

# Interaction of Lexical Tone and Information Structure in Yucatec Maya

Frank Kügler & Stavros Skopeteas

Department of Linguistics  
University of Potsdam, Germany  
{kuegler;skopetea}@uni-potsdam.de

## Abstract

Previous research on the tone system of Yucatec Maya provides contradictory accounts which this paper intends to do away with, disentangling tonal and intonational effects. The first part presents the mere realisation of lexical high and low tones, the only tonal distinction we identify for Yucatec Maya. Second, we claim that in Yucatec Maya no interaction exists between intonation and lexical tone. We prove this claim showing that neither topic nor focus is realized by means of intonational pitch accents; instead they are marked only by syntax. Deviating tonal patterns from tonal default realisation are a result of tonal effects that surface as tonal transitions, and/or phrasing effects.

## 1. Preliminaries

### 1.1. Lexical tones in Yucatec Maya

Yucatec Maya is a Mayan language spoken in Yucatecan Peninsula (Yucatán, Quintana Roo, Campeche, and also in Belize). Among the contemporary Mayan languages, Yucatec Maya is spoken by the largest population (700,000 speakers according to the 1990 census).

Yucatec Maya is the only Mayan language that displays lexical tones. According to the reconstruction in [6], tonogenesis took place already in Proto-Yucatecan, which contains three other Mayan languages, namely Mopan, Itzà, and Lacandon.

It has been argued on the basis of a sparse data base in [1] that the distinction of tones is extinct in currently spoken Yucatec Maya. A complete loss of tone is not reported by other investigations and this is in line with our experience in the field: apart from the uncertainty of certain speakers concerning the tone of particular lexical items, the tonal distinction is active in the language production of older and younger speakers.

There are several and partly controversial accounts about the tonal system of modern Yucatec Maya. The phoneme inventory displays a distinction between short and long vowels. All investigations agree that long vowels are obligatory tone bearing units and display an opposition between a high tone and a low tone. Short vowels are treated as contrasting two levels of pitch in [9], or as instantiating a third tone termed as “neutral” in [6], or as having no tone in [2]. The tonal distinction as well as the distinction between long and short vowels is shown to be contrastive: *luk’ul* ‘goes away’ - *líuk’ul* ‘swallow’ - *liúk* ‘mud’ (examples from [7]; see also [2] and [9]).

Concerning the phonetic realisations, the lexical low tone is a level tone according to [2], [9], and [10]. The lexical high tone is described as a rising tone in [2], but as a falling tone in [6]. However, [6] shows that the falling realisation occurs in

monosyllabic words while in the first syllable of disyllabic words the lexical tone is realized as a rise, and [10] treats the rising contour of the high tone as its indispensable part in the different phonetic realisations. [9] identifies two realisations of lexical high tone, either “falling from a high pitch” or “remaining at a high pitch”. None of these investigations argues that the several realisations of high tone are contrastive at the lexical level.

Properties of Yucatec Mayan intonation are dealt with in [2], which offers a detailed annotation of intonational contours made for didactic purposes. Furthermore, [10] gives an inventory of rules that predict different realisations of the lexical tones in several tonal environments.

### 1.2. Some remarks on Yucatec Mayan syntax

Since a part of this paper is devoted to the prosodic correlates of information structure, some remarks on the syntax are necessary. According to [5] and [11] Yucatec Maya is a head marking VOS language as can be seen in (1).

t-u      hàant-ah                      òon      Pedro.      (1)  
PFV-A.3   eat:TRR-CMPL(B.3.SG)   avocado   Pedro  
‘Pedro ate avocado.’

Topicalisation and focusing are indicated by movement to designated topic and focus positions, respectively. The topic constituent is left dislocated (see [3]), its right boundary is marked by the suffix *-e’*, as illustrated in (2). Arguments as well as non-arguments may be topicalized. Thus, the topic position may be occupied by nouns, pronouns, adverbs, adjectives, and clauses (see [3]). Multiplex topics are also usual in spontaneous discourse (cf. test sentences A1c and A2c in the Appendix).

Pedro-e’   t-u      hàant-ah                      òon      (2)  
Pedro-TOP   PFV-A.3   eat:TRR-CMPL(B.3.SG)   avocado  
‘As for Pedro, he ate avocado.’

Focus assignment is expressed by the displacement of an argument in the preverbal domain (compare (3a) with (1)). Such argument focus constructions with preverbal focus are analyzed as cleft constructions (see [4]).

òon      t-u      hàant-ah                      Pedro.      (3a)  
avocado   PFV-A.3   eat:TRR-CMPL(B.3.SG)   Pedro  
‘It was an avocado, that Pedro ate.’

Pedro      hàant                                      òon.      (3b)  
Pedro      eat:TRR(SUBJ)(B.3.SG)   avocado  
‘It was Pedro, that ate an avocado.’

In (3b), agent focus is illustrated, which is expressed through a special ‘out of focus’ form of the verb. The aspect

auxiliary is dropped together with the cross-reference clitic for the agent. In the perfective aspect (3b), the extrafocal verb bears the zero form subjunctive marker in non-clause-final position.

## 2. Speech materials

### 2.1. Resources

The data presented in this paper was collected during our field work in December 2004 in Quintana Roo, Mexico. Our informants live in a community of about 800 speakers (Yaxley, Quintana Roo), and mainly use Yucatec Maya in their everyday communication, although all are bilingual in Spanish.

In total, twelve speakers have been recorded. However, all twelve speakers did not produce sentences with all test items except for the minimal pair *míis* ‘broom’ and *mìis* ‘cat’.

### 2.2. Description of the production experiment

**Speech Materials.** Since information structure is encoded through particular syntactic structures in Yucatec Maya, the first question is if the topicalisation and focusing constructions illustrated in section 1.2 are associated with particular tonal events. In order to isolate tonal events associated with information structure and lexical tones, we have developed a small text containing the three constructions under investigation (cf. Appendix). Two versions of this text have been used, one for animate (cf. A1) and one for inanimate target words (cf. A2): (a) a sentence with the target word as a single argument of the existential verb (broad focus condition; see A1a and A2a); (b) a sentence with the target word in the focus position (narrow focus condition; see A1b and A2b); (c) a sentence with the target word in the topic position (topic condition; see A1c and A2c).

It should be noticed that Yucatec Maya is one of the languages that encode discourse functions through syntactic constructions and morphological marking (see section 1.2), hence comparing the tonal realisation sentences which are morpho-syntactically identical but differ in information structure is not allowed for by the structure of the language. By consequence, the target elements are necessarily embedded in different sentences specifically chosen to allow for observation of (possible) tonal events that accompany the morpho-syntactic structures that are related to information structure. In all sentences the target words are non-initial and non-final, in order to avoid interactions with sentence initial reset or sentence-final lowering.

The carrier sentences are listed in the Appendix. The lexical elements have been chosen from the YUCLEX database (see [8]), in order to consider instances of all possible tonal patterns (see Table 1). In this article, we discuss just some representative cases of the tonal phenomena at issue.

**Data elicitation.** The speech data were elicited by means of question-answer pairs. Since most Yucatec Mayan speakers are not trained in reading Mayan orthography, we had to present our stimuli orally. The carrier sentences with target items as given in Table 1 were thus read by a native speaker before running the experimental sessions. The pitch contour of each provided sentence, however, has been reduced to a flat level pitch in order to eliminate all linguistic information

that is encoded by pitch. In the experimental sessions, informants heard the resynthesized stimuli. The informants’ task, then, was to answer a generic question by repeating the text they had just heard before. All recordings were made on a DAT recorder (SONY 100) using head microphones. For the manipulation of the test sentences and for pitch analyses we used Praat (see [13]).

Table 1: *Tonal patterns in lexical items.*  
(*N* = neutral; *L* = low; *H* = high; grave accent indicates low tone, acute accent high tone)

tonal pattern	lexical item	translation
N	am	spider
L	lòol	flower
L	mìis	cat
H	míis	broom
H	lálal	stinging nettle
N-N	ahaw	chief
N-L	konkùum	pot seller
N-H	konchúuk	shoe seller
L-N	yùuyum	bird
L-H	kòolnáal	farmer
L-L	xtùuxkùuts	pheasant
H-N	yáalam	fawn
H-L	óochkàan	snake
H-H	tóokchúuk	coal merchant

## 3. The realisation of lexical tones

The first observation to be made is that older speakers as well as younger ones exhibit tone in their grammar of Yucatec Maya – in contrast to the observations in [1]. On syllables containing a long vowel we identify a tonal distinction between an underlying high (H) and underlying low tone (L), which is in line with [2], [6], and [9]. In addition, syllables containing a short vowel are toneless underlyingly (= neutral, cf. Table 1). In the following, we provide a qualitative overview of the data comparing monosyllabic with disyllabic target words that bear a low or a high tone, or a combination of the two according to Table 1.

### 3.1. The lexical low tone

A lexical low tone in Yucatec Maya is realized with low level pitch. As can be seen in Figure 1, the monosyllabic target word *lòol* ‘flower’ is pronounced with flat pitch at a constant level. The rise in pitch at the end of the target word is due to a high tone associated with the topic marker *-e’*.

Similarly, a disyllabic target word with a low tone on the first and a high tone on the second syllable, i.e. *kòolnáal* ‘farmer’, is realized with low pitch on the first and a rising pitch on the second syllable (cf. Fig. 2). Comparing the low tone of Fig. 1 with that of Fig. 2, we observe that the former is low flat while the latter is realized slightly falling. The additional pitch height at the onset of the first syllable’s vowel is due to the segmental context of the syllable’s onset, i.e. the unvoiced velar plosive [k] raises the pitch. Thus, the slightly falling realisation can be explained as a microprosodic effect. Further, in case of a following topic marker as in Fig. 2, an additional rise due to the high tone associated with the topic marker can be observed. To conclude, our data verifies the view in [2] and [9] that the lexical L is a level tone.

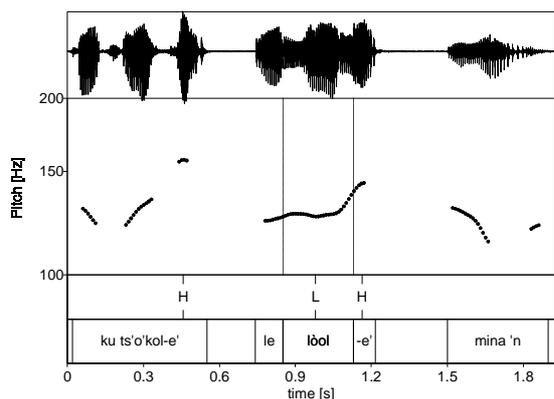


Figure 1: Target word lòol ‘flower’ with lexical low tone in topic position; cf. sentence frame (A2c).

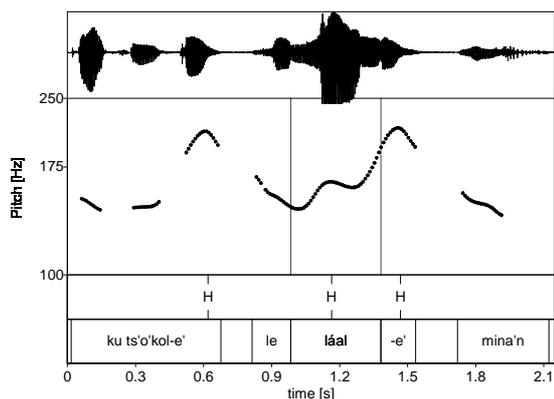


Figure 3: Target word láal ‘stinging nettle’ with lexical high tone in topic position; cf. frame (A2c).

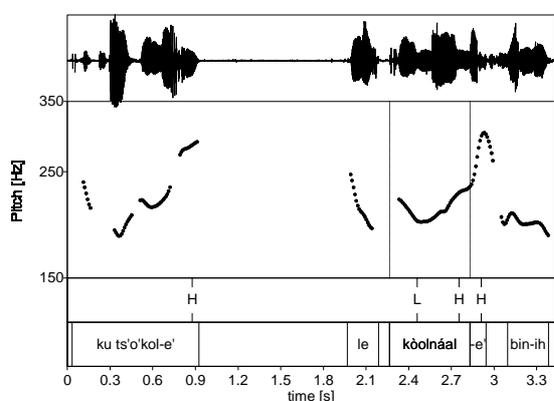


Figure 2: Target word kòolnàal ‘farmer’ with lexical low on the first and high tone on the second syllable in topic position; cf. sentence frame (A1c).

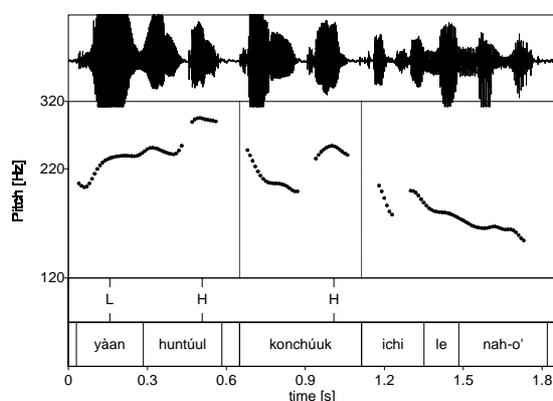


Figure 4: Target word konchúuk ‘shoe seller’ with lexical high tone on the second syllable in broad focus; cf. sentence frame (A1a).

### 3.2. The lexical high tone

A lexical high tone in Yucatec Maya is realized with a rise in pitch approaching a high tonal target, cf. Fig. 3. The rise starts from a low pitch level that is equivalent to the low pitch levels of the sentence initial word *ku ts'o'kol-e'* ‘afterwards’, about 140 Hz for the particular speaker in Fig. 3. From that level at the onset of the target word, the pitch rises about 23 Hz. A preliminary analysis of the rise for four speakers reveals a mean rise of 1.99 semitones.

A comparison of the target word of Fig. 3 with a disyllabic target word containing a lexical high tone on the second syllable while the first one is tonally unspecified (*konchúuk* ‘shoe seller’) reveals, again, that a high tone is realized similarly as in a monosyllabic word, cf. Fig. 4. In order to implement a rise, the pitch on a preceding syllable falls to a low target level. In Fig. 4, the rise is interrupted due to the unvoiced segmental context of the second syllable’s onset, yet the target of the high tone is clearly visible on the nucleus of the second syllable. The pitch falls gradually after the target word towards the end of the intonation phrase.

The present data suggest that a lexical high tone is realised as rising, which is in line with [2] and [10]. However,

considering the disyllabic word *tóokchúuk* ‘coal merchant’ with each syllable associated with a lexical high tone, we observe a rise in pitch for only one of four speakers. Three speakers realise these two successive high tones as high level pitch (cf. Fig. 11 below). What we may conclude, however, is that the view of [6] and [9], who claim *falling* pitch for high tones, is refuted. A Yucatec Mayan high tone appears to be realised as rising or high level pitch but not falling (for a discussion of falling pitch in combination with a high lexical tone, see below section 4.3).

## 4. Yucatec Mayan Intonation

### 4.1. Focus in Yucatec Maya

As illustrated in section 1.2, narrow focused constituents appear preverbally (cf. sentence frames (A1b) and (A2b)). If a word containing a lexical prespecified tone occurs in the focus position, the underlying shape of the tone as described in sections 3.1 and 3.2 remains preserved. Any deviation from the underlying pattern may be explained by tonal effects, such as tonal transitions, and/or phrasing. Thus, we observe no interaction of lexical tone and intonation, in particular pitch accents for the expression of focus (see section 4.2 below for a

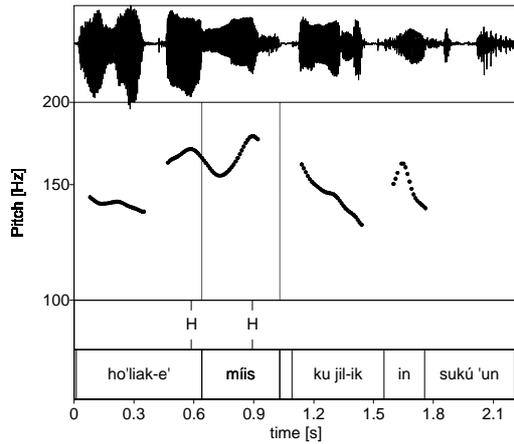


Figure 5: Target word *mís* 'broom' with lexical high tone in narrow focus; cf. sentence frame (A2b).

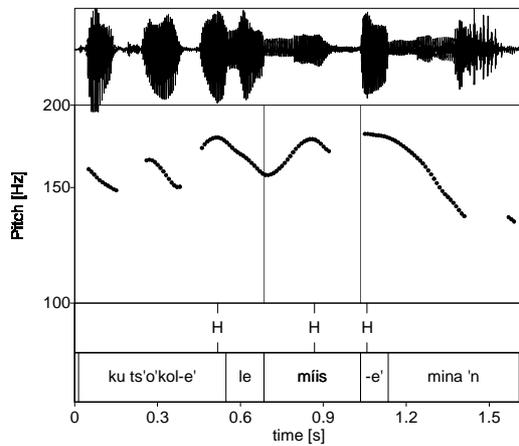


Figure 6: Target word *mís* 'broom' with lexical high tone in topic position; cf. sentence frame (A2c).

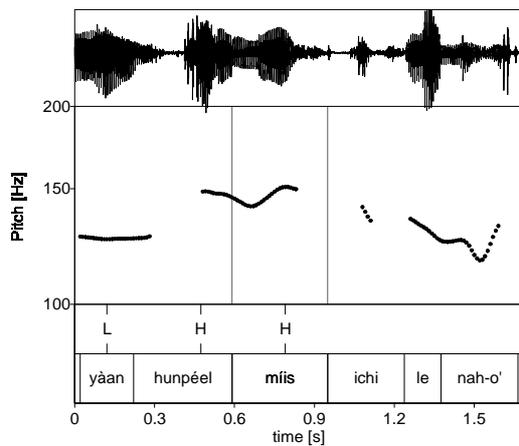


Figure 7: Target word *mís* 'broom' with lexical high tone in broad focus; cf. sentence frame (A2a).

discussion of a possible phrase tone as a result of the topic marker).

In Fig. 5, a pitch track of the monosyllabic target word *mís* 'broom' in narrow focus position is shown. The target word is realized with the rise in pitch that characterizes a lexical high tone (see section 3.2). There appears no further tonal event that might be analysed as a pitch accent indicating focus tonally. If we compare the narrow focus realisation of a target word containing a lexical high tone with a realisation in broad focus (postverbally) or in topic position (preverbally as in the narrow focus condition, cf. Fig. 6), we observe the same tonal pattern, i.e., a rise in pitch on the target word (cf. Figs. 5, 6, and 7). Thus, we may conclude that information structural components such as topic, narrow and broad focus are not expressed by means of post-lexical tones (pitch accents) as is the case in intonation languages such as English (cf. [12]).

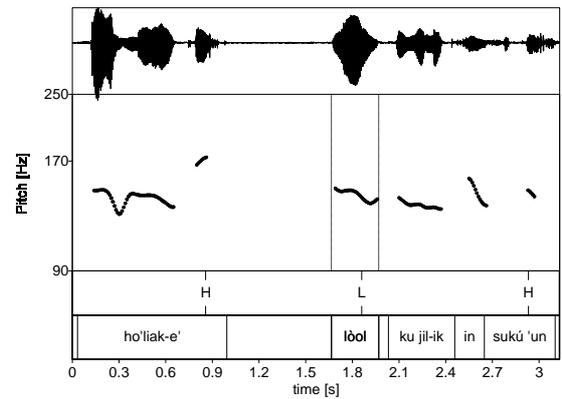


Figure 8: Target word *lòol* 'flower' with lexical low tone in narrow focus; cf. sentence frame (A2b).

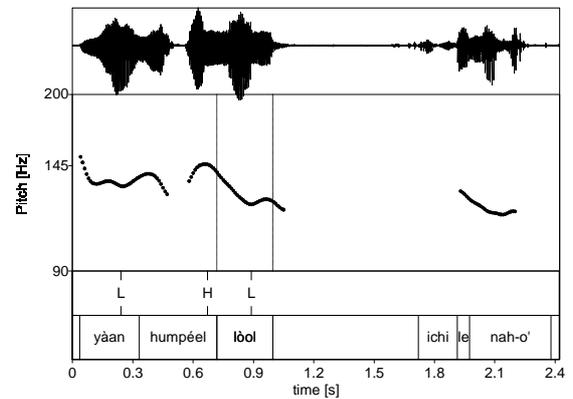


Figure 9: Target word *lòol* 'flower' with lexical low tone in broad focus; cf. sentence frame (A2a).

If we compare different instantiations of the low tone realised on the same target word (here: *lòol* 'flower'), we observe that the realisation in Fig. 8 (narrow focus) corresponds to the properties of lexical low tones as illustrated in section 3.1, but the realisation in Fig. 9 (broad focus) displays an unexpected fall in pitch. Yet, we argue that broad and narrow focus are not distinguished tonally. The difference in the observed contours is due to a difference in

phrasing. In case of Fig. 8 (narrow focus), a clear phrase break prior to the target item occurs, whereas in case of Fig. 9 (broad focus), the phrase break occurs first after the target word. To reach the low target of the word *lòol* ‘flower’ in Fig. 9, a tonal transition arises between the previous lexical high tone on the inanimate indefinite *hunpéel* and the following target word. Thus, the greater fall in pitch is not a characteristic of the low tone itself, nor is it directly due to a difference of information structure. If phrased differently, i.e. with a pause prior to the target word, we would expect the low tone in Fig. 9 to be similar to that of Fig. 8.

A similar effect arises when a disyllabic target word with a high tone associated with the second syllable follows the animate indefinite *huntúul*, cf. Fig. 4. The tonal sequence of two H-tones is interrupted by a syllable with no lexical tone. The pitch on that syllable is a mere transition, and the fall resembles the fall towards a low tonal target as in Fig. 9. This strengthens our basic assumption concerning the realisation of lexical L-tones. Whenever a falling realisation occurs in our corpus, it may be accounted for through a preceding high target.

In sum, our data does not provide evidence for tonal events associated with the focus position. Comparing the realisation of narrow focus with that of a topic, no differences can be observed (cf. Figs. 1 and 8). As for the lexical high tone associated with words in different information structural positions, in case of a target word containing a lexical low tone we observe no tonal event that might be analysed as a post-lexical tone (pitch accent) to express topic or focus.

#### 4.2. Topic in Yucatec Maya

As [1], [3], and [7] observed, topics are left dislocated in Yucatec Maya, and the topicalized constituent is obligatorily marked with a topic suffix. As can be observed in Figs. 1, 2, 3, 5, 6, and 7, topicalized constituents – either single or multiplex topics – are accompanied by a salient tonal event: a high tone associated with the right edge of the topic phrase.

There are four possible hypotheses about the status of this tonal event: (i) it is related to information structure, thus marking a phrase as topic (in this case it would be a boundary tone); (ii) it is a lexical high tone associated with the suffix *-e'*; (iii) it is the result of the phrase boundary, thus being a boundary tone, but in contrast to (i) it is independent of the information structure; and (iv) it is associated with the glottal stop. According to hypothesis (ii) this high target is a lexical tone, according to hypotheses (i) and (iii) it is a postlexical tone, and according to hypothesis (iv) it is conditioned by a phonological segment. We have stated in section 3 that lexical tones are associated with long vowels, so the occurrence of a lexical tone on the suffix *-e'* would violate the general principles of tonal association in Yucatec Maya.

In case of two successive topicalized constituents, the effect of tonal upstep can be accounted for as a result of a sequence of two high tones. Consider Fig. 2, for instance. The tonal sequence of L-H-H causes an upstep of the second H tone, which is associated with the topic suffix. The same effect is shown in Fig. 3, where the second high tone of a H-H sequence is realized higher than the first. Again the second high tone is associated with the topic suffix *-e'*, and in both cases (see Figs. 2 and 3), the second topic suffix is realized at the same pitch level as the first one.

In case of a low tone preceding the topic suffix (i.e., a tonal sequence of L-H), we observe a similar rise due to the

high tone associated with the suffix (cf. Fig. 1). The crucial difference between a L-H and a H-H sequence is that in the former case, the pitch level of the second topic suffix is lower than the first (cf. Fig. 1).

However, if two lexical high tones occur in the same word (see Fig. 11, right panel), no upstep of the second high tone occurs. The pattern shown in Fig. 11 has been produced by three of four speakers. As mentioned in section 3.2, the fourth speaker realised the high tones as rising ones, yet also with no upstep of the second high tone (cf. Fig. 10).

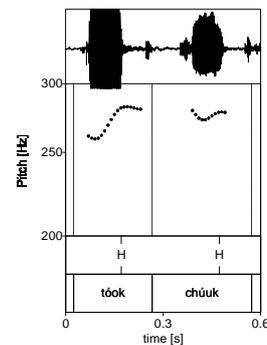


Figure 10: Target word *tóokchúuk* ‘coal merchant’ with two lexical high tones realised as rising tones in narrow focus, extracted from sentence frame (A1b).

Based on the observation that sequences of high tones show different tonal behavior, i.e., upstep or no upstep, we might assume that in case of upstep, two different types of tones are involved. Given that lexical tones are not upstepped as Figs. 10 and 11 show, we draw the conclusion that the second high tone in Figs. 1, 2, 3, and 6 is not a lexical one, what is in line with the phonological restriction that tone bearing units be long vowels in Yucatec Maya. This piece of evidence supports the exclusion of hypothesis (ii), according to which the high tone at the right edge of topic constituents is a lexical tone.

The suffix *-e'* belongs to a class of suffixes that display the same phonological structure, the local deictic suffixes *-a'* ‘D1’, *-o'* ‘D2’, and the negative enclitic *-i'* ‘NEGF’. All these elements occur phrase finally and are associated with the same tonal events as the topic suffix *-e'*. The tonal behavior of these elements may be observed in Fig. 7 (see the high tone associated with the right boundary of the final phrase). The realisation of the high tone in the environment in which we would expect a final lowering is not obligatory, but it is a characteristic property of IPs ending with suffixes of this class. On the basis of this evidence we can rule out hypothesis (i), that this tonal event is associated with the discourse function of topic phrases.

In sum, we have given empirical evidence that the high tone occurring at the right edge of topic phrases is neither a lexical tone nor a boundary tone related to the information structure of these constituents. Our experimental study does not provide conclusive evidence to decide between hypothesis (iii) that the high tone is a postlexical tone associated with a type of IP or (iv) that the high tone is associated with the glottal stop, since hypothesis (iv) requires the examination of items with a final glottal stop that were not part of our sample (see Table 1).

In line with the conclusions in section 4.1, our analysis of topic constituents shows that the corresponding tonal events are not triggered by the information structure, but relate either to phrasing or to phonological conditions.

### 4.3. Boundary tones in Yucatec Maya

In Yucatec Maya, we observe tonal phenomena that we might analyse as boundary tones. We have already argued in section 4.2 for a possible high boundary tone that delimits phrases ending to a special class of enclitics. In this section, we discuss the instance of a low phrase boundary tone that interacts with a lexical high tone.

According to [9], it remains unclear whether a distinction between a falling and a high level lexical tones exists. Our analysis provides evidence against such a claim, i.e. we assume that a high tone may fall if the tone-bearing unit happens to occur phrase finally. The left panel of Fig. 11 displays a one-word phrase taken from a spontaneous discussion with one of the informants, who explains the target word several times in isolation. Given that a so-called citation form forms its own intonation phrase (e.g. [12]), we analyse the tonal fall in this particular case as an interaction between a lexical high tone and a low intonation phrase boundary, thus an interaction between tone and intonation. If the target word is not phrase-final (cf. right panel of Fig. 11), both high tones are realized high, thus no fall is produced.

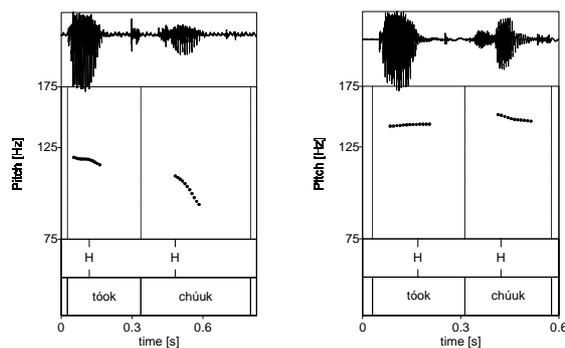


Figure 11: Target word *tókchúuk* ‘coal merchant’ with two lexical high tones in a one-word phrase (left panel) and extracted from frame (A1a) (right panel).

## 5. Acknowledgments

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## 7. Appendix

- yàan hun-túul \_\_\_ ichi le nah-o'. (A1a)  
 EXIST INDEF-CL.AN \_\_\_ in DEF house-D2  
 ‘There is an \_\_\_ in the house.’
- ho’lyak-e’, \_\_\_ hàant-ik le òon-o'. (A1b)  
 yesterday- TOP \_\_\_ eat-INCMPLE DEF avocado-D2  
 ‘Yesterday, it was \_\_\_ who ate the avocado.’
- ku ts’o’kol-e’ le \_\_\_-e’ bin-ih. (A1c)  
 afterwards-TOP DEF \_\_\_-TOP go-B3  
 ‘Afterwards, what the \_\_\_ concerns, (s)he went away.’
- yàan hun-péel \_\_\_ ichi le nah-o'. (A2a)  
 EXIST INDEF-CL.IN \_\_\_ in DEF house-D2  
 ‘There is an \_\_\_ in the house.’
- ho’lyak-e’, \_\_\_ k-u yil-ik in sukú’un. (A2b)  
 yesterday \_\_\_ IPFV-A.3 see-INCMPLE POSS.1.SG brother  
 ‘Yesterday, it was \_\_\_ that my brother saw.’
- ku ts’o’kol-e’ le \_\_\_-e’ mina’n. (A2c)  
 afterwards-TOP DEF \_\_\_-TOP NEG.EXIST  
 ‘Afterwards, what the \_\_\_ concerns, it disappeared.’

### Abbreviations:

A	person clitic, class A	AN	animate
B	person clitic, class B	CL	noun class
CMPL	completive aspect	DEF	definite
D	deictic marker	IN	inanimate
INCMPLE	incompletive aspect	INDEF	indefinite
INTR	intransitivizer	IPFV	imperfective aspect
NEG	negation	PFV	perfective aspect
POSS	possessor	SG	singular
SUBJ	subjunctive	TOP	topic
TRR	transitivizer		