considers all other occurrences of [ɯ] to be underlying.

2.1. The analyses of Schlenker and Scott. The first concern of this analysis will thus be to establish that [ɯ] , contrary to the accounts of Schlenker, Scott, and Dalby, is the same as other vowels of Temne. According to most analyses, the phonemic vowels of Temne are those in (2).

(2) i u
e o
ɛ ʌ ɔ
a

If we include [ɯ] as a phonemic vowel, Temne can be characterized as having a nine vowel system with three unrounded front vowels, three rounded back vowels, and three unrounded back vowels.[2]

[2]Only the vowels, /i,e,ɛ/ condition palatalization of /t,s,w/ . There-

(3) i ɯ u
e ʌ o
ɛ a ɔ

[ɯ] , therefore, fits into the symmetrical pattern in (3). While this is not a persuasive argument for the status of this segment as a vowel, the symmetrical pattern does have aesthetic appeal.

[ɯ] is somewhat shorter in duration that other Temne vowels, and this might have been what Schlenker meant when he described it as "imperfect". However, as will be shown below, it has the same phonological and distributional characteristics as non-controversial Temne vowels and therefore the length of [ɯ] cannot be considered a criterion for classifying it as something other than a normal vowel.

Scott analyzes [ɯ] as a semi-vowel. However, the semi-vowels have a defective distribution, appearing underlyingly in stem and word initial position only.[3] [ɯ] has the same distribution as the other vowels. Moreover, the only segments which bear surface tone in Temne are vowels and sonorant consonants, specifically /m, n, ŋ, r, l/ . The semi-vowels never bear tone. High back unrounded [ɯ] carries tone just like the other vowels. [ɯ] therefore acts like a vowel and not like a semi-vowel.

2.1.1. Dalby's analysis and Temne pronouns as independent words. Since Dalby's analysis hinges on a defective distribution for [ɯ] as opposed to other vowels, the environments in which [ɯ] is found are presented below. Temne vowels appear (a) word-initially, (b) between consonants, (c) after a semi-vowel, (d) in the environment of another vowel, and (e) word-finally. We will examine each possible environment in turn.

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fore, /a/, although phonetically rather front, can be said to act like a back vowel.

[3]All other surface occurrences of [w] and [y] can be shown to be derived from the underlying high vowels:

ɔ́ tʊ́		'he is sick'	ùtwɪ́	/tu+i/	'he is sickly'
ɔ́ g͡bʌ́Ts	/g͡bʌl+s/	'he chops wood'	ɔ́ g͡bʌ́y	/g͡bʌi/	'he breaks open'
			ʌ̀g͡bʌ́yʌ́	/g͡bʌl+ʌ/	'it is broken'

For a formalization of this rule, see (27), rule 6.

(a) Vowels appear word-initially in concord elements and pronouns. [ɯ] does not appear in this position as there is no concord element or pronoun which begins with this segment. As can be seen in (4), /ɵ/ and /o/ also do not appear in this position.[4]

(4) Word-initially

ɾ	'I'	-------		ù	'a [+AN]' (ANimate)
-------		ńŋ	'the (sg.)'	-------	
é	'the (pl.)'	ńŋ	'the (pl.)[+AN]'	ó	'the (sg.) [+AN]'

Therefore, the fact that [ɯ] does not appear word-initially is not significant.

(b) All vowels, including [ɯ] , appear between consonants. In our corpus there are no [ŋɯC] sequences, a fact which Dalby considers significant, but there are also no [ŋaC] or [ŋɛC] sequences.

(c) Vowels appear after /y/ and /w/ .

(5)	mùyɾ	'a state, condition'	yùnt	'trees'	kùyókó	'a cassava'
	rùyèm	'a lie'			ùyòlɔ́	'a rich person'
	ùyɛ́k	'a monkey'	ùyɔ́	'an old woman'		
	ùwìr	'a goat'			ùwùnɾ	'a person'
	ùwèr	'a rodent'			ʌ̀wɔ́l	'a game'
	ɔ́ wɛ́k	'he squeezes out'	ùwàn	'a child'	mʌ́ wɔ́n	'it is hot/warm'

As the examples in (5) show, any gaps do not seem to be significant. [ɯ] does not occur after /w/ , but neither does /ʌ/ , a segment whose status as a vowel has never been questioned. And while there are very few cases of [ɯ] appearing after /y/ , there are no occurrences of /u/ or /ʌ/ in this posi-

[4]Throughout this paper /ɡ͡b/ indicates a voiced co-articulated labio-velar stop, /t̪/ indicates a voiceless unaspirated lamino-alveolar stop, /t/ indicates a voiceless aspirated apico-alveolar stop, and /ɯ/ indicates a high back unrounded vowel. Tone will be indicated as follows: High tone V̂ or H (underlying); Low tone V̌ or L (underlying); Mid tone V̄ or M (underlying) or H (with surface tone derived by downstep); Lowered mid V̄ or M (underlying); High tone falling to mid V̂ or HM (underlying) or HL (with surface tone derived).

tion.

(d) Vowels can appear in the environment of another vowel, usually a high vowel. If the two vowels differ in tone, both vowels appear as vowels on the surface:

(6)	ʌ̀ràfʃà	'a raffia'	ɔ̀ yáʌ̀	'he is lazy'
	mʊ̀sɔ̀ʃ	'some soap'	ʊ̀kʃàmdɛ̀r	'a carpenter'

There are very few examples of this type, and the fact that none of them contains [ʊ] does not seem to be significant.

If the two vowels have the same tone, the high vowel appears as the corresponding semi-vowel (cf. (27), Segmental Rule 6). The overwhelming majority of these sequences have the shape CVy . The rest have shapes CwV and CyV .

(7)	ʌ́ bʃyā	'it becomes black'	-------		ʌ̀kwʃ	'an alligator' (/kʊ́ʃ/)
	mʌ̀ fɛ́y	'it is hot'	ʌ̀ gbʌ́yʌ́	'it is broken'	ʊ̀sɔ́y	'a horse'
	-------		ʊ̀fày	'a butcher'	rʊ̀fɔ̀y	'an evening'
			dʊ́nyʌ́	'the world'		

As can be seen in (7), [ʊ] does not appear adjacent to a semi-vowel derived from a vowel, but then neither does /ɛ/ . Again this gap in the distribution of [ʊ] does not seem to be significant.

(e) All vowels appear in word-final position. This includes [ʊ] , contrary to Dalby's analysis.

(8)	sʊ́	'we'
	nʊ́	'you (pl., subj.)'
	tʊ́	future marker

Granted, pronouns and tense/aspect markers which appear before a verb are not usually considered the strongest evidence for claims about word-final position, since in some languages they are merely particles which are cliticized to the verb. However, this is not the case in Temne. There is ample evidence that the pronouns and tense/aspect markers are independent words, and most analyses of Temne treat them as such (see Coleman [1967], Schlenker [1861], Scott [1956], Sumner [1922]). Thomas [1916], Wilson [1961, 1968], and Dalby

[1966] treat them as clitics (hence Dalby's statement that there are no word-final [ɯ]). To clarify this matter, we present below a review of the evidence indicating that pronouns and tense/aspect markers are independent words.

The basic sentence in Temne is on the model of:

(9) rʌ́mès rʌ́ fūmpɔ̄ 'the egg fell'
def+egg pro fall-past

If the full NP subject does not appear, the sentence is on the model of:

(10) rʌ́ fúmpɔ̄ 'it is falling'
pro fall-pres.

The morpheme labelled "def" in the first sentence marks plurality, definiteness and noun class. Similar agreement particles appear before adjectives, genitives, and demonstratives. The morpheme labelled "pro" in both sentences above agrees with the antecedent or referent noun in class and plurality. Dalby and Wilson label all of these morphemes which agree with the head noun "CE's" (that is, concord elements), and do not discriminate among them, treating the morphemes that appear before nouns, adjectives, genitives, demonstratives, and verbs as all being cliticized to the following word, even extending this treatment to the personal pronouns. However, the morphemes which appear before the verb in a Temne sentence behave significantly differently from similar morphemes which appear before the nominal elements. Note that in sentences like the first one above, according to this analysis, there is a double subject. Both [rʌ́mès] and [rʌ́] are the subject of the verb [fúmpɔ̄] .[5] The second subject does disappear in relative clause structures:

(11) a. rʌ́mès fūmpɔ̄ é rʌ́ g͡bʌ̀y (/é/ marks a subordinate clause (SUB))
def+egg fall-past SUB pro break open-past
'the egg that fell broke open' (cf. (9))

[5]Although the analysis of sentences of any language as routinely containing a double subject may seem bizarre, especially for those linguists who are used to person/number markers as clitics, it seems that this is the correct analysis for Temne. Aside from the syntactic and tonal evidence presented below, Hutchinson [1969, 1979] adopts this analysis for syntactic reasons independent of those presented here.

b. ɔ́làŋ͡gb̀á tù é ɔ́ nŵŋk mT
def+man sick-past SUB pro see-past me
'the man who was sick saw me'

The second subject also does not appear in sentences in which the longer forms of the pronoun appear:

(12) mɨ́n mʌ̀ yɔ́ mʌ́+pán̂t ʌ́+mɨ́
I non-past do-pres def+work CE+my
'*I* am the one doing the work'

(See Appendix I for further examples.)

These "pro" elements are, then, at the very least not a necessary constituent of the verb morphology. There are, additionally, reasons for not considering them to be cliticized to the verb when they do appear. First, several elements routinely appear between the pronoun and the verb. These are most commonly the tense/aspect markers [lá] 'habitual', [tŵ] 'future', [pɔ́] 'completive', [dé] 'about to', and combinations of them such as [tŵ dé] 'about to (near future)', [tŵ lá pɔ́] 'will usually have'.

(13) ɔ́tàr ɔ́ lá yàk ɨ́ lá rù
def+slave pro hab wash-past I pro hab weave-past
'the slave used to wash' 'I used to weave'

ɔ́tàr ɔ́ tŵ yák ɨ́ tŵ rú
def+slave pro fut wash-pres I pro fut weave-pres
'the slave will wash' 'I will weave'

In addition, adverbs can separate the pro from the verb:

(14) ɨ́ Tá dɨ́ê 'I haven't eaten yet'
I yet eat+NEG

Moreover, adverbs also sometimes appear between the pro-tense/aspect marker series and the verb:

(15) ɔ́ tŵ pɔ́ Tɔ̀ŋ kàr or ɔ́ tŵ pɔ́ kàr Tɔ̀ŋ
he pro fut compl by now wait-past
'by now, he will have been waiting'

Therefore, free morphemes can be interposed between the pro and the verb and between the tense/aspect markers (which in turn separate the pro from the

verb) and the verb. Since neither the pro nor the tense/aspect markers can be analyzed as being cliticized to the following verb, the [ɯ] in sɯ̰ 'we', nɯ̰ 'you' and tɯ̰ (future marker) must therefore be word-final.

The second block of evidence which supports the analysis of the pro and tense/aspect markers as independent words concerns the tonal process of downstep. Within the nominal paradigm, where the effects of downstep are most evident, a high tone followed by a high tone is downstepped to mid tone:

(16)

H+ H	→	H+ M	cf.	L+ H	→	L+ H
/ɔ+kas/		[ɔ+kas]		/u kas/		[u+kas]
def+father				ind+father		
'the father'				'a father'		

(For a complete description of this phenomenon see Mountford [1979].) The underlying tone of the root for 'father' is a high. This tone appears on the surface when it is preceded by the low-toned indefinite prefix. When /kɑ̰s/ is preceded by a high tone, e.g. the definite marker, the underlying high tone is realized as a mid tone. A low-toned root is not affected by the tone of the prefix:

(17)

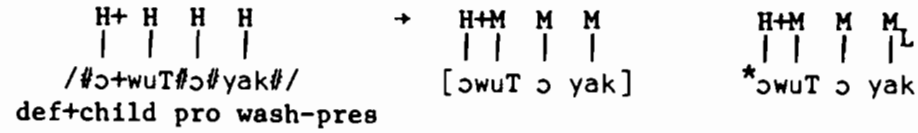
H+ L	→	H+ L	cf.	L+ L	L+ L
/ɔ+tar/		[ɔ+tar]		/u+tar/	[u+tar]
def+slave				ind+slave	
'the slave'				'a slave'	

Note that except for proper names and a few cases in which the class marker has become fused with the nominal root, every noun appears with its class/definiteness marker, either in the definite or indefinite form. [kɑ̰s] is therefore not a grammatical utterance. Also, no element ever intervenes between a class marker and the following root. It is best, then, to analyze the class/definiteness markers as being prefixed onto the verb root.

Contrast this with the tones found on a verb and its preceding pro (which is sometimes homophonous with the definite class marker):

(18)

H H	→	H H	H M
/ɨ́ɔɨ́yɑ́kɨ́/		[ɔ yak]	*ɔ yak
he wash-pres			
'he washes'			



(NB: Once the high tone register is lowered by downstep, it stays lowered throughout the rest of the clause.) If the domain of downstep is the word as is indicated by the way in which it functions in nouns and adjectives, then this appearance of a high tone on the verb is further evidence that the morphemes we have been calling "pro" are independent words.[6]

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[6]There are certain tonal patterns on pro followed by verb which look like there is some sort of process of downstep in operation. This occurs when the verb is a Class II verb, that is, its past tense is marked with a mid tone.

Class I		Class II	
ɔ́ bʌ́f	ɔ́ bʌ̀f	ɔ́ dér	ɔ́ dēr
he farm-pres	he farm-past	he come-pres	he come-past
'he is farming'	'he farmed'	'he is coming'	'he came'

The mid tones in these cases and in the further examples are due to the verb class, and not to a process of downstep conditioned by the preceding pronoun or tense/aspect marker. How much of the verbal tone patterns should be analyzed as a result of the process of downstep is a difficult question. There is certainly nothing to stop us from assuming the widest possible applicability and analyzing any M tone which follows a H tone in verbs as an underlying H downstepped to mid. In addition, Pattern VII (see Appendix Two) is clearly a pattern best analyzed as being formed by the application of downstep. On the other hand, unconditioned word-initial M tones occur in the past tense forms of Class II verbs, contrasting with the word-initial L tones in the past tense forms of Class I verbs. This and the contrast of present tense H L and past tense M L in Pattern VI verbs suggest that the mid tone is acquiring semiphonemic status in the Temne verb. This is further supported by the existence of close triplets in which H, M, and L contrast on the first syllable of a word:

dí	'eats'				
dīs	'feeds'	dĪs	'fed'	dìs	'yesterday (adv)'
fúmpɔ̄	'falls'	fūmpɔ̄	'fell'	fùmpɔ́	'Fall down!'

(There is no sign of unconditioned mid tones in Temne nouns and adjectives.) There is also a contrast of M and H after L in verbs (but not in nouns and ad-

The non-occurrence of downstep, incidentally, provides evidence that the tense/aspect markers (for the most part, high-toned) are also independent words. As we have seen in the first part of this discussion, even the longest concatenation of tense/aspect markers produces a surface sequence of high tones:

(19) ɔ́ tʊ̋ dɛ́ tɔ́ŋ 'he is about to cook (in the near future)'
he fut about to cook-pres

ɔ́ŋ tʊ̋ pɔ́ bèk 'they will have arrived'
they fut compl arrive-past

ɔ́ŋ tʊ̋ lɔ́ pɔ́ yɔ̄kā 'usually they will have gotten up'
they fut hab compl get up-past

mʌ́ tʊ̋ lɔ́ pɔ́ tɔ̄sʌ̀ 'usually it will have boiled'
it fut hab compl boil-past
(ref=water)

This and the previous evidence concerning the interposability of other morphemes between the tense/aspect markers or pro and the verb lead us to consider both the pro morphemes and the tense/aspect markers to be independent words. The [ʊ] in sʊ̋ , nʊ̋ and tʊ̋ thus appear word-finally and the distribution of [ʊ] is not as defective as Dalby's [1966] analysis would lead us to believe. Thus, the high back unrounded vowel [ʊ] has a normal distribution; any gaps in its distribution are shared by at least one other vowel.

2.1.2. Phonological processes affecting all vowels, including [ʊ] . In addition to the above evidence, [ʊ] also behaves like other Temne vowels in that it is subject to processes which affect other vowels. For example, there is an allophonic rule in Temne which lengthens vowels, including [ʊ] , before /r/ .

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jectives). Any verb with a L M past tense (Patterns IV, V, VII, VIII, VIIIa) contrasts with the form of that verb in the imperative, which in Temne has the pattern L H, e.g. yànɛ̄ 'washed one's face' vs. yànɛ́ 'wash your face!', tʊ̀lā 'heard something' vs. tʊ̀lʌ́ 'listen!'. There are thus some M tones in verbs which are difficult to derive from H tones. Since the resolution of the problem of the extent of the applicability of downstep in verbs does not affect the issues under consideration in this paper, we will for the moment treat all mid tones in verb patterns as underlying.

(20)	[rʉ̀fɩ̀]	'a death'	[ɔ́ fɩ̀:r]	'he found (something)'
	[ɔ́ bèk]	'he arrived'	[mʉ̀bè:r]	'some liquor'
	[ɔ́ bɛ́nt]	'he prevents'	[mɛ́:r]	'some salt'
	[kʉ̀nt]	'a tree'	[kʉ̀:r]	'a louse'
	[kʉ̀mʌ́ŋk]	'an ear of corn'	[mʉ̀mʌ́:rɔ́]	'some oil/fat'
	[ùkás]	'a father'	[ɔ́ ká:r]	'he waits for'
	[rʉ̀wù]	'a knee (area)'	[ɔ́ wù:r]	'he came from'
	[ɔ́ bɔ́t]	'he puts'	[ɔ́ bɔ́:r]	'he peels'
	[ɔ́ bɔ́]	'he gives credit to'	[ɔ́ bɔ́:r]	'he is in debt to'

Furthermore, there is a tendency for central vowels, including [ʉ] , to be slightly rounded after labials, and especially when they are between two labials:

(21)	/ùfàdɛ́ŋ/	'an enemy'	[ùf {à, ɔ} dɛ́ŋ]
	/bàfù/	'April'	[b {à, ɔ} fù]
	/ʌfʌ́sʌ/	'some strength'	[ʌf {ʌ́, o} sʌ]
	/rʉ̀pʌ́mpɔ̀/	'some cotton'	[rʉ̀p {ʌ́, o} mpɔ̀]
	/ùpʉ̀ŋk/	'a fool'	[ùp {ʉ̀, u} ŋk]
	/àfʉ́m/	'people'	[àf {ʉ́, u} m]

The vowel [ʉ] is thus subject to the same processes which affect other vowels.

2.2. Wilson's analysis of the status of [ʉ] as an underlying vowel. One may ask whether [ʉ] is an *underlying* vowel. At this point it is necessary to examine Wilson's generalization that [ʉ] is inserted when it appears between the second and third consonants of a polysyllabic stem. For this generalization to hold, one would expect it to be possible to state a rule of [ʉ]-insertion which would insert this vowel in a definable environment. Such a statement would capture the generalization that Temne does not allow consonant clusters of a certain type in medial position. Although there are se-

quences of the type CVCɯCV in Temne, there are many more sequences of the type CVCCV .[7] Most of the -CɯC- sequences involve stop-r sequences, as in (22a), but as can be seen in (22b), there are also stop-r sequences which never appear with an intervening [ɯ] .

(22) a.	CVCɯCV		b.	CVCCV	
	ùkòmɯ̀rɔ́	'a mother with infant'		ɔ̀ Tàmrɔ́	'he is uncontrollable'
	kɯ̀làpɯ̀rɔ́	'a hat'		bàprɔ̀n	'March'
	ʌ̀bʃtɯ̃́rʌ	'a bottle'		ʌmáŋkrɔ̀	'a mango'

Thus between a stop and a following /r/ is not an adequate statement of an environment for insertion. Nor do the tone patterns of these words provide a context for insertion. If [ɯ] were to be inserted in /làpùrɔ́/ the tonal pattern on the words /làpùrɔ́/ and /Tàmrɔ́/ underlyingly would both be low

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[7]For example:

-NC-		ùbɔ́lɔ́mbá	' a doctor'
		ùsámpá	'a female dancer'
		TʌmTùrkʃn	'six'
		ʌ̀bɔ́ndɔ́	'a women's secret society'
		ʌ̀lɔ́nTɔ̄	'an okra'
		mʌ́ntɯ̃r	'some tears'
		rɯ̀wʌ́nkɔ̀m	'a symbolic gift'
		mɯ̀làŋkɔ̀	'some palm kernel oil'
		kɯ̀gbɛ̀ŋ͡mgbɛ̀	'a pepper'
- [-nas, -cont]	[-cont]	- ʌ̀bɯ̀Tkà	'a heel'
		ʌ̀kòndɛ̀dʌ́kdʌ́k	'a lizard'
		ɔ́ bɔ́kTɛ̄	'he churns up'
		ɔ́ rɯ́pnɛ̀	'he turns around'
- [+cont]	[-cont]	- ùbɔ̀rkɔ́	'a young woman'
		ʌ̀kɔ́fTá	'a shoe'
		ʌ̀kúfnà	'a wing'
- [-nas, -cont]	[+cont]	- ʌ̀bɔ́Trèbá	'familiarity' (and other examples in (11))
- [+cont]	[+cont]	- ùkɯ́rfì	'a spirit/devil'
		ɔ́ fɔ́flá	'he whispers'

Dalby [1966:7] also notes the existence of these consonant clusters, although he doesn't consider it an argument against the derived status of [ɯ] .

high and would thus not supply a context for [ɯ]-insertion.[8] Any attempt to write an insertion rule to account for the presence of [ɯ] in cases like these would have to be lexically specific in order to derive the correct output. So, for at least these cases, [ɯ] must be considered to be underlying.[9] This is not to claim, however, that all [ɯ]'s are underlying.

3. Some Theoretical Predictions of Tone-Segment Interactions

Taking the status of [ɯ] as an underlying vowel to be established, what, then, is the status of the tone which [ɯ] bears? What happens to this tone when [ɯ] is deleted? And where does the tone come from when [ɯ] is inserted? Given the currently available frameworks, one could reasonable expect any of the following:

Tone as a segmental feature: If tone is considered to be part of the feature specification of a segment, one would expect that if the segment were deleted the tone on that segment would also be deleted. If, however, a potential tone-bearing segment were inserted one could expect one of two things: either the tone would be inserted with the segment and therefore all segments inserted by the same rule would bear the same tone, or the tone would be derived from surrounding tones, either by copying or assimilation. In either case, the tone on the inserted segment would be predictable.

Tone as a property of the syllable: If tone is considered to be the property of a syllable and the syllabic nucleus merely functions as its carrier in the surface structure, then one would expect that if the syllabic nucleus were deleted the tone would not necessarily delete. If the role of the syllabic

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[8]Nor is there any reason to believe that the tone on [ɯ] in these forms is not underlying. The three tone patterns represented in these examples are also found in other three-syllable noun stems: (H H L) àg͡bánʃkà 'an area of the Pɔrɔ bush', (L L H) àbɔ̀Trèbá 'familiarity', and (H L H) àTámbàlɛ̄ 'a prayer drum'.

[9]Dalby's statement that [ɯ] in one syllable stems is inserted will not be considered here. Given an analysis in which tone is not the property of a segment or syllable (as in an autosegmental framework) there is no way to argue against such an analysis. The same is true of Wilson's analysis of [ɯ] as inserted in indefinite articles /kɯ̀/ , /mɯ̀/ , /tɯ̀/ , /rɯ̀/ , that is, between his underlying indefinite article /k-/ and the noun stem which begins with a consonant. We will merely point out that such analyses buy us nothing. There is no simple generalization about the impermissibility of stem-initial consonant clusters which would be captured here since there are consonant clusters in this position: [krʃfì] 'spirit/devil' (a variant pronunciation of [kʷ́rfì]), [g͡brán] 'clean'. As for his statement that [ɯ] appears between words we have found no evidence for this whatsoever.

nucleus were to be assumed by another segment, the tone could be expected to appear on that segment. If another segment within the syllable did not become the syllabic nucleus, it is uncertain what would happen to the tone (perhaps it would turn up on the syllable nucleus of the readjusted syllable). But, if the syllabic nucleus which carries tone were shown to have been inserted between two non-syllabic consonants then the only way in which the tone could be *underlying* would be if consonant clusters were marked with a tone just in case a syllabic nucleus should become available and a syllable formed. This would be highly suspect. The tone cannot be inserted with the vowel for if the tone were inserted with the vowel that would imply that the tone was a property of the vowel and not the syllable. Rather the tone would have to be inserted or derived by a separate rule.

Tone as an autosegment: If, as in an Autosegmental Framework [Goldsmith 1976], tone is considered to be on a level independent of consonant and vowel features and to be associated with morphemes or words rather than segments, then if a surface tone-bearing segment were to delete, one would not expect the tone to delete, but rather that it would reassociate with another segment capable of carrying tone or be deleted by an independent rule. If the surface tone-bearing segment were shown to have been inserted, then the tone with which it is associated could be an underlying tone. Since tones do not necessarily have to be associated with an underlying vowel this tone could either be one associated with a particular morpheme or could spread from an adjacent morpheme.

The purpose of this paper is not to go into all the details of these frameworks nor to discuss all their advantages and disadvantages, but rather to examine their claims concerning the status of a tone vis à vis the segmental level with respect to deletion and insertion phenomena in Temne.

3.1. Tonal behavior when [ɯ] is deleted. There are several processes affecting [ɯ] in Temne, among them deletion and insertion. A rule of deletion will be examined first. Wilson [1961:4] notes that [ɯ] optionally deletes in rapid speech giving the example: [ɔ́ bɯ̄p] 'he found' becoming [ɔ́ þp] . (The tones are ours, Wilson [1961] does not mark tone.) He does not mention what happens to the tone on the deleted vowel. Our corpus contains no cases of deletion in this environment, but there are cases of deletion of [ɯ] in rapid speech before a sonorant consonant. The tone which was carried by the [ɯ] then appears on the conditioning sonorant. This rule can affect [ɯ] in any syllable, carrying any tone:[10]

[10]An alternative analysis would be to have underlying syllabic consonants, /ç/ which are realized on the surface as [ɯC] with the [C] desyllabified

(23) [ɯ] → Ø / __ [+son] (optional, rapid speech)

TʌmTɯ̀rèŋànlè	'nine'	→	TʌmTì̩èŋànlè	kɯ̀bɯ̀lə́y	'a basket'	→	kɯ̀bì̩ə́y
TʌmTɯ́dɛ́rɯ́ŋ	'seven'	→	TʌmTɯ́dɛ́rŋ́ (*TʌmTdɛ́rɯ́ŋ)	ʌlɛ́mɯ̀rō	'an orange'	→	ʌlɛ́mì̩ō
pɯ́lə́	'some rice'	→	pí̩ə́	mɯ̀sɯ̀m	'some taboos'	→	mɯ̀sm̩̀
ùkɯ́rfì	'a devil'	→	ùkf̩́fì				

In order to account for this, a segmental analysis would have to include an ad hoc rule which would copy the tone onto a following sonorant in just those cases in which [ɯ] deletion is going to apply. However, if it is assumed that tone is the property of a string of segments, the analysis is rather straightforward. If tone is considered to be a property of syllables, as in the second framework mentioned above, it would be expected to appear on whatever was acting as the nucleus of the syllable. Since the deletion of the vowel in the above case is associated with the following sonorant becoming syllabic, and thus the nucleus of the syllable, it is no surprise that the tone appears on this sonorant. A derivation within this framework would look like that in (24):

(24) Syllable-Base Framework (brackets indicate the domain of a syllable)

	# $[_{L}ʌ]$ + $[_{H}kɯr]$ $[_{L}fì]$ #	
[ɯ]-deletion	# $[_{L}ʌ]$ + $[_{H}kr]$ $[_{L}fì]$ #	
Syllabification	# $[_{L}ʌ]$ + $[_{H}kr̩]$ $[_{L}fì]$ #	
Output	# ʌ + kf̩́fì #	'a devil'

---

and its role as tone-bearer taken over by an inserted [ɯ]. However, there is no convincing evidence that there are any underlying syllabic consonants in Temne. The only syllabic consonants which appear consistently on the surface (that is, appear on the surface without an alternate form of the same word with a vowel and a consonant ever appearing) are in the word [ŋ́] 'you (sg., subj. pro) and various words for 'yes' and 'no': [ŋ́kō] 'yes' from [ə́ŋkō], and [ḿ̩], [m̩̀ ḿ̩], and [C̀ C̀] 'no' ('C' representing a velar click with nasal release). Most of the words for 'yes' and 'no' are clearly ideophones and can be excluded from consideration. This leaves only [ŋ́] 'you'. It makes more sense to consider this word to have an underlying vowel than to consider it alone as evidence for underlying nasal consonants in Temne.

Similarly, if an Autosegmental framework is adopted, then the deletion of a vowel would again not affect the tonal level. The tone would simply reassociate to the nearest segment capable of bearing tone on the surface. A derivation within this framework would look like (25):

(25) Autosegmental Framework

	# ʌ + kwrfi #	Segmental Level
	L H L	Tonal Level
[w]-deletion	# ʌ + krfi #	
	L H L	
Syllabification	# ʌ + krfi #	
	L H L	
Reassociation	# ʌ + krfi #	
	L H L	
Output	# ʌ + krfi #	'a devil'

While (24) and (25) are very much alike, the analyses are not identical. The Syllable-Base framework offers a ready explanation for the syllabification of the following sonorant after the deletion of [w] because a syllable must have a nucleus; however, this is considered to be a separate phonological process in the Autosegmental analysis.[11]

Thus, in order to account in a principled way for the persistence of a tone after the segment which bears it is deleted, it is necessary to abandon the assumption that tone is part of the feature matrix of any *one* segment and to adopt a framework in which tone may be associated on the underlying level

[11]Note that a Syllable-base framework and an Autosegmental framework are not mutually exclusive [Goldsmith 1976:1-3]. The tonal level is not the only independent level which can be posited for a language. One could also assume a level of syllable structure. Such an analysis would give the following derivation:

with a larger unit.

3.2. Insertion analysis of [ɯ] in three suffixes. The case of [ɯ]-insertion in Temne presents a more interesting example of the interaction, or non-interaction, of tonal and non-tonal rules. Consider the forms in (26):

(26) Examples of [ɯ] insertion[12]

/r ∿ ɯr ∿ ɡ/ transitive

1.	stop+[ɯr]	ɔ́ kɔ́t	'he ties'	ɔ́ kɔ́tɯ́r	'he ties on'
2.	fric+[ɯr]	ɔ́ fɔ́f	'he talks'	ɔ́ fɔ́fɯ́r	'he scolds (talks on)'
3.	m+[ɯr]	ɔ́ bɔ̃́m	'he defecates'	ɔ́ bɔ̃́mɯ́r	'he defecates on'
4.	{n, ŋ}+[d]	ɔ́ tã́ŋ	'he locks'	ɔ́ tã́ŋɡ	'he locks out'
5.	V+[r]	ɔ́ yé	'he gives to'	ɔ́ yér	'he shares with'
6.	VV+[r]	ɔ́ wáy	'he buys'	ɔ́ wáyr	'he buys from'

/s ∿ ɯs/ segmentative I

7.	stop+[ɯs]	ɔ́ yák	'he washes'	ɔ́ yákɯ̄s	'he washes repeatedly'
8.	fric+[ɯs]	ɔ́ Túf	'he spits'	ɔ́ Túfɯ̄s	'he spits repeatedly'
9.	r+[ɯs]	ɔ́ mér	'he swallows'	ɔ́ mérɯ̄s	'he swallows repeatedly'
10.	m+[ɯs]	ɔ́ lɯ̃́m	'he throws'	ɔ́ lɯ̃́mɯ̄s	'he throws repeatedly'
11.	{n, ŋ}+[s]	ɔ́ tã́ŋ	'he locks'	ɔ́ tâs	'he locks repeatedly'
12.	V+[s]	ɔ́ bɔ́	'he gives credit'	ɔ́ bɔ̂s	'he gives credit to several people'
13.	VV+[s]	ɔ́ pʌ́y	'he jumps'	ɔ́ pʌ́Ts	'he skips'

---

[12]There are in addition to these three suffixes a Causative, a Converse and a Partial Completive.

/s/$_{CAUS}$	ɔ́ dí	'he eats'	ɔ́ dî s	'he feeds'
	ɔ́ bɔ́l	'it becomes long'	ɔ́ bɔ́lɯ̄s	'he makes long'
/r/$_{CON}$	ɔ́ bɔ́	'he gives credit to'	ɔ́ bɔ́r	'he is in debt to'
	ɔ́ yép	'he lends'	ɔ́ yépɯ́r	'he borrows'
/r/$_{PC}$	ɔ́ yé	'he gives'	ɔ́ yér	'he shares'
	ɔ́ yák	'he washes'	ɔ́ yákɯ́r	'he washes part of something'

Segmentative I (/s/$_{SI}$) and Transitive (/r/$_{T}$) are phonetically indistinguishable from the Causative and the Partial Completive, respectively. The Transitive and the Converse are indistinguishable except in those cases in which the Reciprocal (/ʌnɛ/) is also present on the verb (see examples in Appendix Two, and also Section 4).

/T ∿ ɯɪ/ segmentative II

14.	stop+[ɯT]	ɔ́ sʊ́k	'he moves'	ɔ́ sʊ́kʊ̄ɪ	'he scoots down'
15.	fric+[ɯT]	ɔ́ fɔ́f	'he talks'	ɔ́ fɔ́fʊ̄ɪ	'he talks continuously'
16.	m+[ɯT]	ɔ́ sɔ̰́m	'he sends'	ɔ́ sɔ̰́mʊ̄ɪ	'he sends continuously'
17.	{n, ŋ}+[T]	ɔ́ sɔ̂ŋ	'he gives'	ɔ́ sɔ̂nT	'he gives continuously'

In these forms [ɯ]C appears after /m/ , /r/ , and obstruents, and C appears after vowels, glides derived from vowels, and the non-labial nasals. Other rules which apply to these forms are listed in (27):

(27) Segmental Rules

1. [+syl] → [+nas] / __ [+nas]

   All vowels before nasals are nasalized. (cf. 3, 4, 10, 11, 16, 17)

2. $\begin{bmatrix}+\text{son}\\+\text{cons}\\-\text{nas}\\-\text{lat}\end{bmatrix} \rightarrow \begin{bmatrix}-\text{son}\\-\text{cont}\end{bmatrix} / \begin{bmatrix}+\text{nas}\\\alpha\text{cor}\\\alpha\text{ant}\end{bmatrix} (\#) \begin{bmatrix}\text{———}\\-\text{stem}\end{bmatrix}$

   Non-stem /r/ , that is /r/ in concord elements, locatives and suffixes, becomes [d] after [n] and [ŋ] (optional across word boundaries). (cf. 4)[13]

3. $\begin{bmatrix}+\text{nas}\\\alpha\text{ant}\\\alpha\text{cor}\end{bmatrix} \rightarrow \emptyset \; / \_\_ \begin{bmatrix}-\text{syl}\\+\text{cont}\end{bmatrix}$

   /n/ and /ŋ/ delete before non-syllabic continuants. (cf. 11)

4. $\begin{bmatrix}+\text{nas}\\+\text{back}\end{bmatrix} \rightarrow \begin{bmatrix}\alpha\text{ant}\\\beta\text{cor}\\\gamma\text{co-art}\end{bmatrix} / \_\_ (\#) \begin{bmatrix}+\text{cons}\\\alpha\text{ant}\\\beta\text{cor}\\\gamma\text{co-art}\end{bmatrix}$ (co-art = co-articulated labio-velar)

   The velar nasal [ŋ] assimilates to the point of articulation of the following consonant. (cf. 4, 17)

5. [-son] → [-voice] / __ #

   Obstruents are voiceless word-finally. (cf. 4)

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[13]For more on the alternation of [r] and [d] , and similar stop-formation processes in other languages, see Nemer [1979].

6. $\begin{bmatrix} +syl \\ +high \\ \alpha tone \end{bmatrix} \rightarrow [-syl] \; \% \; \underset{[\alpha tone]}{V}$ (where [αtone] indicates identical tones)

A high vowel becomes a glide when it is in a VV sequence and agrees in tone with the other vowel. (cf. 6, 13)[14]

This analysis will consider the /C/ form of these suffixes to be underlying. The [ɯ] in these cases is, then, inserted. We exemplify these rules in (28), omitting tones for the moment. Non-applicable rules are not included in the derivations; [ɯ]-insertion applies after rule 4.

(28) Sample Derivations

	#bɔT + r#	#bɔT + r + ʌnɛ#
[ɯ]-insertion [Ex. 36]	#bɔT + ɯr#	does not apply
Output	[bɔTɯr]	[bɔTrʌnɛ]
	'to like'	'to like each other'
	#taŋ + s#	#sɔŋ + T#
1.	#tãŋ + s#	#sɔ̃ŋ + T#
3.	#tã + s#	does not apply
4.	does not apply	#sɔ̃n + T#
Output	[tãs]	[sɔ̃nT]
	'to lock repeatedly'	'to give continuously'

3.2.1. The alternative deletion analysis of [ɯ] and other arguments for insertion. The alternative analysis is that the underlying forms of these suffixes are the ones with the high back unrounded vowel. Such an analysis would necessitate a rule like the following:

(29) $[ɯ] \rightarrow \emptyset \; / \; \left\{ \begin{bmatrix} +syl \end{bmatrix} \right\} + \_\_ \; C \; \#$

[14]Underlying /ui/ sequences which agree in tone appear on the surface as [wi] (*[uy]), e.g. /ù+tú+ɾ/ [ùtwɾ] 'he is sickly'. The process could be expressed, however, and possibly with more explanatory value, in metrical formalism.

which would delete [ɯ] after vowels, /n/ , and /ŋ/ , when in a word-final morpheme. Such an analysis would consider it to be accidental that the vowel in these suffixes is always [ɯ] . Moreover, given the following data, the deletion analysis becomes even more complicated:

(30)	1.	2.		3.	
ʌ́ bɔ́T	'it becomes sweet'	ɔ́ bɔ́T̈ʊ̈r	'he likes'	sɯ̈ bɔ́Trʌnɛ̄	'we like each other'
ɔ́ yɛ́p	'he lends'	ɔ́ yɛ́pɯ̄s	'he lends to several people'	sɯ̈ yɛpsʌnɛ̄	'we lend to each other'
ɔ́ fɔ́f	'he talks'	ɔ́ fɔ́fɯ̄T	'he talks continuously'	sɯ̈ fɔ́fTʌnɛ̄	'we talk to each other continuously'

To account for the non-appearance of [ɯ] in the forms in the third group, a deletion analysis would also have to specify that the vowel deletes whenever another morpheme follows.

(31)

$$[ɯ] \rightarrow \emptyset \;/\; \left\{ \begin{array}{l} + \_\_ \; C \; + \\ \left\{ \begin{array}{l} [+syl] \\ \left[\begin{array}{l} +nas \\ \alpha ant \\ \alpha cor \end{array} \right] \end{array} \right\} + \_\_ \; C \; \# \end{array} \right\}$$

The rule required in a deletion analysis is thus highly complex. Moreover, it seems suspiciously linked to these particular VC morphemes (the only suffixes of this type, see footnote 12).

In contrast, an analysis which treats the [ɯ] in these forms as inserted involves an insertion rule which captures a generalization about allowable consonant sequences in Temne, viz. the rule would insert [ɯ]

1. between two consonants word-finally, when the first is non-nasal, and
2. between a nasal and a consonant word-finally when they disagree as to point of articulation.

That is, the only consonant clusters which appear word-finally in Temne are homorganic nasal-stop clusters. This generalization is a simple one, but it is not statable as such within the traditional phonological formalism.

Within a rule formalism referring only to segments, the rule appears as:

(32) $$\emptyset \rightarrow [\omega] \; / \; \left\{ \begin{bmatrix} -syl \\ -nas \end{bmatrix} \_\_ [-syl] \;\; , \;\; \begin{bmatrix} -syl \\ +nas \\ \alpha cor \end{bmatrix} \_\_ \begin{bmatrix} -syl \\ -\alpha cor \end{bmatrix} \right\} \#$$

or $\emptyset \rightarrow [\omega] \; / \; C \_\_ C \; \#$ except in $/ \begin{bmatrix} +nas \\ \alpha ant \\ \beta cor \end{bmatrix} \_\_ \begin{bmatrix} -syl \\ \alpha ant \\ \beta cor \end{bmatrix} \; \#$,

i.e. [ω] is inserted between two consonants word-finally except between homorganic nasal-stop clusters.

Note that the insertion analysis can account for the forms in column 3 above without further modification. The consonant clusters in these forms are not word-final. Therefore the structural description for [ω]-insertion is not met and no [ω] appears.

A simplification in formalizing [ω]-insertion could be achieved by treating homorganic nasal-stop clusters as one segment. The rule would then simply be:

(33) $\emptyset \rightarrow [\omega] \; / \; C \_\_ C \; \#$

There is independent evidence that [mp], [nt], [nT], [ŋk], [mb], [nd], and [n͡m͡gb] clusters act as one segment. This involves a raising rule which affects /e/ and /o/ in closed syllables.

(34) $$\begin{bmatrix} +syl \\ -high \\ -low \\ \alpha back \\ \alpha round \end{bmatrix} \rightarrow [+raised] \; / \; \_\_ \; C \left\{ \begin{matrix} C \\ \# \end{matrix} \right\}$$

/kʷìòp/	'a fish'	[kʷìòp]	cf.	/àyɔ́ká/	'a cassava'	[àyɔ́ká]
/àlèŋ/	'a song'	[àlìŋ]	cf.	/rʷbéŋà/	'a rope'	[rʷbéŋà]
/àlɔ́nTō/	'an okra'	[àlɔ́nTō]	cf.	/ɔ́ bɔ́kTɛ̄/	'he churns up'	[ɔ́ bɔ́kTɛ̄]
/pɛ́ndɛ́/	'some millet'	[pɛ́ndɛ́]	cf.	/àg͡bɛ́ŋkrá/	'a scream'	[àg͡bɛ́ŋkrá]

The nasal-stop clusters in 'an okra' and 'some millet' do not condition raising and thus do not act like a -CC- cluster, suggesting that these are single segments, rather than a sequence of two consonants.

A problem with such an analysis for homorganic nasal-stop clusters in

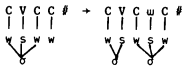
forms which insert [ɯ] is that some of these clusters are created by suffixing, e.g. /ɗ wɗŋ + r/ → [ɗ wɗŋɡ] 'he enters upon'. We would have to say that for the morphology these consonants are two segments, but that as far as the phonological rules are concerned, they are one segment. Recent papers dealing with problems of this kind [Leben 1980, McCarthy 1981], although directed towards geminate consonants, provide a formalism for expressing the idea that homorganic nasal+stop sequences can act as a unit. These analyses allow some morphological and phonological rules to be expressed at the metric level (that is, to be defined at the level of syllable composition).

The incorporation of this level into Temne analysis in order to more succinctly express the [ɯ]-insertion process involves the addition of the following readjustment rule after the rule of nasal assimilation (rule 4):

(35) $\begin{bmatrix} C \\ +nas \\ apl\ of\ art \end{bmatrix} \begin{bmatrix} C \\ -cont \\ apl\ of\ art \end{bmatrix} \rightarrow \begin{bmatrix} C \\ +nas \\ apl\ of\ art \end{bmatrix} \begin{bmatrix} C \\ -cont \\ apl\ of\ art \end{bmatrix}$ (w)

Rules of [ɯ]-insertion and vowel raising can then be expressed as syllable-sensitive segmental rules:

(36) [ɯ]-insertion



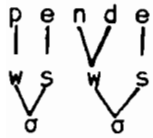
(37) Mid-vowel raising

$\begin{bmatrix} +syl \\ -high \\ -low \\ aback \\ around \end{bmatrix} \rightarrow [+raised] \ / \ \_\_ \ C$ (S W, O)

The [ɯ]-insertion rule (36) will insert [ɯ] between two consonants of the configuration: C C # (W W), but not C C # (W), the configuration of word-final ho-

morganic nasal-stop clusters.

Similarly, since the raising rule only affects mid vowels in heavy syllables, it will not affect a word such as /pɛ́ndɛ́/ which has the structure



One further indication of the correctness of the insertion analysis is that this insertion rule affects forms without verbal extenders. For instance the verb ɔ́ g͡bʌ́lʊ̀p 'he blinks' has the past tense form ɔ́ g͡bʌ̀lʊ̀p 'he blinked'. This is the only bisyllabic verb in our corpus with this tone pattern in the past tense. There is, however, a large class of monosyllabic verbs with high tone in the present and low tone in the past. Clearly (within any framework) the [ʊ] has been inserted in an underlyingly monosyllabic stem and has copied (or become associated with) the tone on the stem vowel.

3.2.2. Tonal behavior when [ʊ] is inserted. If it is accepted that [ʊ] is inserted in these forms, what is the status of the tone which appears on this vowel? Consider the forms in (38) which show the tone patterns associated with these forms when the verb stem is held constant.

(38)

ɔ́ Tʊ́f	'he spits'	ɔ́ Tʊ́fʊ̄s	'he spits repeatedly'	ɔ́ Tʊ́fʊ̂r	'he spits on'
ɔ́ fɔ́f	'he talks'	ɔ́ fɔ́fʊ̄T	'he talks continuously'	ɔ́ fɔ́fʊ̂r	'he scolds'
ɔ́ pʌ́y	'he jumps'	ɔ́ pʌ́ɪ̄s	'he skips'	ɔ́ pʌ́yr	'he jumps on'
ɔ́ tã̋ŋ	'he locks'	ɔ́ tâs	'he locks repeatedly'	ɔ́ tã̋ŋg	'he locks out'
ɔ́ bɔ́	'he gives credit to'	ɔ́ bɔ̂s	'he gives credit to several people'	ɔ́ bɔ́r	'he is in debt to'

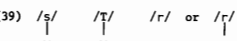
Within a segmental framework one would expect that the tone on an inserted vowel would either be inserted as part of the vowel and thus always be the same if the same rule were involved or that it would be predictable from surrounding tones. The derived forms of 'spit' and 'talk' in (38) show that neither of these possibilities holds.

If, on the other hand, tones are considered to be the property of syllables, the status of the tones on these suffixes is puzzling. While /r/ can

be accounted for by a simple copying rule, the tones on /T/ and /s/ are not predictable and therefore must be underlying (unless they are inserted by some ad hoc tone rule). If tone were the property of an underlying syllable, a single consonant, including an improbable syllabic nucleus like /T/ , would have to be considered a syllable underlyingly. This suggests that any segment could be considered an underlying syllable and be assigned an underlying tone just in case a syllabic nucleus became available, a suspect solution at best.

The only framework in which the above forms can be satisfactorily accounted for is an autosegmental one. Because tone within this framework is not associated with segments or syllables, but with larger units like morphemes or words, any particular segment (provided that it is a morpheme) could be attached to any number of tones underlyingly, including no tone. The only condition on this is that lines of association do not cross. Thus morphemes which happen to consist of single consonants can have the underlying forms shown in (39), where /s/ and /T/ have underlying mid tones, and /r/ has either an underlying high tone or no underlying tone at all.

(39)



The forms in (23), (26) and (38) can then be accounted for by the rules of tone association in (40). Sample derivations are shown in (41).

(40) Association Rules

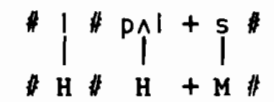
1. Tones which are not associated with a syllabic segment associate with the nearest syllabic segment which is unassociated (if one exists and association lines will not cross).
2. If there is no syllabic segment which meets the description above, the tone will associate with the syllabic segment to its left (within a word). If there is no syllabic segment to the unassociated tone's left, it will associate to the right.
3. Any syllabic segment which is not associated with a tone will associate with the tone to the left.

The derivations in (41) make use of the segmental rules 1-6 in (27). Only applicable rules are mentioned. The order of rule application is as follows: Segmental rules 1-4, [ɯ]-Insertion (36), Segmental rule 5, [ɯ]-Deletion

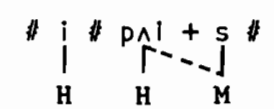
(23), Syllabification, Association rules (40), Downstep, Segmental rule 6.

(41) Autosegmental derivations

a.



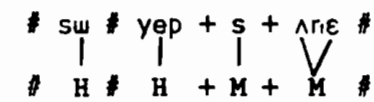
Association R1



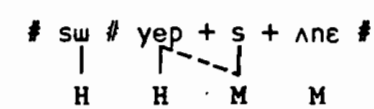
OUTPUT [ʃ pʌ̃ts][15]

'I skip (jump repeatedly) (pres. tense)'

b.



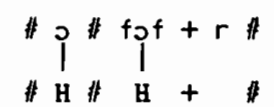
Association R2



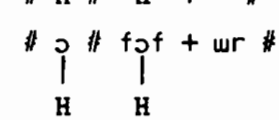
OUTPUT [sɯ́ yêpsʌ̄nɛ̄]

'we lend to each other (pres. tense)'

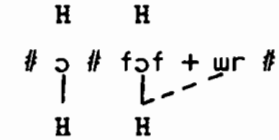
c.



[ɯ]-insertion



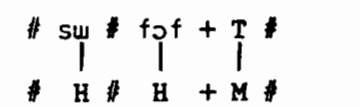
Association R3



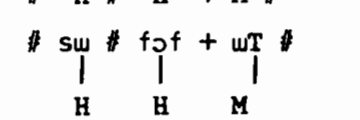
OUTPUT [ɔ́ fɔ́fɯ̂r]

'he scolds (pres. tense'

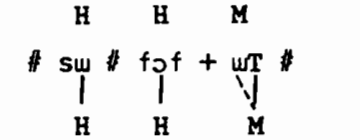
d.



[ɯ]-insertion



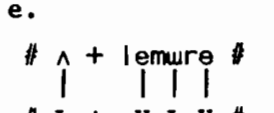
Association R1



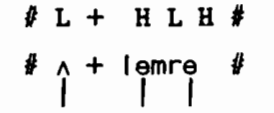
OUTPUT [sɯ́ fɔ́fɯ̄T]

'we talk continuously (pres. tense)'

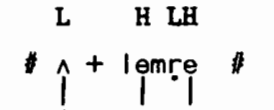
e.



[ɯ]-deletion

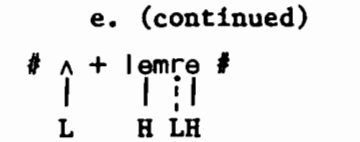


Syllabification



e. (continued)

Association R1



Downstep

OUTPUT [ʌ̀lɛ́mr̀ɛ̄]

'an orange'

[15]Rule 6, which changes high vowels to glides, is one of the few segmental rules which applies after the association of tone. However, the poten-

4. The Non-Additive Nature of Tones in Morphologically Complex Verbs

To retrace the steps in this paper, we have moved from considering an analysis which views tone as a feature of segments to one in which tone appears to be the property of strings (syllables or morphemes) in order to account for the persistence of tones after the deletion of the tone bearing segments. We were forced to discard the syllabic analysis in favor of an analysis in which tone is the property of a morpheme, based on evidence that many morphemes which seem to be associated with a particular tone in Temne are underlyingly non-syllabic consonants which only form separate syllables on the surface under well-defined conditions.[16] We will now consider further evidence which

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tially affected vowel here is associated with the next syllable, bleeding rule 6. Note that such rules which refer to both the tonal and segmental levels are at a very low level in the derivation.

[16]Independent evidence supporting an analysis of tone as the property of a morpheme in Temne, rather than of a syllable, comes from downstep in nouns and adjectives:

/ɔ́+yárɾ/	[ɔ́yārɪ̄]	'the cat'	/ù+yárɾ/	[ùyárɪ]	'a cat'
def sg+cat			ind sg+cat		
/ɔ́+ká/	[ɔ́kā]	'the creature'	/ù+ká/	[ùká]	'a creature'
def sg+creature			ind sg+creature		

We account for downstep in high-toned noun roots like 'creature' by positing the following rule: # H H # → # H M #. To account for downstep in words like 'a cat' we must only realize that downstep is not a process conditioned by the presence of the definite, but is a phonological process which affects two high tones within a word. Words like 'the cat' show the downstep process applied twice. # H H H # → # H M H # → # H M M_L #. The tone associated with /yari/ can be adequately described either as the property of the syllable or of the noun morpheme: /yárɾ/ /yari/ . However, there is yet another pattern to be

H H

considered:

/kʌ́+yɔ́ká/	[kʌ́yɔ̄kā]	'the cas-	/kù+yɔ́ká/	[kùyɔ́ká]	'a cas-
def sg+cassava leaf		sava leaf'	ind sg+cassava leaf		sava leaf'

In order to distinguish words like /yari/ from words like /yoka/ (in which the entire noun root downsteps together) tone must be analyzed as a property of the morpheme. A syllable analysis either cannot distinguish these two patterns, or is forced to have one vowel of all roots like /yoka/ as underlyingly toneless, which is equivalent to saying that there is one tone per morpheme: /-yárɾ/ /-yari/ , /-yɔ́ká/ /-yoka/ or /-yɔka/ . Detailed consid-

H H H

indicates that even the analysis of tone as a property of the morpheme is an oversimplification.

So far in this discussion, we have examined only a very limited set of Temne verbs, and then only the present tense forms of these verbs. When the past tense of these and other verbs is taken into consideration, it soon becomes necessary to view the tonal level, at least in verbs, as even further removed from the segmental level. Consider the forms in (42):

(42)

1.

ɔ́ fɔ́f	'he talks'	ɔ́ fɔ́fɨ̄T	'he talks continuously'	ɔ́ fɔ́fɨ̂r	'he scolds'
ɔ́ fɔ̀f	'he talked'	ɔ́ fɔ̄fɨ̄T	'he talked continuously'	ɔ́ fɔ̄fɨ̄r	'he scolded'
ɔ́ tã́ŋ	'he locks'	ɔ́ tã̂s	'he locks repeatedly'	ɔ tã́nḡ	'he locks out'
ɔ́ tã̀ŋ	'he locked'	ɔ́ tã̄s	'he locked repeatedly'	ɔ́ tã̄nḡ	'he locked out'
ɔ́ pʌ́y	'he jumps'	ɔ́ pʌ́Ts	'he skips'	ɔ́ pʌ́yr	'he jumps on'
ɔ́ pʌ̀y	'he jumped'	ɔ́ pʌ̄ys	'he skipped'	ɔ́ pʌ̄yr	'he jumped on'

2.

ɔ́ fɛ́T	'he cleans thoroughly'	ɔ́ fɛ́Tɨ̂r	'he cleans part of sth. thoroughly'
ɔ́ fɛ̄T	'he cleaned thoroughly	ɔ́ fɛ̄Tɨ̄r	'he cleaned part of sth. thoroughly'
ɔ́ g͡bɛ́p	'he climbs'	ɔ́ g͡bɛ́pɨ̄s	'he climbs repeatedly'
ɔ́ g͡bɛ̄p	'he climbed'	ɔ́ g͡bɛ̄pɨ̄s	'he climbed repeatedly'

There are two main verb classes in Temne: (1) verbs which have a low tone on the first syllable of the stem in the past tense, and (2) verbs which have a mid tone on the first syllable of the stem in the past tense. (Additional differences define these classes as well—see Appendix Two.) However, as the examples in (42) show, all verbs ending in the three suffixes under discussion fall into the mid-tone class, regardless of the class of the verb stem.

In our discussion thus far, we have been assuming that if tones are the property of morphemes, then the tones are additive, much as semantically we

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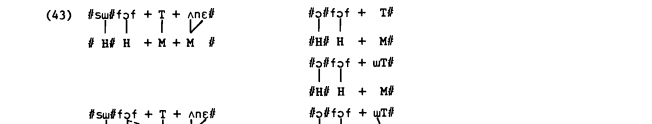
eration of this evidence is found in Mountford [1979].

have considered that the meaning of a word is the sum of its morphemes (other things remaining equal). That is, we have assumed that given

/fɔf/	pres	H	past	L
/T/		M		
/ʌnɛ/		M		

the tone pattern on any verb which contains these morphemes would be these underlying tones strung together.

(43)



However, (44) and the other examples in (42) show that we can no longer maintain this assumption.

(44)

Note that the mid tone in these examples is not the result of any tonal processes changing LM to MM. There is nothing impermissible about a LM tone pattern, a pattern which does occur in bisyllabic verbs on the surface (see Appendix Two, Patterns IV, V, VIII, VIIIa).

There is, however, a second way to view tones as the property of a mor-

pheme. This is to assume that a particular morpheme, say the last one, is responsible for the tone melody found on the entire word. This is similar to certain stress patterns in English which are associated with particular suffixes regardless of the stress pattern of the word from which it is formed:

(45) fábricàte fàbricátion
provóke pròvocátion
frústrate frùstrátion

For Temne, this kind of analysis gives the following (with suitable modifications to our tone association rules):

(46) /fɔf/ + Ø (unsuffixed) pres H past L
/T/ pres H M past M
/r/ pres H past M

#ɔ#fɔf + Ø#	#ɔ#fɔf + T #	#ɔ#fɔf + r#
#H# + H#	#H# +H M#	#H# + M#
	#ɔ#fɔf +ɯT #	#ɔ#fɔf +ɯr#
	#H# +H M#	#H# + M#
#ɔ#fɔf + Ø#	#ɔ#fɔf +ɯT #	#ɔ#fɔf +ɯr#
#H# + H#	#H# +H M#	#H# + M#
ɔ́ fɔ́f	ɔ́ fɔ́fɯ̄T	ɔ́ fɔ̄fɯ̄r
'he talks'	'he talks continuously'	'he scolded'

Of course, we do not want to give up the concept of additivity of tones altogether. It is the principle at work at the sentence level and for nouns. However, in order to account for the past tenses of Temne verbs, it seems that we must give it up in favor of an analysis in which the tone pattern is the property of the word as determined by the morphemic composition of that word.

To take another example, /ʌnɛ/ takes the following tone pattern:

	pres H M		past L M	
(47) ɔ́ fɔ́f	'he talks'	sɯ́ fɔ́fʌ̄nɛ̄		'we talk to each other'
ɔ́ fɔ̀f	'he talked'	sɯ́ fɔ̀fʌ̄nɛ̄		'we talked to each other'

ś már	'he helps'	nú márʌ̄nɛ̄	'you (pl.) help each other'
ś mār	'he helped'	nú màrʌ̄nɛ̄	'you (pl.) helped each other'
ś yépʊ̂r	'he borrows'	ár̀ yéprʌ̄nɛ̄	'they borrow from each other'
ś yɛ̀pʊ̄r	'he borrowed'	ár̀ yɛ̀prʌ̄nɛ̄	'they borrowed from each other'[17]

Moreover, it is clear from further examples like those in (48) that the tone pattern on the verb is not determined solely by the final suffix.

(48)

		a.	
ś fɔ́flá	'he whispers'	nú fɔ́flʌ́nɛ́	'you whisper to each other'
ś fɔ̄flā	'he whispered'	nú fɔ̄flʌ̄nɛ̄	'you whispered to each other'
ś ʈɔ́ŋklá	'he gathers (pieces)'	ár̀ ʈɔ́ŋklʌ́nɛ́	'they assemble themselves'
ś ʈɔ̄ŋklā	'he gathered (pieces)'	ár̀ ʈɔ̄ŋklʌ̄nɛ̄	'they assembled themselves'

verb + /la/ + /ʌnɛ/ pres H past M

		b.	
ś fɔ́fʊ̄ʈ	'he talks continuously'	sú fɔ́fʈʌ̄nɛ̄	'we talk continuously to each other'
ś fɔ̄fʊ̄ʈ	'he talked continuously'	sú fɔ̀fʈʌ̄nɛ̄	'we talked continuously to each other'
ś yépʊ̄s	'he lends continuously'	sú yèpsʌ̄nɛ̄	'we lend continuously to each other'
ś yɛ̄pʊ̄s	'he lent continuously'	sú yèpsʌ̄nɛ̄	'we lent continuously to each other'
ś bɔ́ʈʊ̂r	'he likes'	sú bɔ̀ʈrʌ̄nɛ̄	'we like each other'
ś bɔ̄ʈʊ̄r	'he liked'	sú bɔ̀ʈrʌ̄nɛ̄	'we liked each other'

verb + $\left\{\begin{matrix}/\mathrm{T}/\\ /\mathrm{s}/\\ /\mathrm{r}/\end{matrix}\right\}$ + /ʌnɛ/ pres H͡M M past L M

That is, not all verbs which end in /ʌnɛ/ have H M in the present and L M

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[17]The Converse ($/\mathrm{r}/_{\mathrm{CON}}$) is phonetically indistinguishable from the Transitive and the Partial Completive except when /ʌnɛ/ is added:

sú yépʊ̂rʌ̄nɛ̄	'we borrow from each other'
sú bɔ́ʈrʌ̄nɛ̄	'we like/love each other'

We speculate that the converse forms have been relexicalized as monomorphemic Pattern II verbs.

in the past. The tone pattern which appears on these verbs depends not on the last suffix, but on *which* suffixes are present. The more morphemes present in a Temne verb, the more complex the tone patterns become, as will become apparent by a quick scan of Appendix Two. However, there are some tone patterns which are associated with specific meanings:

(49)

Transitive:	pres H	past M		
verb+/r/$_T$	ɔ́ bɔ́Tŵr	'she likes'	cf. ŋʌ́ bɔ́T	'it becomes sweet'
	ɔ́ bɔ̄T$\bar{\text{w}}$r	'she liked'	ŋʌ́ bɔ̀T	'it became sweet'
verb+/ʌ/$_T$	ſ Tɔ́rʌ́	'I lower s.th.'	ſ Tɔ́r	'I go lower'
	ſ Tɔ̄rʌ̄	'I lowered s.th.'	ſ Tɔ̀r	'I went lower'
Segmentative:	pres H M	past M		
verb+/T/	ɔ́ yſfw̄T	'he asks continuously'	cf. ɔ́ yſf	'he asks'
	ɔ́ yTfw̄T	'he asked continuously'	ɔ́ yɬf	'he asked'
verb+/s/$_{SI}$	ɔ́ bɔ́tw̄s	'he arranges'	ɔ́ bɔ́t	'he puts'
	ɔ́ bɔ̄tw̄s	'he arranged'	ɔ́ bɔ̀t	'he put'
Causative:	pres H M	past M		
Verb+/s/$_{CAUS}$	ɔ́ dʃs	'he feeds'	cf. ɔ́ dſ	'he eats'
	ɔ́ dTs	'he fed'	ɔ́ dT	'he ate'
Reciprocal:	pres H M	past L M		
verb+/ʌnɛ/	ǽŋ fɔ́fʌ̄nɛ̄	'they talk to each other'	cf. ɔ́ fɔ́f	'he talks'
	ǽŋ fɔ̀fʌ̄nɛ̄	'they talked to each other'	ɔ́ fɔ̀f	'he talked'

Tri-morphemic Reciprocal:		pres H	past M			
(1)	verb+/ia/+/ʌnɛ/	[Examples in (48a)]				
(2)		pres H L M	past L M			
	verb+/ʌ/$_T$+/nɛnɛ/	ǽŋ g͡bɛ́ŋʌ̀nɛ̄nɛ̄	'they hate each other'	cf. ɔ́ g͡bɛ́ŋʌ́	'he hates'	
		ǽŋ g͡bɛ̀ŋʌ̀nɛ̄nɛ̄	'they hated each other'	ɔ́ g͡bɛ̄ŋʌ̄	'he hated'	

(Verbs which take /ʌ/$_T$ do not take /ʌnɛ/ , probably to minimize confusion

with reflexive forms; cf. ɔ́ gbɛ́ŋʌ́nɛ́ 'he hates himself' vs. ɔ́ gbɛ̄ŋʌ̄nɛ̄ 'he hated himself'.) The appearance of a H L M tone pattern on the present tense of these complex reciprocal verbs suggests that the high falling to mid found on verbs of the type

$$\text{verb} + \left\{ \begin{matrix} /\text{T}/ \\ /\text{s}/ \\ /\text{r}/_{\text{T}} \end{matrix} \right\} + /\text{ʌnɛ}/$$

e.g. sʊ́ yɪ́fTʌ̄nɛ̄ 'we ask each other continuously' and other examples in (48b), is underlyingly H L and that such verbs are further examples of this tri-morphemic reciprocal tone melody. There are no four-syllable morphologically complex verbs in our corpus which end in /ʌnɛ/ , so there is no independent evidence for this. Nevertheless, such an analysis has the advantage of accounting for an otherwise unusual tone pattern.

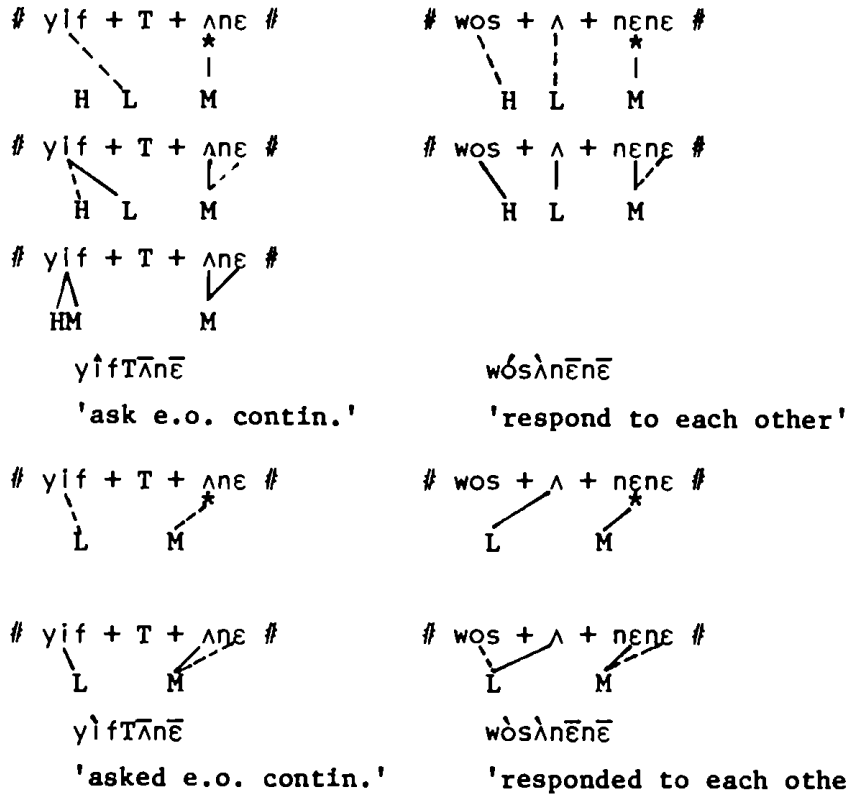
Tone patterns, then, seem to be the property of the entire word, in the sense that the particular pattern which appears is dependent on the morphological composition without being the result of particular tones being part of particular segmental morphemes. In this sense, tone melodies for Temne words are more synthetic than agglutinative. The tone patterns on Temne verbs, in fact, strongly resemble the prosodic templates proposed in McCarthy [1979] for Semitic. The templates consist of empty consonant and vowel patterns which are associated with a particular semantic verb class. For example, the template for the intensive (pɪʕʕel) in Hebrew is CVCCVC. The template for the causative (hɪtpaʕʕel) is CVCCVC plus the prefix template CVC. Given the root /ktb/ 'write' and the vowel melodies /ɪ e/ , /a e/ , the verb is derived as follows:

(50)

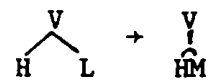
Vowel melody		e	a e
Prosodic template	CVCCVC		CVC + CVCCVC
Root melody	k t b		hɪt k t b
	[kɪtteb]		[hɪtkatteb]
	'scribble'		'cause to write'

In much the same way, we can say that we have a Reciprocal tone pattern H L M in the present and L M in the past and derive our verbs as follows:

(51)



This new perspective will require certain modifications in our tone rules and conventions. First, we will need a rule which changes a HL associated with the same vowel to a HM:



Second, we must include in the underlying form for the reciprocal morphemes an asterisk on the first vowel. This is a convention, as in Goldsmith [1976], which ensures that this is the vowel which gets associated first.

Third, we must add to our Association Rules (40) a preliminary rule which states that tones in Temne associate from right to left within the word. That is, the last tone always associates first, then the tone on its left associates with the next possible syllabic segment and so on. This last rule along with the asterisk convention does the work of the morpheme boundaries in our previous derivations.

These three changes and the analysis of verbal tone patterns as tem-

plates allow us to account for all tone patterns of Temne verbs. Our derivations of nouns, it should be noted, need not be modified. The tone patterns in the nouns considered in this paper are all clearly additive.

5. Summary

In this paper we have explored the interaction of tonal and non-tonal levels in Temne using as an example rules of deletion and insertion affecting the high back unrounded vowel [ɯ] . First the distribution of [ɯ] in Temne was presented and its status as an underlying vowel was established. We then went on to examine segmental rules of deletion and insertion which affect [ɯ] in conjunction with a consideration of the status of tone vis à vis the segmental level. We considered three possibilities: that tone is the property of the segment, that tone is the property of the syllable, and that tone is the property of larger units such as the morpheme or the word. An analysis in which tone is considered to be the property of segments was quickly shown to be inadequate to account for the retention of the tone on [ɯ] when this vowel is deleted. An analysis in which tone is considered to be the property of syllables was later shown to be unable to account for the tone which appears when [ɯ] is inserted. Only an account which considers tones to be the property of morphemes could account for the interaction of tone and segment which resulted from the application of these deletion and insertion rules. We then presented a detailed analysis of these processes within an autosegmental framework. However, additional evidence suggested that even this analysis of tone as independent of segmental units such as the segment and the syllable had not gone far enough. Instead of being the property of individual morphemes, verbal tone patterns in Temne seem to be determined by the morphological composition of the entire word, without any part of the pattern being attributable to any particular morpheme. We argued that these verbal tone patterns are best considered as fused templates. The alternative to this approach, it should be pointed out, is to simply list each verb in the lexicon indexed for tone pattern.

The fact that we are forced to adopt such a framework in order to account for these data implies that there are two distinct levels within the phonology of Temne and languages like it: a segmental level (corresponding

to vowel and consonant features) and a tonal level (which operates independently of the segmental level during most of the derivation). The tonal level is independent of such segmental units as the segment and the syllable. In verbs it appears to be independent of individual morphemes, at least in the additive sense. As we have seen, there is some interaction between the segmental and tonal levels: there is a segmental rule of gliding which refers to tone in its structural description; the rule which changes a H L series to a HM falling tone requires both tones to be associated to the same segment. But for the most past, except for the relatively automatic reassociation of tones when vowels are deleted or inserted, the segmental and tonal levels in Temne have a very low degree of interaction.

APPENDIX I: Pronouns

For a more complete listing of pronominal forms, see Wilson [1961].

Subject:		Singular		Plural
	1.	ʃ		sʊ́
	2.	ŋ́		nʊ́
	3. I	ɔ́	II	ə́ŋ
	III	kʌ́	IV	tʌ́
	V	ʌ́ŋ	VI	ɛ́
	VII	rʌ́	VIII	mʌ́
			IX	pʌ́
			X	nʌ́
			XI	tʌ́

Subject (long forms):		Singular		Plural
	1.	mʃn		sə́
	2.	mʊ́n		nə́
	3. I	kɔ́n	II	ŋə́
	III	kʌ́	IV	tʌ́
	V	ŋʌ́	VI	yʌ́
	VII	rʌ́	VIII	mʌ́
			IX	pʌ́
			X	nʌ́
			XI	tʌ́

short: ʃ yɔ́ mʌ́pān̄ɪ 'I am working'

long: /mʃn mʌ yɔ́ mʌ+pʌ́n ʌ+mɪ/ 'I am the one doing the work'
I non- do- def+work CE+my
past pres

Object:

		Singular		Plural
1.		mʃ́		sú
2.		mú		nú
3.	I	kɔ̀	II	ŋà
	III	kʃ́	IV	tʃ́
	V	ŋʃ́	VI	yʃ́
	VII	rʌ́	VIII	mà/mʃ́
			IX	pʃ́
			X	nʃ́
			XI	tʃ́

Possessive (animate only; prefixed by an element which agrees with the head noun):

	Singular	Plural
1.	-mʃ́	-sú
2.	-mú	-nú
3.	-ɔ́ŋ	-ʌ́ŋ

Emphatic (animate only; inanimate forms are the same as the long form pronouns):

	Singular	Plural
1.	mʃ́nɛ́	sʌ́
2.	múnɔ́	nʌ́
3.	kɔ́nɔ́	ŋʌ́

/ɔ́+wʃ́r kɔ́nɔ́ ɔ́+wúT ɔ́ wàI dì̀s/
def+goat he-emph def+child pro buy-past yesterday

'as for the goat, the child bought him yesterday'

APPENDIX II: Verb Classes

As we have noted in the text of this paper, there are two main classes of verbs in Temne: (1) those which take a low tone on the first syllable of the stem in the past tense and (2) those which take a mid tone on the first syllable in the past tense. The eight tone patterns found in Temne verbs fit into the classes shown in the table on the following page.

Several of these patterns are associated with particular meanings. Pattern I appears on verbs marked with transitive suffixes /r/$_{T}$ and /ʌ/$_{T}$. Pattern II appears on verbs marked with the Segmentative suffixes /s/$_{ST}$ and /T/ and with the Causative. Patterns IV, II, VIII and VIIIa are associated with reciprocals. The most common Reflexive patterns are V and II. VII is the pattern which marks intensive. Many of these patterns and their associated meanings are discussed in the final section of the paper.

Beginning on page 147 is a list of a representative number of verbs from each tone pattern, showing a modification of the tonal melody as verbal suffixes are added. The melodies are shown for the present and past tenses, other tenses are marked in Temne by means of pre-verbal tense/aspect markers, as in the examples in section 2.1.1 of this paper, which do not affect the tonal melody of the verb.

Pattern I verbs are by far the most numerous in our sample of Temne. Because of this, the examples of the other verb patterns are not as complete. Gaps in the following paradigms represent gaps in the present corpus and not necessarily the non-existence of a particular form in Temne. We have found, however, that the more suffixes are added to the verb, the less likely it is to be judged acceptable by speakers.

For an explanation of the subscripts which appear on the suffixes heading each column, please see footnote 12.

Tone Patterns in Temne Verbs

(1) Low tone in past

	Pres	Past	
I	H	L	
	bʌ́f	bʌ̀f	'farm'
	gb̂ʌ́lẃp	gb̂ʌ̀lẁp	'blink'
IV	HM	LM	
	tẃlʌ̄	tẁlʌ̄	'hear s.t.'
	tẃlʌ̄nɛ̄	tẁlʌ̄nɛ̄	'hear e.o.'
	kẃlʃʌ̄nɛ̄	kẁlʃʌ̄nɛ̄	'watch e.o.'
V	HL	LM	
	mʌ́ŋknɛ̀	mʌ̀ŋknɛ̄	'hide oneself'
VII	HM	LM	
	rẃprw̄p	rẁprw̄p	'spin'
	pʌ́Tspʌ̄Ts	pʌ̀Tspʌ̄Ts	'skip (intensive)'
VIII	HLM	LM	
	pʃàrʌ̄	pʃ̀àrʌ̄	'spend the day'
	wósʌ̀nɛ̄nɛ̄	wòsʌ̀nɛ̄nɛ̄	'answer each other'
VIIIa	HM M	LM	
	sâysāy	sàysāy	'make a fuss'
	yêpsʌ̄nɛ̄	yèpsʌ̄nɛ̄	'exchange repeatedly'

(2) Mid tone in past

	Pres	Past	
II	H	M	
	bá	bā	'lay an egg'
	bɛ́mpá	bɛ̄mpā	'make'
	fɔ́fʃʌ́nɛ́	fɔ̄fʃʌ̄nɛ̄	'whisper to e.o.'
III	HM	M	
	tû	tw̄	'hear'
	fúmpɔ̄	fūmpɔ̄	'fall'
	sɔ́kānɛ̄	sɔ̄kānɛ̄	'confuse someone'
VI	HL	ML	
	tɔ́sʌ	tɔ̄sʌ	'boil (INT)'
	ʃʌ́Tẃrʌ	ʃʌ̄Tw̄rʌ	'be soaked by the rain'

(In reduplicated forms, all subsequent tones are lowered by equal increments.)

Pattern I Verbs: Pres H Past L

		+/r/$_{T}$	+/r/$_{CON}$	+/r/$_{PC}$	+/s/$_{SI}$
pres	fɔ́f	fɔ́fŵr			
past	fɔ̀f	fɔ̄fw̄r			
	'talk'	'scold'			
pres	sóm	sómŵr			
past	sòm	sōmw̄r			
	'send'	'send s.o.'			
pres	bɔ́		bɔ́r		bɔ̂s
past	bɔ̀		bɔ̄r		bɔ̄s
	'give credit to'		'owe'		'give credit repeatedly'
pres	yέp		yέpŵr		yέpw̄s
past	yèp		yēpw̄r		yēpw̄s
	'lend'		'borrow'		'lend repeatedly'
pres	táŋ	táŋg			tâs
past	tàŋ	tāŋg			tās
	'lock'	'lock out'			'lock repeatedly'
pres	yέ			yέr	yês
past	yè			yēr	yēs
	'give'			'share'	'give repeatedly'
pres	báŋ				
past	bàŋ				
	'hurt (imp)'				
pres	bɔ́ɪ	bɔ́ɪŵr			
past	bɔ̀ɪ	bɔ̄ɪw̄r			
	'become sweet'	'like'			
pres	mʌ́ŋk	mʌŋkŵr			mʌ́ŋkw̄s
past	mʌ̀ŋk	mʌ̄ŋkw̄r			mʌ̄ŋkw̄s
	'hide'	'hide sth.'			'hide repeatedly'
pres	kɔ́				
past	kɔ̀				
	'go'				
pres	gbʌ́lʊ́p				gbʌ́lpw̄s
past	gbʌ̀lʊ̀p				gbʌ̄lpw̄s
	'blink'				'blink repeatedly'

Pattern I (cont.)

		+/s/$_{CAUS}$	+/T/	+/l/	+/s/$_{CAUS}$+/r/$_{T}$
pres	fɔ́f		fɔ́fw̄T	fɔ́flā́	
past	fɔ̀f		fɔ̄fw̄T	fɔ̄flā̀	
	'talk'		'talk cont.'	'whisper'	
pres	sṓm		sṓmw̄T		
past	sòm		sōmw̄T		
	'send'		'send cont.'		
pres	bɔ́				
past	bɔ̀				
	'give credit to'				
pres	yép				
past	yèp				
	'lend'				
pres	táŋ				
past	tàŋ				
	'lock'				
pres	yé				
past	yè				
	'give'				
pres	báŋ	bâ̄s			bā́sẃr
past	bàŋ	bā̄s			bā̄sw̄r
	'hurt (imp)'	'make hurt'			'make s.o. hurt'
pres	bɔ́T	bɔ́Tw̄s			
past	bɔ̀T	bɔ̄Tw̄s			
	'become sweet'	'make sweet'			
pres	mʌ́ŋk				
past	mʌ̀ŋk				
	'hide'				
pres	kɔ́		kɔ̂T		
past	kɔ̀		kɔ̄T		
	'go'		'walk'		
pres	g͡bʌ́lẃp				
past	g͡bʌ̀lẁp				
	'blink'				

Pattern I (cont.)

		+/s/$_{CAUS}$+/s/$_{SI}$	+/T/+/r/$_{T}$	+/T/+/s/$_{SI}$	+/r/$_{T}$+/s/$_{SI}$
pres	fɔ́f				
past	fɔ̀f				
	'talk'				
pres	sǒm				
past	sòm				
	'send'				
pres	bɔ́				
past	bɔ̀				
	'give credit to'				
pres	yép				
past	yèp				
	'lend'				
pres	tə́ŋ				tə́ndɨ̄s
past	tə̀ŋ				tə̄ndɨ̄s
	'lock'				'lock out repeatedly'
pres	yé				
past	yè				
	'give'				
pres	bə́ŋ	bə̄́sɨ̄s			
past	bə̀ŋ	bə̄sɨ̄s			
	'hurt (imp)'	'make hurt repeatedly'			
pres	bɔ́ɪ				bɔ́ɪrɨ̄s
past	bɔ̀ɪ				bɔ̄ɪrɨ̄s
	'become sweet'				'make s.o. like'
pres	mʌ́ŋk				mʌ́ŋkrɨ̄s
past	mʌ̀ŋk				mʌ̄ŋkrɨ̄s
	'hide'				'hide s.o. repeatedly'
pres	kɔ́		kɔ́ɪ̀ʊ́r	kɔ́ɪ̀ʊ̄s	
past	kɔ̀		kɔ̄ɪʊ̄r	kɔ̄ɪʊ̄s	
	'go'		'walk to'	'walk repeatedly'	
pres	g͡bʌ́ɪʊ́p				
past	g͡bʌ̀ɪʊ̀p				
	'blink'				

Pattern I (cont.)

		+/r/$_{CON}$+/s/$_{SI}$	+/r/$_{FC}$+/s/$_{SI}$	+/r/$_{T}$+/T/	+/ʌnɛ/
pres	fɔ́f			fɔ́frw̄T	fɔ́fʌ̄nɛ̄
past	fɔ̀f			fɔ̄frw̄T	fɔ̀fʌ̄nɛ̄
	'talk'			'scold cont.'	'talk to each other'
pres	sɔ́m			sɔ́mrw̄T	sɔ́mʌ̄nɛ̄
past	sɔ̀m			sɔ̄mrw̄T	sɔ̀mʌ̄nɛ̄
	'send'			'send s.o. cont.'	'send each other'
pres	bɔ́	bɔ́rw̄s			bɔ̂:nɛ̄
past	bɔ̀	bɔ̄rw̄s			bɔ̀:nɛ̄
	'give credit to'	'owe repeatedly'			'give credit to each other'
pres	yɛ́p	yɛ́prw̄s			yɛ́pʌ̄nɛ̄
past	yɛ̀p	yɛ̄prw̄s			yɛ̀pʌ̄nɛ̄
	'lend'	'borrow repeatedly'			'lend each other'
pres	táŋ				
past	tàŋ				
	'lock'				
pres	yɛ́		yɛ́rw̄s		yɛ̂:nɛ̄
past	yɛ̀		yɛ̄rw̄s		yɛ̀:nɛ̄
	'give'		'share repeatedly'		'give each other'
pres	báŋ				
past	bàŋ				
	'hurt (imp)'				
pres	bɔ́T				
past	bɔ̀T				
	'become sweet'				
pres	mʌ́ŋk				
past	mʌ̀ŋk				
	'hide'				
pres	kɔ́				
past	kɔ̀				
	'go'				
pres	g͡bʌ́lẃp				
past	g͡bʌ̀lẁp				
	'blink'				

Pattern I (cont.)

		+/r/$_{T}$+/ʌnɛ/	+/r/$_{CON}$+/ʌnɛ/	+/r/$_{PC}$+/ʌnɛ/	+/s/$_{SI}$+/ʌnɛ/
pres	fɔ́f	fɔ́frʌ̄nɛ̄			
past	fɔ̀f	fɔ̀frʌ̄nɛ̄			
	'talk'	'scold e.o.'			
pres	sɔ́m				
past	sɔ̀m				
	'send'				
pres	bɔ́		bɔ́rʌ̄nɛ̄		bɔ́sʌ̄nɛ̄
past	bɔ̀		bɔ̀rʌ̄nɛ̄		bɔ̀sʌ̄nɛ̄
	'give credit to'		'owe e.o.'		'give credit to e.o. repeat.'
pres	yɛ́p		yɛ́prʌ̄nɛ̄		yɛ̂psʌ̄nɛ̄
past	yɛ̀p		yɛ̀prʌ̄nɛ̄		yɛ̀psʌ̄nɛ̄
	'lend'		'borrow from e.o.'		'exchange repeatedly'
pres	tɑ́ŋ				
past	tɑ̀ŋ				
	'lock'				
pres	yɛ́			yɛ̂rʌ̄nɛ̄	yɛ̂sʌ̄nɛ̄
past	yɛ̀			yɛ̀rʌ̄nɛ̄	yɛ̀sʌ̄nɛ̄
	'give'			'share w/e.o.'	'give e.o. repeatedly'
pres	bɑ́ŋ				
past	bɑ̀ŋ				
	'hurt (imp)'				
pres	bɔ́T	bɔ̂Trʌ̄nɛ̄			
past	bɔ̀T	bɔ̀Trʌ̄nɛ̄			
	'become sweet'	'like e.o.'			
pres	mʌ́ŋk	mʌ̂ŋkrʌ̄nɛ̄			
past	mʌ̀ŋk	mʌ̀ŋkrʌ̄nɛ̄			
	'hide'	'hide e.o.'			
pres	kɔ́				
past	kɔ̀				
	'go'				
pres	g͡bʌ́lʊ̀p				
past	g͡bʌ̀lʊ̀p				
	'blink'				

Pattern I (cont.)

		+/s/$_{CAUS}$+/ʌnɛ/	+/T/+/ʌnɛ/	+/l/+/ʌnɛ/
pres	fɔ́f		fɔ̂fTʌ̄nɛ̄	fɔ́flʌ́nɛ́
past	fɔ̀f		fɔ̀fTʌ̄nɛ̄	fɔ̄flʌ̄nɛ̄
	'talk'		'talk to e.o. cont.'	'whisper to e.o.'
pres	sɔ́m		sɔ̂mTʌ̄nɛ̄	
past	sɔ̀m		sɔ̀mTʌ̄nɛ̄	
	'send'		'send e.o. cont.'	
pres	bɔ́			
past	bɔ̀			
	'give credit to'			
pres	yɛ́p			
past	yɛ̀p			
	'lend'			
pres	táŋ			
past	tàŋ			
	'lock'			
pres	yɛ́			
past	yɛ̀			
	'give'			
pres	báŋ	bâ̰sʌ̄nɛ̄		
past	bàŋ	bà̰sʌ̄nɛ̄		
	'hurt (imp)'	'hurt e.o.'		
pres	bɔ́T			
past	bɔ̀T			
	'become sweet'			
pres	mʌ́ŋk			
past	mʌ̀ŋk			
	'hide'			
pres	kɔ́			
past	kɔ̀			
	'go'			
pres	g͡bʌ́lʉ́p			
past	g͡bʌ̀lʉ̀p			
	'blink'			

Pattern II Verbs: Pres H Past M

		+/r/$_{T}$	+/r/$_{CON}$	+/r/$_{PC}$
pres	gb̂ép			
past	gb̄ēp			
	'climb up'			
pres	bṵ́p			bṵ́pṵ́r
past	bṵ̄p			-----
	'meet s.o., reach s.wh.'			'be present, be in attendance'
pres	ŋém	ŋémṵ́r		
past	ŋēm	ŋēmṵ̄r		
	'yawn'	'yawn at'		
pres	yókā			
past	yōkā			
	'get s.o. up'			
pres	fúŋʌ́	fúŋʌ́r		
past	fūŋʌ̄	fūŋʌ̄r		
	'fan s.o.'	'fan at s.o.'		
pres	tʃsṵ́m			
past	tʃsṵ̄m			
	'sneeze'			
pres	Tʃlá	Tʃlár		
past	Tʃlā	Tʃlār		
	'sell'	'sell to s.o.'		
pres	gb̂étʌ́	gbétʌ́r		
past	gb̄ētʌ̄	gbētʌ̄r		
	'shriek'	'shriek at s.o.'		
pres	tɔ́ká	tɔ́kár		
past	tɔ̄kā	tɔ̄kār		
	'scoop up with one's hand'	'grab'		

NB: Most of the verb forms which follow the pattern II tone pattern are transparently: Pattern I verb $\left\{\begin{matrix}+/r/\\+/la/\end{matrix}\right\}$. See Pattern I paradigm for the effects of adding further suffixes.

Pattern II (cont.)

		+/s/$_{SI}$	+/s/$_{CAUS}$	+/T/	+/l/	+/r/$_{T}$+/s/$_{SI}$
pres	gb̂ép	gb̂épw̄s				
past	gb̂ēp	gb̂ēpw̄s				
	'climb up'	'climb up repeat.'				
pres	bẃp					
past	bw̄p					
	'meet s.o., reach s.wh.'					
pres	ŋ́ém	ŋ́émw̄s				
past	ŋēm	ŋēmw̄s				
	'yawn'	'yawn repeat.'				
pres	yókā́		yókās			
past	yōkā		yōkās			
	'get s.o. up'		'make s.o. get up'			
pres	fúŋʌ́	fúŋʌ́s				fúŋʌ́rw̄s
past	fūŋʌ̄	fūŋʌ̄s				fūŋʌ̄rw̄s
	'fan s.o.'	'fan s.o. repeat.'				'fan at s.o. repeat.'
pres	tʃsẃm	tʃsmw̄s				
past	tTsw̄m	tTsmw̄s				
	'sneeze'	'sneeze repeat.'				
pres	Tʃlá					
past	TTlā					
	'sell'					
pres	gb̂étʌ́	gb̂étʌ̄s				gb̂étʌ́rw̄s
past	gb̂ētʌ̄	gb̂ētʌ̄s				gb̂ētʌ̄rw̄s
	'shriek'	'shriek repeat.'				'shriek at repeat.'
pres	tɔ́ká	tɔ́kās				tɔ́kárw̄s
past	tɔ̄kā	tɔ̄kās				tɔ̄kārw̄s
	'scoop up with one's hand'	'scoop up repeat.'				'grab repeat.'

Pattern II (cont.)

		+/ʌnɛ/	+/r/$_T$+/ʌnɛ/	+/s/$_{SI}$+/ʌnɛ/
pres	gb͡ɛ́p			
past	gb͡ɛ̄p			
	'climb up'			
pres	bɯ́p			
past	bɯ̄p			
	'meet s.o., reach s.wh.'			
pres	ŋɛ́m			
past	ŋɛ̄m			
	'yawn'			
pres	yɔ́kā	yɔ́kānē		
past	yɔ̄kā	yɔ̀kānē		
	'get s.o. up'	'get each other up'		
pres	fúŋʌ́	fúŋʌ̄nɛ̄		fúŋʌ̄sʌ̄nɛ̄
past	fūŋʌ̄	fùŋʌ̄nɛ̄		fùŋʌ̀sʌ̄nɛ̄
	'fan s.o.'	'fan each other'		'fan each other repeat.'
pres	tʃsúm			
past	tʃsūm			
	'sneeze'			
pres	tʃlá			
past	tʃlā			
	'sell'			
pres	gb͡étʌ́		gb͡étʌ̄rʌ̄nɛ̄	
past	gb͡ɛ̄tʌ̄		gb͡ɛ̀tʌ̀rʌ̄nɛ̄	
	'shriek'		'shriek at each other'	
pres	tɔ́kā		tɔ́kārʌ̄nɛ̄	
past	tɔ̄kā		tɔ̀kàrʌ̄nɛ̄	
	'scoop up with one's hand'		'grab each other'	

Pattern III Verbs: Pres HM Past M

		+/r/$_{T}$	+/r/$_{CON}$	+/r/$_{PC}$	+/s/$_{SI}$
pres	šêT				šéTms
past	šēT				šēTws
	'build'				'build repeat.'
pres	bóyā				
past	bōyā				
	'swell'				
pres	kẃ|T				
past	kw̄|T				
	'look at'				
pres	g͡bósʌ̄			g͡bósʌr	
past	g͡bōsʌ̄			g͡bǭsʌ̄r	
	'scrub'			'scrub part of something'	

NB: Most verb forms with a Pattern III tone pattern are transparently: $\left\{\begin{matrix}\text{Pattern I verb}\\ \text{Pattern II verb}\end{matrix}\right\}$ + $\left\{\begin{matrix}/s/\\ /T/\end{matrix}\right\}$. See Pattern I paradigm for the effects of adding further suffixes.

Pattern III (cont.)

		+/s/$_{CAUS}$	+/T/	+/ʌnɛ/
pres	šêT			
past	šēT			
	'build'			
pres	bóyā	bóyās		
past	bōyā	bōyās		
	'swell'	'cause to swell'		
pres	kẃ|T			kẃ|ʃʌnɛ̄
past	kw̄|T			kẁ|ʅʌnɛ̄
	'look at'			'watch each other'
pres	g͡bósʌ̄			
past	g͡bōsʌ̄			
	'scrub'			

Pattern IV Verbs: Pres HM Past LM

		+/r/$_T$	+/r/$_{CON}$	+/r/$_{PC}$	+/ʌnɛ/
pres	ʃɛ́lɔ̄				
past	ʃɛ̀lɔ̄				
	'be willing'				
pres	tɔ́mɔ̄	tɔ́mɔ̄r			
past	tɔ̀mɔ̄	tɔ̀mɔ̄r			
	'dance'	'dance on s.o./s.th.'			
pres	ŋɔ́mT	ŋɔ́mTr			
past	ŋɔ̀mT	ŋɔ̀mTr			
	'make faces'	'make faces at s.o.'			
pres	tɔ́rT				tɔ́rʃʌ́nɛ̄
past	tɔ̀rT				tɔ̀rʃʌ̀nɛ̄
	'show'				'show each other'

NB: Verbs which follow Pattern IV are morphologically complex:

ʃɛlɔ		'be willing'	(Pattern IV)	from	ʃɛl	'smile' (Pattern I)
fʌlɪr	*fʌlwr	'fly over'	(Pattern IV)	from	fʌl	'fly' (Pattern III)
Tɔfswl		'cool s.th.'	(Pattern IV)	from	Tɔ́fw̄l	'cool, quiet (Adj.)'
					Tɔ́f	'soil (N)'

The complex tones on /Tɔmɔr/ and /ŋɔmir/ then indicate that these forms are more complex than is immediately apparent.

Pattern V Verbs: Pres H L Past L M

All verbs of this pattern are reflexives. Many are transparently derived from Pattern I verbs. They do not appear with additional suffixes.

pres	ĝbɑ́nɛ̀	pres	rɑ́nnɛ̀
past	ĝbɑ̀nɛ̄	past	rɑ̀nnɛ̄
	'carry on one's shoulders'		'sweat'
pres	sɔ́tnɛ̀		
past	sɔ̀tnɛ̄		
	'lean oneself against'	Cf. sɔt	'lean something against' (Pattern I)

Polymorphemic verbs ending in /nɛ/ have the following tone patterns:

kwlɪ	(III)	'look at'	kwlɪnɛ	(III)	'watch oneself'
ĝbɛŋʌ	(II)	'hate'	ĝbɛŋʌnɛ	(II)	'hate oneself'
rwprwp	(VII)	'spin'	rwprwpnɛ	(IV)	'spin (oneself)'

Pattern VI Verbs: Pres H L Past M L

pres fʷ́ntʌ̀
past fʷ̄ntʌ̀
'lie down' cf. fʷ́nt 'bed (N)'

pres tɛ́rʌ̀
past tɛ̄rʌ̀
'drown (INT)' cf. ter 'let go' (Pattern II)

pres rɛ̋́sʌ̀
past rɛ̋̄sʌ̀
'be on top of' cf. reŋ 'put on top of' (Pattern I)

pres lʌ́Tʷ́rʌ̀
past lʌ̄Tʷ̄rʌ̀
'be soaked by the rain' cf. lʌTwr 'drench (subj=rain)' (Pattern II)

Verbs which have this pattern do not usually take further suffixes. The only such example in our corpus is (pres.) fʷ́ntʷ̄r , (past) fʷ̀ntʷ̄r 'lie on' with the final vowel missing (i.e. [ɯ] instead of [ʌ] before the suffix /r/$_T$) and Pattern IV tones. Such forms require further study.

Pattern VII Verbs: Pres H M (M_L M_{LL}) Past L M (M_L M_{LL})

pres bɔ́tʷ̄sbɔ̄̄tʷ̄̄̄s cf. botws 'arrange' (Pattern III)

past bɔ̀tʷ̄sbɔ̄̄tʷ̄̄̄s bot 'put' (Pattern I)
'arrange everything'

pres fʌ̂lfʌ̂̂l ($\hat{\hat{}}$ = a lowered fall fʌl 'fly' (Pattern III)
past fʌ̀lfʌ̂̂l as in bɔ́tʷ̄sbɔ̄̄tʷ̄̄̄s)
'fly around'

pres rʷ́prʷ̄p cf. rwp 'go around' (Pattern I)
past rʷ̀prʷ̄p
'spin'

This is the most productive pattern for reduplicated verbs. The only suffix that can be added to verbs of this pattern is the reflexive /nɛ/:

rʷ́prʷ̄pnɛ̄
rʷ̀prʷ̄pnɛ̄
'spin oneself around'

Pattern VIII Verbs: Pres H L M Past L M

pres gb̀úràŋ̀
past gb̀ùràŋ̀
'become clear' cf. gbráŋ 'clean (Adj.)'

pres sòmùrà
past sòmùrà
'send for' cf. somur 'send to' (Pattern II)

pres gb̀ántànɛ̀nɛ̀
past gb̀àntànɛ̀nɛ̀
'slap each other' cf. gbanta 'slap' (Pattern II)

pres tʃl̀ànɛ̀nɛ̀
past tʃl̀ànɛ̀nɛ̀
'sell for each other' cf. tʃla 'sell' (Pattern II)

Verbs with this pattern are all morphologically complex and do not appear with any further suffixes.

Pattern VIIIa Verbs: Pres HM M Past L M

pres gb̀ɛ̀ngb̀ɛŋ
past gb̀ɛ̀ngb̀ɛŋ
'check something out'

pres sâysāy
past sàysāy
'be fussy'

pres tʃ̀mtʃm
past tʃ̀mtʃm
'struggle' cf. tʃm 'fight' (Pattern I)

pres bɔ̀tʳʌ̀nɛ̀
past bɔ̀tʳʌ̀nɛ̀
'love each other' cf. bɔT 'become sweet' (Pattern I)

pres gb̀ɛ̀tʳʌ̀nɛ̀
past gb̀ɛ̀tʳʌ̀nɛ̀
'fasten together (pl. subj.)' cf. gbetur 'fasten' (Pattern II)

All verbs of this pattern are morphologically complex. The reduplicated verbs can take the reflexive /nɛ/ as an additional suffix, e.g. (pres.) tʃ̀mtʃ̀mnɛ̀ , (past) tʃ̀mtʃ̀mnɛ̀ 'struggle with oneself'.

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