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*Prosodic domains in Baule**

William R. Leben
Stanford University

Firmin Ahoua
University of Cocody

1 Introduction

This paper deals with the domains of some phonological rules of Baule, a Bia language of the Central Tano group (Stewart 1989) spoken in Côte d'Ivoire, West Africa. Like the other languages in this group, Baule has phonological Low and High tones, and a Low tone lowers the register of following High tones – the phenomenon widely referred to as downdrift. But Baule is distinguished from other members of the Central Tano group (and, indeed, from other downdrifting languages that we have studied) in that, within specified domains, sequences of two or more High tones exhibit a rise in pitch over the sequence.

In this paper we show that the occurrence of the rising pattern over High-tone sequences helps to make a clear distinction in Baule between the prosodic word and the morphological word, in line with the results of Selkirk (1980), Nespor & Vogel (1986), Inkelas (1990) and others. We motivate the Baule prosodic word as a phonological constituent whose delimitation is based on the morphological word, but with modifications based on language-particular syntactic, morphological and phonological considerations. Baule prosodic words include, along with simple morphological words that are lexical items in the language, compounds, proper names, noun + adjective and noun + numeral constructions. Other prosodic words are formed by affixing monosyllabic elements (including pronouns, nouns and numerals) to adjacent lexical units.

We adduce independent support from Baule non-tonal phenomena to back up the delimitation of the prosodic word that is manifested by the tones. Because the phenomena that motivate the prosodic word as a domain in Baule crucially use phonological factors as well as syntactic and morphological ones, this language supports the conclusion that prosodic structure is indeed a separate level of structure, not just a set of grammatical environments that happen to condition phonological rules. Baule also supports the notion of the minimal word (Prince 1980, McCarthy & Prince 1986) as a disyllabic sequence.

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2 The domain of upsweep

The literature on Baule[1] is in agreement on the fact that the language has two phonological tones, High and Low. But Baule is interesting because the phonetic realisation of these tones is subject to a variety of systematic modifications. In what we will identify as prosodic words, a sequence of High tones is never realised as level High, but instead as some variant of an upstepping pattern. In Central Baule, the dialect of one of the authors of this article, spoken in Bouake and the surrounding area, this upstepping pattern ordinarily involves a gradual rise in pitch, from a level phonetically close to Low tone to a level that we will refer to as Super-High.

In such a case, a phonological High–High sequence needs to be carefully distinguished from a phonological Low–High sequence, since both involve upward movement, as pointed out by Creissels & Kouadio (1979).[2] In the Low–High sequence, the High tone is downdrifted, and the resulting High contrasts clearly in level with the final High tone of a High–High sequence, which is realised as Super-High. Schematically:

(1) Low – High High – High
[_ –] [– ¯]

The range of realisations of the rising pattern of High-tone sequences has not received a great deal of study, but the following three patterns seem to be the major ones. The first is a rise over the entire sequence, as illustrated for utterance (2) in Fig. 1. This Baule noun phrase contains eleven High-toned syllables produced on a nearly perfectly ascending slope.[3]

(2) bé nín wá sí nín wún jé kpángbán blú yé
their mother child father mother husband teeth many ten here are
'the many ten teeth of their brother's father's mother's husband'

Creissels & Kouadio (1979) describe a variant that they find systematically in the idiolect they examine, in which only the first three syllables of a sequence of Highs rise gradually. Any following syllables are on the same Super-High level as the third syllable, based on impressionistic observations. Impressionistically also, there is a variant with no noticeable rise among any of the High tones in the sequence except for the final one, which is Super-High. We do not know to what extent these variants are identified with particular individuals, particular dialects or particular styles. The variant we will focus on in this paper is the one illustrated in Fig. 1.

Figure 1 provides an oscillogram and a pitch track of an utterance with eleven High tones in a row. As the three numbers above the F0 curve help to indicate, there is a gradual rise in F0 throughout the span. Apart from allowances for extraneous effects of consonants and vowels in the span, the overall pattern, instrumentally as well as impressionistically, is of a

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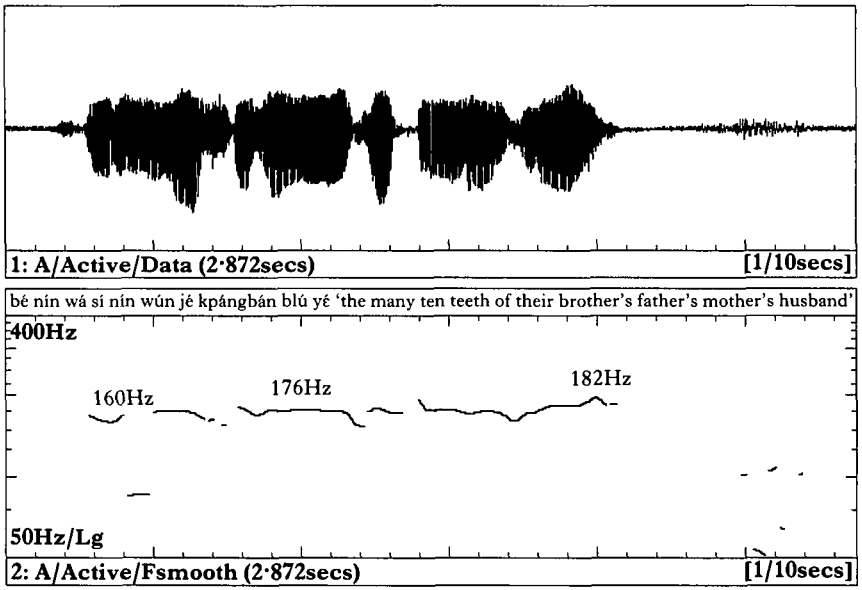


Figure 1
Eleven High tones in the same domain.

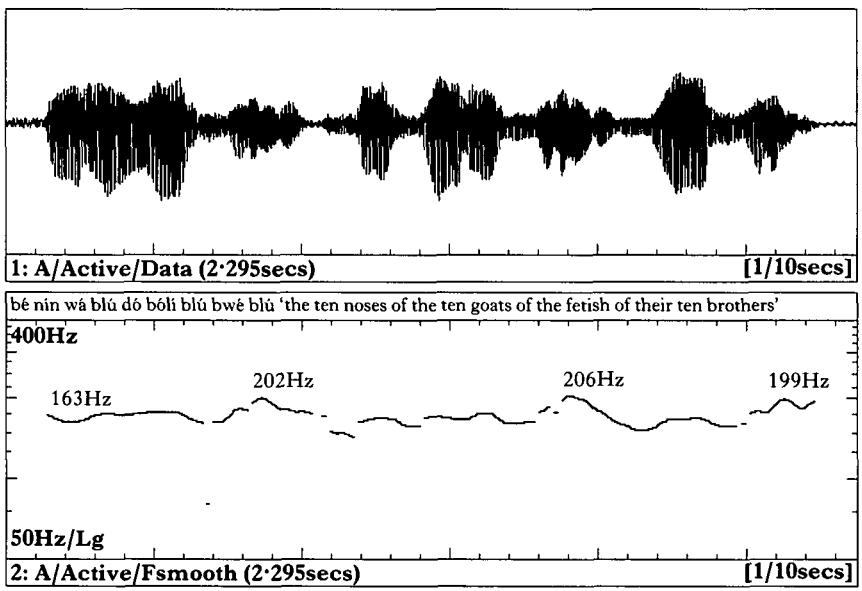


Figure 2
Oscillogram and pitch track of a token of utterance (3).

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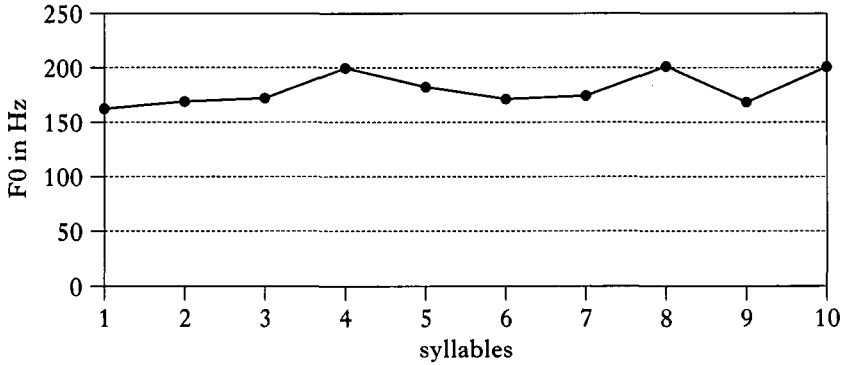
smooth rise throughout, with a slightly more pronounced upturn at the end.

The utterance in Fig. 1 was especially constructed to avoid any internal constituent boundaries that might break up the upward slope of the High-tone sequences. More typical phrases consisting of High-tone sequences exhibit a succession of rising sequences, interrupted by internal constituent boundaries. The constituents in question will be argued below to be prosodic constituents, but they can just as well be regarded as syntactic constituents in the example in Fig. 2, which provides a graphic representation of utterance (3).

(3) bé nín wá blú dó bólí blú bwé blú
their mother child ten fetish goat ten nose ten
'the ten noses of the ten goats of the fetish of their ten brothers'

Average F0 values for each syllable, based on seven repetitions of utterance (3), are plotted in (4). The first line of the chart below (4) provides the F0 averages and the second line gives the standard deviations. F0 measurements were determined by locating the peak F0 over the stable portions of each vowel, as determined from the complex wave form.

(4) *Average pitch values of* bé nín wá blú dó bólí blú bwé blú



	bé	nín	wá	blú	dó	bó	lí	blú	bwé	blú
F0	162·3	168·9	172·1	199·7	182·5	171·4	174·3	201·4	168·4	200·8
std. dev.	3·3	4·1	3·3	5·8	20·8	1·8	3·4	5·0	1·3	5·0

Each constituent contains a rising sequence ending on a Super-High tone. The initial and middle constituents contain four syllables. In the initial constituent, *bé nín wá blú*, the syllables occur in an ascending order. In the middle constituent, *dó bólí blú*, the final syllable is markedly higher than any of the preceding three. (The first tone in the sequence, on *dó*, may be raised somewhat because of proximity to the Super-High on the left.) The final constituent, *bwé blú*, also rises to Super-High. The important thing to note in (3) is that the phrase is broken into three segments, each of them rising to Super-High.

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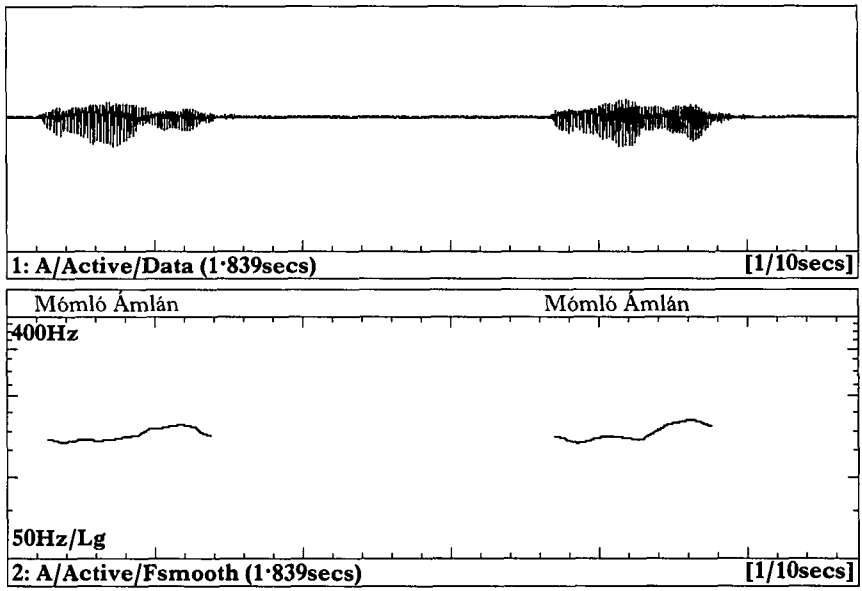


Figure 3
Momlo Amlan (proper name) cf. (5d)

We refer to the upward drift of High tones within each constituent as UPSWEEP. The examples below show upsweep operating in a variety of nominal expressions, including monomorphemic words (5a), noun + adjective constructions (5b), noun + noun compounds (5c), proper names, consisting of a surname and a given name (5d) and nouns followed by a numeral (5e):

(5) *Environments of upsweep*

a.	*noun*	Ákísí [_ – ¯]	'Akisi'
b.	*noun + adjective*	bólí kpángbán [_– – ¯]	'many goats'
c.	*noun + noun compound*	bólí nɔ́nnɔ́n [_– – ¯]	'goat milk'
d.	*proper name*	Mómló Ámlán [_ – – ¯]	'Momlo Amlan'
e.	*noun + numeral*	bólí blú [_– ¯]	'ten goats'

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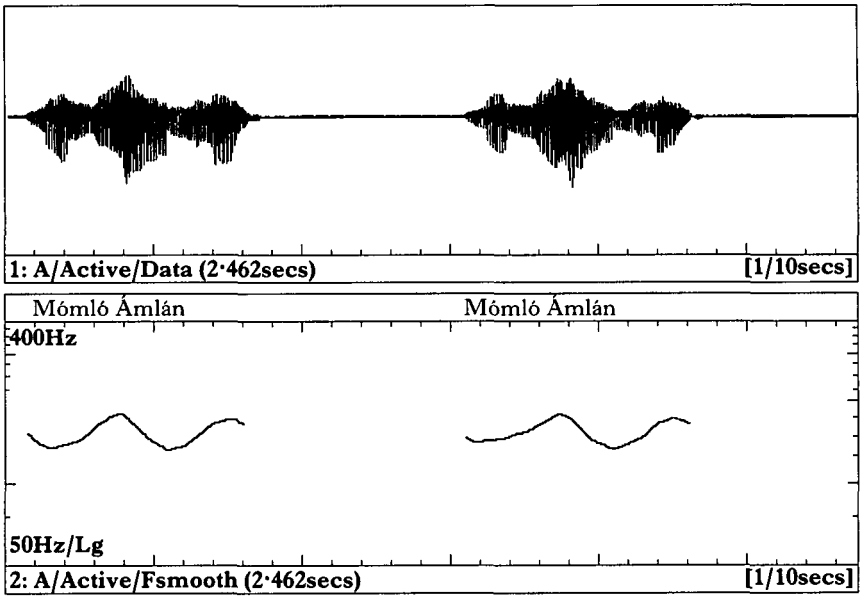


Figure 4
Momlo Amlan 'Momlo's Amlan' cf. (6a.ii))

Compare the examples in (6), where upsweep is interrupted by an internal constituent boundary. As above, upsweep operates within each of the separate constituents.

(6) *Environments in which upsweep is interrupted at a constituent boundary*

a. *possessor + possessed*	i.	bólí mángún	'goat's friend'
		[_ ‾ _ ‾]	
	ii.	Mómló Ámlán	'Momlo's Amlan'
		[_ ‾ _ ‾]	
b. *subject + predicate*		Áyá bólí	'Aya is a goat'
		[_ ‾ _ ‾]	

To illustrate the phenomenon more graphically, we include pitch tracks of a sample utterance from (5) and (6) in Figs. 3 and 4 respectively. To make the comparison as clear as possible, we have chosen utterances (5d) and (6a.ii), which have the same words but in a different grammatical combination. The first version of *Momlo Amlan* is a compound noun that serves as a proper name. The second version of the same sequence is a possessive phrase, meaning 'Momlo's Amlan'.[4]

Nothing to date in the literature on Baule tone discusses the upper limit of the domain of upsweep, but the chart in (7) suggests a good first approximation to the generalisation:

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(7) *Summary of evidence for upsweep domains in Baule*

a. *one upsweep domain*	b. *two upsweep domains*
simplex noun	possessor + possessed
compound noun	subject + predicate
proper noun	
noun + adjective	
noun + numeral	

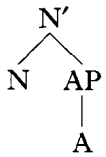
The unbroken pattern occurs in more tightly knit constructions such as single words and morphological compounds. Noun + adjective phrases also fit this pattern in Baule, as do multi-word proper names, which behave like compounds. Constructions containing major constituent breaks, like the examples in (6), which have two complete phrasal elements syntactically, possessor + possessed or subject + predicate, have a corresponding break in the tonal upsweep pattern.

Schematically, the multi-word structures with a single upsweep pattern correspond to (8a) and those that contain breaks in the pattern are sketched in (8b). Additional tonal data introduced later will further differentiate the structures in (8b).

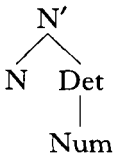
(8) a. *noun compound*



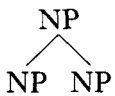
noun + adjective



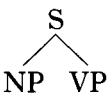
noun + numeral



b. *possessor + possessed*



subject + predicate



These diagrams illustrate that the syntax indeed captures an important factor in the difference between (5) and (6). However, as we will see in the following section, there is an equally important phonological factor at work. When one of the phrasal constituents in (6) is replaced by a High-toned monosyllable, the tone becomes indistinguishable from the single upsweep pattern in (5).

3 Exception: a phonological factor in High-tone sequences

The break in the upsweep pattern shown in (6) is not found in cases that are syntactically parallel but where one of the phrasal constituents is a High-toned monosyllable.[5] This is true whether the monosyllable is on the left or on the right, whether it is a pronoun or a full noun. The first

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example in (9) has a monosyllabic pronoun *í* on the left. The final two examples have a monosyllabic noun *tí* on the right:

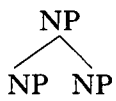
(9) *Possessor + possessed constructions, if one or both elements are monosyllabic*

pronoun + noun	í bólí [_ – ¯]	'its goat'
noun + noun	Mó Bólí [_ – ¯]	'Mrs Boli'[6]
	bólí tí [_ – ¯]	'goat's head'
	Ákísí tí [_ – ¯ ¯]	'Akisi's head'

Recall that the unbroken pattern doesn't occur in (6a), though it is the same syntactic construction: possessor + possessed. The relevant difference between the possessed element in (9) and (6a) is the number of syllables in the constituent.

This implies that noun + noun expressions consisting of High tones will have an ambiguity when they contain a monosyllabic noun that they would otherwise lack. The forms below demonstrate that this is in fact what happens. Each one can be interpreted either as a compound or as a possessor + possessed phrase. The example in (10b) appears after the possessive pronoun *í* 'his/her' to amplify the difference between the compound reading and the possessor + possessed reading:

(10)

	noun compound	*possessor + possessed*
		
a. bólí tí [_ – ¯]	'goat head'	'goat's head'
b. í sí bólí [_ – ¯ ¯]	'its father-goat'	'its father's goat'

The conclusion is apparent: the syntactic differences between (5) and (6) do not suffice to characterise the environments in which the different High sequencing rules apply. We also need to know how many syllables each constituent has.[7] This is a clear sign that the domain of upsweep is a not a syntactic one, in the normal sense. Rather, upsweep operates in a prosodic domain, in the sense of Nespor & Vogel (1986) and Inkelas & Zec

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(1990), where a variety of factors – including syntactic, morphological and phonological ones – play a role in determining the domain. In §4 we discuss this conclusion at greater length.

In a variety of African languages, possession is marked by a floating tone between the possessor and possessed. Sometimes subjects and verbs are separated by floating tones as well.[8] Could it be that the disruption of upsweep evidenced in (6) results from a floating tone, or from a tonal boundary of some sort? In considering this possibility, we need to recognise that what is uncontestable is that precisely where the domain of upsweep is interrupted there is a phrasal constituent break, as in (8b). We have seen that where that sort of break is absent, the upsweep pattern continues uninterrupted. Whether that break coincides with a tonal morpheme or a tonal juncture is something we need to determine.

The facts do not appear to recommend either a High tone or a Low tone in this environment on independent grounds. If we did posit a tone in this position, and if it were Low, this might capture the break in the High-tone pattern, but it would be ad hoc, because the Low tone never surfaces as such. Indeed, the raising noted in (4) between the initial syllable of the second phrase when it assimilates to the preceding Super-High does not correspond with normal expectations of the effects of an inserted Low tone. If, on the other hand, we posited a High tone, it would not be immediately clear why it should cause a break in a High-tone sequence. Nor would a tonal morpheme or boundary tone *per se* explain why monosyllables required special treatment.

4 A difference in prosodic constituents

The mixture of syntactic and phonological criteria that determine the behaviour of High-tone sequences in (9) suggests that the difference between the compounds and possessive phrases of (10) is indeed a difference in prosodic constituency. To establish the validity of this hypothesis, our plan of action in this paper is the following. First, we need to show that the constituents in (5) and (6) are indeed different phonological domains. Next we must motivate the statement that the rules for prosodic domain formation treat monosyllables differently from longer elements. Finally, we must demonstrate that the rules applying to sequences of High tones are sensitive to the prosodic domain difference. Baule offers justification independent of tonal upsweep for each of these three aspects of the argument.

For exposition's sake, our first step will be to name the two proposed prosodic constituents. Since monomorphemic nouns like *Ákísí* in (5a) are *morphological* words, they are natural candidates for being *prosodic* words. Similarly for noun+noun compounds: because such constructions are syntactically nouns in most languages, a reasonable working hypothesis is that, like Baule single nouns, they are PROSODIC WORDS as well. Proper names composed of two or more personal names can be analysed as having

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the same structure as compounds, and indeed behave like compounds with respect to upsweep, so we group them into single prosodic words as well. Since noun + adjective constructions like (5b) *bólí kpángbán* and noun + numeral constructions like (5e) *bólí blú* behave tonally like the other candidates for prosodic wordhood, we can surmise that they too must be prosodic words.[9] On the other hand, the broken upsweep pattern characteristic of (6) always involves more than one prosodic word, and so we refer to constructions that take the latter pattern as PHONOLOGICAL PHRASES. In §5 we will show that the subject and predicate can constitute a single phonological phase.[10] Possessive constructions also constitute a single phonological phrase, as will be seen in §5.

The hypothesised structures are listed in (11):

(11)

Prosodic words	*Phonological phrases*
$[\text{noun}]_{PW}$	$[[\text{noun}]_{PW}\ [\text{noun}]_{PW}]_{PP}$ (possessive)
$[\text{noun}+\text{noun}]_{PW}$ (compound, proper name)	$[[\text{subject}]\ [\text{predicate}]]_{PP}$
$[\text{noun}+\text{adjective}]_{PW}$	
$[\text{noun}+\text{numeral}]_{PW}$	

Justification for positing the prosodic word as a distinct domain of rule application from the phonological phrase comes from several segmental phenomena in the language. We will describe two processes involving the loss of a prefix vowel *a-*. Both are sensitive to the difference between prosodic words and phonological phrases.

Baule has an optional rule of Apheresis, expressed informally in (12):

(12) *Apheresis*

Initial *a-* drops if the word is longer than four syllables.

The examples in (13) show that the word referred to in (12) is the prosodic word:

(13)

	regular form	*abbreviated form*	
a.	akɛndɛwa	—	'spider'
	akɛndɛwa boli	—	'spider's goat'
b.	Akɛndɛwa Aya	Kɛndɛwa Aya	'Akendewa Aya'
	akɛndɛwa-boli	kɛndɛwa-boli	'spider-goat'
c.	akɛndɛwa si	kɛndɛwa si	'spider's father'

The noun *akɛndɛwa* in the first line of (13a) does not undergo Apheresis, since it is only four syllables long. In the second line of (13a), putting this word into a possessive construction does not lengthen it for the purposes of Apheresis. As proposed above, and schematised in (10), possessive constructions involve two separate prosodic words. This explains why Apheresis is no more possible in line 2 than in line 1 of (13a).

But in examples (13b) and (13c), Apheresis applies everywhere. This is because we are dealing with single prosodic words – even though each example consists of two *morphological* words. Schematically:

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(14)

	regular form	*abbreviated form*	
a.	$[akɛndɛwa]_{PW}$	—	'spider'
	$[akɛndɛwa]_{PW}$ $[boli]_{PW}$	—	'spider's goat'
b.	$[Akɛndɛwa\ Aya]_{PW}$	Kɛndɛwa Aya	'Akendewa Aya'
	$[akɛndɛwa\text{-}boli]_{PW}$	kɛndɛwa-boli	'spider-goat'
c.	$[akɛndɛwa\ si]_{PW}$	kɛndɛwa si	'spider's father'

The first form in (14b) is a proper name. As shown in (5d), by our upsweep criteria, proper names, like compounds, are indeed single prosodic words. For example, the proper name *Ayá Bólí* would be pronounced with a single upsweep pattern, making for a minimal contrast with the predicative construction (6b) *Áyá bólí* 'Aya is a goat'.

(15)

proper name	*predicative*	
Áyá Bólí	Áyá bólí	'Aya is a goat'
[_ – ¯ ¯]	[_ – _ –]	

The application of Apheresis to proper names like (14b) *Akɛndɛwa Aya* to give '*Kɛndɛwa Aya*[11] shows that they are prosodic words.[12] This test is particularly important, because it motivates the prosodic word independently of any tonal considerations.

Similarly for the second form (14b), a compound. Our upsweep criteria put this into the same class as monomorphemic words, and the Apheresis test supports this classification independently.

Possessive constructions, on the other hand, were shown above to have a break in their upsweep pattern, except when a monosyllable was involved. We can now phrase this condition more explicitly: monosyllables form prosodic words with neighbouring constituents rather than forming their own prosodic words. This predicts that examples like (14c), though syntactically parallel to those in (14a), ought to behave like single prosodic words. Apheresis confirms this prediction. In (14c), we see that Apheresis applies, just as in the prosodic words in (14b).

A second optional process elides a word-final vowel when the following word begins with a vowel, but only within a single prosodic word. The rule is expressed in (16), and examples and contrasting cases appear in (17).

(16) *Elision*

$$V \rightarrow \emptyset / [\ldots __\ V \ldots]_{PW}$$

(17)

name 1	*name 2*
Kwajo	Aya
Nja[13]	Akɛndɛwa

a. *noun*

Kwaj' Aya 'Kwajo Aya'

Nj' Akɛndɛwa 'Mr Akendewa'

b. *possessor + possessed*

Kwajo Aya 'Kwajo's Aya'

Nja akɛndɛwa 'Mister's spider'

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(17a) contains a proper name, which forms a single prosodic word, permitting Elision to apply internally. By contrast, Elision doesn't apply in the possessor + possessed constructions in (17b). Elision provides an independent test of the ability of monosyllables to attach to an adjacent prosodic word. Baule has no monosyllables capable of fitting into slot 2 of the constructions above (since these would need to be single vowels, and there are no words of that form). But below is an example in which a monosyllable appears in the slot for name 1:

(18) *name 1* *name 2*
Ya Akisi

a. *proper name*
Y' Akisi 'Ya Akisi'

b. *possessor + possessed*
Y' Akisi 'Ya's Akisi'

As a final test of the account in this section, we can check for upsweep in expressions like those in (13) and (17). Any unbroken string of High tones in a prosodic word should exhibit uninterrupted upsweep, and this ought to happen in the cases where Apheresis and Elision apply, since they have been shown to apply only in prosodic words. The exact examples in (13) and (17) cannot be used, because they do not contain unbroken sequences of High tones. However, in (19) we substitute High-toned words for the words in (17) that do not have unbroken High-tone sequences:

(19)	*name 1*	*name 2*	*noun*	
a.	Ákísí	Bólí	'Kísí Bólí [_ – ¯ ¯]	'Akisi Boli'
b.	Tálúá	Ákísí	Tálw' Ákísí [_ – ¯ ¯]	'Talua Akisi'
c.	Áyá	Ákísí	Ay' Ákísí [_ – ¯ ¯]	'Aya Akisi'

The prediction is correct, as illustrated by the pitch diagrams below the expressions. Thus, Apheresis and Elision provide independent support for the status of the prosodic word as a distinct constituent from the phonological phrase and for the thesis that monosyllables are elements in prosodic words rather than constituting prosodic words by themselves.

Here, in a nutshell, are the syntactic and phonological generalisations observed thus far. In the syntactic environments listed in (7a), prosodic words are formed. Monosyllables, rather than forming their own prosodic words, attach to a neighbouring prosodic word, which can be characterised as the structurally closest sister. However, there are restrictions on this attachment that have not yet been discussed. A clear case is direct address:

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Yá, bólí 'Ya, (you) goat' consists of two prosodic words, just like a disyllabic subject.

(20) Yá, bólí 'Ya, (you) goat' Áyá, bólí 'Aya, (you) goat'
[¯ – ¯] [– ¯ – ¯]

On the other hand, the pronominal subject marker forms a prosodic word with a following verb, as in *bé fá* 'they will take (it)', which has the same tone pattern as *be tí* 'their head':

(21) bé fá 'they will take (it)' bé tí 'their head'
[– ¯] [– ¯]

Subject markers like *bé* also mark aspect. In (21), the form *bé* on the left is a future aspect marker for the 1st person singular. From a morpho-syntactic standpoint, *bé* functions as part of the verb.

Prosodic words have most often been defined recursively, as by McCarthy & Prince (1993). This means that, of the constituents labelled as prosodic words in examples like (11) and (14), some contain internal submembers that themselves are prosodic words. We assume this recursive structure for Baule, since it permits the relatively straightforward definition in (22), but we regard it as a matter for further investigation. For our descriptive purposes here the only constituent really needed is the outermost unit with the label PW, that is, the maximal prosodic word. The prosodic word is defined in (22), and the maximal prosodic word is defined in (23):

(22) *Prosodic word formation*

A word is a prosodic word if:

a. It is a morphological word of more than one syllable in length.
b. It is a noun + adjective construction or a noun compound.
c. It is a constituent consisting of a monosyllabic element and an element identifiable as (a) or (b).

We can capture the restriction that prosodic words do not cross certain boundaries (e.g. with direct address, as in (20)) by restricting (22c) to constituents in the same phonological phrase and positing that subject and predicate form separate phonological phrases. Phonological phrases are discussed in §5.

(23) *Maximal prosodic word*

A maximal prosodic word is a prosodic word that is not itself contained within a prosodic word.

If we posit that the domain of upsweep is the maximal prosodic word, then the definitions in (22) and (23) make a new prediction. Constructions that would be expected to interrupt the upsweep pattern on syntactic grounds will instead take a single uninterrupted upsweep pattern if they involve *any number* of monosyllabic words. By the same token, they will also be expected to serve as domains for Apheresis (12). The example in

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(24) shows that both predictions are correct for a construction with *two* monosyllabic elements:

(24) (Á)kísí sí tí 'Akisi's father's head'
[_ – – ¯ ¯]

In fact, this is true for an indefinite number of monosyllables, as seen below, where an unbroken upsweep pattern is the norm for all of the examples interpreted as indicated in the glosses on the right. In the following expressions, note that the expression *bólí tí* is a compound, 'sheep head', rather than a possessive phrase, 'sheep's head'. If it were the latter, there would be two prosodic words, one containing *Ákísí* along with the monosyllable or monosyllables just to its right and the other containing *bólí* and the monosyllable to its right. In this case, the variant '*Kísí* of *Ákísí* would not be permitted, nor would the single upsweep pattern be found.

(25) i boli 'his/her sheep'
i si boli 'his/her father's sheep'
i si boli ti 'his/her father's sheep head'
Akisi si boli ti ~ 'Kisi si boli ti 'Akisi's father's sheep head'
Akisi ni si boli ti ~ 'Kisi ni si boli ti 'Akisi's mother's father's sheep head'

A final question for this section is why monosyllables behave differently from longer words. Since the difference stems from what appear to be very standard prosodic considerations, the most reasonable explanation is that Baule prosodic words must be minimal words, in the sense of Prince (1980) and McCarthy & Prince (1986, 1993), and that the minimal word is two syllables long.

5 The phonological phrase and beyond

We have seen several processes in Baule whose domain of application is the prosodic word. In this section, we introduce a rule that applies within a larger domain, the phonological phrase. Recognising the prosodic word and the phonological phrase as separate domains helps to explain some important tonal differences that have escaped notice in earlier work.

The rule of Low Tone Spreading, described by Creissels & Kouadio (1979), can be formulated as in (26). The examples in (26) show that after a Low tone, the contrast between a HH word and a LH word is indeed neutralised:

(26) *Low Tone Spreading*
H → L/L __ H

(27) a. /tò bólí/ tò bòlí 'buy a goat (IMP)'
b. /tò nànnín/ tò nànnín 'buy a cow (IMP)'

The rule applies in nominal expressions comparable to those treated earlier in the paper, but with a Low tone in place of one or more of the

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initial High tones. Compare (28) with (5) above, and compare the surface tones in the second column with the underlying ones in the third.

(28)	*output*	*underlying*
a. *noun + adjective*	nànnìn kpàngbán [_ _ _ –]	[nànnín kpángbán]$_{PW}$ 'many cows'
b. *noun + noun compound*	nànnìn nɔ̀nnɔ́n [_ _ _ –]	[nànnín nɔ́nnɔ́n]$_{PW}$ 'cow milk'
c. *proper name*	Kwàjò Àmlán [_ _ _ –]	[Kwàjó Ámlán]$_{PW}$ 'Kwajo Amlan'
d. *noun + numeral*	nànnìn blú [_ _ –]	[nànnín blú]$_{PW}$ 'ten cows'

In (28a–c), Low Tone Spreading lowers High tones in the first word as well as in the second. Due to downdrift, the High tone at the end in each case is, as we would expect, markedly lower than in the corresponding example in (5), where it was Super-High.

The domain of application of Low Tone Spreading extends beyond the prosodic word, as seen in (29). Compare these structures to (6):

(29)	*output*	*underlying*
a. *possessor + possessed*	nànnìn màngún [_ _ _ –]	[nànnín]$_{PW}$ [mángún]$_{PW}$ 'cow's friend'
b. *possessor + possessed*	Kwàjò Àmlán [_ _ _ –]	[Kwàjó]$_{PW}$ [Ámlán]$_{PW}$ 'Kwajo's Amlan'
c. *subject + predicate*	Kwàjò bòlí [_ _ _ –]	[Kwàjó]$_{PW}$ [bólí]$_{PW}$ 'Kwajo is a goat'

Verb phrases offer evidence that helps to delimit the domain of Low Tone Spreading. Because all Baule verbs change their final (or only) syllable to Low tone before a direct object, the verb provides a reliable left-hand environment for Low Tone Spreading, as seen in (30). In this particular case, because the pronominal subject marker *bè* and the verb *flè* are monosyllabic, they can be assumed to be incorporated into the same prosodic word as the direct object:

(30) *output*	*underlying form of post-verbal complement*
[bè flè Mòmlò Àmlán]$_{PW}$	[Mómló Ámlán]$_{PW}$
'They call Momlo Amlan (proper name)'	

Verbs can also take as their objects phrases that consist of several prosodic words. A good example to compare with (30) is the expression

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Mómló Ámlán 'Momlo's Amlan', which was shown in (6) to consist of two prosodic words. As (31) illustrates, here Low Tone Spreading continues its change across the prosodic word boundary that separates the two words of the direct object:

(31) *output*	*underlying form of post-verbal complement*
[bè flɛ̀ Mòmlò]$_{PW}$ [Àmlán]$_{PW}$	[Mómló]$_{PW}$ [Ámlán]$_{PW}$
'They call Momlo's Amlan'	

Examples (30) and (31) show that if the verb is followed by a direct object with High tones, Low Tone Spreading will apply across the entire object, whether it is a single prosodic word or one that consists of several prosodic words.

Still, there is a limit to the domain of application of Low Tone Spreading, as can be seen from (32), where the expression *Mómló Ámlán* is interpreted as a double object. Note that the operation of Low Tone Spreading stops after changing *Mómló* to *Mòmló*, without affecting *Ámlán*. This is unlike what was just seen in (30) and (31). To capture this difference, we label each constituent in the output of (32) as a separate phonological phrase. This move is discussed directly below.

(32) *output*	*underlying form of post-verbal complement*
[bè flɛ̀ Mòmló]$_{PP}$ [Ámlán]$_{PP}$	[Mómló]$_{PW}$, [Ámlán]$_{PW}$
'They call "Momlo Amlan"'	(double object)

The fact that *Ámlán* is unchanged in (32) shows that it is in a separate domain from the preceding words. This domain must be larger than the prosodic word, since (30) and (31) have shown that Low Tone Spreading applies across prosodic words. We will assume that the domain in question is the phonological phrase (Selkirk 1980, Nespor & Vogel 1986). This means that the sentences in (30) and (31) constitute a single phonological phrase, while (32) consists of two phonological phrases.

Another case of a phonological phrase division in a simple sentence is appositive phrases, as in (33):

(33)	*output*	*underlying*	
a.	[Kwàjó]$_{PP}$ [bólí]$_{PP}$ [_ – – ¯]	[Kwàjó]$_{PP}$ [bólí]$_{PP}$	'Kwajo, a goat'
b.	[nànnín]$_{PP}$ [Ákísí]$_{PP}$ [_ – – – ¯ ¯]	[nànnín]$_{PP}$ [Ákísí]$_{PP}$	'a cow, Akisi'

We can also point to an independent factor that differentiates the prosodic word from the phonological phrase, namely the behaviour of monosyllables. Above, monosyllables were shown to resist incorporation as prosodic words, preferring instead to be attached to a neighbouring element as part of its prosodic word. Examples were given in (9), (10),

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(14c) and (18). But monosyllables can perfectly well function as phonological phrases by themselves, as seen from the final elements of the following examples:

(34) a. *double object*

output	*underlying*
bè flɛ̀ Mòmló Mó	[bè flɛ̀[14] Mómló]$_{PP}$ [Mó]$_{PP}$
'they call Momlo "Madam"'	
bè flɛ̀ nànnín sí	[bè flɛ̀ nànnín]$_{PP}$ [sí]$_{PP}$
'they call the cow "father"'	

b. *appositive phrases*

output	*underlying*
Àmànî, Mó	[Àmànî]$_{PP}$ [Mó]$_{PP}$
'Amani, a mother'	
nànnín, Yá	[nànnín]$_{PP}$ [Yá]$_{PP}$
'a cow, Ya'	

Thus, in the statement of prosodic word formation in (22), the constituent that a monosyllable may join with to form a single prosodic word must be construed to exclude cases like those just described. This can be done in a natural way under the Strict Layer Hypothesis (Selkirk 1984), which restricts any prosodic unit from membership in more than one prosodic unit on the next higher level. If we stipulate that appositives and the two objects of double object constructions belong to separate phonological phrases, then the Strict Layer Hypothesis will automatically restrict prosodic word formation to cases confined to a single phonological phrase. Therefore, monosyllables will not be able to move from their phonological phrase to take up residence in a neighbouring prosodic word.

To see this more clearly, imagine a hierarchical representation in which the phonological phrase and the prosodic word are stacked vertically in two layers, the first above the second. As shown below, it is OK for the composition of the phonological phrase to be coextensive with that of the prosodic word. The Strict Layer Hypothesis rejects the situation depicted in the right-hand column, where a single prosodic word is aligned with more than one phonological phrase.

(35)

	OK	*
Phonological phrase	[...σ...]$_{PP}$ [σ]$_{PP}$	[...σ...]$_{PP}$ [σ]$_{PP}$
Prosodic word	[...σ...]$_{PW}$ [σ]$_{PW}$	[...σ... σ]$_{PW}$

A third way in which phonological phrases are demonstrably different from prosodic words involves a difference in the upsweep pattern that was observed in the earlier cases. Consider the cases in (36), where all-High nouns have been substituted for the Low–High nouns in (33).

(36) a. [Ákísí]$_{PP}$ [bólí]$_{PP}$ 'Akisi, a goat'
b. [bólí]$_{PP}$ [Ákísí]$_{PP}$ 'a goat, Akisi'

Each phrase labelled PP behaves as a separate upsweep domain. Impressionistically, the final High of the first word is somewhat variable in

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relation to the starting point of the second. For example, as shown in (37a), in *Akisi boli* 'Akisi, a goat', there can be a step down between the High at the end of *Akisi* and the High at the beginning of *boli*. But, impressionistically again, it seems equally natural for these two High tones to be pronounced on the same level.

(37) [Ákísí]$_{PP}$ [bólí]$_{PP}$ 'Akisi, a goat'

a. [_ –¯ _¯]

b. [_ _– –¯]

The same pattern of variation obtains for example (36b):

(38) [bólí]$_{PP}$ [Ákísí]$_{PP}$ 'a goat, Akisi'

a. [_¯ _ –¯]

b. [_– – –¯]

The variability between the High tones abutting the phrase boundaries of appositives also exists between the two objects of a double object construction. Thus, (39) sketches alternative phonetic realisations of the final word in (32):

(39) [bè flɛ̀ Mòmló]$_{PP}$ [Ámlán]$_{PP}$ 'They call Momlo "Amlan"' (DOUBLE OBJECT)

a. [_ _ _ – _ –]

b. [_ _ _ – – ¯]

This variation is not what occurs within single phonological phrases, whether within prosodic words as in (5) or between prosodic words as in (6). This reinforces the case for separate phonological phrases for appositives and for the two objects of a double-object construction. Though much more study is needed for a full-fledged account of phonetic realisation of tone in Baule, the contrasts between the alternative pronunciations of (37)–(39) are great enough and consistent enough to suggest that the starting point of a PP-initial High tone is somewhat independent of any preceding High, in a sense that does not apply to the structures in (5) or (6).

Thus, there are three separate criteria that characterise a phonological phrase. First, it is the domain of Low Tone Spreading. Second, unlike the case with prosodic words, monosyllables can constitute their own phonological phrase. Third, the phonological phrase is the domain in which the starting point of a phrase-initial High tone is set.

7 Conclusions

This paper has motivated a set of rules whose domain of application is crucially a prosodic one. Baule upsweep interacts with its environment in intricate ways. The fact that monosyllables behave differently from

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polysyllables in certain cases provides a sign that prosodic differences are involved, in addition to grammatical ones. The segmental rules dropping the prefix *a-* provide additional support for the prosodic structures posited. Finally, Low Tone Spreading points to a prosodic constituent larger than the prosodic word, the phonological phrase.

NOTES

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[1] The transcriptions in this paper are given in Baule orthography, with the addition of acute accents to mark High-toned syllables and grave accents to mark Low-toned syllables. In some of the examples, syllables are left unmarked for tone. These are all High-toned. Nasalised vowels are symbolised with a plain vowel followed by *n*. The literature includes two monographs devoted exclusively to tone in Baule: Creissels & Kouadio (1979) and Ahoua (1996), plus several detailed treatments making reference to tone: Quaireau (1981), Timyan (1979) and Creissels & Kouadio (1977).

[2] Creissels & Kouadio suggest that the initial tone in High-tone sequences is nearly neutralised with Low tone: 'Le premier d'une succession de tons hauts est réalisé presque bas, le deuxième presque haut, et c'est seulement à partir du troisième que le niveau haut est atteint' (1979: 18). But in the dialect that we report on here, the difference LH and HH is quite clear, because an underlying LH sequence undergoes downdrift. For instance, *nànnín* 'cow' ends with a lowered High, while *nónnón* 'milk' ends with a raised High.

[3] This utterance was pronounced by Konan Kouadio Raymond, a 25-year-old linguistics graduate student at the University of Bouaké. He was born and raised in the village of N'Douakro, near Bouake. The graphs for this and other figures were produced with Cecil, a pitch extraction and wave form display programme produced by the Summer Institute of Linguistics.

[4] This expression would be used to refer to a specific person named Amlan, namely the one associated with the individual whose name is Momlo.

[5] The instrumental data in (3) provide an illustration. There the monosyllabic possessed item *dó* forms a single constituent with the possessor, *bólí blú*.

[6] *Mó* 'mother' is used as a title of polite reference, roughly equivalent to 'Mrs' or 'Madame'.

[7] Monosyllabic constituents have been reported to have the same tendency to be adopted by neighbouring prosodic words in other languages, including Hausa (Inkelas 1990) and English (Culicover & Rochemont 1983).

[8] See Hyman & Leben (to appear) for examples from a variety of languages.

[9] Selkirk (1986) proposes that French noun + adjective constructions have the structure of compounds in order to account for prosodic structure.

[10] In the right-hand column of (10), the subject and predicate are shown as belonging to a single phonological phrase. This is not intended to imply that *all* subject + predicate sequences constitute a single phonological phrase, but only

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that the ones to be discussed in §5 fulfil the conditions for phonological phrasehood. Subjects themselves can be of any length, from zero through being a prosodic word that is an element in a phonological phrase to being complete phonological phrases in themselves.

[11] The apostrophe on *'Kɛndɛwa* is used to indicate that the initial vowel has been elided. We should add, though, that a trace of the former vowel is often heard in this position. The pronunciation of the word's onset thus contrasts slightly with *kàká* 'many', whose *k* is initial underlyingly.

[12] As pointed out to us by Bohoussou Amani, Kouamé Emmanuel and Konan Kouadio Raymond, the rule of Apheresis is general and applies to an example like *Ajanun Kwajo Twanu* (name of a specific fish) that is realised as *'Janun Kwajo Twanu*. Yet, as we predict, if *Ajanu* is interpreted as a possessor, then the apheresis of initial *a* is not acceptable. Similarly, a name like *asamlangangan* (name of a ghost) is realised as *'samlangangan* and a proper name like *Akpɛtɛ Kwasi* is realised as *'Kpɛtɛ Kwasi*.

[13] *Nja* 'Mister' is disyllabic, as shown by the fact that the initial nasal has its own tone, Low, separate from the High of the following syllable.

[14] The tone of the verb *flɛ* is actually High underlyingly, but changes to Low by a prior rule, which lowers the final tone of any verb before a complement.

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