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THE INTERACTION OF STRESS AND TONES IN KUBEO

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This paper discusses the interaction of stress and tones in Kubeo. It shows how stress and tones have independent properties, while at the same time both rely on properties that are relevant to both stress and tones, such as primary accent and iambic feet. The assessment of the interaction and independent properties of both systems has significant implications for current theories and the typology of word-level prosody.

1. INTRODUCTION. Kubeo is a language spoken in the Northwestern Amazon, mostly along the middle section of the Uaupés River and its tributaries Querarí and Cuduyarí rivers, in the border areas of Brazil and Colombia. It belongs to the Eastern branch of the Tukanoan family and is spoken by about 8,000 people.

In Kubeo, stress and tone are related properties that appear in the surface forms of words. The integration of both systems is seen in the phonological derivation, where primary accent (i.e., the syllable that has both primary stress and the first high tone in a word) and iambic feet are relevant metrical properties of both stress and tone.

Nevertheless, both systems are better analyzed as independent. Tones are specified in the underlying representation of lexical morphemes, and they present properties in the output of derivations that are clearly not stress-related, such as a unique contrast of high and low tones in unstressed, post-tonic syllables. Stress can be lexically contrastive and affects segmental phonology, a rhythmic structure that creates secondary stress alternations and, more important, constraints on output forms, such as the presence of one and only one more prominent stressed syllable in a word.

A feature that is central to the analysis of Kubeo prosody presented here is that although both systems are independent, tones seem to presuppose a given metrical structure when they are assigned to words. This metrical structure follows necessarily from stress-related properties. Stress can also be affected by some surface properties of tones, but these are secondary to the phonology of both systems and seem to be related more to the perception of secondary stress on low-toned syllables.

I begin section 2 by describing of the stress system. In section 3, I describe the tone system and its correlation with the stress system. In section 4 I propose an analysis that treat tones and stress distinctly while showing how they correlate. In section 5, I present the paper's conclusions.

2. STRESS. All words in Kubeo, including monosyllabic ones, are stressed. Consider the examples in (1):[1]

(1) a. 'ú
‘sloth’
b. 'má
‘macaw’

[1] Examples are presented following the Leipzig Glossing Rules. Ideally it would be good to distinguish forms presented as examples according to whether they come from single words elicited in fieldwork or from texts or longer sentences in a naturally occurring environment. In future work on the language, it will be possible to do this. However, for the purposes of this paper, I have attempted to determine whether there are any significant differences affecting stress or tone between words elicited in isolation and those from longer contexts. None has been detected, with the minor exception that sentence intonation may make perception of secondary stress in word-final position more difficult under special circumstances. With this in mind, throughout the paper I have attempted to comment on any pattern that might behave differently according to speech rate and register, although only minor, secondary variation has been detected.

c. 'buɨ́
‘agouti’
d. 'hiá
‘river’

Some monosyllabic words have a fixed stress location, while others show a stress shift to the right when combined with bound morphemes to the right. Consider the contrast of the pronominal forms in (2):

(2) a. 'ṍ
‘she’
b. 'ṍrẽ
ṍ-rẽ
she-OBL
‘to her/ at her’

(3) a. yɨ
‘I’
b. yɨ̀'ré
yɨ-re
I-OBL
‘to me, at me’

(4) a. ĩ̃́
‘he’
b. ĩ̃́rẽ
ĩ̃-rẽ
he-OBL
‘to him, at him’

(5) a. 'mɨ́
‘you’
b. mɨ'rɛ́̃
mɨ-rẽ
you-OBL
‘to you/at you’

The same type of contrast is found with monosyllabic verb roots. Some of them have a fixed stress on the root, while others allow stress to be located on a suffix:

(6) a. kɨ̀'bébí
kɨ-be-bi
exist-NEG-3MSC
‘he is not (here)’

b. ðà-'bíkó
ða-biko
make-3FEM
'she's made (it)'

(7) a. 'ɛ̃́nebu
'ɛ́-nebu
burn-INFRR.EVID
'it has burnt'

b. 'híhakɨ́
'hí-ha-kɨ́
give-IMP-MSC
'Give it!'

In roots with two or more syllables, stress always falls on the first or the second syllable counting from the left edge of the word. This creates lexical contrasts, as in (8) to (10):

(8) a. 'kúyàbì
kúya -bi
run -3MSC
'He ran'

b. ku'yábí
kuya -bi
bathe -3MSC
'He bathed'

(9) a. 'máká
máka
'tarantula'

b. mà'kárɔ̃́
maka -rõ
jungle -CNT
'a forest'

(10) a. 'ókò
óko
'a heron'

b. ò'kó
oko
'water'

In no word in Kubeo can stress fall after the second syllable counting from the left. If a bound morpheme is added to the left of a word, stress will be shifted to the left, as in examples (11) to (12):

(11) a. yò'ká
yoka
‘leaf’

b. ì'yókà
i=yoka
this=leaf
‘this leaf’

(12) a. hã'rã́wɨ́
hãrãwɨ
‘day’

b. di'hã́rã̀wɨ̀
di=hãrãwɨ
ANAPH=day
‘in that referred day’

If a bound morpheme is added to the right of a word already consisting of two syllables, no stress shift will take place, as in examples (13) and (14):

(13) a. ò'kó
oko
‘water'

b. ò'kórè
oko-re
water-OBL
‘to/at the water’

(14) a. ì'hí
ihi
pineapple
‘pineapple’

b. i'híbó
ihi=bo
pineapple=CL.OVAL
‘a pineapple’

If a bound morpheme is added to the left of a word whose first syllable is already stressed, no subsequent stress shift will occur, as the examples in (15) illustrate:

(15) a. 'yókɨ̀
yó-kɨ
younger.sibling-MSC
'younger brother'

b. hì'yókɨ̀
hi=yó-kɨ
'my brother'

These facts so far demonstrate four important points about Kubeo stress:

1. All words have stress.
2. Stress in Kubeo is **bound**; i.e., it must fall no more than two syllables to the right of the left edge of the word;
3. Stress is **free** in the sense that it can fall on any of the first two syllables from the left edge of words; and,
4. Most important, between the two possible locations of stress in Kubeo (first or second syllable), when stress falls on the first syllable of words, it has a fixed location, never shifting even if additional segmental material is added (as examples in (2), (4), (7), and (15) demonstrate). When stress falls on the second syllable of words, it has a dynamic location, being subject to stress shift whenever segmental material is added (as in (11) and (12)) or absent (as in (3) and (5).

Another important feature is that stress is not quantity-sensitive in Kubeo; i.e., a heavy syllable does not attract stress from a light syllable, as seen in the examples in (16) to (17), where words with syllables containing two vowels follow the general pattern also found in words with only light syllables:[2]

(16) a. yaì'kɨ́bè
yai-kɨbe
die-3MSC.INFRR.EVID
'he has died'

b. 'yaímé
yai =me
heron=CL.THICK.LINE
'A liana sp.'

(17) a. boà'yɨ́bè¸bù
boa-yɨ-bebu
kill-MSC.NMZ-ASSUM.COP
'he might be killing'

[2] Syllables in Kubeo have the shape (C)V(V), with no coda, an optional onset, and an optional branching nucleus. A heavy syllable would be composed of two (C)VV, which are not canonical diphthongs (as linguists use the term cross-linguistically), but still are part of the same syllable.

b. 'moákɨ̀
moa-kɨ
fish-3MSC
‘A fish’

In addition to the fixed and non-fixed distinction of stress location, it should be added that words with stress on the first syllable are rarer than words with stress on the second syllable, which suggests that stress falling on the second syllable of words is the default case and stress on the first syllable of words is the exceptional case.

I propose that stress on the first syllable of words is specified in the underlying structure of lexical morphemes, fixed in this position. This means that some morphemes will have an underlying specification that exceptionally marks the first syllable as stressed. A direct consequence of this analysis is that it can explain why stress never shifts in words such as (15) above.

Words with stress on the second syllable do not have any underlying indication of stress. Stress is predictable based on a general rule that always stresses the second syllable of a word, if there is no underlying stress specified.

This general rule seems to be related to the **rhythmic** nature of Kubeo stress. In the language, one perceives a rhythmic alternation affecting every other syllable from the location of the stressed syllable, which gives the perception of **secondary stress**. The template of how this alternation operates is given in table 1 both for words in which stress falls on the second syllable by default and in words where stress is fixed, exceptionally, on the first syllable.

TABLE 1: RHYTHMIC ALTERNATION OF STRESS

REGULAR STRESS	EXCEPTION STRESS
σ'σσ˛σσ˛σ	'σσ˛σσ˛σσ

The following words illustrate secondary stress alternation:

(18) a. hɛ̀'hɛ́ná˛kɨ́
hɛ̃hɛ̃na-kɨ
kuebo.clan-MSC
‘a man from the Hehenawa clan’

b. tè'kɨ́yɨ̀˛mù
te-kɨyɨmu
do-FUT.MSC.NMZ
‘I will become’

c. mɨà'máwá˛wàwɨ̀
mɨama-wa-wa-wɨ
hiccup-CAUS-HAB-N.3.AN
‘it usually makes (me) hiccup’

(19) a. 'ɔ̃rɛ̃ˌwè
ɔ̃rɛ̃ =we
banana =CL.FLAT
‘a banana’

b. 'bákɨ̀ˌyɨ̀mù
ba -kɨyɨmu
be -FUT.MSC.NMZ
‘I will be’

c. 'hiórèˌtà
hio -re =ta
garden -OBL =EMPH.FOC
‘at/to the garden’

Primary stress is always on the left-most stressed syllable in a word, and secondary stress is always on the subsequent stressed syllables to the right of the primary stressed syllables.

A word composed of **stem affixes and other bound morphemes** will always be subject to parsing into binary alternations, as represented in table 1. Other grammatical structures such as **compounds**, **serialized verbs,** and **incorporated noun + verb** present a different behavior. Since these structures are composed of at least two stems, each stem is a separate domain for the application of the binary alternation represented in table 1. This can be demonstrated by the fact that the separation between primary stress (on the first stem) and secondary stress (on the second or third stem) in these structures can be longer or shorter than the separation by no more than two syllables that occurs in words composed of a single stem. Consider the examples in (20):

(20) a. à‘búhù mìˌmìyò
abuhu#mimi=yo
devil#hummingbird=CL.2D.SMALL
‘hummingbird sp.’

b. ‘hɑ̃́mè tèˌwɨ́
hã-me#te-wɨ
see-NEG#DYN-1
‘I did not see’

c. ɛ̀‘tɑ̃́ ˌmì yàˌwí
ɛ̃tã#mi#yawi
starch#bird#jaguar
‘an eagle species’

Given that the two or more stems in the structures above are separate domains for application of rhythmic structure, what causes the primary vs. secondary stress distinction? The rule that gives rise to this distinction is actually different from the rule that creates rhythmic structure. While the latter cannot apply across different stems, the former can apply across stems and is related to what classical metrical theory has called the End Rule (cf. Hayes 1995), which is a rule that occurs after the metrical structure is built and gives the right-most or left-most stressed syllable primary stress status. In general this relates to

culminativity, i.e., the existence of a single most prominently stressed syllable in a domain. So, ultimately it does not matter if the relevant domain is the word, the compound, or the sentence; it is predictable that there will always be a single most prominent syllable.

Prominence is a relative property related to how pitch, duration, intensity, and loudness are bundled in each syllable of a word. It is not an absolute property nor there is an absolutely clear-cut phonetic manifestation of stress and prominence (cf. Hayes 1995). Kubeo, of course, also has a considerable amount of variation in marking prominence. **Duration**, which makes the stressed syllable the longest one in the word, is the most common and consistent indication of prominence in Kubeo. It is followed by **pitch**, though as I will discuss in section 3, pitch is sometimes less important because of up-step effects, which can create unstressed syllables with higher pitch than the pitch of stressed syllable, or to down-step effects, which can cause a secondary stressed syllable to take a low tone. **Intensity** in Kubeo is not a good correlate of stress either, since most syllables in a word have very similar values of intensity. **Relative loudness** seems to be a reliable clue for stress and prominence, though it lacks more objective acoustic means for measuring it.

In table 2 , I present a sample from 80 words that were acoustically analyzed, showing how a stressed syllable is marked as the more prominent syllable in a word. Also, the secondary stress alternation should be noticed. The vowels as nuclei of syllables in the words below are analyzed for pitch values (measured in Hertz "HZ"), duration (measured in milliseconds "MS"), and intensity (measured in decibels "DB").

TABLE 2: ILLUSTRATION OF PROMINENCE IN STRESSED SYLLABLES

(a)	**'hárò¸bèbì¸kò**	**ha**	**ro**	**be**	**bi**	**ko**	
	haro -be -biko	170	160	129	116	131	HZ
	be.seen-NEG-3FEM	114	70	097	084	160	MS
	'she is not being seen'	73	71	74	73	65	DB
(b)	**ko'ðobo¸bo-yɨ**	ko	ðo	bo	bo	yɨ	
	koðobobo-yɨ	125	165	151	122	106	HZ
	shout -MSC.NMZ	096	100	067	085	55	MS
	'the one who shouts'	54	58	57	53	48	DB
(c)	**kɨ'bébí¸kó**	**kɨ**	**be**	**bi**	**ko**		
	kɨ -be -biko	115	125	127	129		HZ
	exist-NEG-3FEM	37	118	105	072		MS
	'she is not (here)'	53	61	58	55		DB
(d)	**'hũámé¸nótà¸mù**	**hũa**	**me**	**no**	**ta**	**mu**	
	hũa-me-no =ta -mu	138	148	153	123	103	HZ
	red-NEG-CNT=EMPH.FOC -N3AN.COP	167	082	91	080	115	MS
	'it is not ripen yet'	61	60	61	59	53	DB

It is very important for theoretical and analytical purposes to separate the phonetic clues used to code stress and tones in Kubeo. This is clear in words in which most or all syllables have H tones, such as words in (c) and (d) in table 2 and words (g), (h), (i), (j), (l), and (m) in table 3 (below), which, however,

do not fail to express **culminativity**, a prototypical property of languages with stress, by some other phonetic clue besides pitch. Tones are contrastive in Kubeo and constitute a relatively autonomous system that explores only pitch as its phonetic correlate, while stress relies especially on duration and loudness, but also on pitch. In a cross-linguistic perspective, duration is the more general means of marking prominence in languages where tonal contrasts exist, while pitch is expectedly the least important means (Wetzel and Meira 2010, Hulst 2010).

It is important to notice that down-step effects related to a low tone in a word (cf. section 3) can sometimes obliterate the perception of secondary stress, though in most cases secondary stressed syllables can be marked by longer duration than unstressed syllables, as the words in table 2 above and table 3 below demonstrate. Secondary stress is also usually best perceived when it is followed by an unstressed syllable, since it tends to be less audible in word-final position.

Finally, it is worth mentioning how stress correlates with segmental phonology. There are three important points to this correlation that I discuss below:

1. Deletion of segments and reduction of unstressed syllables, as in (21) below:

(21)	a.	'hiáðò˛kṵ̃	>	[‘hia.^{o}.kũ]
		hiaðo=kũ		
		tree.sp=CL.TRUNK		
		‘a canoe’		
	b.	hɨ̀'tɨ́rá	>	[^{h}.‘tɨ́rá]
		hɨtɨra		
		flour		
		‘flour’		
	c.	ko'parĩ	>	[kopaĩ]
		kopa-rĩ		
		return-CONV		
		‘returning’		
	a.	ñɨ'hẽ	>	[ñe]
		ñɨhẽ		
		our		
		‘our’		
	b.	ba'hu	>	bu
		bahu		
		intensifier		
		‘whole, completely, thoroughly’		

2. Articulatory effects on consonants. So-called “debucalization” (change of a consonant to *h*) affecting voiceless stops, in stressed and unstressed position, is a recurrent phenomenon, as seen in (22):

(22)	a.	'ai˛pe te˛ni	[‘aí˛hétènì]
		aipe#te-dĩ	
		what#do-CONV	
		‘what happened?’	

b. 'hapu˛rabi [‘há**h**ù˛ràbì]
'hapu˛ra-bi
be.heard-3MSC
‘He is heard’

c. 'kaini˛kũ **ma˛karõ** [mà̰˛**h**ǎ́rõ̰]
'kaini=kũ#**ba-kadõ**
whole=cl.bunch#be-PAST.IN.CNT.NMZ
‘which was the whole bunch’

d. 'yãhi-˛ki-dõ [‘ɲã́hì˛hìnõ̰]
'yãhi-ki-dõ
suffer-FUT.NMZ-CNT
‘a future suffering’

e. nu're ku˛kemawɨ̀ [‘nṹrḛ̀ hù˛kémàwɨ̰̀]
nu-re ku-kema-awɨ̃̀
smoke-OBL walk-PAST.ASSUM-FINITE
‘he used to smoke’

Although the data might seem to show a random debucalization process, it is important to realize that debucalization can either be cause by some sort of lenition (e.g., in clines such as p > f > h) or by fortition, as related to a greater effort of articulation.

In addition, it should be noticed that more continuant sounds, such as [ʤ] and [m], tend to be pronounced with greater tension and a longer duration in stressed syllables then in unstressed syllables.

3. Stress shift. When a stressed syllable is deleted, the previous syllable on the left becomes stressed (as predicted by an iambic foot, cf. Hayes 1995). See the contrast of the phonological and phonetic forms on the left and the right, respectively:

(23) a. kuì'tótè **kà˛hé** [kùì'tótè˛**ká**]
kuitote#kahe
cotton#skin
‘clothes’

b. 'hápù˛rà **tè˛wɨ́** ['hápù˛rà˛**té**]
hapura#te-wɨ
be.heard#DYN-3IN
‘it was heard’

Stress shift also occurs in stress-clash situations, which occur at the boundary between two stressed morphemes, usually involving an underlyingly stressed bound morpheme. The examples in (24) illustrate this:

(24) a. nai'nú'támú ['naínù˛tàmu]
nainu=ta=mu
evening=EMPH.FOC-N.3.AN.COP
'it is late already'

b. 'hí 'mákɨ̀ ['hímà˛kɨ̀]
hi#ma-kɨ
my#off.spring-msc
'my son'

3. Tones. The examples in table 3 below represent all the attested ways that stress and surface tones interact. In the left-most column, surface tones and the location of stress are presented in a general template. These patterns represent words with up to three syllables only, since that is the minimal necessary number of syllables for one to represent all phonologically relevant variation among surface tones and location of stress. Stress is marked by " ' ", following standard IPA notation. Tones are represented by the codes L= low tone; H= high tone; M= medium tone. An M tone refers to two types of pitch levels: (1) the second-highest tone in the word or (2) a tone whose pitch is significantly near in pitch to that of the highest tone in the word. Because I analyze M tones as non-phonemic, there is no need to mark them in the transcriptions. In the second column from the left, an example word is presented. In the third and fourth columns the individual vowels of the example words are acoustically analyzed similarly to what was done in table 2. Table 3 presents the stress and tone patterns in the left and an illustrative word of each pattern in the right:

TABLE 3: STRESS AND SURFACE TONES PATTERNS

(a) L.'H	ò'kó oko water 'water'	o		ko	
		130		178	HZ
		88		74	MS
		62		62	DB
(b) 'H.L	'ókò oko heron 'heron'	o		ko	
		204		138	HZ
		178		089	MS
		72		65	DB
(c) 'H.H	'máká maka tarantula 'tarantula'	ma		ka	
		274		272	HZ
		175		151	MS
		72		69	DB
(d) L.'H.L	yɨ̀'rínò yɨri-i-dõ smile-ST-CNT 'to smile'	yɨ	ri	dõ	
		132	169	125	HZ
		117	158	092	MS
		54	51	50	DB

(e) L.'H.M	è'dábìkò eda-biko arrive-3FEM ‘She has arrived’	e	da	bi	ko	
		82	102	88	79	HZ
		072	085	051	060	MS
		34	40	35	33	DB
(f) M.'H.L	bɨ̀'bɨ́kò bɨbɨ-ko toad-FEM ‘toad’	bɨ	bɨ	ko		
		150	192	120		HZ
		090	082	076		MS
		70	77	67		DB
(g) L.'M.H	kɨ̀'bóbá kɨbo=ba foot=CL.BRANCHED ‘a foot’	kɨ	bo	ba		
		144	162	170		HZ
		056	069	059		MS
		48	49	51		DB
(h) L.'H.H	ma'kárõ̩rẽ́ maka -rõ =rẽ jungle –CNT =OBL ‘at the jungle’	ma	ka	rõ	re	
		99	124	128	126	HZ
		073	083	083	077	MS
		51	50	51	48	DB
(i) M.‘M.H	kɨ̀'rã́má kɨrã-bã spawn-3.AN.PL ‘they spawned’	kɨ	rã	ma		
		100	103	115		HZ
		067	108	083		MS
		63	65	60		DB
(j) M.'H.H	kɨ̀‘bébɨ́kó kɨ-be-biko exist-NEG-3FEM ‘she was not’	kɨ	be	bi	ko	
		115	125	127	129	HZ
		37	118	105	072	MS
		53	61	58	55	DB
(k) 'H.M.L	'kúyàrì kuya-ri run-INTRR ‘did he run?’	kú	ya	ri		
		129	112	Ø		HZ
		083	101	094		MS
		54	53	40		DB

(l) 'H.H.H	'kámúká kamu=ka ear=CL.3D.SMALL 'an ear'	ka	mu	ka	
		139	140	139	HZ
		125	125	094	MS
		56	55	51	DB
(m) 'M.H.H	'pípídí pipidi bird.sp 'bird.sp'	pi	pi	di	
		180	190	192	HZ
		132	081	116	MS
		65	65	67	DB

First, I direct attention to the status of M tones. There are no lexical contrasts (i.e., no minimal pairs) based only on the presence of an M tone. This follows from the fact that (as analyzed here) M tones are actually raised L tones or lowered H tones, with no independent status of their own. Hence, there are always additional conditions that are more fundamental or that feed the occurrence of M tones. One sort of M tone is better regarded as a transitional tone; i.e., cases of this M tone seem to function as a phonetic cue to the drop of H to L in post-tonic position or to a rise from L to H in tonic or pre-tonic position. One can also see that the only cases of M tones on a stressed syllable are the ones followed by H. This is related to the up-step effect (discussed below), where an H tone will always be higher in pitch than another H tone immediately to its left. Hence, the phonemic H tone of a stressed syllable may surface not as the highest pitch in the word. In addition, an M tone may freely alternate with an L tone in the same word according to intonational patterns that are determined outside the scope of the word, such as by phrasal and sentential intonational patterns. Based on these considerations, M tones can be eliminated by analyzing them either as a lowered H or a raised L. The following table summarizes the proposed analysis:

TABLE 4: M TONE AS SURFACE REALIZATION OF L OR H TONE

	Examples
M as an underlying H tone	(g), (i) second M, (m)
M as an underlying Low tone	(e), (f), (i) first M, (j) and (k)

If this analysis is correct and Kubeo has only two phonemic surface tones, then the patterns in table 2 can be simplified to the patterns in (25) and (26):

(25) a. L.'H

b. 'H.L

c. 'H.H

(26) a. L.'H.L

b. L.'H.H

c. 'H.L.L

d. 'H.H.H

The pre-tonic L tones in examples (25a), (16a), and (26b) are predictable, since there is no contrast with H tones in pre-tonic position. Hence, one can eliminate pre-tonic L from Kubeo phonemic tones. H tones on the stressed syllable are also predictable, since the first H tone of a word and stress are always correlated.

The tones that follow a syllable bearing the first H tone of the word are unpredictable. One can never tell *a priori* whether H or L tone will follow the primary stressed syllable. In addition, regardless of whether L or H follows the first H tone in the word, the next two syllables will exhibit the same tone value, which can be seen in examples (26c) and (26d). In connection with that, it should also be noted that pre-tonic L tones and post-tonic L tones are different from one another, since pre-tonic L tones do not cause the subsequent syllables to bear L tones.

To represent these unpredictable tones, I propose the tones H and HL for the unpredictable post-tonic H and L tones respectively, which are specified in the underlying representation of morphemes in the language. H tones are rarer than HL tones in the underlying position. Consider the examples in (27) to (30), where H and HL create lexical contrasts in Kubeo:

(27) a. H

'mea -kɬ ['meákɬ́]

good -MSC

‘a good male’

b. HL

'mea -kɬ ['meákɬ̀]

ant -MSC

‘an edible ant’

(28) a. H

bu'tʃi -kɬ [bù'tʃíkɬ́]

snail -MSC

‘a snail’

b. HL

bu'tʃ̌i =kɬ [bù'tʃíkɬ́]

tobacco =CL.TREE

‘a tobacco plant’

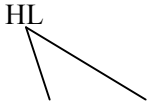
(29) a. H

ho'kɬ -kɬ [hò'kɬ́kɬ́]

caterpillar -MSC

‘a caterpillar’

b. HL

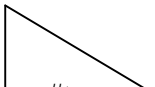


ho'kɨ =kɨ [hò'kɨ́kɨ́]

tree =CL.TREE

'a tree'

(30) a. H

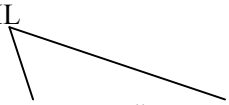


ã'me #te -wɨ [à'mété,wɨ́]

bad #DYN -3.IN

'it has (become) rotten'

b. HL



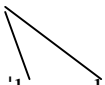
ã -me #te -wɨ [à'métè,wɨ̀]

eat -NEG #DYN -3.IN

'I did not eat'

Both H and HL can cross stem boundaries, as seen in (30) above. When this happens, the second stem misses its tonal properties and shows surface tones according to H or HL. Additional examples are seen in (31):

(31) a. H HL > H



maˈkã weˈkɨ maˈka weˌkɨ [màˈká wéˌkɨ́]

jungle tapir 'tapir'

b. HL H H L

kõhã bɨyo-ko kõ'hã bɨ'yoko [kõ̀hã́ bɨ̀yòkò]

palm sp. lizard-FEM 'lizard species'

One curious property of two-stem words, such as the compounds in (31), is that although the second stem loses its own tones, stress can still be perceived in its expected location. In more than a few cases, however, in extra-careful speech, when the first stem has HL tone, stress may not be heard in the second stem. This is usually the case where the first syllable of the second stem has a transitional M tone before the surface L tone of the syllable that one would have expected to be stressed. On the other hand, stress in the second stem is always perceived when the first stem has H tone.

These facts correlate with an important phonetic characteristic of H and HL tones: up-step and down-step effects, respectively. Up-step makes the syllables to the right of a H tone syllable higher in pitch than the H tone syllables on the left, even higher than the primary stressed syllables. The down-step produces the opposite effect, making syllables on the right lower in pitch than syllables to the left. See the words in table 3 above showing an up-step effect, e.g., in (d), (e), (f), and (k), and down-step effect e.g., in (g), (i),

(j), and (m).

Up-step and down-step effects do not cover entire phonological domains, however. As H and HL tones, they target up to two iambic feet, as in the contrasts in example (32) below. In (32a) H targets the head of the first iambic foot and the head of the second iambic foot in the word. This causes the second, third, and fourth syllables of the word to bear H tones. In the fifth syllable, however, the surface tones drop to L. In (32b), stress falls exceptionally on the first syllable of the word, causing the first syllable to form a degenerate iambic foot composed of only one syllable. H tone targets the first and second foot, but since the first foot is composed of a single syllable only, it is just the first, second, and third syllables of the word that bear H tones. In the fourth syllable, the surface tone drops to L tone (parentheses “( )” indicate a foot).

(32) a. H

(mà'kā́)(rṍˌká)(wɨ̀ˌrè)

makã-rõ=ka=wɨ-re

jungle-CNT=FROM=AN.COLL-OBL

‘to the ones from the jungle’

b. H

('pí)(píˌdi)(ˌbɨ̀)

pipidi=bɨ

bird.sp=CL.MANIOC.ROOT

‘a manioc root sp.’

Although some special assumptions could be made for explaining the facts above with a trochaic foot, evidence that one really needs iambic feet for explaining tones in Kubeo comes from words composed of two-stems, as seen in examples in (33) below. In (33a) the two stems of a compound are within the two iambic feet domain, so H makes all the syllables of the second stem bear H tones. In (33b) and (33c) the second stem forms a third foot and hence is outside the scope of H spreading. This occurs because two feet were already formed in the first stem: in (33b), a stem of three syllables was parsed by a full iambic foot and a degenerate iambic foot (apparently distressed), e.g., (σˈσ)(ˌσ).

In (33c) a disyllabic word has exceptional stress on the first syllable, forming a degenerate stressed foot on the first syllable and a degenerate, apparently unstressed foot on the second syllable, e.g., (ˈσ)(ˌσ) (given the H tone-spreading rule, the second foot is always counted even when it is apparently unstressed).

(33) a. H

('tā́ũ̃)(míˌmí)(jò)

'tãu#mi‘mi=jo

metal#hummingbird=CL.2D.SMALL

‘a hummingbird sp.’

b. H

(kɨ'rɑ̃́)(mé)(tè¸mà)

'kɨrã-me#te-ma

spawn-NEG#DYN-3PL.AN

'they did not spawn'

c. H

('bó)(bé)(tè¸dì)

'bó-be#te-di

heat.by.sun-NEG#DYN-INTRR

'Weren't they hot?'

It should be noticed that analyzing Kubeo with trochaic feet would predict the wrong results, since in (33b) and (33c) a trochaic foot (assuming the first syllable in (33b) as extra-metrical) would allow for a second foot to be formed in the second stem.

Since iambic feet are needed to explain the data above, it follows that a degenerate foot at the edge of the first stem seems mandatory in Kubeo phonology. What seems to force the formation of a degenerate foot in that position is the fact that each individual stem is a separate domain for foot parsing, and a foot can never cross over two stems (cf. section 2 above). Impressionistically, however, in most situations in connected, normal speech, degenerate feet on the right edge of words are acoustically very similar to extra-metrical syllables.

Similar phenomena to those presented in example (33) can be seen with compounds of three stems, where the second stem fall neatly in the domain of the second foot, but the third stem is outside this domain. In example (34) below, a HL tone causes the second stem to bear L tones, but the third stem still maintains its H tone melody.

(34)[3] HL (HL) H

('míú)(pè¸wè)↘ ('bèí)(bó́)

miu#pewe#bei=bo

thorn#?#rat=CL.OVAL

'a rat sp.'

The third stem's H tones are definitely lower than those of the first stem, but that is related to the general tendency in Kubeo prosody to have fading contours towards the end of phonological domains and down-step effect between two domains. It thus looks plausible that intonational fading contour, down-Step, and HL tones might all be related as some type of default tonal profile in different phonological domains in the language.[4]

[3] Although I list the tones of the second stem in the example above, technically they are deleted by the prosodic rules of compounds discussed above.

[4] It is worth entertaining the possibility that if HL is the default case and underlyingly unmarked in Kubeo

4. Accent and the dependency between tones and stress. That Kubeo has both contrastive stress and tone should be firmly established by this point. Tones are part of the underlying representation of at least some morphemes in the language, and stress is obligatory and culminative (cf. Hyman 2006, Hayes 1995).

In addition, the two systems also have different phonetic cues and show some additional fundamental differences, such as:

a. unstressed syllables can bear H tones due to H spreading;

b. L tones syllables can receive secondary stress due to foot parsing;

c. unstressed, post-tonic syllables are the sole location where one finds a tonal contrast.

On the other hand, there are two central points where tone and stress correlate in Kubeo:

d. primary stress and docking site of tone melodies have the same location in the word;

e. both systems make use of metrical structure based on iambic feet.

With respect to point (e), it is important to remember that the domain for forming iambic feet in the language is the stem. Every stem is a single domain for foot parsing. For tone, on the other hand, the existence of a metrical structure is already presupposed before HL or H spreading, which can cover more than one stem, provided it does not go beyond two iambic feet.

So, the question that needs to be answered based on these facts is how exactly stress and tone are correlated and whether one is more fundamental than another. To answer these questions, I propose separating three components in Kubeo's prosody (following Hulst 2000, 2010):

- Tones, H and HL, as underlying properties of morphemes, and surface properties of two feet.
- Stress as rhythm, a manifestation of the metrical structure in the language that builds iambic feet in stems.
- Primary Accent: the point of interaction between the docking site of underlying tones and primary stress of words.

The idea behind this analysis assumes accent as an abstract phonological entity that is marked on a specific syllable in Kubeo single-stem words. The use of this term in prosodic studies has at least two applications: (1) the term "accent" has been used for different metrical-like systems, such as pitch-accent and stress-accent (where "stress" and "pitch" refers to the phonetic clue that characterizes "accent" in the language, cf. Hulst 2000, 2010). (2) In languages with stress as a manifestation of metrical structure, Hulst (2000, 2010) separates the location of primary stress/accent from the rhythmic component in the language, which is responsible for iterative foot construction. Hulst's idea is that not only the rhythmic component creates secondary stress that echoes the location of the primary stressed/accented syllable (e.g. stress first, third, and fifth syllables or stress second, fourth, and sixth syllables), but that primary stress/accent is usually subject to more variation and exceptions than the rhythmic structure that creates secondary stress, meaning that it makes sense to treat both as distinct phenomena.

My proposal for Kubeo is that accent is the source for the interaction of stress and tones. In this sense, the location of primary accent is subject to both stress-related and tone-related properties. For instance, two crucial stress-related properties that frame the assignment of primary accent are the constraints that all words in Kubeo need to be stressed and the ability of a prefix to cause primary accent to shift one syllable to the left from their otherwise expected location (cf. section 2).

A tone-related constraint can be shown where a particular morpheme repels H tones and primary accent simultaneously. This is the case with the morpheme *-wa* 'habitual', which repels primary accent

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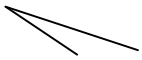
morphemes (which seems also to follow from the fact that it is more frequent than H tone), the only underlying tone we are left with is H. Given that stress might be responsible for the surface H of stressed syllables, it makes sense to represent H as /H/ and surface L tones and the H tone of a stressed syllable with Ø "zero-tone" in underlying representations. In this explanation, an /H/ tone would be assigned to the second foot of a word.

and H tones, causing a stress shift to the left, though it still can be parsed in iterative iambic feet, showing a distinction between foot parsing, in one hand, and accent and tones on the other hand. The examples below show the accent shift caused by *-wa* 'habitual' (35), the blocking of H spreading (36), and the parsing of the same morpheme in iterative foot construction (37):

(35) a. (nɨ'mí)
nɨ-mi
go-3MSC
'he went'

b. ('nɨ́)(wà˛bì)
nɨ-wa-bi
go-HAB-3MSC
'HE WENT'

(36) HH

(mɨamá)(wáwà)(wɨ)
mɨama-wa-wa-wɨ
hiccup-CAUS-HAB-3IN
'it usually causes me to hiccup'

(37) 'hárò˛wàìbì˛kó
haro-wa-i-biko
be.seen-HAB-ST-3FEM
'she is usually seen'

The stress shift in (35) must be related to the same type of constraint that blocks H spreading in (36), since iterative foot construction in (37) is not a problem for *-wa* 'habitual'. I interpret (35) as a tone-related constraint on the location of primary accent, specifically to the first H tone of a H or HL melody, probably because *-wa* 'habitual' is underlyingly specified with a L tone. Hence, the location of primary accent is subject to both stress-related and tone-related constraints.

To summarize, accent, tone, and stress correlate in Kubeo in the following ways:

1. Assign primary accent to the first (exceptional) or second (regular) syllable of a single-stem word (it implies that every single-stem word is accented).
2. From the location of the primary accent, create iterative iambic feet in the single-stem word domain. In words with two or more stems, each stem is a separate domain for foot construction.
3. In the location of primary accent, dock H and HL underlying tone melodies.
4. If a word has more than one accented syllable, i.e., if a word has more than one stem, promote the left-most as the primary and the others as the secondary accented syllables.
5. Link H and HL tones to iambic foot heads from the location of primary accented syllables (de-link another tone melody from secondary accented syllables if they are within two iambic feet from the primary accented syllable).

5. Conclusions. Kubeo is a very interesting case for the study of the interaction of distinct prosodic components in languages. Stress, tones, and intonation correlate in different ways, making unique usage of the abstract notions foot, accent, and word. While the independent existence of tone and stress systems is based on unique properties of each system, the way they interact provides a case for testing different prosodic theories and for classifying the language's prosody according to current views of language typology. It is hoped that the analysis presented here to classify Kubeo prosody and to explain its basic properties will contribute not only to understanding these properties of Kubeo, but also to the typology of stress and tone generally. Fine details of the analysis await future refinements in the light of more data that will be analyzed in future research and the application of additional typological and theoretical proposals to these data and the testing of their claims. Limitations of space, however, make it necessary to leave this discussion for later work.[5]

Appendix

1 List of Abbreviations

AN	**ANIMATE**	**IMP**	**IMPERATIVE**
ANAPH	**ANAPHORIC**	**IN**	**INANIMATE**
ASSUM	**ASSUMED**	**INFRR.EVID**	**INFERRED EVIDENTIAL**
CAUS	**CAUSATIVE**	**INTRR**	**INTERROGATIVE**
CL	**CLASSIFIER**	**MSC**	**MASCULINE**
CNT	**COUNT**	**N**	**NON**
COLL	**COLLECTIVE**	**NEG**	**NEGATIVE**
CONV	**CONVERB**	**NMZ**	**NOMINALIZER**
COP	**COPULA**	**OBL**	**OBLIQUE**
DYN	**DYNAMIC**	**PAST**	**PAST**
EMPH.FOC	**EMPHATIC FOCUS**	**ST**	**STATIVE**
FEM	**FEMINE**	**3**	**THIRD PERSON**
FUT	**FUTURE**	**2D**	**2 DIMENSIONS**
HAB	**HABITUAL**	**3D**	**3 DIMENSIONS**

2 Morpheme Boundaries key

* The list below is given in an order from more bound to less bound.

-	Affix / Phrasal Affix
=	Clitic
#	Stem boundary
(blank space)	Word-Boundary

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[5] There are additional interesting theoretical proposals to be tested with respect to Kubeo data, such as a pure tonal analysis using Rhythmic accent (cf. Hyman 2006) and/or tonal feet (cf. Leben 2001), or a pure metrical analysis, using metrical grids and prominence rules similar to intonational rules for linking stressed syllables and underlying tones (cf. Hayes 1995).

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