

Word Tone in a Papuan Language: An Autosegmental Solution*

Dorothy J. James
Summer Institute of Linguistics

1 Introduction

In my first attempt to formalise the phonological component of a generative grammar of Siane (James 1966), a suffix tone specification rule first copied the tone of the final syllabic segment of the stem onto every syllabic segment of the suffix complex. It was then necessary to have a series of tone adjustment rules, in addition to the clearly motivated HL sequence tone adjustment rule, to adjust the stem tones of exactly those stems which had falling or rising tones in their underlying representations and to adjust sentence final high tone to falling tone following a consonant, or to low tone following a vowel. It was also necessary to set up geminate sequences in the underlying forms even though there are no phonetic geminates in Siane.

In this paper it will be shown that an autosegmental representation (Goldsmith 1990) of tonal and segmental phenomena in Siane, a Highlands language of Papua New Guinea,¹ allows for a more general and insightful account of the phonological processes of the language than does that afforded by incorporating only one string of segments in a phonological representation.

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¹ There are approximately 27,000 speakers of the Siane language, living in the area bordering the Eastern Highlands and Chimbu Provinces of Papua New Guinea. Siane is a Papuan language of the East Central Family of the East New Guinea Highlands Stock of the Trans-New Guinea Phylum according to Wurm (1975). There are several dialects and numerous sub-dialects of Siane; examples in this paper are from the Komogu dialect spoken in the Watabung area of the Eastern Highlands Province. Data for this paper have been collected during extensive periods of residence from 1960 to 1993 in Nonabalo, one of the villages of the area, under the auspices of the Summer Institute of Linguistics.

2 Tones, Vowel Sequences, and Timing

Siane makes significant use of tone to distinguish between lexical items. For instance, the noun *númúná*² 'his house' and *númúná* 'his sore' differ only in that the second syllable of the first word is pronounced with high tone, and of the second, with low tone. Similarly, *kéfá* 'stick, club' and *kêfá* 'meat' differ only in that the first syllable is pronounced with high tone in the first word, and falling tone in the second.

Five vowel qualities, represented by the symbols, *i, e, a, o, u*, are distinguished in underlying representations in Siane.³ The diphthongs *ai, ei, oi, au, eu, ou, ae, ao*, and *ui* occur, with timing corresponding to that of single vowels occurring with the same tones in the same positions in the word. For instance, the timing and tonal pronunciations of *kéilá* 'shell necklace' and *kélá* 'frog' are perceptually the same, as also are *kêufá* 'opossum species' and *kêfá* 'meat'. Consider also *kifôfê* 'did I plant?', *kifôi fê* 'did we 2 plant?', *kifâfê* 'did they plant?', and *kifâifê* 'did he plant?', all of which are spoken with essentially the same rhythmic and tonal characteristics. Diphthongs are therefore treated as single syllabic units, and are marked for tone on the first vowel of the sequence in the examples in this paper.

A sample of over 800 wordforms from the Siane dictionary, comprising free monomorphemic stems of all word classes and bound noun stems with a single possessive suffix, revealed that bisyllabic words accounted for 465, well over half the total, trisyllabic words 299, and monosyllabic words 50. There are comparatively few stems of more than three syllables in Siane, and of those which occur, many are either clearly traceable compounds or onomatopoeic forms describing types of flora and fauna. Stems of more than three syllables were therefore excluded from the count, as were all suffixed wordforms except possessed bound noun stems. The basic stem tone patterns in Siane are listed in (1), with monomorphemic one, two, and three syllable examples of each of the occurring forms. The numerals in parentheses preceding each example show the relative population size of each class included on the chart.

1)	monosyllabic	bisyllabic	trisyllabic
H	(19) <i>nó</i> 'eat'	(128) <i>kúlá</i> 'dog'	(66) <i>kétufú</i> 'saliva'
L	(12) <i>kò</i> 'rain'	(6) <i>mèinà</i> 'payment'	(2) <i>kòsinà</i> 'sky'
LH	(17) <i>yò</i> 'fire'	(74) <i>mâfô</i> 'taro'	(36) <i>kilifú</i> 'trap'
HL	(2) (<i>ô</i> 'yes')	(119) <i>lónò</i> 'work'	(87) <i>mâfunà</i> 'owl'
HLH	(130) <i>kéfá</i> 'meat'	(108) <i>kólipá</i> 'pine'	
		(8) <i>diyâu</i> 'bright blue'	

² High tone is represented with an acute accent over the vowel, \acute{V} , falling tone with a circumflex accent, \hat{V} , rising tone with a reversed circumflex, \check{V} , and low tone with a grave accent, \grave{V} .

³ For a fuller description of the phonetic properties of the segmental and tonal units of Siane, see Lucht and James (1962).

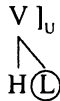
From the examples in the first column of (1), we see that only three of the five basic tone patterns seem to occur on monosyllabic words productively. The pattern HLH does not occur, illustrating a general constraint on tonal contours in Siane: a bidirectional tonal contour on a single syllable is not permitted in Siane wordforms.⁴

The two monosyllabic wordforms in Siane which occur with falling tone are nonsuffixable response words which normally occur as single-word utterances. The only word-final falling tones that occur in Siane apart from exclamations and response words (all of which occur with final falling tone) occur sentence finally. All Siane sentences end in a verb, most of which have final low or falling tone.⁵ The examples in (2) illustrate verbs with sentence-medial vs. sentence-final suffixes.

2)	Medial	Final			
	3s.advers	3s.inter	3s.indic	1s.fut.indic	gloss
a.	<i>minàifâ</i>	<i>minàifê</i>	<i>minàiyê</i>	<i>minènâe</i>	'remain'
b.	<i>ófâifâ</i>	<i>ófâifê</i>	<i>ófâiyê</i>	<i>ófênâe</i>	'hit'
c.	<i>lèkâifâ</i>	<i>lèkâifê</i>	<i>lèkâiyê</i>	<i>lèkênâe</i>	'break'
d.	<i>mélâifâ</i>	<i>mélâifê</i>	<i>mélâiyê</i>	<i>mélènâe</i>	'put'

If the medial verb form ends in a low tone, the final verb forms also end in a low tone, as in (2a). If the medial verb form ends in a high tone, the final verb forms end in a falling tone, as in (2b-d). Assuming (as will be justified later) that the high tone is basic in forms (2b-d), we can account for the falling tone in final forms by the following rule.

Final Low Insertion (FLI)⁶



⁴ Due to the influence of the question intonation pattern of Tok Pisin (Melanesian Pidgin) spoken throughout the Siane area, a very slight upglide at the end of 'yes-no' interrogative sentences (i.e., sentences using the interrogative suffix *-fe* never sentences using question words with the indicative suffix *-e*) is beginning to come into Siane. It was observable only rarely until recently, but is now being heard with increasing frequency. When this occurs the result is a simple slight upglide on the final syllable *-fe* if that syllable would normally have been low tone, but if it would normally have been HL, the result is an HLH tonal contour on the single syllable *-fe*, with the second H varying in pitch from only slightly higher than the L, to up to half the pitch height of the preceding H. This is the only situation that we have observed in any dialect of Siane in which a bidirectional pitch contour occurs.

⁵ Verbs in the historical past may have final high tone. The historical past is both tonologically and segmentally homophonous with the relative clause construction, but is structurally distinct in that it occurs only dominated by S, whereas the relative clause is always dominated by NP; that is, it occurs only in embedded constructions. The historical past suffix must be lexically marked as obligatorily failing to undergo FLI as in:

Yâfô ófô nènâgólônê, lóti lógimámá.
pig hit we-intend-eat saying they-told-them

'They (the ancestors) told them (the grandparents), saying, "We'll have a pig feast."'

⁶ This assumes that the sentence in Siane corresponds with the phonological utterance, following Nespor and Vogel (1986).

Given FLI, I would suggest that exclamation and response words have an underlying H rather than HL tone pattern, and are subject to rule FLI as well. This then leaves us with three basic underlying tone patterns on monosyllabic stems: H, L, LH, with a fourth, HL, surfacing under the operation of FLI.⁷

The basic tone processes needed to account for wordforms based on nominal stems with H, L, LH, and HL patterns are discussed in section 3. Then the interaction of these processes with the segmental processes needed to account for verbal wordforms are discussed in section 4. In section 5 wordforms based on stems with HLH tone patterns are analysed. Finally, in section 6, a few rarer tone patterns and irregular mappings of basic tone patterns are discussed.

3 Basic Tone Processes

Most of the suffixal (including postclitic) morphemes in Siane are unspecified for tone in their underlying representations. Tone is assigned by rule, spreading the final tone of the stem to the suffixes. Consider the nominal forms in (3), showing how stems having H, L, and LH underlying tonal configurations influence the tone of each of their suffixes.

3)	noun stem ⁸	1p.poss	defn	erg ⁹	gloss
	<i>kúlá</i>	<i>kúláté</i>	<i>kúlámá</i>	<i>kúlákáfó</i>	'dog'
	<i>mèinà</i>	<i>mèinàtè</i>	<i>mèinàmà</i>	<i>mèinàkàfó</i>	'payment'
	<i>màfó</i>	<i>màfóté</i>	<i>màfómá</i>	<i>màfókáfó</i>	'taro'

The same pattern can be seen with trisyllabic stems, as seen in (4).

4)	noun stem	1p.poss	defn	erg	gloss
	<i>kétúfú</i>	<i>kétúfúté</i>	<i>kétúfúmá</i>	<i>kétúfúkáfó</i>	'saliva'
	<i>kòsinà</i>	—	<i>kòsinàmà</i>	—	'sky' ¹⁰
	<i>kilífú</i>	<i>kilífúté</i>	<i>kilífúmá</i>	<i>kilífúkáfó</i>	'trap'

Following Goldsmith (1990), I propose that the tone pattern for each stem is associated with the stem as a whole, not with particular vowels. That is, the underlying forms of the stems (3) are /^Hkula ^Lmeina ^{LH}mafo/, respectively. The suffixes, on the other hand, would not include

⁷ There is, in addition, a small set of monosyllabic verb stems in Siane which have rising tone (LH) when they occur without suffixation, but which when suffixed exhibit both the LH and the HLH tone melodies, depending upon the specific grammatical categories involved in the suffixation. Possible reasons for the apparent dual tone patterns with such stems are presented in section 6.2.

⁸ Uninflected noun stems are grammatical.

⁹ In Siane, the ergative clitic may denote agent, instrument, or topic. It may therefore be used with most nouns. For a fuller description of the uses of the ergative and other Siane clitics, see Potts and James (1983).

¹⁰ The morpheme /^Hkosina/ 'sky' cannot be possessed (at least not by people), nor can the ergative be used with it.

any tone specifications. Thus, the underlying forms of *kúlá kúláté màfò màfóté* would be as shown in (5).

5) /^Hkula ^Hkula-te L^Hmafo L^Hmafo-te/

The Association Convention (AC; Goldsmith (1990: 14)) will associate tones and vowels on a one-to-one basis to wordforms, as shown in (6).

6) kula kula-te mafo mafo-te
 | | | | | |
 H H L H L H

The tone spreading rule accounting for the remaining tonal specifications can be formalised as follows.

Tone Spreading (TS)

V
 |
 T

TS would apply to the forms in (6) yielding the forms in (7).

7) kula kula-te mafo mafo-te
 | | | | | |
 H H L H L H

TS will not account for any wordform of four or more syllables with an HL tone pattern. Examples are given in (8).

8)	noun stem	1p.poss	defin	erg	gloss
	<i>lónò</i>	<i>lónòtè</i>	<i>lónòmà</i>	<i>lónókàfò</i>	'work'
	<i>máfùnà</i>	<i>máfùnàtè</i>	<i>máfùnàmà</i>	<i>máfùnàkàfò</i>	'owl'

In *lónókàfò* 'by (means of) work' and all affixed forms of *máfùnà* 'owl', the first two syllables are high instead of only the first. This is due to the fact that a single word initial high tone syllable followed by three or more low tone syllables is a nonpermitted tonal sequence in Siane wordforms. A rule changing the first low tone of such a sequence to high tone is therefore necessary. The rule may be formalised as follows.

HL Sequence Tone Adjustment (HLTA)

#V V V V
 |
 #H L

Derivations of *lónókàfò máfùnà máfùnàmàkàfò* are given in (9).

9)	/ ^H lono-kafo	^H Lmafuna	^H Lmafuna-ma-kafo/
AC	lono-kafo \ H L	mafuna HL	mafuna-ma-kafo \ H L
TS	lono-kafo \ \ H L	mafuna \ HL	mafuna-ma-kafo \ \ \ H L
HLTA	lono-kafo \ \ H L	—	mafuna-ma-kafo \ \ \ H L
	[lónókàfò 'by (means of) work']	máfùnà 'owl']	máfùnàmàkàfò] 'the owl (erg)']

Notice also that TS applies in *máfùnàmàkàfò* to multiple affixes.¹¹

These rules and FLI together account for response words, such as *ô* 'yes' *ákê* 'expression of surprise', as shown in (10).

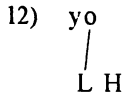
10)	/ ^H o	^H ake/
AC	o H	ake H
TS	—	ake H
HLTA	—	—
FLI	o \ H L	ake \ H L
	[ô	ákê]

¹¹ A few Siane suffixes, such as *-ti* 'also', have their own inherent tone which is retained regardless of the tone of the stem to which they are affixed. Furthermore, any following suffixes copy the tone of that suffix, not the tone of the stem.
Kônúmā-ti kēfā-ti ôlitú áe. 'They brought sweet potato and meat.'
Kēfā-ti-mā ôlitú áiyé. 'He brought the meat as well.'

The only other specification regarding tone assignment of patterns H, L, LH, and HL applies to monosyllabic stems. Examples are given in (11).

11)	noun stem	1p.poss	defn	crg	gloss
	<i>kò</i>	—	<i>kòmà</i>	<i>kòkàfò</i>	'rain' ¹²
	<i>yǒ</i>	<i>yòté</i>	<i>yòmá</i>	<i>yòkáfò</i>	'firc(wood)'

The underlying forms are /^Lko/ and /^{LH}yo/, respectively. The only form needing comment is the unaffixed form *yǒ*. The AC would apply to /^{LH}yo/ to give (12).



For the purposes of this paper, I will propose the following rule to account for the surface form.

Tone Dumping (TD)



Before leaving the discussion of nominal wordforms, it is necessary to discuss the assignment of tone to diphthongs. If each member of the diphthong is a separate tone bearing unit, the AC will assign tones inappropriately to forms like *mòità* 'rubbish' and *àumá* 'bone, strength', as shown in (13).

13)		/ ^{HL} moita		/ ^{LH} auma/
	AC	moita		auma
		 HL		 L H
	TS	moita		auma
		 HL		 L H
	HLTA	—		—
	FLI	—		—
		[*mòità		*àumá]

¹² The morpheme /^Lko/ 'rain' cannot be possessed, but it can take the ergative as when rain causes a flood.

The problem here is that a diphthong in Siane must be considered a single tone bearing unit. This is possible if we adopt Goldsmith's (1990:67) proposal that such diphthongs are single vowels on the skeletal tier. For example, the skeletal representation of /moita/ would be as in (14).



Given this representation, the AC would assign the H to the first V (*oi*) and the L to the second V (*a*). Although I will continue to ignore the skeletal structure in derivations, it should be clear that a diphthong will behave as a single tone bearing unit.

4 Verbs and Segmental Processes

The tonal rules and conventions proposed in section 3 are also sufficient to account for verbal wordforms. In addition, however, there are four phonological rules in Siane which conspire to ensure that no more than two vowels occur together, either between consonants, or between word boundaries and consonants, in phonetic representations of Siane wordforms. (There are no consonant clusters in systematic phonetic representations of Siane wordforms, and no word-final consonants).¹³ These rules further conspire to ensure that the only two-vowel sequences which occur are those permitted by the syllabic structure of the language, either [V, -high] [V, +high] or [V, +low] [V, -low].¹⁴ In this section I examine the interaction of these tonal and segmental rules.

Once again, most verb suffixes are unspecified for tone in their underlying representations. Consider the verbal forms in (15).¹⁵

¹³ There are a few morphemes (bound stems and nonfinal affixes) in Siane which end in a nasal consonant, and which, if followed by a consonant-initial morpheme, have a consonant cluster in the derivations of the resultant wordforms. A late assimilation rule results in the assimilation of such nasal consonants to the point of articulation of the following consonant, while at the same time specifying the following consonant as a voiced stop, unless it is a nasal. The resultant cluster is either a geminate sequence of nasal consonants, coalesced by a late geminate sequence coalescence rule, or a sequence of nasal plus stop, coalesced to a single prenasalised stop by the same rule that prenasalises all voiced plosives in Siane. For example:

¹¹ numuN-ne	<i>niuminé</i>		'my house'
¹¹ numuN-ka	<i>niumigá</i>	[númúngá]	'my house'
¹¹ numuN-te	<i>niumidé</i>	[númúndé]	'our house'
¹² mino-an-e	<i>mináné</i>		'you remain/you're there'
¹² mino-an-fe	<i>minábè</i>	[minànbè]	'are you there?'

¹⁴ The conspiracy of the four rules also allows sequences of high vowels differing in backness. Of the two sequences in Siane which fit that description, *ui* occurs, as noted section 2, but it is very infrequent, occurring only monomorphemically, sometimes under the operation of metathesis.

¹³ buli-ai-fa	<i>biiláifá</i>	'it changes/he is transformed, but...'
¹³ muli-ai-fa	<i>múiláifá</i>	'he peels/skins it, but...'
	<i>ówó kúí</i>	'string cap'

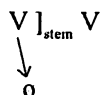
We have not found the expected reverse sequence *iu* in any Siane wordform to date.

¹⁵ There are no verb stems in Siane with underlying L tone pattern.

15)	verb stem ¹⁶	1s.rel	3s.advers	3p.fut.rel	gloss
	<i>ófó</i>	<i>ófómó</i>	<i>ófáifá</i>	<i>ófénàwámó</i>	'hit'
	<i>lèké</i>	<i>lèkómó</i>	<i>lèkáifá</i>	<i>lèkénàwámó</i>	'break'
	<i>minò</i>	<i>minòmò</i>	<i>minàifá</i>	<i>minénàwámò</i>	'remain'

The suffixes are as follows: *-o* '1s', *-ai* '3s', *-awa* '3p', *-en* 'future', *-mo* 'relativiser', and *-fa* 'adversative'. TS accounts for the tone spreading to the suffixes; HLTA also applies in the case of *minénàwámò*. In addition to TS, in the verbal forms in (15) a stem-final vowel is deleted before a vowel initial suffix. This vowel deletion rule can be formalised as follows.

Vowel Deletion (VDel)



When the vowel is deleted, the tone that would have been assigned to the stem vowel is assigned to the suffix; the tone is not deleted with the vowel.

Derivations of some of the examples in (15), showing the application of TS and VDel, are given in (16).¹⁷

16)	/ ^{LH} lcke-o-mo	^{HL} mino-ai-fa	^{HL} mino-en-awa-mo/
VDel	^{LH} lcko-o-mo	^{HL} mino-ai-fa	^{HL} mino-en-awa-mo
AC	lek-o-mo L H	min-ai-fa H L	min-en-awa-mo \ H L
TS	lck-o-mo \ / L H	min-ai-fa \ / H L	min-en-awa-mo \ / \ / \ / H L
HLTA	—	—	min-cn-awa-mo \ / \ / \ / H L
	[lèkómó 'I who break (it)']	minàifá 'he remains but...'	minénàwámò 'they who will remain'

¹⁶ Uninflected verb stems may only be used in serial verb constructions.

¹⁷ Late phonetic rules in Siane palatalise all nonliquid consonants following /i/, labialise all noncoronal consonants following /u/, prenasalise all voiced plosives, specify certain vowels and consonants as nontense in particular environments, and specify /l/ as [r] intervocally. Otherwise, the phonetic representations are as shown throughout the paper.

HLTA must apply after VDcl since its applicability depends on the number of low tone syllables after an initial high tone syllable, and VDcl can change this number.

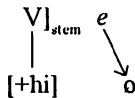
Although VDcl as formalised applies to all stem final vowels preceding a vowel initial suffix, it actually does not apply as widely as the rule implies. First, it only affects verbs, since no nonverbal suffix has been found beginning with a vowel. Second, it only deletes mid vowels. No verb stem has been found ending in *a*. If a verb stem has a final high vowel, that vowel does not delete preceding a vowel initial suffix. Instead, other processes take place, depending upon the quality of the following vowel, to ensure that no nonpermitted vowel sequence occurs.

If a stem final high vowel is followed by the nonhigh front vowel, *e*, the *e* deletes. If a polysyllabic verb stem has a final high vowel and is followed by a suffix beginning with a vowel other than *e*, the stem final high vowel metathesises with the preceding consonant, forming a diphthong or geminate sequence¹⁸ with the preceding vowel. This diphthong takes the initial tone while the tone that would have been assigned to the metathesised stem vowel is assigned to the suffix. Consider the examples in (17) (in which, as noted above, ‘future’ is *-en*).

17)	verb stem	1s.rel	3s.advers	3p.fut.rel	gloss
	<i>áfú</i>	<i>áfómó</i>	<i>áfáifá</i>	<i>áfúnáwámó</i>	‘pluck out’
	<i>ápóli</i>	<i>ápóilómó</i>	<i>ápóiláifá</i>	<i>ápólináwámó</i>	‘distribute’
	<i>làgú</i>	<i>làugómó</i>	<i>làugáifá</i>	<i>làgúnáwámó</i>	‘bake’
	<i>dòli</i>	<i>dòilómó</i>	<i>dòiláifá</i>	<i>dòlináwámó</i>	‘harvest’
	<i>bálù</i>	<i>báulómó</i>	<i>báuláifá</i>	<i>bálináwámó</i>	‘care for’
	<i>kóli</i>	<i>kóilómó</i>	<i>kóiláifá</i>	<i>kólináwámó</i>	‘pack’

The rules of *e*-Deletion and Metathesis may be formalised as follows.

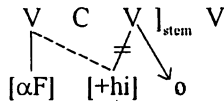
***e*-Deletion (*e*-Dcl)**



¹⁸ Geminate vowel sequences formed by the application of Met must then be coalesced (GSCo (Geminate Sequence Coalescence) in the derivations below) to derive the correct phonetic output. Consider, for example, the verb /^{HL}lipi/ ‘squeeze’:

	^{HL} lipi-o-mo	^{HL} lipi-ai-fa	^{HL} lipi-en-awa-mo
<i>e</i> -Del	—	—	^{HL} lipi-on-awa-mo
Met	^{HL} liip-o-mo	^{HL} liip-ai-fa	—
AC	liip-ò-mo	liip-ài-fa	lipi-n-awa-mo
TS	liip-ò-mò	liip-ài-fà	lipi-n-àwà-mò
HLTA	—	—	lipi-n-àwà-mò
GSCo	lip-ò-mò	lip-ài-fà	—
	[lipòmò]	lipàifà	lipinàwámò]
	‘I who squeeze’	‘he squeezes, but...’	‘they who will squeeze’

Geminate consonant sequences are formed in the derivations of some Siane wordforms by a late assimilation rule. These would also need to undergo GSCo to derive the correct phonetic output.

Metathesis (Mct)

When *e*-Del is ordered preceding Met, it is unnecessary to include ‘a vowel other than /e/’ in the environmental specifications of Met, since any /e/ occurring in that environment will have been deleted by *e*-Del. In addition, if VDel is ordered after *e*-Del and Met, it will automatically apply only to mid vowels since all vowel sequences in which the first vowel is high will have been dealt with by *e*-Del or Met.

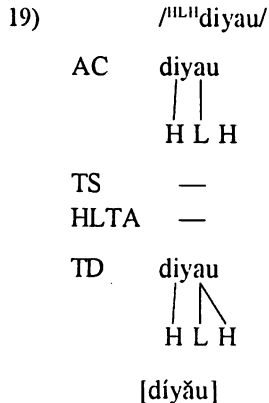
Met results in a diphthong, which, as argued in section 3, is a single V dominating two root nodes. The resulting diphthong will be associated with only one tone. Since both *e*-Del and Met, like VDel, change the number of syllables in a wordform, HLTA must be ordered following both *e*-Del and Met. Derivations of some of the examples in (17), illustrating the application of the rules so far presented, are given in (18).

18)	/ ^H a <u>fu</u> -o-mo	^{L^H} doli-ai-fa	^{H^L} koli-cn-awa-mo/
<i>e</i> -Del	—	—	^{H^L} koli-on-awa-mo
Met	^H a <u>uf</u> -o-mo	^{L^H} doil-ai-fa	—
VDel	—	—	—
AC	a <u>uf</u> -o-mo H	doil-ai-fa L H	koli-n-awa-mo H L
TS	a <u>uf</u> -o-mo H	doil-ai-fa L H	koli-n-awa-mo H L
HLTA	—	—	koli-n-awa-mo H L
	[áufómó ‘I who pluck out’	dòiláifá ‘he harvests, but...’	kólináwámò ‘they who will pack’

5 Wordforms with HLH Tone Patterns

The application of the tone rules and conventions discussed up to this point results in correct tone assignment for all trisyllabic stems with an HLH tone pattern. For example, *kólipá*

'pine' is derived from /^HL^Hkolipa/. The AC will assign the three tones to the three vowels. The tone rules and conventions also result in correct tone assignment for forms like *díyǎu* 'bright blue' as shown in the derivation in (19).



Forms like *díyǎu*, where HLH is mapped as H–LH on bisyllabic forms are, however, a minority. Approximately a quarter of the two syllable stems in the dialect of Siane under study are of the tone pattern HL–H, that is, falling-high. In general, when such stems are suffixed, the underlying tonal specification of the stem spreads to cover the entire wordform. Consider the examples in (20).

20)	noun stem	1p.poss	def.in	erg	gloss
	<i>kéǎ</i>	<i>kéǎté</i>	<i>kéǎmá</i>	<i>kéǎkǎǎǎ</i>	'meat'
	<i>kéufǎ</i>	<i>kéufǎté</i>	<i>kéufǎmá</i>	<i>kéufǎkǎǎǎ</i>	opossum sp
	<i>fěni</i>	<i>fěnité</i>	<i>fěnimá</i>	<i>fěnikǎǎǎ</i>	'cel'
	<i>nóǎ</i>	<i>nóǎté</i>	<i>nóǎmá</i>	<i>nóǎkǎǎǎ</i>	'string'
	verb stem	1s.rel	3s.advers	3p.fut.rel	gloss
	<i>mélé</i>	<i>mélómó</i>	<i>mélǎǎǎ</i>	<i>mélénǎwámó</i>	'put'
	<i>léki</i>	<i>léikómó</i>	<i>léikǎǎǎ</i>	<i>lékinǎwámó</i>	'pour'
	<i>kóǎ</i>	<i>kóǎfómó</i>	<i>kóǎǎǎ</i>	<i>kóǎnǎwámó</i>	'dig'

Apart from the frequently occurring falling tones in the stems illustrated in (20), and those resulting from FLI, only three examples of falling tone have been found to occur, namely *ògómú* 'spider', *èbénú* 'grasshopper', and *kònúmá* 'sweet potato', a less frequently occurring tonal variant of the form more commonly occurring as *kònúmǎ* 'sweet potato'. Note that in each of these trisyllabic examples, the tonal pattern consists of a word initial low tone syllable followed by the same pattern in the second and third syllables as that of bisyllabic words

involving falling tone, namely falling-high. The tone spreading when these nouns are suffixed follows the same pattern as that of the bisyllabic nouns. Compare the examples given in (20) with those in (21).

21)	noun stem	defn	erg	gloss
	<i>ògómú</i>	<i>ògómùmá</i>	<i>ògómùkáfó</i>	'spider'
	<i>èbènú</i>	<i>èbènùmá</i>	<i>èbènúkáfó</i>	'grasshoper'
	<i>kònúmá</i>	<i>kònúmàmá</i>	<i>kònúmàkáfó</i>	'sweet potato'

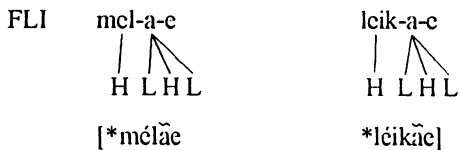
Obviously, falling tones in Siane are the result of underlying HL sequences, as evidenced in the spread of the tonal configurations of the stem over the suffixed wordforms. However, the tone rules and conventions proposed thus far will not account for word internal falling tones. As shown in (19), HLH tone patterns should be realised as H–LH, not HL–H.

Bisyllabic verbal stems with HLH tone patterns will also have tone assigned incorrectly in the third person plural indicative (nonfuture tense) forms. Examples are given in (22).

22)	verb stem	3p.ind	gloss
	<i>mêlé</i>	<i>mêlâe</i>	'put'
	<i>lêki</i>	<i>lêikâe</i>	'pour'
	<i>kôfú</i>	<i>kôufâe</i>	'dig'

The indicative verb forms always occur sentence finally, meeting the structural description of FLI. The result of the application of the rules and conventions discussed so far would thus be a nonpermitted LHL sequence on a single syllable, the final syllable, as shown in the derivations in (23).

23)	$/^{HLH}mcl\text{-}a\text{-}e/$	$^{HLH}lcki\text{-}a\text{-}e/$
<i>e</i> -Dcl	—	—
Met	—	$^{HLH}lcki\text{-}a\text{-}e$
VDcl	$^{HLH}mcl\text{-}a\text{-}e$	—
AC	$mcl\text{-}a\text{-}e$	$lcki\text{-}a\text{-}e$
	$\begin{array}{c} \quad \\ H \quad LH \end{array}$	$\begin{array}{c} \quad \\ H \quad LH \end{array}$
TS	— —	
HLTA	— —	
TD	$mcl\text{-}a\text{-}e$	$lcki\text{-}a\text{-}e$
	$\begin{array}{c} \quad \wedge \\ H \quad LH \end{array}$	$\begin{array}{c} \quad \wedge \\ H \quad LH \end{array}$



One possible solution to this problem is suggested by the fact that there is essentially no difference between the syllable timing of single vowels vs. diphthongs in Siane, and since a geminate sequence coalescence rule is independently motivated for Siane¹⁹ it might be possible to claim, following Lucht and James (1962) and James (1966), that the first syllable in forms like *kêfâ* 'meat' and *kôfû* 'dig' had geminate vowels. This suggestion is supported by the fact that, whereas bisyllabic stems with a falling-high tone pattern are numerous, that tone pattern does not occur with bisyllabic stems having a diphthong in the second syllable. Instead, such stems occur with a high-rising tone pattern. Consider the examples in (24).

24) no diphthong	syll 1 diphthong	syll 2 diphthong
<i>fâlá</i> 'handle'	<i>fâigá</i> 'far'	<i>ákǎi</i> 'harvest (corn)'
<i>êfi</i> 'extinguish'	<i>kêufá</i> 'opossum sp'	<i>ékêi</i> 'carry on shoulder'
<i>dîno</i> 'spinach sp'	<i>dâifá</i> 'round house'	<i>dîyǎu</i> 'bright blue'

When there is no diphthong (as in column 1), or a diphthong in the first syllable (as in column 2), the tone pattern is HL–H. When there is a diphthong in the second syllable (as in column 3), the tone pattern is H–LH.

This limitation of distribution in Siane is not merely a chance result of the infrequency of bisyllabic stems having a diphthong in the second syllable. This may be substantiated by looking at further facts of the language. Many noun stems may be suffixed with the locative *-ku* 'in', as shown in (25a), but if the final syllabic segment of such a stem is /a/, the /k/ of *-ku* is deleted, resulting in the vowel sequence /au/ as shown in (25b-c).

25)	noun stem	locative	gloss
a.	<i>nǎ</i>	<i>nókú</i>	'water'
	<i>fâmó</i>	<i>fâmókú</i>	'dream'
	<i>málú</i>	<i>málúkú</i>	'cooking drum'
	<i>limú</i>	<i>limúkú</i>	'cloud'
	<i>kâlê</i>	<i>kâlékú</i>	'hole in ground'
	<i>kòukâmé</i>	<i>kòukâmékú</i>	'parcel'
	<i>kâfi</i>	<i>kâfikú</i>	'gourd'
	<i>fǒli</i>	<i>fǒlikú</i>	'holiday'

¹⁹ See footnote 18 for a discussion of the Geminate Sequence Coalescence rule.

b.	<i>kábà</i>	<i>kábàu</i>	‘mud’
	<i>kálá</i>	<i>káláu</i>	‘his car’
	<i>kémàná</i>	<i>kémànáu</i>	‘his lap’
c.	<i>míká</i>	<i>míkǎu</i>	‘earth, ground’
	<i>nêlá</i>	<i>nêláu</i>	‘vine, rope’

Note particularly that in (25c), the HLH tone pattern is realised as HL–H on a form with no diphthong, but as H–LH when the second syllable contains a diphthong. However, the proposal to posit the underlying form of *kêfá* as /^{HLH}kccfa/ gives rise to a number of problems, not only theoretical, but analytical and practical as well.

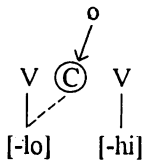
First, although a geminate sequence coalescence rule is independently motivated for Siane, it is needed specifically to coalesce geminate sequences which are created in the derivational history of certain wordforms by the application of the metathesis rule, and in other wordforms by the application of a late consonantal assimilation rule. Geminate sequences never surface in the phonetic output of Siane utterances, and the only geminate sequences to be found in Siane underlying forms would be those specifically set up to account for rising and falling tonal contours, if such a proposal were to be followed.

Second, the postulation of underlying geminate vowel sequences creates otherwise unnecessary complexity in several of the rules of the phonological component of a generative grammar of Siane, and certain anomalies in their application. For instance, most glides in Siane are epenthetic, as illustrated in (26).

26)	verb stem	1sg.-ind	3sg.-ind	gloss
	<i>minò</i>	<i>min-ò-(w)-è</i>	<i>min-ài-(v)-è</i>	‘remain’
	<i>bálù</i>	<i>bául-ò-(w)-è</i>	<i>bául-ài-(v)-è</i>	‘care for’
	<i>kóli</i>	<i>kóil-ò-(w)-è</i>	<i>kóil-ài-(v)-è</i>	‘pack’

The glide epenthesis rule may be formalised as follows.

Glide Epenthesis (GE)



The glide epenthesis rule correctly inserts /y/ between /i/ or /e/ and a following /e/, /a/, or /o/, and inserts /w/ between /u/ and /o/ and a following /e/, /a/, or /o/. However, if geminate vowel sequences are used in underlying forms to account for falling tone contours on single syllabic units, rule GE would incorrectly insert a glide between the geminate /o/'s and geminate /e/'s in

the derivation of many Siane stems. It would therefore be necessary either to modify the rule, or to formulate another rule specifically to block the application of GE to geminate clusters. At the same time, there are a few Siane stems, such as *ówó* ‘string bag’, *éyé* ‘see (him)’, in which glides do occur phonetically between identical vowels. If the application of GE to geminate clusters were blocked, these otherwise epenthetic glides would need to be included in the lexical representations of such stems.

The geminate sequence coalescence rule itself must be made more complex if geminate vowels are to be used underlyingly to account for rising and falling tone contours on phonetically single syllabic segments. In the first place, in the case of verb stems such as *kífi* ‘plant’ and *lúkú* ‘wind or roll up (something)’ the application of Met would result in a geminate sequence of three vowels, which must then be accounted for in the formalisation of the geminate sequence coalescence rule, since only a single vowel may occur in the phonetic representation.

Third, this solution does not account for why an H–LH pattern is never found on forms with no diphthongs. There is no reason why the second syllable in a bisyllabic form could not be a geminate. In fact, given this solution there is no reason why any contour tone should not be allowed anywhere in a form. The facts of Siane distribution, however, are that contour tones are severely limited.

Finally, and perhaps most tellingly, it was argued in section 3 that diphthongs behave structurally as single Vs. The process that degeminates sequences that arise over morpheme boundaries probably deletes one of two Vs dominating a single root node. Since the AC assigns a single tone to a single V, and diphthongs act as single Vs, it is difficult to see how a geminate could act as two Vs.

While positing geminates is not the answer to the realisation of the HLH tone pattern, the segmental structure is significant. This is the only situation in Siane phonology in which tonal association is sensitive to the underlying segmental structure of Vs rather than simply to the number of Vs in the wordform. In nonpermitted forms like **kófĩ* the final V has two tones but only a single segment, while in nonpermitted forms like **kófã* the final V has three tones but only two segments. In addition, in both instances the first tone attached to the V is L. The following rule, then, could account for the realisation of HLH patterns.²⁰

Low Tone Association Adjustment (LTA)

If the number of tones associated with a word final V exceeds the number of segments associated with that V, and if the first tone of the tonal sequence is L, reassociate the L to the preceding V.

²⁰ I am greatly indebted to Michael Kenstowicz for valuable suggestions leading to the formulation of LTA and the greater generality captured by the present treatment of the mapping problems associated with bisyllabic HLH wordforms in Siane than that of any of my previous efforts. Full responsibility for any remaining lack of clarity or of generality remains with the author.

The fact that the L must be reassociated with a preceding V will block its application in monosyllabic forms like *nō* 'water'. Consider the derivation in (27), comparing them with those in (23).

27)	/ ^{HLH} mɛle-a-e	^{HLH} lɛki-a-c	^{HLH} mɛle/
<i>e</i> -Del	—	—	—
Mct	—	^{HLH} lɛik-a-e	—
VDel	^{HLH} mɛlo-a-c	—	—
AC	mɛl-a-c H L H	lɛik-a-c H L H	mɛle H L H
TS	— —	—	
HLTA	— —	—	
TD	mɛl-a-e H L H	lɛik-a-c H L H	mɛle H L H
FLI	mɛl-a-c H L H L	lɛik-a-c H L H L	—
LTA	mɛl-a-e H L H L	lɛik-a-c H L H L	mɛle H L H
	[mɛlɛc 'They put.'	lɛikɛc 'They pour.'	mɛlɛ] 'put'

Note, in the examples in (27), that LTA crucially follows all other tone mapping rules, and in particular it must follow FLI in order that sentence final wordforms such as *mɛlɛ* 'they put', *ɛifɛ* 'they extinguish', and *ɛiyɛ* 'they fight' be correctly specified for tone. Note also that rule LTA must be limited in its application to low tone. If it were stated so as to apply more generally, it would reassociate the high tones on sentence final syllables after the application of FLI, resulting in the removal of the correct tonal specifications for most of the sentence final falling tones in the phonetic representation of the language, such as *mɛlɛnɔ́lɔ́wɛ* 'I intend to put', *ɛfinɔ́iyɛ* 'he will extinguish', and *ɛiyɔ́iyɛ* 'he fights'. The rule as stated limits its application to all and only those wordforms which would be violating the tonal assignment restrictions of the Siane language if it did not apply.

6 Additional Tone Patterns

The general conventions and language specific tone rules discussed thus far account accurately for the tone of over 95% of Siane wordforms not affected by compounding or sandhi. Due to limitations of space, it is not possible to discuss here the rules involved in the various types of compounding and in the tone sandhi affecting certain phonologically close knit verb and noun phrases in Siane. A few examples, however, will be included in 6.2.

6.1 Rarer tone patterns

Although rare, the tone pattern LHL does occur in Siane, as does LHLH, which could be considered as a variant of HLH, i.e., (L)HLH, or of LHL, i.e., LHL(H), or as a separate tone pattern. Consider the examples in (28).

28)	LHL	<i>ólúwè</i>	'turn over'		
		<i>ìyáinà</i>	'betrothe'		
		<i>tùfóli</i>	'green grasshopper'		
	LHLH	<i>fòlólòpé</i>	'panpipes'	<i>mènúmǎ</i>	'wart'
		<i>kòlúgèfá</i>	'lady bug'	<i>ògómú</i>	'spider'
		<i>sàlópàiná</i>	'reptile'	<i>fóumǎ</i>	'round'

Since the only examples of LHL observed so far Siane are found on trisyllabic stems, they present no mapping problems, nor do the four syllable wordforms with an LHLH pattern. Two and three syllable stems with an underlying LHLH pattern, however, do present a problem when they occur unsuffixed in that only one mapping, that of wordforms like *ògómú* 'spider', is accounted for by the rules as presented here. Note that the rules as formulated account accurately not only for bisyllabic wordforms with an HLH tone pattern, but also for trisyllabic wordforms with an LHLH pattern in which a falling tone occurs on the penultimate syllable. Since the general conventions alone would account for the two exceptions, *mènúmǎ* 'wart' and *kònúmǎ* 'sweet potato', if LTA did not apply, they could be treated as exceptions either by marking them lexically as [-LTA], or by a lexical association line associating the second L of the tone pattern to the final syllable, thereby preventing LTA from applying.²¹ The two-syllable

²¹ There are two alternative tonal pronunciations of the stem for 'sweet potato' in the Komogu dialect, *kònúmǎ* and *kònumá*, as noted in section 5. The latter is lexically unmarked, the former marked as exceptional either by [-LTA] or by a lexical association line. It is interesting that the most commonly occurring pronunciation is the exceptional one, possibly indicating that the term is a relatively recent borrowing (although the sweet potato was introduced to the Highlands of Papua New Guinea prior to Western contact, and is by now the staple dietary substance throughout the highlands), beginning to conform to the unmarked tonal pronunciation. Other Siane dialects and subdialects have differing tonal pronunciations, and even different terms (though possibly related), such as Kolepa *kònùmá*, Yadime *kònùmá*, Kemanimowe and Keto *kòiyá* or *kòiyá*, Algo and Labau *kòbá* and *kòbà*, Oluba and Wado *kòbá* or *òbá*, and Yaweyuha (a closely related language, almost close enough to be considered a dialect) *òpá*. (The loss of word initial /k/ is a regular

exception, *fõumǎ* ‘round’, may be accounted for by a lexical association line associating the first H of the tone pattern to the first syllable.

6.2 Irregularities

There are a few verb stems in Siane which occur with a rising tone pattern, all of which take one of three segmental patterns (involving only two syllabic patterns): *cṽ(v)* and *ṽcṽv*, of which the final *v* in each case is a high vowel, as in *kũ* ‘build’, *ḟĩ* ‘fight, strike’, *yõu* ‘carry on head, and *ákãi* ‘harvest corn’. When such stems are suffixed with a vowel initial suffix, if the suffix vowel is /e/, truncation takes place according to *e-Del*. If the suffix vowel is other than /e/, since neither of the segmental patterns found in such stems meets the structural description of *Met*, *GE* applies, inserting /y/ or /w/ as appropriate between the final stem vowel and the initial vowel of the suffix. In either case, the tonal specification of the stem spreads to cover the entire wordform, that is, the final syllable of the stem becomes low tone, and suffixes become high tone, as in *kũ-n-áwá-mó* ‘they who will build’, *yõu-(w)-ài-fǎ* ‘she carries (it) on (her) head, but...’, *ákài-(v)-ó-mó* ‘I who harvest corn’.

A further complication associated with the CV verb stems which have a rising tone pattern when they occur without suffixation is that they may exhibit either an LH or an HLH tone pattern when suffixed. At first glance the choice of which pattern appears is determined by the grammatical categories involved in the suffixation.

29)	verb stem	fut-1s-relative	1cg-relative	3s-adv	gloss
	<i>ḟĩ</i>	<i>ḟi-n-ú-mó</i>	<i>ḟi-(v)-ò-mó</i>	<i>ḟi-(v)-ài-fǎ</i>	‘fight, strike’
	<i>kũ</i>	<i>kũ-nú-mó</i>	<i>kũ-(w)-ò-mó</i>	<i>kũ-(w)-ài-fǎ</i>	‘build’

Such stems could possibly be considered as underlyingly HLH, with the first H deleted when the stem occurs without suffixation, due to two language specific restrictions: a) the nonoccurrence of bidirectional tone contours on a single syllable, and b) the nonoccurrence of falling tone in wordfinal position except as the surface form of underlying H sentence finally. Such a proposal would not, however, account for the future forms of these verbs, all of which exhibit an LH tone pattern, as do the same subject coordinate forms *ḟi-tó* (**ḟi-tó*) ‘I (you, he, we) fight and...’ and *kũ-tó* (**kũ-tó*) ‘I (you, he, we) build and...’.

There is one Siane verb stem which in nonsuffixed form exhibits a freely varying pattern both in its tonal and in its segmental/syllabic structure: *dĩ* ~ *ĩdi* ‘go up’. When this verb is suffixed, it exhibits precisely the same tonal behavior as the monosyllabic CV set illustrated

sound change between Yaweyuha and Obula and the other dialects of Siane. Note also that all *bs* in the above examples are prenasalised, as are all voiced plosives in the dialect names.)

above, with one segmental difference. Since, in its HLH form, it meets the structural description of the metathesis rule, the second syllable metathesises when the stem is followed by a vowel initial suffix. This results (following geminate cluster reduction) in *id-ò-mó* and *id-ài-fá* never **dì-(y)-ò-mó* nor **dì-(y)-ài-fá*. The same subject coordinate and the future forms of this verb exhibit the same freely variant tonal/segmental structure as the unsuffixed stem, although the *c*v variant occurs much more frequently (as it does in unsuffixed form):

- 30) *dì-tó* *ídì-tó* 'I (you, he, we) go up and...'
 dì-n-ú-mó *ídì-n-ú-mó* 'we who will go up'

It is possible that the verbs in the monosyllabic CV set are derived historically from a similar *vcv* vowel harmonic pattern, of which the initial vowel has been lost from every member of the set except *ídi*, rendering Met no longer applicable to the other members of the set. The HLH tone pattern, however, has persisted on those forms of the verbs to which Met formerly applied, whereas the LH tone pattern has persisted on those forms to which Met did not apply, and the first tone was subsequently lost along with the first vowel in the preferred variant, which is now the only one used. The only other member of this set of which we are aware is *kĩ* 'roast'. We have occasionally heard the verb *úmú* 'give him' pronounced without its first vowel in some of its forms, but it occurs much more frequently in its full form than does *ídi*.

There are a few occurrences each in Siane of stems which seem to have an underlying tone pattern (L)LLH or HHL, as shown in (31).

- 31) a) *kòukàmé* 'parcel' b) *sikipài* 'seed type'
 kòpàná 'lightning' *ólúwà* 'pumpkin'
 àlikàní 'happy-go-lucky' *wéyánò* 'father' (voc)

Both of these rare tone patterns are found elsewhere in the language, but under quite predictable circumstances. Certain compounding and sandhi rules in Siane result in a derived tonal pattern *L₁H*, in which the H obligatorily occurs only on the final syllable of the derived form. The examples in (32a) show such forms as a result of compounding, and those in (32b), as a result of sandhi.

- 32) a) *kìmi#wé* → *kìmiwé*
 bow#man 'policeman, soldier'
 yá#kêfá → *yàkêfá*
 tree#meat 'opossum' (generic)
 nǒ#òfúná → *nòfúná*
 water#plateau 'lake'
 wélá#wéná → *wèlàwèná*
 mouth/opening#woman 'divorcee'

b.	<i>kámèná</i> 'time'	<i>kifinávámó kámèná</i> 'time they'll plant'	<i>minénàwàmò kámèná</i> 'time they'll remain'
	<i>ikàná</i> 'moon'	<i>kifinávámó ikàná</i> 'month they'll plant'	<i>minénàwàmò ikàná</i> 'month they'll remain'
	<i>wénèná</i> 'people'	<i>kifinávámó wénèná</i> 'people who'll plant'	<i>minénàwàmò wénèná</i> 'people who'll remain'
	<i>nétá</i> 'thing'	<i>kifinávámó nétá</i> 'thing they plant'	<i>minénàwàmì nétá</i> 'thing that will remain'
	<i>nòmìlì</i> 'girl'	<i>kifinávámó nòmìlì</i> 'girls who'll plant'	<i>minénàwàmò nòmìlì</i> 'girls who'll remain'
	<i>kìpá</i> 'boy'	<i>kifinávámó kípá</i> 'boys who'll plant'	<i>minénàwàmò kípá</i> 'boys who'll remain'
	<i>wé</i> 'man'	<i>kifinávámó wě</i> 'men who'll plant'	<i>minénàwàmò wě</i> 'men who'll remain'
	<i>kà</i> 'talk'	<i>kifinávámó kǎ</i> 'talk about planting'	<i>minénàwàmò kǎ</i> 'talk about remaining'

Words from Tok Pisin (Melanesian Pidgin) or English which end in a consonant are often, when borrowed into Siane, pronounced with an H₁L tonal pattern, in which the L obligatorily occurs only on the final syllable, a vowel added to the final consonant to adapt the word to the obligatory V final structural pattern of Siane wordforms. Consider the examples in (33).

33)	<i>simáti</i>	'smart/attractive'	<i>Élisábèti</i>	'Elizabeth'
	<i>táláki</i>	'truck'	<i>Má-gá-léti</i>	'Margaret'
	<i>kánisólè</i>	'council(lor)'	<i>Ábáláhámù</i>	'Abraham'
	<i>sópù</i>	'soap'	<i>táuni</i>	'town'

It is of course possible that the wordforms in (31a) are in fact compounds, of which the individual component members have been lost in history (*kò* 'rain' could conceivably be the first member of *kòpàná* 'lightning', for instance), and that the first two examples in (31b) could have been borrowed, together with the substances to which they refer, from another language group, the origin of which is also now lost in history. Such speculation, however, is hardly fruitful in a synchronic description of Siane, and in any case, the proposed borrowed words in (31b) do not fit the segmental pattern of borrowed words which would be expected to have an H₁L tone pattern. The overwhelming majority of consonant final borrowed words have a high vowel added in Siane pronunciation, rarely a mid vowel, and never a low vowel nor a vowel

cluster. Words from English and/or Tok Pisin which end in a vowel (or /Vr/, which in Papua New Guinea English, as in many Commonwealth countries, is pronounced [ŋ]) are often borrowed into Siane with an H tone pattern, as in (34), not the H₁L pattern of consonant-final borrowed words.

34)	<i>táiyá</i>	'úrc'	<i>kábání</i> [kambani]	'company'
	<i>pálává</i>	'flower'	<i>élikópútá</i>	'helicopter'
	<i>sitúwá</i>	'store'	<i>Gólóká</i>	'Goroka'

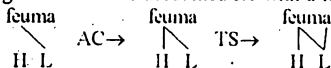
This is by no means a hard and fast rule in Siane, however, as each of the basic tone patterns found in Siane, as well as the rarer LHL, has also been found on borrowed words, except that neither rising nor falling tone has been observed on any known borrowing, nor has a borrowed word with an L tone pattern (which is the rarest of the basic patterns) been found. Consider the examples in (35).

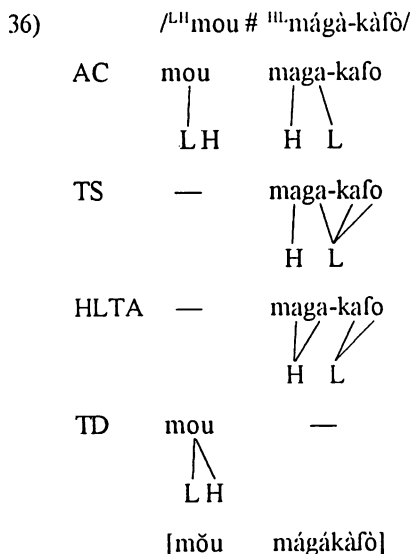
35)	HL	<i>dósà</i>	'(bull)dozer'	<i>bálùsi</i>	'balus (plane)'
	LH	<i>lòli</i>	'lolly (candy)'		
	HLH	<i>Súwàwé</i>	'Chuave'		
	LHL	<i>Sipiki</i>	'Sepik'	<i>nàbìsi</i> [nambisi]	'nambis (coast)'

I assume, therefore, that the examples in (31) are exceptions in Siane, to be marked with a lexical association line associating an L tone with the penultimate syllable of the wordforms in (31a) and an H with the penultimate syllable of those in (31b) and also of the borrowed words in (33).²² Compounds, and nouns affected by sandhi, such as those in (32), will be accounted for by rule.

One other irregular form is *mõumágà* 'orange (colour)'. This wordform also occurs as a proper name, and may as such be suffixed with the agentive suffix *-kafo*. The tonal change which takes place under such suffixation suggests that, although neither **mõu* nor **mágà* occur as independent wordforms in Siane, tonally, at least, the word is acting as a compound with an internal word boundary: ##^L*mou*#^H*maga*##. When affixed, the application of the tone rules gives the correct phonetic result:

²² A further unusual mapping of an HL tone pattern is *feumá* 'heel, deep underneath'. We have found only one example of this mapping. It can also be accounted for with a lexical association line, as shown in the following derivation.





as in *Mǒumáǵákàfò kònúma kóufàifá...* 'Moumaga dug potato, but...'

7 Conclusion

Given the five basic tonal melodies for Siane listed in (1); the general association convention; the three language specific tone mapping and insertion rules Tone Spreading, Tone Dumping, and Final Low Insertion; and the two tone adjustment rules HL Sequence Tone Adjustment and Low Tone Association Adjustment, we are able to account for the tonal specifications of the great majority of Siane wordforms²³ without setting up artificial geminate vowel clusters in an unsatisfactory attempt to account for purely tonal phenomena. More importantly, the Association Convention and Tone Spreading not only fully account for both the tone copying of stem final tone(s) onto suffixes, and the stem tone changes which occur as the result of suffixation of stems with falling or rising tones in their underlying representations, they also explain them: tone is a suprasegmental feature of Siane phonology, not segmental, with underlying tone patterns which relate to wordforms as a whole rather than to individual syllabic segments. Thus, when all phonological rules which change and/or assign segmental syllable structure have applied, the tone is associated with the appropriate tone-bearing unit at a relatively superficial point in the derivation. The rules as presented account for the occurrence

²³ Specifically, the tone rules as presented in this paper do not account for a) compounding, b) intensification and negation, which are special types of compounding, and c) sandhi rules in certain close knit phrase types.

of contour tones on single syllables in Siane, whether those syllables contain a single vowel or a sequence of two vowels, in a much more adequate and explanatory way than was possible in a strictly linear analysis. Thus, the tone spreading processes of Siane are accounted for in a way which reflects their unity and generality, neither obscuring them with unnecessary segmental specifications, nor dividing some of those processes into separate and seemingly unrelated rules as was necessary in James (1966).

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SIL, Box 54
Ukarumpa via Lae
PAPUA NEW GUINEA