Chapter 1

Hybrid falling tones in Limbum

Siri Gjersøe, Jude Nformi & Ludger Paschen

This paper examines the interaction between lexical tone and phrase-level intonation in Limbum. Our main claim is that Limbum has a low boundary tone which can be represented as a floating low register feature and which interacts with lexical tonal specifications, in particular by linking to defective tonal root nodes. Crucially, access to root nodes is governed by a set of principles which we model within OT. Our account supersedes previous analyses in terms of tone sandhi rules. Our analysis is based on an acoustic study of novel data.

1 Introduction

Limbum is a Grassfields Bantu language spoken by about 130,000 speakers in the Donga Mantung division of the North West region of Cameroon. Limbum is an understudied language, especially with regards to suprasegmental phonetics and phonology. In previous work (Fiore 1987; Fransen 1995), Limbum has been described as a tone language with three level tones (H, L, M) and five contour tones (HL, HM, LM, ML, LL). It has also been claimed that the falling tones undergo a tone sandhi rule by which they are simplified to level tones whenever they occur in a non-sentence-final position (Fransen 1995). This paper is aimed at testing these descriptions. We offer an acoustic analysis of novel data from recordings of two native speakers. Based on these data, we claim that Limbum does not have underlying falling contour tones. However, Limbum does have a final low boundary tone (L%) in certain syntactic contexts, and it is L% that is responsible for the emergence of falling tones. Crucially, L% can only create a falling contour when it interacts with "hybrid" tones: tones that have both a fully specified and a defective tonal root node.

The paper is structured as follows: In section 2, we present our methodology and elaborate on the results obtained. In section 3, we lay out our formal analysis, which draws on the tonal geometry and is implemented with OT. In section 4, we offer a discussion of alternative accounts.

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2 Data

2.1 Methodology

Data presented in this study were collected from two native speakers of Limbum, a 27-year-old male speaker (M_1) and a 23-year-old female speaker (F_1). Both speakers grew up in Nkambe and are native speakers of Limbum Central/Linti dialect. The female speaker has been living in Douala for 2 years. Recordings of M_1 were conducted at the phonetics laboratory at Leipzig University in the winter of 2015 using a T-bone SC 440 supercardioid microphone (sampling rate 44.1 kHz, 16-bit). Recordings of F_1 were conducted in Douala using an H5 Zoom recorder. Recordings included a reading task with constructed test sentences given in (1) (in this example, the boldface **fu** is the target word). The tested sentence types were *Declarative (Decl), Control (Con), Wh-Question 1 (Wh1), Wh-Question 2 (Wh2), and Polar question (Pol).* The difference between *Wh1* and *Wh2* is that the former contains a question particle signaling that the wh-element is a known referent. A complete list of target words used in this study is given in (2). Our data set consisted of 7 (tones) x 2 (words) x 3 (repetitions) x 5 (sentence types) x 2 (speakers) = 420 tokens.

(1)
a. Tánkó àm yɛ̄ **fú**
T. PST see rat
'Tanko saw a rat.' *(Decl)*

b. Tánkó àm yɛ̄ **fú** fī
T. PST see rat new
'Tanko saw a new rat.' *(Con)*

c. á ndā àm yɛ̄ bá **fú** a
FM1 who PST see FM2 rat PRT
'Who saw a rat?' *(Wh1)*

d. á ndā àm yɛ̄ bá **fú**
FM1 who PST see FM rat
'Who saw a rat?' *(Wh2)*

e. Tánkó àm yɛ̄ **fú** a
T. PST see rat PRT
'Did Tanko see a rat?' *(Pol)*

The aim of the production experiment was to examine whether lexical tones interact with potential edge-bound prosodic phenomena (boundary tones), and to test prior observations that contour tones alternate with level tones phrase-medially (Fransen 1995). Annotations were made using Praat (Boersma & Weenink 2016), automatically extracted from the TextGrid files; statistic analysis was performed using R studio (v. 3.2.2). We used Linear Models to test SentenceType (5 levels), Target (2 levels: T(arget) word and P(article)), Tone (6 levels: H, M, L, HL, ML, LL), and ToneType (2 levels: contour vs. level). F0 was measured in Hz at the vowel midpoint (level tones) and at the first and third quarter (contour tones). F0 values were then converted into semitones; as a reference point for the semitone scales, we chose the average midpoint values from all occurences of *yē* 'see' (see (1)) for each speaker separately. The dependent variables were *Midpoint* for level tones and [First Quarter MINUS Third Quarter] for contour tones.

(2) *List of target words and attested tone types in Limbum*[1]

Tone	Word 1	Gloss 1	Word 2	Gloss 2
		LEVEL TONES		
H	*bá*	'hill'	*fú*	'rat'
M	*ntā*	'market'	*lē*	'blood'
L	*shà*	'kind of drink'	*bì*	'people'
		LOW-FALLING CONTOUR TONES		
HL	*cwáà*	'yellow bird'	*kúù*	'funnel'
ML	*tāà*	'father'	*bīì*	'co-wife'
LL	*ràà*	'bridge'	*nkfùù*	'bachelor'
		OTHER CONTOUR TONES		
LM	*yàā*	'princess'	*sòō*	'basket'

2.2 Results

2.2.1 Low-falling contour tones

We found that all three low-falling (hence: T(L)) contour tones were clearly falling in *Decl* and *Wh2*, but pitch movement was neglectable in the other contexts. As shown in figure 1, there is a falling slope in *Decl* and *Wh2* (i.e. sentence-finally), while in *Con, Wh1* and *Pol* (i.e. in non-final position), pitch differences between our two measure points lean towards zero. For example, HL has a fall of ca. 2.5 st in *Decl* and *Wh2* but the slope is below 1 st in the sentence-medial conditions. The correlation for Slope $\sim$ SentenceType on HL, ML and LL was highly significant (R2 = 0.39, $p < 0.001$).

2.2.2 Level tones

The main result for level tones is that L tones pattern in a strikingly different way from M and H tones (see fig. 2). The latter did not show any significant variation

[1] Several sources mention an eighth tone, HM. The status of HM is somewhat obscure. Fiore (1987) argues that HM is an allotone of HL and links its distribution to segmental length, a view shared by Fransen (1995). However, Fiore (1987) presents only two examples of HM-toned words, and our informants accept this tone on only a single lexical item, *báā* 'two'. Due to its highly limited distribution, we decided not to include HM in this study.

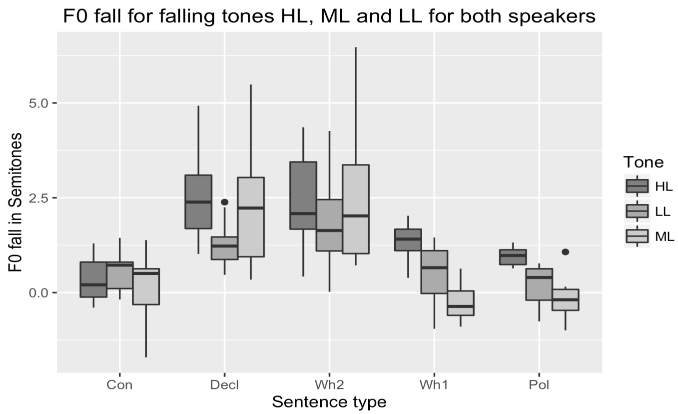


Figure 1: Falling contour tones in final (*Decl, Wh2*) and non-falling "contour" tones in pre-final (*Con, Pol, Wh1*) position.

depending on sentence type. For the L tone, however, midpoint measures were 2.9 – 3.3 st lower in *Decl* and *Wh2* compared to *Con* for speaker M_1; the correlation was highly significant (R2 = 0.84, p $<$ 0.001). Speaker F_1 also produced lower L tones in *Wh2* and *Decl* (0.5 – 0.9 st), though the correlation was not as strong as with M_1 (R2 = 0.49, p $<$ 0.05).

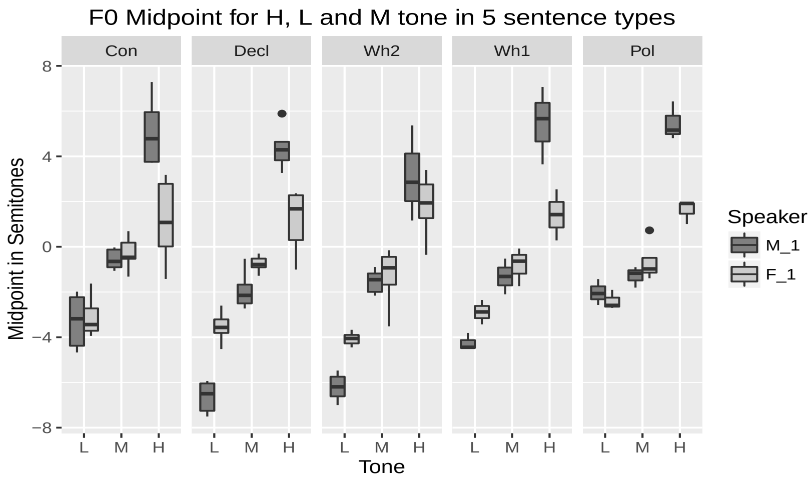


Figure 2: H,M,L in final (*Decl, Wh2*) and pre-final (*Con, Pol, Wh1*) position.

2.2.3 The final particle *a*

The two sentence types in which a final question particle *a* followed the target word showed striking differences. As can be seen in fig. 3, the particle was lower than the target word in *Wh1*, while in *Pol*, they have about the same pitch level. Pitch difference between target word and particle in *Wh1* was highly significant ($R2 = 0.26$, $p < 0.001$).

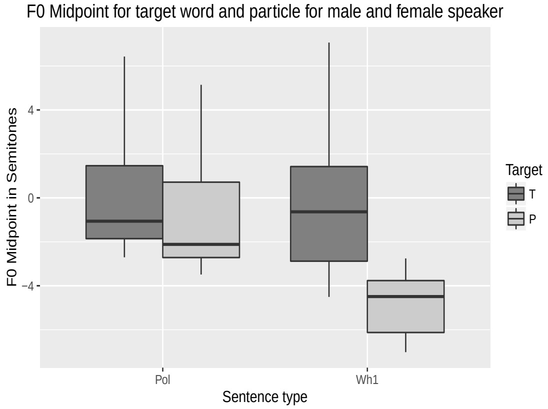


Figure 3: Target word and final particle in *Pol* and *Wh1*.

2.2.4 Rising tones

The only rising contour tone in Limbum is LM. Our results indicate that LM is a stable rising tone in all environments, both phrase-medially and phrase-finally. In a linear model testing a subset with only LM, the intercept (*Con*) had a rise of 2 st, and the other sentence types did not deviate significantly from that.[2]

2.2.5 Duration

Vowel duration was heavily dependent on tone type. Both speakers attested longer vowels on contour tones in final position (*Decl* and *Wh2*). In a linear model with *Con* as intercept, words with contour tones significantly interacted with SentenceType. For speaker F_1, vowels in *Wh2* and *Decl* were 19 and 32 ms longer than in *Con*. For speaker M_1, differences were 43 ms and 29 ms, respectively ($p < 0.01$). Interactions with other sentence types were not significant.

[2] The only exception is *Wh1* where an L-toned particle follows LM, producing a sequence LM-L. This configuration is subject to an independent process, plateauing, the result of which is LLL.

2.3 Interim summary

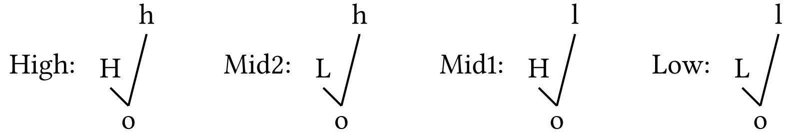
To summarize, our data suggest that T(L) tones are falling before a prosodic break (i.e. in *Decl* and *Wh2*), but not in other environments. L tones are lowered before a prosodic break, but not in other contexts, while M and H are never lowered. The sentence-final particle *a* is low in *Wh1* and non-low in *Pol.* We interpret these results in the following way. The falling contours occurring before a prosodic break are the result of a low boundary tone (%L), whose appearance depends on the syntactic construction: L% is present in declarative statements and wh-questions, but not in polar questions. The exact mechanics of this analysis is laid out in the following section.

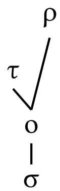
3 Accounting for Limbum tone-intonation interaction

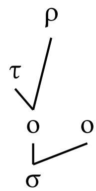
3.1 Defective root nodes and floating register features

In order to formalize the interaction between lexical tones and the low boundary tone, we employ the idea of tonal decomposition and geometry (Clements 1983; Hyman 1986; Snider 1999; Yip 1999). In particular, we adopt the concept of register tones proposed in Snider's (1999) Register Tier Theory (RTT). RTT distinguishes four different tiers: a register tier (with register features h and l), a tonal tier (with tonal features H and L), a tonal root node tier, and a TBU tier. A register feature specifies whether it is higher or lower compared to an adjacent register feature, while a tonal feature specifies whether a tone is high or low within a current register. As shown in (3), RTT thus allows to distinguish four pitch levels: High (H/h), Mid2 (L/h), Mid1 (H/l), and Low (L/l) (Snider 1999: 62).

We represent L% as a floating low register feature (l) and level-falling alternating contour tones as having one fully specified and one defective tonal root node (a root node lacking both tone and register specifications) associated to the TBU. The crucial idea is that a floating l can under certain conditions associate to the empty root node and create a low tone, resulting in a falling contour tone. An overview of our representations of lexical tones and boundary tones in Limbum is given in (5). In the next section, this process is explained in greater detail.

(3)


(4) Level tones: 

Contour tones: 

(5) *Limbum tone inventory (when fully specified)*

	L	M	H	LL	ML	HL	LM	L%
Tone (τ)	L	L	H	L–L	L–L	H–L	L–L	
Register (ρ)	l	h	h	l–l	h–l	h–l	l–h	l

An interesting parallel between register features and boundary tones is that both can be understood as abstract phonetic targets relative to a previous target. In Pierrehumbert (1980), boundary tones following a pitch accent of the same type have the effect of intensifying an already initiated downward or upward movement, while in Snider (1999), a sequence of two low register features is phonetically equivalent to a further lowering. Lexical tones behave differently: a sequence of three H-toned words is not expected to show a rising contour under standard assumptions; instead, it is more likely for pitch to steadily decrease due to downdrift, or for some of the non-initial H tones to become downstepped. For that reason, we suggest that there is a natural ontological link between register features and boundary tones, and we capture this connection by the simplest formal means, viz. an identical representation of low register and L%.

3.2 An OT Analysis

3.2.1 Preliminaries

Having established the representations of lexical and phrasal tones in Limbum, we will now unfold how the tonal alternations described in the previous sections are derived. We couch our analysis in Colored Containment, a version of Optimality Theory (Prince & Smolensky 1993/2008; van Oostendorp 2006; Trommer 2015). The basic idea of Containment is that the generative power of Gen is restricted to modifying association lines between phonological nodes by adding new lines or marking existing lines as invisible. And while Gen can add epenthetic nodes, it is unable to delete any phonological material that is present in the input. This massively reduces the number of possible candidates that need to be evaluated and at the same time calls for specific markedness and faithfulness constraints targeting various types of association lines (Trommer 2015).

A final assumption underlying our analysis is a stratal organization of grammar, as it is modeled in Stratal OT (Bermúdez-Otero 2012; in preparation). All evaluations relevant for the tonal processes in Limbum that we are concerned with at this point take place at a postlexical level corresponding to the intonation phrase domain. The input to this stratum is a sentence, with all words bearing their lexical (and, if applicable, morphological) tones, plus either L% or no boundary tone depending on sentence type. For that reason, we need not engage in further discussion on morpho(syntactic) levels, because only the parallel evaluations taking place at the level of the boundary tone are relevant to our analysis.

3.2.2 Constraints

Colored Containment brings with it a class of markedness constraints on association lines and the types of nodes. This is illustrated in very general terms in (6). For our analysis, the relevant nodes are the tonal root node (o), register features (ρ), and tones (τ). The constraint ρ→o, for instance, should be read as "Count one violation for each register feature not associated to a tonal root node".

(6) *Downward and upward association constraints in Containment*

Abbreviation	$\overset{\alpha}{\underset{\beta}{\downarrow}}$	$\overset{\alpha}{\underset{\beta}{\uparrow}}$
Definition	"Count one ⋆ for each α not associated to a β"	"Count one ⋆ for each β not associated to an α"

Another set of constraints corresponding to classical OT faithfulness constraints Max and Dep are given in (7) and (8). Note that Ident does not apply in Containment since elements in the input are protected from any modification.

(7) $\text{Max}\overset{\alpha}{\underset{\beta}{\downarrow}}$: "Count one ⋆ for each deleted association line between a node α and a node β"

(8) $\text{Dep}\overset{\alpha}{\underset{\beta}{\downarrow}}$: "Count one ⋆ for each epenthetic association line between a node α and a node β"

Another crucial constraint for the analysis is given in (9). Note that this constraint is different from a conjunction of ρ←o and τ←o: while such a local constraint conjunction would penalize only those root nodes that dominate exactly zero tonal and zero register features, the constraint FullSpec in (9) also militates against tonal root nodes lacking even one of the two specifications. The last constraint that needs to be introduced here is *loh, which penalizes tonal root nodes associated to two non-identical register features.

(9) $\begin{matrix}\tau & & \rho \\ & \nwarrow\nearrow & \\ & o & \end{matrix}$ (FullSpec): "Count one ⋆ for each tonal root node that is not associated to both a register feature and a tonal feature"

In the following section, we will turn to concrete cases of tonal phonology in Limbum and discuss the interaction of tones and tonal geometry in greater detail.

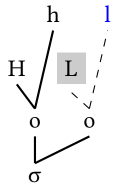
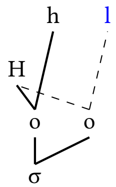
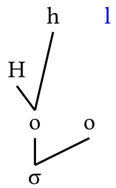
3.2.3 Deriving tone alternations

Recall from the previous section that there are three classes of tones in Limbum: level tones which remain level tones in all positions (L,M,H); level tones that alternate with falling contour tones at the end of declarative sentences and wh-questions (L(L),M(L),H(L)); and rising contour tones (LM).

Let us begin with a discussion of falling contour tones. On our account, the T(L) tones are represented as having a fully specified tonal root node plus an additional empty tonal root node, while boundary tones are represented as floating register features. In the presence of a floating l feature, an empty root node associates to that feature, and an epenthetic L tone is inserted. This process is driven by two constraints: FullSpec militating against the empty o and Dep$\tau\rightarrow$o prohibiting epenthetic insertion of a tone. The whole picture is given in the tableau in (10).[3] The optimal candidate in a. violates Depτ, which is however outranked by the two aforementioned constraints. Note that in the case of LL, the optimal candidate has two identical tonal root nodes associated to the same TBU. The fact that LL is falling follows directly from Snider's geometry: The second l is realized relatively low to the first l.

[3] Our theory makes the prediction that if other boundary tones such as H% exist in Limbum, they should also interact with unspecified tonal root nodes. At present, we have not found any evidence of such boundary tones in Limbum. Our impressionistic judgement of list intonation in Limbum is that non-final items are marked by a toneless prosodic boundary, i.e. T(L) tones are non-falling. Given the complex system of lexical tones, it would not be unexpected to find only a limited inventory of phrasal tones. However, as our prediction cannot be confirmed at this moment, more research on Limbum intonology is necessary to shed light on this matter.

(10) *Deriving falling tones from underspecified tonal root nodes*

	Input = c.	Dep ρ	Dep τ↓o	Max ρ↓o	τ ρ ↖↗ o	Dep τ	*loh	ρ↓o	Dep ρ↓o
☞	a. 					*			*
	b. 		*!						*
	c. 				*!			*	

In phrase-medial position, empty tonal root nodes remain defective. The reason for that are two high-ranked faithfulness constraints barring epenthetic insertion of a register feature (Depρ) or an association line between a tone and a tonal root node (Depτ→o). An illustrative tableau is given in (11). Demoting of any of those constraints below FullSpec would render one of the candidates a. or b. in (11) optimal and can therefore not be a possible ranking in Limbum. The same reasoning holds for sentence-final T(L) tones in polar questions and *Wh1* because there is no adjacent L%.[4]

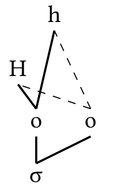
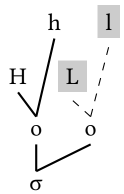
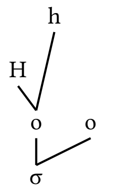
The constraint system advocated so far is compatible with the behavior of the only rising contour tone in Limbum, LM. LM is unaffected by floating material.[5]

[4] It was mentioned in footnote 1 that there is (at least) one lexical item with an HM tone in Limbum. Our informants confirm that for this word, HM patterns like HL in that it alternates with a level H tone when not adjacent to L%. While we cannot say with certainty if this is a productive process, the alternation is well derivable in our model if we represent the second root node of HM as being specified for an H tone and underspecified for a register feature.

[5] In *Wh1*, LM is followed by a particle that acquired a low tone due to L% and is therefore subject to plateauing: LML → LLL. For reasons of space, we will disregard this process in this study.

As shown in (12), this follows from the interplay of two constraints: *loh and Maxρ→o.

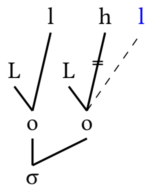
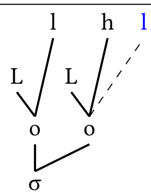
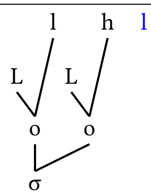
(11) *No falling contour tones in the absence of L%*

	Input = c.	Dep ρ	Dep τ↓o	Max ρ↓o	τ ρ ↖↗ o	Dep τ	*loh	ρ↓o	Dep ρ↓o
	a. 		*!						*
	b. 	*!				*			
☞	c. 				*				

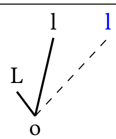
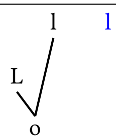
We will now turn to the discussion of level tones. One of the striking arguments in favor of an analysis with L% is the observation that level L tones (but not M or H) are lowered in certain contexts (declarative statements and wh-questions). These are the contexts where we assume a low boundary tone. We can represent this by allowing a tonal root node to host two l features at the same time (this does not violate *loh). The tableau in (13) illustrates this process. Recall that we have just seen in (12) that a fully specified mid tone is not a possible host for a floating l. This is what sets low tones apart from non-low tones: low tones bring with them a low register feature that allows a floating l to be associated to their root node.

For reasons of space, we will only shortly sketch our analysis of particle tones. The particle has a defective tonal root node which behaves exactly like the ones in T(L) tones, i.e. it becomes low-toned if an adjacent l feature is present and remains unspecified if not. When the particle follows an *a*-final word, the two vowels coalesce, yielding a long [a:] with the tonal geometries from both the content word and the particle associated to the TBU. This always results in a falling contour in *Wh2* even if the lexical tone of the content word is a level tone because the coalesced vowel will then have an additional o to which l can associate.

(12) *Full specification as a protective shield: LM in the presence of L%*

	Input = c.	Dep ρ	Dep τ↓o	Max ρ↓o	τ↗o↖ρ	Dep τ	*loh	ρ↓o	Dep ρ↓o
	a. 			*!					*
	b. 						*!		*
☞	c. 							*	

(13) *L% affects L level tones*

	Input = b.	Dep ρ	Dep τ↓o	Max ρ↓o	τ↗o↖ρ	Dep τ	*loh	ρ↓o	Dep ρ↓o
☞	a. 								*
	b. 							*!	

4 Discussion

In this section, we will defend our approach against two potential alternative accounts and briefly discuss some typological implications.

4.1 Alternative: Contour simplification

The analysis we have proposed differs substantially from the contour simplification approach advocated in Fransen (1995). Fransen proposes an analysis in which T(L) tones are fully specified underlyingly, but are then subject to a tone sandhi rule: TL → T. This seems like a rather arbitrary rule, and it is a mere stipulation that the rising tone LM should not be subject to simplification. Our account, however, is able to derive the behavior of LM from the fact that LM has two fully specified tonal root nodes instead of one healthy and one defective root node. Crucially, Fransen also misses the lowering of L tones in the same environments where we predict L% to be present.

4.2 Alternative: Moras

Another possible approach would be a moraic account. Throughout the paper, we have followed Fransen (1995) and Fiore (1987) in assuming the syllable to be the TBU in Limbum. Since in section 2.2.5 we reported that contour tones are longer than level tones, it seems appropriate that we defend our decision to ignore the mora in our analysis. First, our Limbum speakers rejected all minimal pairs that were put forward to support a phonemic opposition of long vs. short vowels in the literature. For that reason, there is no independent reason to assume a moraic level of representation. Second, an analysis in terms of moras would have to argue that a fully integrated but toneless mora is not realized at all if it wanted to account for the shortness of medial T(L) tones. This would require a rather unusual definition of prosodic structure integration and is at odds with standard assumptions about moras (cf. Zimmermann 2014). Third, there seems to be a great deal of inter-speaker variation in how prominent the length differences are, as they were considerably lower for F_1 than for M_1. We thus think that the emergence of vowel length is best ascribed to different phonetic accomodation strategies with respect to simple and complex tones and needs not be reflected on an abstract phonological level.

4.3 Typological considerations

Interaction between lexical tones and intonation is a topic that has recently attracted growing attention by scholars. The situation in Limbum is that ρ→o is ranked relatively low which has the effect that L% in some cases fails to be realized (e.g. in the case of LM). Limbum can therefore be characterized as an instance of *incomplete avoidance* according to the typology proposed in Hyman & Monaka (2011): *avoidance* because lexical M and H block L% from surfacing, *incomplete* because L does not. It is also interesting to note that in Limbum, boundary tones affect only final syllables, as opposed to other languages where sequences of syllables are affected (Kula & Hamann forthcoming).

From a functional point of view, it is not surprising that Limbum makes use of intonational means to distinguish declarative sentences and polar questions, and neither is it unusual that wh-questions pattern differently from polar questions in this regard (see e.g. the surveys in Chisholm, Milic & Greppin 1984 and Jun 2005).

5 Conclusion

In this paper, we have presented acoustic evidence for the presence of a low boundary tone (L%) in Limbum. We have argued for an analysis of tonal alternations in terms of "hybrid" lexical tones which are underspecified for certain features and can therefore surface in different guises depending on their phrasal tonal environment. Limbum illustrates the benefits of register features and defective phonological representations, and provides justification for the use of geometry-oriented constraints in the analysis of tone-intonation interactions.

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References

Bermúdez-Otero, Ricardo. 2012. The architecture of grammar and the division of labour in exponence. In Jochen Trommer (ed.), *The morphology and phonology of exponence*, 8–83. Oxford: University Press.

Bermúdez-Otero, Ricardo. in preparation. *Stratal optimality theory*. Oxford: University Press.

Boersma, P. & D. Weenink. 2016. Praat, v. 6.0.2.1. *http://www.praat.org*.

Chisholm, W., Louis T. Milic & John A.C. Greppin (eds.). 1984. *Interrogativity*. Vol. 4 (Typological studies in language). Amsterdam/Philadelphia: Benjamins.

Clements, G. N. 1983. The hierarchical representation of tone features. In Ivan R. Dihoff (ed.), *Current approaches to African linguistics*, vol. 1, 145–176. Dordrecht: Foris Publications.

Fiore, L. 1987. *A phonology of Limbum*. SIL Cameroon.

Fransen, Margo Astrid Eleonora. 1995. *A grammar of Limbum: A Grassfields Bantu language spoken in the North-West province of Cameroon*. Amsterdam PhD thesis.

Hyman, Larry. 1986. The representation of multiple tone heights. In Koen Bogers, Harry van der Hulst & Maarten Mous (eds.), *The phonological representation of suprasegmentals*, 109–152. Dordrecht: Foris.

Hyman, Larry M. & Kemmonye C. Monaka. 2011. Tone and non-tonal intonation in Shekgalagari. In Sónia Frota, Gorka Elordieta & Pilar Prieto (eds.), *Prosodic categories: Production, perception and comprehension*, 267–289. Springer.

Jun, Sun-Ah (ed.). 2005. *Prosodic typology: The phonology of tone and intonation*. Oxford: University Press.

Kula, Nancy C. & Silke Hamann. Forthcoming. Intonation in Bemba. In L. J. Downing & A. Rialland (eds.), *Intonation in African tone languages*. Berlin: De Guyter.

van Oostendorp, Mark. 2006. A theory of morphosyntactic colours. Amsterdam.

Pierrehumbert, Janet Breckenridge. 1980. *The phonology and phonetics of English intonation*. MIT PhD thesis.

Prince, Alan & Paul Smolensky. 1993/2008. *Optimality theory: Constraint interaction in generative grammar*. Wiley.

Snider, Keith L. 1999. *The geometry and features of tone*. SIL.

Trommer, Jochen. 2015. Moraic affixes and morphological colors in Dinka. *Linguistic Inquiry* 46(1). 77–112.

Yip, Moira. 1999. *Tone*. Cambridge: University Press.

Zimmermann, Eva. 2014. *A phonological account of morphological length*. Leipzig PhD thesis.