Bruce Connell

Tone and Intonation in Mambila

Abstract: Mambila is a Bantoid language spoken in the Nigeria-Cameroon borderland. It is a language with four level lexical tones and two grammatical tones. Previous work by the author (see references) indicates that pitch realization in Mambila is rather tightly constrained with respect to downtrends, the intrinsic F0 of vowels, and the overall scaling of tones. The present chapter combines this earlier work with newly reported research to present an overview of tone and intonation in Mambila. The major question addressed is whether Mambila, with its complex and crowded tone space, uses F0 differences to signal differences in sentence type: declaratives, polar questions, and content questions. The results of a series of experimental investigations reveal no consistent contribution of F0 in distinguishing sentence type: Mambila is a language which does not have intonation, as this concept is usually understood. The implications of these findings for intonation theory are discussed in the closing paragraphs of the chapter.

Keywords: downtrend, declination, downdrift, final lowering, polar question, content question, F0 scaling, question

1 Background

1.1 Tone and intonation in tone languages

There are a number of important and interesting issues with respect to the realization of intonation in tone languages. Since both tone and intonation have as their principal phonetic correlate controlled variation of F0, the potential for interaction between the two leading to ambiguity or miscommunication exists; so, it is of interest to know what strategies are employed with tone languages to resolve or avoid possible conflicts. It is reasonable to suggest that there would not be one 'blanket' strategy, but that the nature of the tone system in question would to a large extent be the determining factor. That is, and simply put, tone

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in a language with a small tone inventory, or one in which tone carries a relatively small functional load, would be less susceptible to misinterpretation than otherwise.

The aim of this chapter is to provide an account of the role of pitch and other phenomena related to intonation in Mambila. The variety of Mambila examined here features four level lexical tones and two grammatical tones, the latter realizing several tonal morphemes. Together, these tones may combine to form a number of contour tones. As tone in Mambila is, like in most African languages, realized primarily through F0, it is of interest to learn how tone-based F0 variations interact with possible intonation-based F0 variations. Alternatively, one might ask to what extent intonation functions in Mambila are realized through F0 variations or by other conceivable means. A number of studies of pitch realization in Mambila have been undertaken, including Connell (1999a, b, 2002a, b, 2003, 2004, 2005). There are two studies on phonological aspects of Mambila tone, Perrin (1974, 1991), both of which are difficult of access, as is Perrin & Hill (1969), which provides a sketch of the phonology of Mambila. The present chapter draws on this work as well as the results of further as yet unreported work en route to an admittedly still partial characterization of intonation in Mambila. The remainder of this section looks at certain terminological issues and gives background on Mambila. Section 2 examines the status of tone in Mambila; §3 reports a series of instrumental studies into downtrends in Mambila, looking at the extent to which declarative utterances are marked intonationally. Section 4 looks at F0 scaling relative to sentence length; §5 presents results of experimental work investigating polar questions compared to the associated declarative utterances, and §6 at the pitch characteristics of content questions compared to similar statements. Section 7 gives discussion pertaining to the possible phonological representation of intonation in Mambila and §8 provides a summary and concluding statement.

1.2 Terminological concerns

The terminology used in describing pitch phenomena – both tone and intonation – has been used somewhat inconsistently in the Africanist literature, or differently than in other traditions. In the present chapter, and following the rationale given in Connell (2011), I use the relevant terminology defined in the following manner.

Declination: a gradual lowering of the phonetic backdrop of F0 over the course of an utterance. It is often said, or assumed to be, phonologized to mark declarative intonation.

Downstep: the lowering of a High tone following another High tone with the effect that a new ceiling is established for subsequent High tones within a specifiable domain. Downstep is *automatic* when a surface Low tone triggers the lowering, and *non-automatic* when there is no surface trigger; in such cases it is often attributable to a floating L tone. The new ceiling set for Hs leads to a terracing effect, hence the description of many languages as *terrace-level* languages.

Final lowering: a relatively abrupt lowering of F0 restricted to the ends of utterances. Liberman & Pierrehumbert (1984) and Pierrehumbert & Beckman (1988) report final lowering in English and Japanese respectively, and suggest it is restricted to (or extends over) approximately the last 250 ms or so of an utterance, i.e. approximately the last syllable. It is often said to fall to the bottom of a speaker's normal pitch range. It is often attributed to an utterance final boundary or edge tone. For African languages, Welmers (1973) notes that final (pre-pausal) L tones are typically falling. Two experimental studies investigating final lowering in African languages are Herman (1996) for Kipare, and Myers (1996) for Chichewa, both Bantu languages. Final lowering is often assumed to have a demarcative function relative to utterance boundaries in the form of a low boundary tone (L%).

Downdrift: Downdrift is most often used in the literature synonymously (and confusingly) with either automatic downstep and declination; here, and following the practice adopted in Connell (2002a, 2011) downdrift refers to a lowering of F0 that is the result of successive cumulative local lowerings through tone coarticulation; i.e., as shown in Connell 2002a, a H tone is lowered by a preceding L tone. However, in sequences involving a string of H tones, e.g. HLHHH, within two to three syllables the H has achieved its earlier, initial, height. In sequences of alternating High(er) and Lowe(er) tones, e.g. HLHLHL, H does not have the possibility to achieve its initial height, but rather, the lowering effect of the intervening Ls is cumulative. So while in certain contexts this effect may be indistinguishable from automatic downstep, unlike downstep, it does not impose a new, lower, ceiling on succeeding Hs, as is a characteristic of downstep. In this, downstep (either automatic or non-automatic) can be seen as phonologically based while downdrift, as described here, is phonetic in nature.

Register: Clements (1990: 59) defines register as the "frequency band internal to the speaker's range which determines the highest and lowest frequency within which tones can be realized at any given point in an utterance", to distinguish it from an individual's normal pitch *range*. The register can be raised or lowered, expanded or narrowed.

1.3 Mambila

Mambila is a Bantoid language spoken on both sides of the Nigeria-Cameroon border, in Taraba State in Nigeria and Adamawa Region in Cameroon. With approximately 100,000 speakers[1], it is the largest language of the Mambiloid group. It comprises two dialect clusters, East and West Mambila, most of whose lects are mutually unintelligible, within as well as across clusters. Mambila speakers of whichever variety who claim to understand other lects are able to do so largely through exposure; exceptions would be in certain cases of neighbouring lects, i.e. a restricted dialect chain. The division into two clusters has been established on the basis of a number of phonological and morphological characteristics (Connell 2000a); one of these characteristics appears to be that languages of the eastern set have three lexical tones, while those of the western grouping operate a system of four lexical tones. In making this claim it should be noted that the presence of four tones in West Mambila vs three in East Mambila has not been confirmed for all varieties of the two clusters, though it does appear to be true of all that have been examined thus far; the circumstances of the development from three in the east to four in the west are relatively transparent. The only Mambila lect that has been the subject of detailed phonetic investigation is Ba Mambila; Ba is spoken principally in three villages on the Tikar Plain in Adamawa Province, Cameroon: Atta, Sonkolong and Somié, together with smaller villages and hamlets in the orbit of these three. There are some relatively minor subdialectal differences across the Ba speaking area; to the extent that these bear on the present work, they are mentioned below where relevant. Perrin & Hill (1969) is a sketch of the phonology of Ba as spoken at Atta, and Mouh & Perrin (1995) is a lexicon based on Ba as spoken at Sonkolong. Perrin (1974) is a sketch of the tone system of Tungba Mambila spoken in Gembu and environs, to some extent in comparison with that of Atta. (Tungba is a

1 There are no reliable census figures, particularly for Nigeria, since questions pertaining to ethnic affiliation (including language) are not used in the national census.

distinct, and in fact the largest, variety of West Mambila; Gembu is the seat of local government in the Mambila region in Nigeria.) Finally, while Perrin (1991) is presented as an update ('Some further comments…') on tone in Mambila, comments therein are in fact based on Ba spoken at Sonkolong. Other than these, a number of studies by the present writer which, as mentioned above, inform this chapter, have been carried out at Somié, the third and smallest of the three main Ba speaking villages. In the remainder of the chapter I refer to simply to 'Mambila', though my remarks should be understood as being specific to Ba as spoken at Somié unless otherwise mentioned.

2 The status of tone in Mambila

Tone can be said to function on three different levels in Mambila: lexically, grammatically and deictically. Perrin (1974, 1991) identifies three units she says are required to describe tone in Mambila: the syllable, the phonological word, and a larger, grammatically determined, unit referred to by Perrin as the span. There are four level lexical tones; for ease of reference, these are numbered from 1 to 4 (High to Low). The positing of four underlying level tones is defended in Perrin (1991), who considers and rejects an analysis that tone 3 be analyzed as underlyingly 42, and need not be explored in detail here. Motivation for the identity of underlying tones is based in the fact that most tone patterns on verbs occur in what Perrin (1991) refers to as the narrative tense and these correspond to patterns on verbs given in citation form. Every syllable bears at least one of the four level tones. Contour tones, which can be analyzed as combinations of level tones borne on a single syllable, are not uncommon. This analysis is straightforward and to some extent will be seen as justified in the discussion below, though detailed discussion is outside the scope of the present work.

2.1 Lexical tone in Mambila

There is sufficient lexical contrast based solely on tone that it is not problematic to find minimal pairs or triplets; minimal quadruplets are less common but do exist, as shown in (1).

(1) Examples of lexical tonal contrasts, level tones[2].

Word	*Tone*	*Gloss*
baŋ	1	defensive trench around village
	2	type of wild cat (genet sp.)
	3	begin
	4	wound (n.)
go	1	guardian
	2	habit, custom
	3	sell
	4	journey (n.)
ker	1	sparrowhawk
	2	new field
	3	cut (v.), dig
	4	cup used for palm wine
jere	1	dirtiness
	2	pity
	3	go up (e.g. smoke)
	4	type of flea

Figure 1 illustrates pitch differences for the four tones spoken in collocation with the 1SG-POSS marker mò (tone 4). Since baŋ T3 is a verb (as are the other T3 words in the above examples) it is not possible to place it in the comparable tone environment, so two minimal sets are used, baŋ (tones 1, 2, 4 and ba (tones 2, 3, 4); ba T1 is a grammatical form and so it too cannot fit into the environment used.)

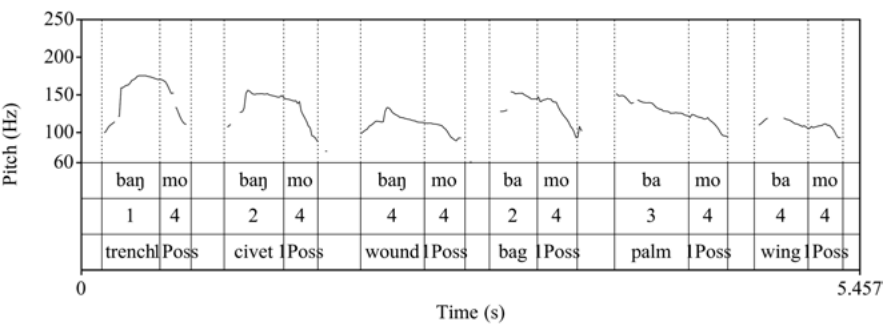

Figure 1: Pitch tracks for the four tones of Mambila, illustrated using two minimal sets, baŋ (tones 1, 2, 4 and ba (tones 2, 3, 4); speaker CD

2 Examples throughout are given in the accepted Mambila orthography, with the exception of tone marking. The orthography provides for marking only T1 (H = ´) and T4 (L = `); in this chapter I use one of two conventions, according to which is best suited for a given example: either numbers (1 to 4, High to Low) or diacritics with T2 being marked with a macron (= ¯) and T3 left unmarked. When using tone numbers the syllable boundary is indicated (.) where necessary.

Possible tonal combinations or sequences of tones within the syllable are limited to 2-1, 3-1, 4-1, 1-4, 2-4, 3-4, 2-1-4. These patterns appear to define the phonological word, along with others introduced through the addition or influence of grammatical tones, whether a word is of one, two, or three syllables. Two tritonal contours, which occur only rarely, have been identified in monosyllabic or disyllabic nouns: 214 and 314. In disyllabic words bearing these tone sequences the contour is always on the second syllable (i.e. 2.14, 3.14). The majority of words in Ba Mambila are monosyllabic, while three syllable words are uncommon. It is worth noting, though tangential to the concerns of this study, that the four way lexical contrast is found only on the initial syllable of nouns. The functioning of grammatical tone gives a four way contrast on the second (final) syllable of verbs.

Contour tones on one syllable are normally restricted to monosyllabic words. On disyllabic words they occur only rarely (except as a result of grammatical conditioning, discussed below) and when they do, the contour is invariably on the second syllable. The presence of contour tones on monosyllables gives evidence the syllable is the relevant tone bearing unit in Mambila. Examples of contours, in contrast with level tones are given in (2).

(2) Examples of lexical tonal contrasts involving compound contour tones.

Word	*Tone*	*Gloss*	*Word*	*Tone*	*Gloss*
man	14	thus	lam	1	row
man	24	small	lam	4	type of tree
man	31	learn	lam	21	lose consistency
beh	1	we	lan	3	today
beh	3	aspect marker	lan	4	society
beh	4	arm, handle	lan	31	invite to work
beh	14	me and …	bam	3	traditional 10 week
beh	21	to spoil, ruin	bam	34	day in the 10 day week
beh	31	braid (v.)			
beh	24	our			

Level tones and contours combined give 11 surface tone contrasts; these are augmented by other contours found on grammatical morphemes, e.g. na 212, a tense marker.

2.2 Grammatical tone in Mambila

Tonal morphemes exist in Mambila which serve a number of grammatical functions; with disyllabic words, these result in a contour on the final syllable of the

word. Grammatical modifications of inherent tones can also level a pre-existing contour. Modifications occur in both noun phrases and verb phrases.

2.2.1 The noun phrase

In dependent constructions (associative, attributive, genitive, possessive), a tone 4 is suffixed: i.e. final T1 > T14; T2 > T24; T3 > T34, T21 > T214; T31 > 314. Perrin describes this as a floating tone morpheme in Atta/Sonkolong which still has a segmental counterpart in Gembu. The segmental morpheme is also said to be still in use by older speakers in Atta, though only with CVC nouns. My own work confirms the existence of this segmental counterpart in a small number of forms in Gembu as well as all varieties of East Mambila examined to date, and I am aware of at least one instance in Ba as spoken at Somié which appears to be a fossilization of the segmental marker. An example of the productive tonal morpheme is given in (3), with tones indicated by number.

(3) T4 as a marker of dependent (genitive) constructions
feh 1 'head'

wo	sie	jule	feh
4	31	2.1	1-4
2SG	comb	hair	head-GEN

'You comb (your) hair of head.'

2.2.2 The verb phrase

There are several grammatical functions of tone at the level of the verb phrase, unlike the situation of the noun phrase, just described. That is, inherent tone patterns are changed, and in some cases contrasts neutralized, through the addition of grammatical tones. It is not within the scope of this chapter to give a complete description of the grammatical role tone plays in Mambila, though the following paragraphs attempt to illustrate at least some of them. Imperative and negative formation involve changes to the inherent tonal pattern of verbs in which existing contours are leveled rather than new contours created: T2, T21 > T1; T3, T31, T34 > T4. Negative formation also sees a permutation of the basic SVO word order to SOV. These are illustrated in (4).

(4) Imperative and negative formation

a. T2 > T1: yila 2.2 ‘enter’

car	yila	lɔ
2	2.2	2
monkey	enter	village

‘The monkey enters (into) the village.’

yila	lɔ
1.1	2
enter.IMP	village

‘Enter the village.’

car	lɔ	yila	ŋgweh
2	2	1.1	1
monkey	village	enter	NEG

‘The monkey doesn’t enter (into) the village.’

b. T21 > T1: yila 21 ‘call’

car	yila	mi
2	2.1	4
monkey	call	1SG.OBJ

‘The monkey calls me.’

yila	mi
1.1	4
call.IMP	1SG.OBJ

‘Call me.’

car	mi	yila	ŋgweh
2	4	1.1	1
monkey	1SG.OBJ	call	NEG

‘The monkey doesn’t call me.’

In past tense formation, verbs with inherent level tone (i.e. either tone 2 or 3) form a contour with the addition of a polar tone: i.e. 2 > 24, 3 > 31. This is illustrated in (5), which may be compared with (4a).

(5) Past tense

T2 > T24: yila 2.2 ‘enter’

car	le	yila	na	lɔ
2	1	2.4	212	2
monkey	PST	enter	COP	village

‘The monkey entered (into) the village.’

In discontinuous verb phrases (Perrin 1991) the verb comes at the end of the clause, with a tone 1 morpheme being suffixed to the verb. This neutralizes the 2–21 distinction, though tone 3 remains unchanged. Verbs may be repeated clause finally for emphasis; in these cases, the inherent tone of the verb is replaced with a 24 contour. Finally, in verb nominalization or infinitive formation, a tone 4 is suffixed to the existing tone of the verb (together with a reduplicative prefix), which may already be a contour as a result of being clause final; hence 2, 21 > 214; 3, 31 > 314. Examples are given in (6):

(6) Infinitive formation

luo (2) 'push'	bə (31) 'plait'
lu-luo-INF	bə-bə-INF
2-2-4	4-31-4
'to push'	'to plait'

2.3 Tone as a deictic marker

Finally, tone serves what may be termed a deictic function in Mambila: e.g. motion toward can be indicated by replacing the inherent tone with tone 4 (7a, b), and nouns with a 21 contour bear tone 2 when indicating location (7d–f). As the examples in (7) show, these sometimes involve segmental changes as well as tone alternations. As 7c indicates, use of tone to mark deixis is not restricted to nouns.

(7) Tonal deixis

a.	nde (2) 'go'	nde (2-4) 'come'
b.	Ndeba (3) Somié (the village name in Ba)	Ndeba (4) 'comes from Somié'
c.	nji (21) 'verb indicating a certain direction'	nji (24) 'action/movement towards the speaker'
d.	lɔ (21) 'village'	lɔ (2) 'in(to) the village'
e.	ton (21) 'market'	tan (2) 'to the market'
f.	cibi (2.1) 'night'	cibi (2) 'in the night'

2.4 The span

Little mention is made by Perrin of pitch or tonal behaviour with respect to what she terms 'the span', though she does say it corresponds to the grammatical clause, which I assume is equivalent to the intonational phrase. If this is the

case, many of the phenomena under examination in this chapter can be seen as properties of, or corresponding to, the span. These are the subject of the following sections of the chapter, which look at downtrends generally, to arrive at a characterization of the intonation of unmarked affirmative declarative utterances, at possible intonation differences between declaratives and interrogatives in polar questions, and at differences between questions and answers in content-word questions.

3 The use of pitch in declarative sentences in Mambila

Cross linguistically different sentence types are typically characterized by different intonations, with declarative utterances being marked by a fall in pitch across the utterance and interrogatives by a suspension of the fall or heightened pitch being the default expectations (Gussenhoven (2004) offers a possible biological basis to these tendencies). While this seems generally as true of tone languages as it is of non-tone languages, Rialland (2007; see also Clements & Rialland 2008) provides numerous counterexamples to this with respect to question intonation. The complex tonal structure of Mambila as presented above suggests that even slight downtrends could introduce a potential for ambiguity and so it is of interest to investigate and ascertain to what extent the use of a downward course in F0 serves intonation purposes in the language. Research investigating downtrends in Mambila was first published in Connell (1999a, b, c) and summarized in Connell (2003). It was known already from early phonological work on Mambila (Perrin 1974, 1991; Perrin & Hill 1969) that non-automatic downstep, as is found in such classic terracing languages as Akan, Efik, and Igbo, is not present in Mambila. However, it was not known to what extent different types of downtrend existed in the language and might therefore be associated with different sentence types. Thus the aim of this work was to establish whether, or to what extent, any of the various downtrends attested generally in tone languages, as defined above in §1.2, exist in Mambila.

The essence of the method in these experimental investigations was to test for pitch effects using sentences comprised of words bearing the same phonemic tone ('like-tone sentences'); in this way any observed downtrend would be attributable to phrase or utterance level effects rather than to phonemic tone. Inclusion of sentences with sequences of different tones ('mixed-tone sentences') allowed for testing of local effects, and use of sentences of different lengths permitted testing for pitch effects that might be tied to utterance length, such as

heightened pitch initially for longer sentences. Standard experimental procedures were used for all the investigations described here;[3] details are available in the different published reports. The investigations typically involved between four and six speakers, both male and female (the first, published as Connell 1999a was conceived as a pilot study and used just two speakers, both male). Since they were conducted in the field over a period of approximately a decade, the pool of participants inevitably varied; despite this there is a core set of speakers who participated in each study. All participants were adult native speakers of Ba Mambila, were born and had grown up in Somié. All were also fluent in French and Fulfulde (both non-tone languages) and many had varying degrees of competence in various other local languages.

3.1 Experiment 1

The preliminary investigation of the occurrence of pitch downtrends in Mambila is reported in Connell (1999a). This study used both like-tone sentences and mixed tone sequences, where for the latter, for the most part all but one tone were the same. The odd tone was placed in some cases early in the sentence, and other cases late in the sentence. Sentences ranged in length from two to nine syllables (the same range was not possible for all four tones). In all, 30 sentences were used. The corpus was recorded by two male speakers, both native speakers of Mambila in their early twenties. The results of this study suggested that downtrends are minimal in Mambila pitch realization. The clearest example of an effect on F0 of was the lowering of tone 1 when following a tone 4, considered to be tone coarticulation (as discussed above in the section on terminology). This is a local effect, with the lowered tone typically regaining its target value within one or two syllables; in, for example, 4111 sequences, the first in the tone 1 sequence did not reach the height of an earlier tone 1, though typically the second did so. Mid tones (2 and 3) in similar circumstances appeared to be only slightly affected, if at all. Evidence for utterance-level effects, e.g. declination, was somewhat ambiguous, particularly for the mid tones, where it was not clear whether observed slight downtrends were evidence of declination or final lowering. Tone 1 however, showed no tendency to declination for these two speakers, while tone 4 seemed subject to final lowering. There was no evidence of downstep (the lowering attributed to tone coarticulation did

3 All recordings were done during fieldwork in Cameroon, and so were not done in a recording studio. High quality digital recording equipment was used and multiple (usually five) randomized repetitions of test items recorded.

not set a new, lowered, ceiling for the H tone), while evidence for final lowering was clearest for tone 4 and nonexistent for tone 1. This near absence of downtrends was accounted for by postulating that the relatively crowded tonal space, phonologically, left little room for flexibility with respect to the phonetic realization of tone.

3.2 Experiment 2

3.2.1 Declination and final lowering

A follow up investigation (Connell 1999b) using a modified set of sentences and an expanded subject pool attempted to test the results of the pilot study and to explore in greater depth two questions which arose from the earlier study: whether the mid tones, tone 2 and tone 3, are subject to declination or final lowering, and whether the local lowering of tones observed earlier is cumulative, e.g. in a 414141 sequence, therefore resulting an apparent downdrift effect. The test materials comprised 16 declarative sentences, including like-tone sequences for all four tones and mixed tone sequences alternating tone 1 and tone 4, tone 4 and tone 1, and tone 2 and tone 3. Short and long sentences of each of these patterns were included. F0 measurements were taken of each syllable at a point judged to be the tonal target;[4] these were analyzed using linear regression, first to determine whether a significant F0 downtrend occurred in a particular sentence type, and then to separate a potential effect of final lowering from that of declination.[5] Inspection of the data suggested that in potential cases of final lowering, a relatively steep drop in F0 occurred over the last 1–2 syllables of an utterance; these were therefore examined separately in the regression analysis. In previous attempts to separate declination from final lowering, somewhat different statistical techniques were used: Laniran (1992) used a regression analysis, but rather than looking at the F0 slope of the final syllable(s), she examined the decline in F0 when successive final syllables were removed. If the slope became less steep, she concluded that final lowering had contributed to the overall downtrend. Herman (1996) used an ANOVA rather than regression, and examined whether the F0 value of a target syllable was more greatly affected by its distance from

4 An effort to help establish standard procedures for determining tonal targets is presented in Connell & Ladd 1990; Connell (2002) elaborates these for Mambila.

5 I am grateful to Mario Cortina Borja, Statistics Consultant at Oxford University for his help with this aspect of the research.

the beginning of the utterance, or its proximity to the end of the utterance; the former case she took to be evidence for declination and the latter to be evidence of final lowering. While both of these techniques provide some insight into F0 downtrends, neither of them asks directly whether the F0 decline over the last syllable or two is significantly different (steeper) from that of the preceding part of the sentence. The technique adopted here specifically addresses this question. Figure 2 illustrates the output of the regression analysis. The black dots represent raw F0 values; in the left panel, the dotted trace represents the F0 curve, an average of the raw measurements represented by the dots, and the solid trace is the regression line. In the right panel, the regression line for the main part of the utterance is compared to the regression line for the final two syllables. The table at (8) gives the regression summary for the left panel, and shows a significant downtrend over the entire utterance (p = 0.0000). The regression summaries at (9) and (10) examine the main part of the utterance (9) and the final two syllables (10); these show that slope of the first part is not significant (p = 0.1228) while that for the final two syllables is significant (p = 0.0019).

(8) Regression summary for all the data (Figure 2, top panel):

Coefficients:

	Value	Std. Error	t value	Pr(>|t|)
(Intercept)	237.9867	3.6410	65.3624	0.0000
NS0	5.1486	0.9349	−5.5069	**0.0000**

(9) Regression summary for first part of the data (Figure 2, bottom panel):

Coefficients:

	Value	Std. Error	t value	Pr(>|t|)
(Intercept)	231.5000	3.9574	58.4980	0.0000
NS0	−2.3400	1.4450	−1.6193	**0.1228**

(10) Regression summary for last two syllables (Figure 2, bottom panel):

Coefficients:

	Value	Std. Error	t value	Pr(>|t|)
(Intercept)	320.8000	24.8827	12.8925	0.0000
NS0	−20.4000	4.5056	−4.5277	**0.0019**

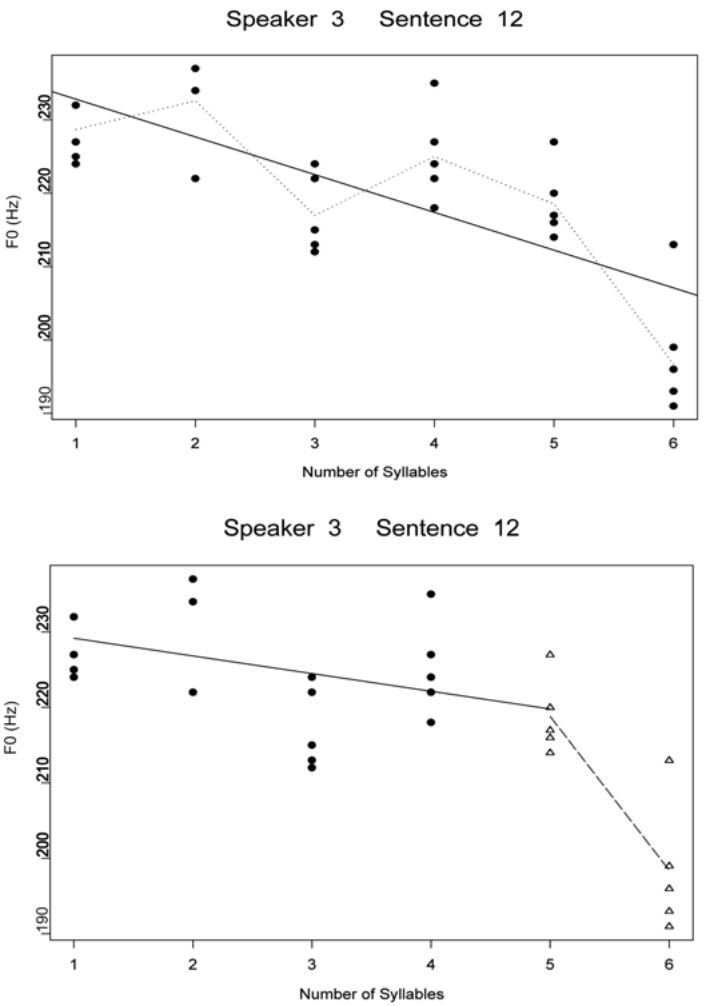

Figure 2: Regression line superimposed on averaged pitch trace for a short (six syllables) T2 utterance (top), and for the main part of the utterance compared to that for last two syllables (bottom). (Speaker 3, VM, female)

Finally, the results of T-tests comparing the two slopes (11) and the mean F0 of the two portions of the sentences (12) are both significant:

(11) Difference of slopes = 18.06 StdError = 4.7316
T-value = 3.8169, p-value = **0.0001**

(12) Standard Two-Sample t-Test
t = 4.6377, df = 28, p-value = **0.0001**

With the difference between the two slopes being significant and with a significant drop in F0 between the first and last parts of the utterance, we can say final lowering is present.

A regression analysis of this sort was applied to results from data for all the like-tone sentences. Conclusions based on the results of the regression analysis are summarized in Table 1. 'D' or 'F' in a cell indicates the presence of declination or final lowering, respectively. (F) indicates final lowering was present but accompanied by a slight rise in F0 on the penultimate syllable. This rise was slight, typically on the order of 2–4 Hz relative to the antepenultimate. A dash in a cell indicates an absence of either or both of declination or final lowering. S, M or L denote the length of the sentence, short, medium or long. For tone 4, three sentence lengths were used.

Table 1: Summary of results for like tone sentences across five speakers

	Tone 1		Tone 2		Tone 3		Tone 4		
Speaker	**S**	**L**	**S**	**L**	**S**	**L**	**S**	**M**	**L**
1 (M)	–, –	–, –	–, –	–, –	–, –	D, (F)	–, F	D, F	D, –
2 (M)	D, –	–, –	D, –	D, –	–, –	D, (F)	–, F	D, –	D, F
3 (F)	–, –	–, –	–, (F)	–, (F)	D, –	–, (F)	–, F	D, F	D, –
4 (F)	–, –	D, –	D, –	D, –	–, (F)	D, –	–, F	D, F	D, (F)
5 (M)	–, –	D, –	D, –	D, (F)	–, (F)	D, (F)	–, F	D, F	D, (F)

A striking aspect of these results is the different treatment accorded different tones; in particular, the lower the tone, the more likely it is subject to either or both of declination or final lowering. Tone 1, the high tone, is subject to little in the way of downtrends, while tone 4, the low tone, consistently shows some form of downtrend. Moreover, the effects seen are relatively consistent across speakers: e.g. for tone 4, the short utterance shows final lowering, while the two longer sentences offer evidence of both declination and final lowering. However it may be noted that, given the length of the short utterance – four syllables – it may not be possible to conclusively distinguish between declination and final lowering. The two mid tones, however, are less regular in exhibiting either declination or final lowering. While a downtrend of some sort appears for these two tones more often than not, one is not always present and, when there is, there is no consistency as to whether declination or final lowering is used, either across the two tones or across speakers. What does appear to be consistent is that when final lowering does occur with these tones it is facilitated by a slight rise in F0, of approximately 2–4 Hz, on the penultimate syllable relative to the antepenultimate. The more consistent appearance of a downtrend with tone 4 is presumably possible because there is no lower tone whose space it would be violating. Or, from the opposite perspective, tones 1–3 do not show down-

trends consistently because they would risk impinging on the space of the lower tone(s).

3.2.2 Downdrift vs. tone coarticulation

The pilot study indicated that lowering of tone 1 following tone 4 in 4111 sequences was a local effect, lasting only one or two syllables. In addition to looking at final lowering and declination, the follow up study also addressed the question whether this lowering effect in mixed tone sentences is cumulative; i.e. in sequences alternating tones 4 and 1, does tone 1 still reach its normal value, or does it show a downdrifting effect. Figures 3 and 4 show T1–T4 alternations for three utterances of difference lengths for two speakers, male and female respectively, representing an average of five repetitions. Utterances were four, six, and eight syllables in length; note that in Figure 3 the trajectory of the medium and long utterances are virtually identical (one superimposed upon the other) and so are difficult to distinguish.

For speaker CD (male, Figure 3), the difference between the initial tone 1 and the final tone 1 (syllables one and seven) is not large, but it is significant (p = 0.032); similarly the difference between initial and final tone 4 (syllables two and eight) is significant (p = 0.000). Tone 1 showed no declination for this speaker in the earlier experiments (i.e. in like-tone sentences), so it may be assumed here that the consistent drop in values across the sentence for tone 1 is a result of the local interaction with tone 4 observed in the pilot study, and that this effect is cumulative. A syllable by syllable analysis of the lowering of tone 4 values for all three utterances shows that the difference between the last

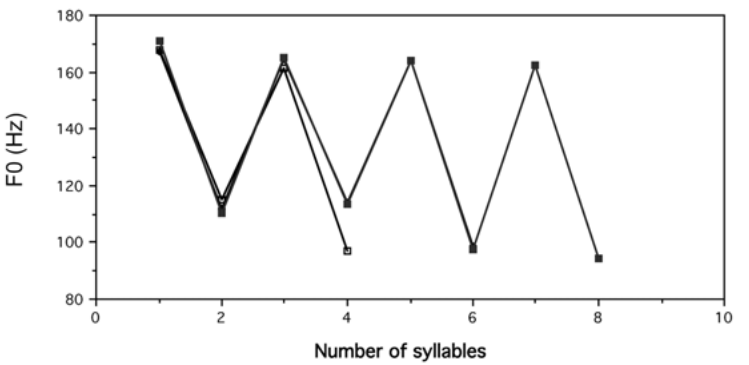

Figure 3: Averaged pitch traces for alternating tone 1–tone 4 sequences of three different lengths. (Speaker CD, male)

two syllables is significant for the two shorter phrases (p = 0.005; p = 0.006), though not for the longer phrase. This appears consistent with the behaviour observed above for this speaker with tone 4.

For the second speaker (VM, female), there were no significant differences between initial and final tone 1, or initial and final tone 4, for any of the three utterances. This suggests that the local lowering effect observed in the preliminary study may not exist for all speakers. We note that this speaker showed what appeared to be declination with T1 in the like tone sequences reported above, though the evidence was ambiguous; in the absence of declination or downdrifting effects here, it is tempting to suggest the possible declination effect noted above maybe due to other, as yet undetermined, causes. This reanalysis would then be in line with observations for other speakers, where T1 shows no declination. The absence of a downtrend for T4 here, where one was reported above for this speaker in the like tone sequences, may be due to the interrupting effect of T1.

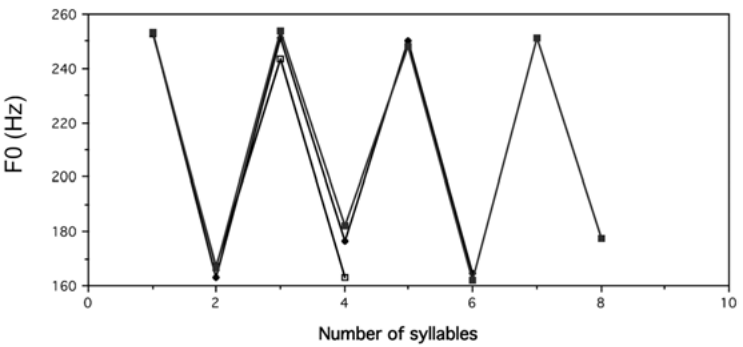

Figure 4: Averaged pitch traces for alternating tone 1–tone 4 sequences of three different lengths. (Speaker VM, female)

The pilot study also found little interaction between tone 2 and tone 3 or between these two tones and the others, but the possibility of such effects was not systematically investigated. Figures 5 and 6 show pitch traces (averages of five repetitions) for sequences of alternating tone 2 and tone 3 which shed some light on possible interactions between these two tones. Note that in the longer utterance syllables five and six represent a bisyllabic tone 2 word.

For speaker CD, the short utterance shows a noticeable lowering of tone 2 following tone 3, though the difference between initial and final tone 2 is not significant; in the longer utterance, however, the difference between initial and final tone 2 is significant (p = 0.006). It may be concluded that the slight lowering effect found in the shorter utterance is cumulative, i.e. downdrifting does

occur in tone 2–tone 3 sequences for this speaker. A slight lowering of tone 3 is also observable in the longer utterance, though this is not statistically significant.

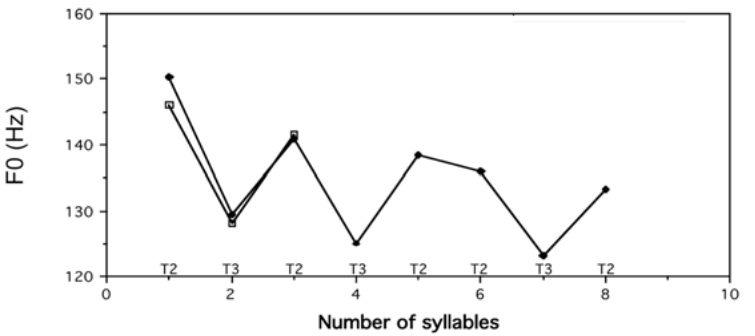

Figure 5: Averaged pitch traces (5 repetitions) for T2–T3 alternating tone sequences of two different lengths. (Speaker CD, male)

For the second speaker, a similar trend exists, confirming the existence of downdrift as a cumulative local effect. In her case, though, the difference between initial and final tone 2 in the shorter utterance is significant ($p = 0.028$), as well as that in the longer utterance ($p = 0.005$). Final tone 2 also appears to show final lowering here, though the downtrend is not statistically significant. This speaker also agrees with the other in showing no significant downtrend for tone 3.

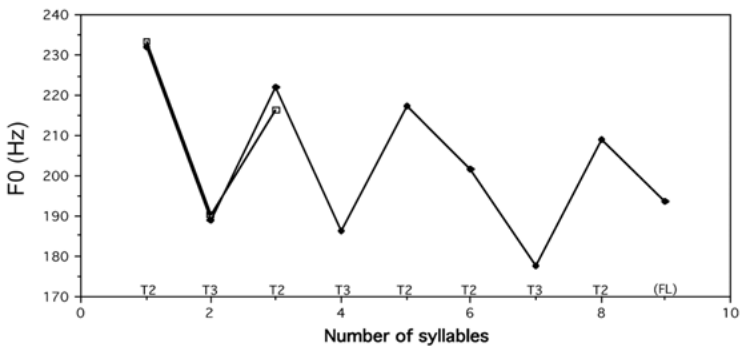

Figure 6: Averaged pitch traces for T2–T3 alternating tone sequences of two different lengths. (Speaker VM, female)

3.3 Experiment 3

Another issue of relevance to the possibility of pitch contributing to identifying declaratives is the scaling of F0. A basic hypothesis in this is that, assuming a constant rate of declination, utterance length will be a determining factor of initial and/or final pitch height. Longer utterances will involve either a higher initial F0 and/or a lower final F0 than is found in shorter utterances. The first of these two possibilities, higher initial F0, suggests a preplanning mechanism by which utterance initial F0 is raised proportionate to utterance length. An alternative is that adjustment is made 'on-the-fly', and given that F0 range is finite, its bottom may be reached before utterance end. Preplanning is most often taken as a means of phonetically accommodating utterance length; alternatively, it could be taken as evidence that declination has been phonologized, in the sense that it has gone beyond simply being phonetic and serves specifically to signal (declarative) utterance type. Research on preplanning has been conducted primarily on non-tone languages (see, e.g. Cooper & Sorenson 1981, 't Hart 1979, Ladd & Johnson 1986). The general finding is that initial pitch height does increase with sentence length, though Ladd & Johnson (investigating English) hold the opposite view, that utterance length has no effect on F0 scaling.[6] Lindau (1986, for Hausa), and Snider (1998, for Chumburung) are two studies conducted on tone languages. Lindau's results appear to support the general finding, but Snider reports this to be true of H but not L tone. In Mambila, the use of F0 scaling is an open question; first, as reported above, declination appears not to be used for intonation purposes as it only really appears in L tone utterances. However, if F0 is scaled upwards utterance initially for longer sentences in low tone contexts in Mambila, it could be interpreted as lending support to a claim that Mambila has phonologized the use of declination, at least to this limited extent.

A third experiment investigated the possibility of F0 scaling in Mambila, details of which were originally reported in Connell (2004). The procedures summarized above were also employed for this study. The focus was on tone 4 utterances since it most reliably showed declination in the earlier work; tone 1 utterances were also investigated since, even though previous experiments did not show declination for this tone, in theory it could rise without endangering tonal contrasts since it is the highest tone. (And note, it was with H that Snider found scaling in Chumburung.) Our findings indicate that for Mambila speakers

6 This conclusion was supported by only one of two speakers who participated in Ladd & Johnson's study; they suggest metrical factors are responsible for the raising or non-raising of utterance initial pitch.

utterance length does not play a role in determining either the beginning or the end point F0 of either High or Low tone utterances. We show this first for tone 4 and then for tone 1.

Figure 7 presents results for one speaker (MD, female) for tone 4, to illustrate the nature of the Mambila data. The findings for this speaker are typical of those of the other speakers in several respects: first, although there is variation as to which utterance length had the highest initial F0, for none of the speakers did the longest sentence have the highest; second, for all speakers, the final F0 of each utterance, regardless of utterance length, was approximately the same; and third, all speakers showed the shortest sentence to have the steepest slope.

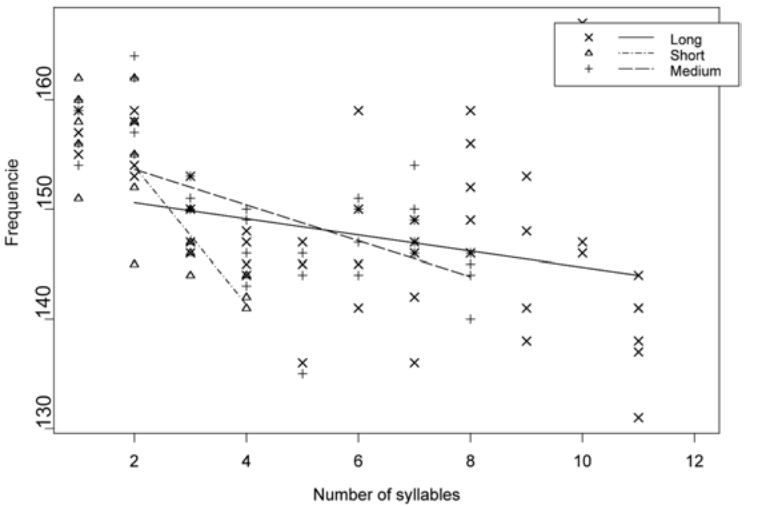

Figure 7: Regression trends for short, medium and long utterances of L tone sentences. (Speaker MD, female)

Table 2 presents the statistics for all speakers (three male, two female), male and female speakers are treated separately. To test for differences in initial F0, an analysis of variance was run, comparing measurements for the three different sentence lengths. Values for the first two syllables were tested. Table 2 gives means and standard deviations for F0 of these syllables, and the significance levels. Neither group, male or female, showed a significant difference in initial F0 for the three sentence lengths.

Table 2: Means, standard deviations and statistical results of F0 for the first two syllables of Mambila Low-toned utterances for three different sentence lengths, Short, Medium and Long

	Male		Female	
Mean	**F01 (SD)**	**F02 (SD)**	**F01 (SD)**	**F02 (SD)**
S	105.7 (10.3)	108.7 (11.6)	167.4 (13.5)	173.6 (21.6)
M	112.3 (11.3)	113.6 (11.4)	166.5 (12.5)	173.9 (20.0)
L	107.1 (10.2)	111.8 (10.7)	168.8 (14.4)	173.9 (20.6)
Stats	F (2, 49) = 1.887; p = 0.162, ns	F (2, 49) = 0.863; p = 0.428, ns	F (2, 28) = 0.08; p = 0.923, ns	F (2, 28) = 0.001; p = 0.999, ns

Differences in utterance final F0 for each of the three sentence lengths were tested for significance in a similar fashion (Table 3); again no significant differences were found for either group of speakers.

Table 3: Means, standard deviations and statistical results of F0 for the final syllable of Mambila Low-toned utterances for three different sentence lengths, Short, Medium and Long

	Male	Female
Mean	**F0-final (SD)**	**F0-final (SD)**
S	92.47 (7.3)	152.6 (13.8)
M	91.4 (6.7)	153.7 (11.4)
L	96.75 (11.3)	151.1 (14.3)
statistic	F (2, 49) = 1.838; p = 0.170, ns	F (2, 28) = 0.105; p = 0.901, ns

Figure 8 illustrates the results for one speaker (SM, male) for tone 1. Four of the five speakers showed very similar tendencies. First, the longer utterance did begin slightly higher than the shorter one, their end points were approximately the same, and the slopes of the regression line for each ran nearly parallel.

Statistical analyses of beginning and endpoints were done as above, presented in Tables 4 and 5. Despite the tendencies just noted for individual speakers, e.g. that longer utterances start with a slightly higher F0 for High tone, none of the differences observed is statistically significant.

The absence of significant differences in either initial or final pitch height concurs with Snider's (1998) results for Low tone in Chumburung, a typical two tone language, but not his findings for High, in which higher initial F0 correlated with longer utterance length. There are a number of possible explanations for this. First, one might argue that for L to increase in F0 would risk overlap with the tone above, thereby creating a situation of potential ambiguity. A constraint to inhibit this potential overlap need not apply to initial High, which

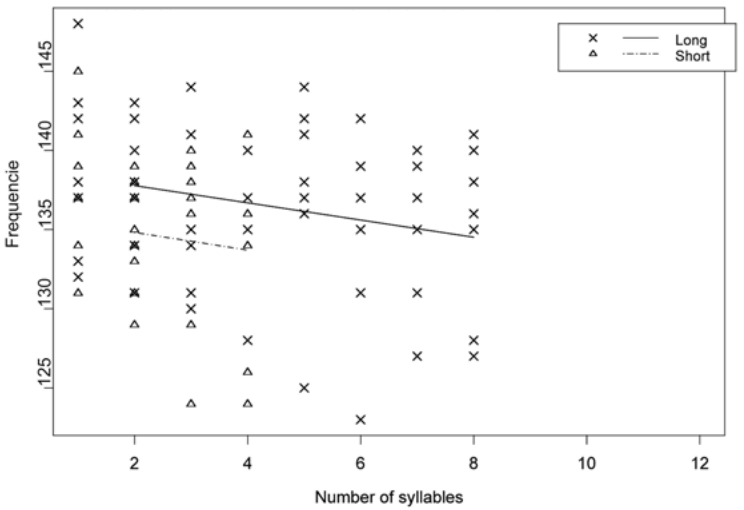

Figure 8: Regression trends for short and long utterances of H tone sentences. (Speaker SM, male)

Table 4: Means, standard deviations and statistical results of F0 for the first two syllables of Mambila High-toned utterances for two different sentence lengths, Short and Long

	Male		**Female**	
	F01 (SD)	**F02 (SD)**	**F01 (SD)**	**F02 (SD)**
S	141.2 (17.9)	142.2 (21.2)	224.1 (26.0)	226.5 (26.6)
L	140.6 (17.8)	141.2 (18.5)	228.3 (28.6)	231.1 (31.3)
Stats	F (1, 31) = 0.009; p = 0.924 (ns)	F (1, 30) = 0.02; p = 0.888 (ns)	F (1, 19) = 0.125; p = 0.728 (ns)	F (1, 19) = 0.130; p = 0.722 (ns)

Table 5: Means, standard deviations and statistical results of F0 for the final syllable of Mambila High-toned utterances for two different sentence lengths, Short and Long

	Male	**Female**
Mean	**F0-final (SD)**	**F0-final (SD)**
S	139.1 (20.0)	221.5 (24.2)
L	140.4 (19.5)	222.6 (24.2)
Statistic	F (1, 31) = 0.038; p = 0.846 (ns)	F (1, 19) = 0.10; p = 0.922 (ns)

would be free to rise in order to accommodate declination in a longer utterance where the end point is specified. While this may be the case for H in Chumburung, in Mambila, since neither tone 4 nor tone 1 is scaled, an alternative suggestion is that both start and end points are specified; this corresponds to Snider's proposal for Chumburung L, that is, rather than the rate of declination being constant or predetermined in Mambila and Chumburung, it may be seen as a byproduct of tone specifications.

4 Experiment 4, Polar Questions in Mambila

Polar (Yes/No) questions in Mambila take the same word order as corresponding declarative statements, and there is no alternative order as is permitted in some languages. They are obligatorily marked by the addition of a sentence final particle, wā; if the question is emphatic, the marker is wɔ̄. Of course, the presence of a question particle does not preclude the possibility of pitch signalling questions: register raising or expansion, or a rise in pitch over the terminal part of the sentence are all possible manipulations of pitch that, except perhaps for the latter, would not necessarily threaten tone contrasts. More generally, one might argue that contextual and pragmatic concerns would lessen the possibility of intonation based pitch manipulations having a detrimental effect on tone contrasts. The question thus arises whether Mambila, despite the general absence of pitch marking for declaratives, marks interrogatives through pitch differences.

The possibility of differences in intonation between declarative utterances and associated polar questions was again investigated using like-tone sentences, one declarative, one the associated polar question (originally reported in Connell 2005). The sentence pair on tone 1, is given as an example at (13).

(13) bɔ́ bú kúkúm témá ké ŋgwéh (wā)
3PSBJ 3SOBJ cassava send PRP NEG (Q)
They didn't send the cassava to him. (?)

Figure 9 shows pitch tracks for this sentence pair, with the declarative form in the top panel and the question form, with the Q-marker wā (tone 2), in the bottom.[7]

7 All pitch tracks were produced using Praat 5.4 (Boersma & Wineenk 2015).

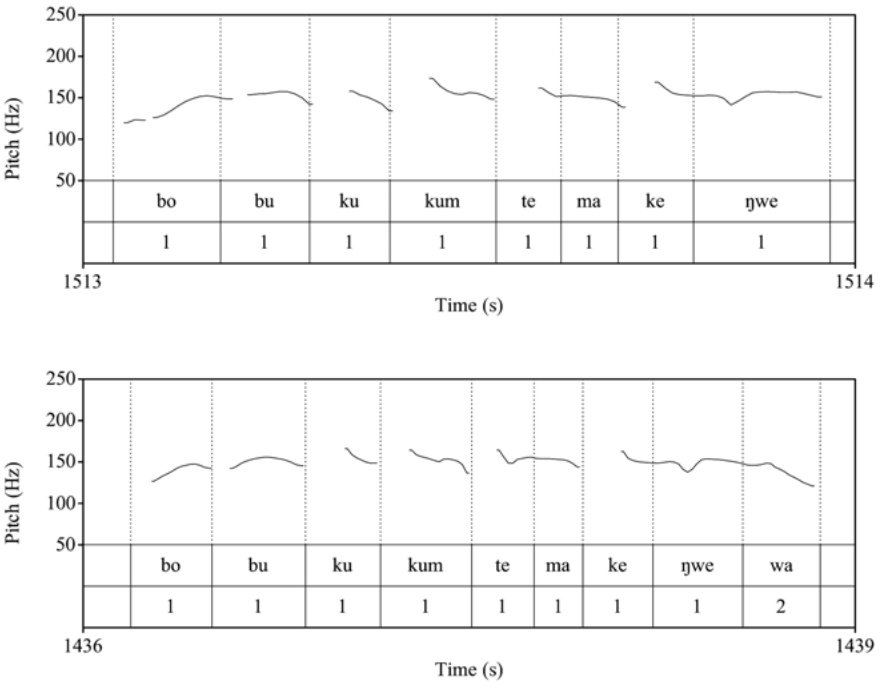

Figure 9: Pitch traces for the sentence pair bɔ́ bú kúkúm témá ké ŋgwéh (top) and bɔ́ bú kúkúm témá ké ŋgwéh wā (bottom). (Speaker BP, male)

Measurements of F0 were taken for each syllable and an analysis of variance was run on the data to compare, syllable by syllable, the F0 of statements vs questions. Six hundred pairs of syllables (4 speakers × 5 repetitions × 30 syllables) were compared in total. Overall, no statistically significant differences were found for the pairs of sentences of like-tone sequences. There were occasional individual pairs of syllables which did show a significant difference, but these were not systematic and cannot taken as indicative of a difference in pitch realization between statements and questions. Given the results of earlier work, these sentences were not tested for declination; however based on the results obtained, any downtrend that does exist must be present in both questions and statements.

A fifth sentence pair allowed comparison of mixed tone utterances, where the sentence wē ŋgie cār bē (wā), i.e. 2-3-2-2(-2) was used.[8] With three of the

8 Literally, 'Fire burn monkey hand (Q)'. The collocation 'cār bē' bears comment; in order to maintain the desired tone sequence the intended reading was 'monkey hand' rather than 'monkey's hand' as the latter would have involved an added tone 4 (see §2.2.1 above). At least one speaker consistently used the latter reading; to accommodate this measurements were taken earlier in the syllable to recognize the tone 2 target.

four speakers, again there were no significant differences in F0 between corresponding syllables of the statement and question. For one speaker (SM), however, the step between tones 2 and 3 was smaller in questions, i.e. a narrowing of the register. This result is remarkable on two counts: first, a narrower register for questions, though not unheard of, is not expected; and second, this particular speaker already operates with a relatively narrow range. These points aside, since only one speaker showed this narrowing, it is difficult to see this as a strategy to differentiate polar questions and statements in Mambila.

4.1 Question particle wā

A few remarks as to the realization of the question marker wā are of interest. This is described as bearing an inherent tone 2 by Mouh & Perrin (1995; Mouh per. comm.) It is sometimes realized in the data here with a slight fall, typically from tone 2 to the range of tone 3; this occurs only infrequently. It might be possible to suggest this to be the influence of a L boundary tone, however this leaves two problems, first that it does not fall to the level one might expect of a L% (i.e. the bottom of the pitch range), and second is its infrequency. However, wā itself, could arguably be seen as a segmental manifestation of intonation. This possibility is taken up in the concluding section, below.

4.2 Summary

The results presented here indicate declarative sentences and the associated polar questions are not differentiated in Ba Mambila by pitch. A functional explanation may be offered for this, that greater flexibility in the realization of tone, given the dense nature of the tonal space in Mambila, would potentially endanger the stability of tone contrasts. It is worth noting however that pitch manipulations such as overall register shift or expansion could potentially be used without endangering tone contrasts, yet these variations are absent. A structural, as opposed to functional, account is discussed in §7.

5 Content questions

Content questions are coded in Mambila through use of specific question markers. These include: nī ‘who’; kī ‘what’; hī ‘where’; hèh ‘when’; nàn ‘how’; mèn ‘how many’; mé ŋgī ‘why’ (or dé kì̀; the former is more polite, the latter more demand-

ing in its pragmatics). Perrin (ms) reports question markers occur clause finally, and wā is not used, as in the following example (and using her transcription conventions):

(14) lé haá naâ wò nēì?
PST give PST 2SG Q
Who gave (it) to you?

Perrin does not specify where these data were collected, but as mentioned earlier, her work was on Tungba, spoken at Gembu, and Ba as spoken at Sonkolong.

In Somié (also recognized as Ba Mambila), Q-words for content questions are found in-situ, i.e. in the grammatical slot being questioned, and the Q-marker wā still appears finally; e.g.

(15) nī lé há nā wò wā?
Q PST give PST 2SG Q
Who gave (it) to you?

Perrin does, though, present her examples as having neutral focus; similarly, when investigating interrogatives in Somié, our language assistants were asked to supply 'basic' or 'default' structures, so we presume the differences in structure are (sub-)dialectal and not due to pragmatic factors.

The possible role of F0 in the realization of Mambila question intonation was investigated using a basic set of sentences comprised of like-tone sequences, as in previous work and, also as in previous work, one sentence which alternated tone 1 and tone 4 was included, to give a total of five base sentences. These were then adapted to form questions which asked for the subject or the object, using the question markers ní 'who', kī 'what', and hī 'where' from the above possibilities. These introduced tone-induced pitch variations into the like-tone sentences, such that the pairs of sentences (question and answer) were neither segmentally nor tonally identical (i.e. as was the case for the polar questions described above); paired sentences however did contain a portion of shared material.

The sentences were arranged to form mini-dialogues which were played out in two groups of three people each, such that Speaker A said the question to Speaker B, who answered and then asked the question of Speaker C; Speaker C answered and the repeated the question to Speaker A, who in turn answered.[9] This process was repeated for each of the five sentence sets, for both subject

9 This method is adopted from Myers (1996).

and object questions. The alternating tone sentence formed the basis of three questions, asking for the subject, for the object, and for the object of a preposition. Sentence sets were arranged in a randomized list, and five repetitions were recorded. An example of the procedure, using the tone 3 sentences and questioning the subject is given in (16). Only the first portion is morphologically glossed. For analysis purposes, as discussed below, the tonally identical shared portion in this pair is 'bele tele yaga tele'.

(16) Example sentence (tone 3), Subject questioned:

Speaker A: Q	nī	mé	bele	tele	yaga	tele	wā
	Q	REL	shave	father	wash	father	Q
	'Who washed and shaved the father?'						
Speaker B: A	kwer	bele	tele	yaga	tele		
	slave	shave	father	wash	father		
	'The slave washed and shaved the father.'						
Speaker B: Q	nī mé bele tele yaga tele wā?						
	'Who washed and shaved the father?'						
Speaker C: A	kwer bele tele yaga tele.						
	'The slave washed and shaved the father.'						
Speaker C: Q	nī mé bele tele yaga tele wā?						
	'Who washed and shaved the father?'						
Speaker A: A	kwer bele tele yaga tele.						
	'The slave washed and shaved the father.'						

Recording and analysis followed standard procedures, as with the previously reported work, including use of high quality digital recording equipment.[10] The pitch tracks in Figure 10 represent the question and answer for the pair of sentences in (16), as produced by speaker MD (female).

The results reported here are based on one of the two groups, comprised of two female speakers (VM and MD) and one male (CD), each of whom had participated in some or all of the studies reported above. Several measurements were taken (e.g. F0 at various points within the sentence, final vowel duration); of relevance here is mean F0 of the shared portions of the sentence pairs. An analysis of variance was run to test for differences between the mean F0 of

10 A report of this work was presented at WOCAL8, Kyoto, as Connell & Im (2015). I am grateful to Hannah Im for her input to the present chapter.

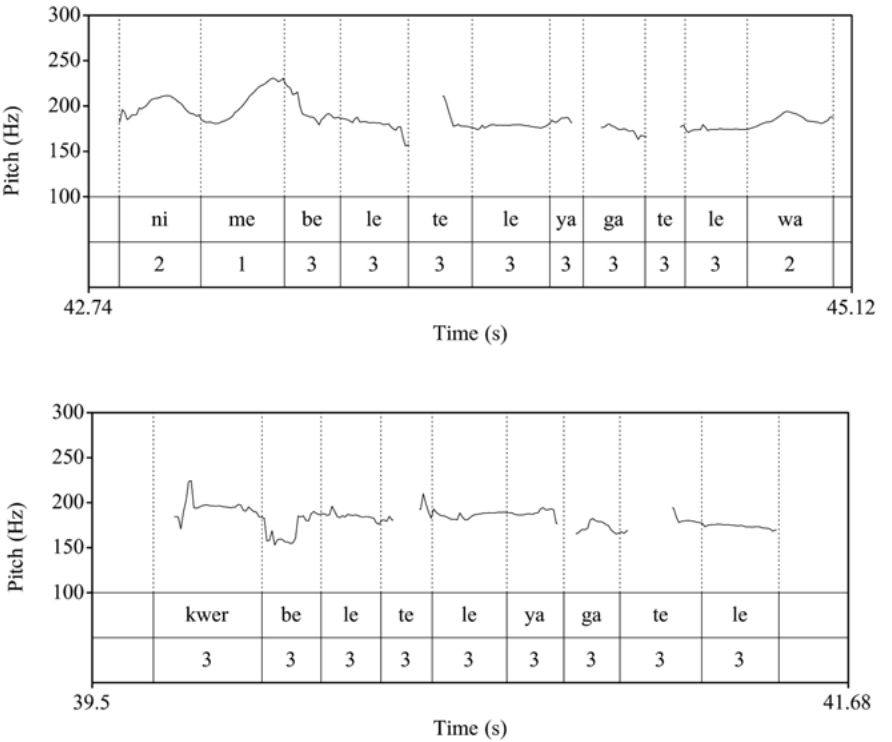

Figure 10: The sentence pair nī mé bele tele yaga tele wā? Who washed and shaved the father? (top) and kwer bele tele yaga tele. 'The slave washed and shaved the father.' (bottom) (Speaker MD, female)

question vs statement of the shared portions of the utterances. A significant difference between the two would indicate F0 is used to signal content-Qs, through raising (or lowering) the pitch range. The results are given in Table 6.

Table 6: Mean F0 of Questions and Answers for tones 3 and 4 compared, with significance levels

	Mean F0 (SE) of Q	Mean F0 (SE) of A	Significance Level
CD 3	150.00 (1.770)	141.93 (1.375)	$p = 0.002$
CD 4	135.91 (2.698)	131.56 (2.001)	$p = 0.212$
VM 3	200.46 (2.152)	194.32 (2.351)	$p = 0.070$
VM 4	180.84 (2.781)	174.72 (1.284)	$p = 0.061$
MD 3	184.24 (1.520)	183.62 (1.797)	$p = 0.794$
MD 4	167.07 (2.187)	161.30 (1.907)	$p = 0.062$

The results of the comparison of the shared portions of the utterance pairs for tones 3 and 4, shown in Table 6 showed in only one of the six comparisons is significance achieved (speaker CD, for tone 3; $p = 0.002$).[11] In short, like polar questions, content questions in Mambila appear not to be differentiated from corresponding statements by pitch.

Yet further confirmation of this is reflected in the pitch curves of the tone 4 sentence pair shown in Figure 11. The question form of this pair, ní bɔ̀ bùnɔ̀ mò gwàn bèh wā? Who don't my enemies like?', begins with ní 'who' and ends with wā (Q); the intervening content, bɔ̀ bùnɔ̀ mò mì gwàn bèh 'My enemies don't like me.' is entirely on tone 4 and also constitutes the statement, or reply. It is noticeable that the shared tone 4 portion of the two sentences is spoken on approximately the same pitch (the mean F0s are 131 Hz for the question and 133 Hz for the statement), and both show a slight downtrend; for the statement this lowering continues across the last two syllables of the sentence, but in the presence of final wā, is not present in the question form.

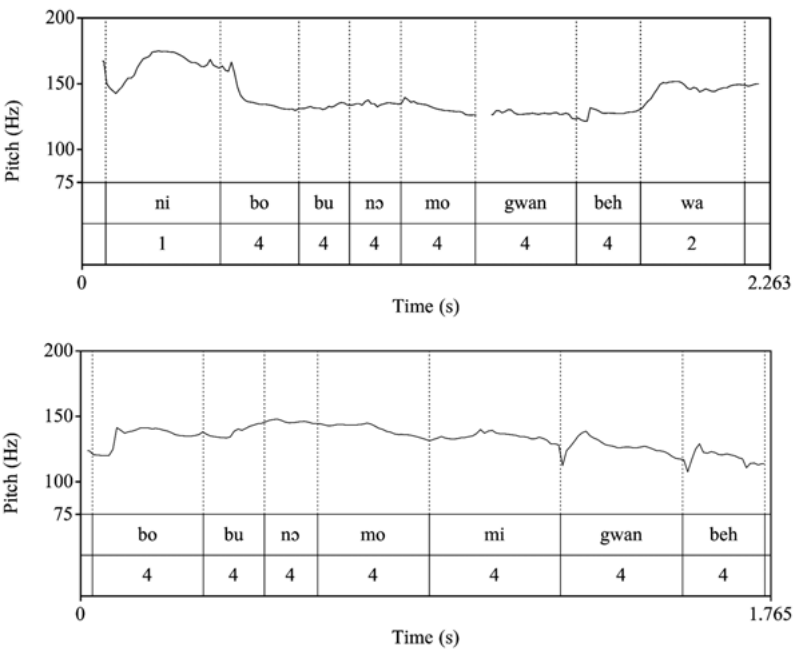

Figure 11: The sentence pair ní bɔ̀ bùnɔ̀ mò gwàn bèh wā? 'Who don't my enemies like? (top) and bɔ̀ bùnɔ̀ mò mì gwàn bèh 'My enemies don't like me.' (bottom). (Speaker CD, male)

11 Comparison of the mean F0 of the entire utterance did show differences, but given the results of the shared portions these can be safely attributed to the contribution of the tone 1 and tone 2 question words to the overall F0. In confirmation of this, comparison of the tone 2 sentences showed no significant difference between questions and statements for any of the speakers.

6 Tone and intonation in Mambila

The results of the experiments contributing to this chapter show that pitch variations play a minor role at best in marking Mambila sentence types. Declination and/or final lowering appear to be present in lower tone contexts (tones 3 and 4, and more consistently in tone 4) in declarative sentences, but declination is present in questions in these tone contexts as well. Polar questions showed no significant difference in pitch relative to corresponding statements; the same is true of content questions where the words and tonal structures are comparable. In this respect Mambila is similar to Yoruba (Connell & Ladd 1991). Where content questions and statements differ in Mambila is in the absence of a steeper fall over the last two syllables (final lowering) in the lower tone contexts in questions. Mambila differs in this respect from Yoruba, where questions too show a final fall in L tone contexts. In Yoruba however the Q-marker (sẹ́ or ńjẹ́) occurs sentence initially whereas, as seen, in Mambila the Q-marker wā is final, removing the environment for a final fall. This is evident in Figure 11, where bèh shows a slight fall when final (Fig 11, right panel) but maintains a level trajectory when followed by wā (left panel).

The question then arises as to whether the final lowering is the implementation of a L boundary tone (L%); if so its presence must be dependent on the specification of the final lexical tone: it may mark the intonational phrase in the two lower tone contexts (or at least tone 4), but not the higher tones. This raises the question as to whether the two upper tones are marked by a H%. If so, it would offer an interesting, albeit limited, symmetry with the tone alternations induced by grammatical tones reported in §2 with imperative and negative formation, in which upper level tones alternate to tone one (H) and lower level tones to tone 4 (L). There is, though, little positive evidence to support this; e.g. tones 1 and 2 do not differ markedly in their realization when occurring finally or prepausally compared to when they are not, and in particular tone 2 does not rise to the level of tone 1. Similarly, tone 3 does not fall as low as tone 4 in the presence of an ostensible L%. (In addition at least some speakers occasionally showed what appeared to be final lowering – a relatively steep fall over the last syllable or two – in tone 2 sentences.) Apart from these concerns, the degree of inconsistency across speakers within tone contexts must be noted. This may not be particularly unusual; Connell & Ladd (1991) note this in their discussion of Yoruba, as does Myers (1996) for Chichewa. This suggests that if present, boundary tones may be optional. Gussenhoven (2004), citing data from Venlo Dutch, along with data from a number of other languages, advocates this possibility, contrary to the more accepted view that they are obligatory. It is not

clear however that Gussenhoven would use their optionality as an explanation for variation of the sort seen in Mambila; rather, an interesting alternative also suggested by Gussenhoven (2004) may be considered: just as some people are better swimmers or better writers than others, some speakers may have better control over the phonetic implementation of their phonological representations. For Chichewa, Myers suggests that boundary tones are associated to a higher node than lexical tones, and this presumably accounts for their transparency with respect to interactions between adjacent tones within an intonational phrase, as well as influences on the entire phrase such as register raising or expansion. The same is possibly true of Mambila since one of the effects of L% might be seen as inducing declination in tone 4.

The prevailing view of intonational phonology (see Ladd 2008 for an overview), divides the phonological effects that determine the pitch contour of an utterance into core tones and edge tones, the former essentially being lexical, and the latter being postlexical and governing phrase level phenomena. There is no insistence that both types of tone appear in a given language; indeed Ladd (2008) speculates that Yoruba may not have edge tones, and that this is reflected in the absence of intonational differences between questions and statements. A similar conclusion may drawn regarding Mambila. The relative absence of pitch phenomena attributable to phonological elements beyond those that may be specified in the lexicon, or predictable from those specified in the lexicon, points strongly in this direction.

It is possible to equate the division of labour between core and edge tones in intonation phonology, at least loosely, with the distinction between lexical and register tones, current in some approaches to tonal phonology, e.g., register tier theory. That is, tones specified on the register tier are in some sense equivalent to edge tones, in that they function postlexically and modulate the realization of tones on the lexical tier (cf. Leben et al 1989). The representation of Mambila tone in such a framework, however, requires use of the tones on both tiers to specify its four lexical tones, presumably leaving register tones unavailable for such postlexical functions as distinguishing questions and statements. While other versions of register tier theory may vary in their handling of the lexical – postlexical divide (see, e.g. several of the contributions to van der Hulst & Snider 1993; Snider 1999), a reasonable expectation would be that the more tones a language has functioning lexically, the more restricted would be the use of register (or edge) tones for marking intonation and other phrase level phenomena.

Finally, to address the question, 'Does Mambila have intonation'? The answer, not surprisingly, depends at least in part on how one defines intonation. Ladd's (2008: 4) definition, "... the use of *suprasegmental* phonetic features to convey "postlexical" or *sentence-level* pragmatic meanings in a *linguistically*

structured way" (emphasis in the original) can be taken as standard; by this, and based on the present evidence, we are obliged to conclude that while Mambila does indeed make sentence level distinctions, it does not do so through use of pitch. Ongoing research in Mambila may reveal whether suprasegmental features other than pitch play a role, as e.g. Rialland's (2007) Lax Prosody question marking or Hyman & Monaka's (2011) treatment of intonational phenomena in Shekgalagari, and while it is still premature to draw conclusions, indications thus far seem to show features such as duration and intensity are not used in marking such contrasts in Mambila. A more restrictive definition of intonation such as that at least implicit in the various contributions to Jun (2005) or in Beckman & Venditti (2011), and which forms the basis of the ToBI transcription system, is apparently exclusive even of suprasegmental features other than pitch. But, in Mambila the difference between question types and declaratives is only marked segmentally, with a final Q-marker, wā. This may fit in the constellation of features identified by Rialland (where a final low vowel is found to mark interrogatives in some languages), but it is excluded in Ladd's insistence on suprasegmental rather than segmental marking of intonation, and the ToBI reliance only on pitch. So in order to say Mambila 'has intonation', it would be necessary to adopt a broader definition, one that permits segmental marking of discourse functions and as such would be based in function, not in structure.

7 Summary

In this chapter I have looked at a possible intonational role or roles for pitch in distinguishing different sentence types. Simple declaratives, F0 scaling with respect to sentence length, polar questions vs corresponding declaratives, and content questions compared to associated statements have all been examined, using as a basis, sentences constructed of words bearing the same tone. With the tones within a sentence being phonologically lexically equivalent, pitch differences found will be due to post-lexical effects. Unlike the other languages discussed in this volume, few have been found. The possibility of attributing the final fall found over the last two syllables of low tone sequences to final lowering, reflecting a L%, was considered but seen as unlikely; arguments for a H% governing phrase boundaries for the upper tones are even less convincing. Still the work presented here, while covering those areas where exploitation of pitch differences might be most expected, represents only a beginning. Other areas, such as a role for pitch in signalling the clause structure of complex sentence structures, or indeed the detailed examination of other suprasegmental features such as duration and intensity are waiting to be examined.

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