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journal article

THE ACQUISITION OF YUCATECAN MAYA PROSODY

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Paper presented at The UBC International Conference on the Acquisition of Phonology

1.0 Overview

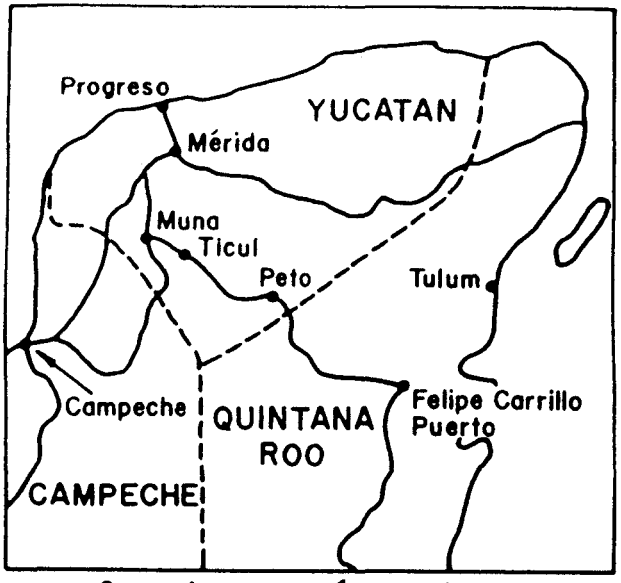
In this paper I'm going to talk about some data that I gathered and analyzed while I was in Mexico. I had the opportunity to get involved with a research project at the Autonomous University of the Yucatan, headed by Dra. Barbara Pfeiler, that was looking at the acquisition of Yucatecan Maya.

The Maya language family consists of 31 languages, spoken mainly in Guatemala and the south of Mexico by about 3.5 million people. See Figures 1 & 2 below. Yucatecan Maya is estimated to have about 600,000 speakers. The influence of Spanish in the area is, of course, strong. Many of the people are bilingual and the issue of maintaining the Mayan language in the next generation is a hot educational topic. This will become an important factor when we look at some of the prosodic changes that seem to have happened to YM in the past century. But outside of the major cities it is possible to find people who have very little contact with Spanish.

Figure 1 - Middle America

1. Middle America

Figure 2 - The Yucatán Peninsula



2. The Yucatán Peninsula

The data that we collected were drawn from a family outside of Valladolid (between Peto and Tulum on the map in Figure 2). The mother speaks to the children all the time in Maya. The father has some knowledge of Spanish as he works in the tourist town of Cancun. However, the father is away for most of the week and by all reports didn't talk much to the kids anyway. By these controls (such as they are), I was hoping to get Maya data fairly uncontaminated by Spanish influence. Ultimately, it seems that on a micro-level the influence of Spanish can be minimized while on the macro-level it cannot. The data I refer to here were taken from a recording of a family in their home. The mother was playing with her three children ages two, four and five. A bilingual Maya/Spanish researcher was also present. In this paper I will only refer to the words spoken by the two-year old (listed in the Appendix).

For your information, Figure 3 shows the phonetic inventory of Yucatecan Maya:

Figure 3 - Phonetic Inventory

Stops	p	t	c	č	k	ʔ
Ejectives	p'	t'	c'	č'	k'	
	ɓ'					
Fricatives	(f)		s	š		h
Nasals	m	n		(ñ)	(ŋ)	
Glides	w			y		
Liquids		l				
		r (r̃)				
Vowels	i	e	a	o	u	

Note that there are glottalized consonants that I will refer to very briefly when discussing the acquisition data. Or maybe now - the two-year-old seemed to be very good at her glottalized consonants. We also note that vowel length is contrastive in Yucatecan Maya. Traditional grammars have referred to a wide range of vowel types as shown in Figure 4:

Figure 4 - Vowel Types

Long	vv
Short	v
Clipped	vʔ
Rearticulated	vʔv

My position is that we really just have a two way distinction of long versus short vowels to be acquired. The clipped vowels seem to arise as a result of having to have a word-final coda. If there is none, then a glottal stop is epenthetically inserted. These epenthetic consonants are quite unstable in informal speech (Pfeiler, undated). Sometimes they are deleted and sometimes they become [h]. The rearticulated vowels seem to pattern as a series of short vowels, as, we shall see, they never attract an irregular accent.

2.0 Yucatecan Maya Prosody

Now, when it comes to describing the prosody of this language, there seems to be a fair amount of controversy. Some researchers (e.g. Pike, 1943) refer to Yucatecan Maya as a tone language because of what was referred to as its "sing-song" nature and the existence of a few minimal pairs that seemed to be contrasted only by pitch differences. However, it should be noted that so-called high tone is found only on long vowels. Short vowels never have a high tone. Hanks (1984) seems to suggest that it is a quantity-sensitive stress language with stress

"predictable from the pitch contour". Pfeiler (1992) suggests that it is a pitch accent language. Perhaps, not surprisingly, there seem to be good and bad points of all of these positions. Exactly how to distinguish between stress, pitch accent and tone languages has generated a considerable amount of discussion in the literature (Beckman, 1986; Haraguchi, 1991; Hyman, 1978; Hayes, 1995; McCawley, 1968; Mock, 1988; Pulleyblank, 1986; van der Hulst & Smith, 1988; Woo, 1972). Hayes (1995:49-50) comes out most clearly when he says, "pitch accent languages must satisfy the criterion of having *invariant tonal contours* on accented syllables, since tone is a lexical property. This is not so for pure stress languages, where the tonal contours of stressed syllables can vary freely" and furthermore be influenced by intonation.

Pike first proposed that YM was a tone language because of the existence of a small number of minimal pairs that differed only in terms of pitch. I believe that many of the cases cited were in fact length differences (i.e. long versus short vowels), but there do still seem to be a small number of words that are said to be distinguished only by pitch (e.g. long vowel with high pitch and long vowel with low pitch). My suspicion is that current speakers of YM would not have a significant pitch difference on these words - for reasons that I will get to - but, sadly, I do not have recordings of these words. Because it seems to affect such a small number of words, and for other reasons that I will discuss shortly, I am questioning the classification of YM as a tone language. But what of deciding between pitch accent versus stress?

In Yucatecan Maya, the vast majority of words seem to have only one accent (making it seem to be a lexical property, and hence pitch accent). In the dictionary search I conducted, I could find only one word that had two accents marked, *cháachál* 'cloth'. This fact too, seems to argue against the tone analysis. But what about a stress analysis? There are a couple of reasons that a stress analysis appeals to me. One is that we see an interaction of syllable weight and accent and (2) we see patterns that suggest metrical constituents. All this has to do with the distribution of the long vowels.

The vast majority of words seem to have only one long vowel in them (usually in the first syllable). Again, in the dictionary search, I found three examples - *áanikaab* 'wicker', *cháachál* 'cloth', and *iipfil* 'traditional dress'. It is also worth noting that I found no words in which the second syllable of a three-syllable word was long. In other words, there were no non-initial, non-final long vowels. This looks to be some sort of foot constraint. The second syllable of a three syllable word looks to be a weak metrical position that cannot branch. This fits in well with an analysis of YM stress as iambic. We wouldn't expect this kind of constituency in a pitch accent language. Also, more anecdotally, many of the grammars that I consulted (e.g. Blair & Vermont Salas) spend an enormous amount of time on how YM intonation patterns can change the accent in a word. Again, following Hayes (1995) this seems to point more to a stress analysis than a pitch accent one.

The fact that long vowels tend to occur non-finally has something to do with a constraint that makes strong syllables be bimoraic. A YM word must end in a consonant. Final superheavy syllables can occur but are much rarer than final CVC syllables. The non-final syllable can either be CVV or CVC.

The big question that remains in my mind about the adult grammar of YM is why some long vowels are accented and some are not. If it is stress it should be predictable. At this point, I

am just going to consider them as irregular stresses that have to be learned. I feel this is consistent with the small number of words said to be distinguished by accent alone. There may also be historical support for this, as it has been suggested that the irregular accents in YM derive from heavy syllables in Proto-Maya (e.g. VhC or VjC sequences). Sociolinguistically, it has been noted, as well, that irregular accents (high tones) tend to be deleted in informal contexts (Pfeiler, undated). This makes YM fit in with other Mayan languages which are stress languages, as shown in Figure 5:

Figure 5 - Stress Types

Type A: •stress the heaviest syllable in the word
•Wasteko, Mam del Norte

Type B: •stress the first syllable of the root of a word in the middle of a phrase; stress the last vowel of a word at the end of a phrase
•Tzeltal, Q'anjob'al

Type C: •stress the penultimate syllable
•Mam del Sur, Ixil

Type D: •stress the last vowel of each word
•K'iche', Mam Occidental, Q'eqchi', Poqom

Salmons (1992: 56) proposes a general tendency (particularly in language contact situation) for languages to move along the following path shown in Figure 6:

Figure 6 - Move From Tone to Stress Accent
Tone -> Pitch Accent -> Stress Accent

As documented in Bantu languages, first we might see the H/L contrast change into a H/Ø contrast, and then a metrical grid would take the H as a prominent position. Once a word can have only one H tone then that syllable becomes prominent. This kind of prominence is more of an accentual than a tonal phenomenon. Goldsmith (1987a: 76-77) considers the limiting of one H per word to be causal in the development of a metrical grid.

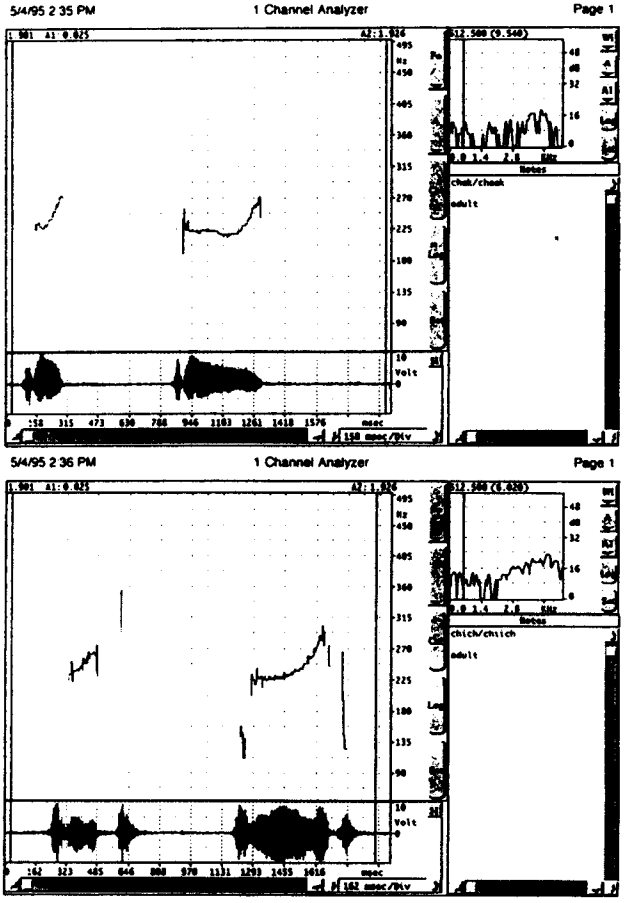
Salmons' model may well document what has been going on in YM. Perhaps originally, it was a tone language that subsequently moved through the pitch accent stage to the stress stage. This seems to be much more likely in areas of language contact, and certainly YM is in frequent contact with Spanish. I would argue then that modern YM is somewhere between stages two and

three with properties of both pitch accent and stress languages. The dominant pattern seems to be final stress but there may be some lexical items that have non-final long vowels stressed.

3.0 Instrumental Analysis of the Adult

I have conducted a number of instrumental acoustic analyses on both a child and adult speaker of YM. In a number of forms I compared the vowel length of long and short vowels, as shown in Figure 7 (*chak/chaak*; *chich/chiich*):

Figure 7



Visually, we can clearly see the difference between the long and short vowels. Statistically, the difference is borne out as we see that the long vowels are significantly longer than the short vowels (p=.0025). Adults also showed a significant tendency to lengthen final vowels (p=.0147). This analysis emerged from a two factor ANOVA on the effects of phonological long or short status and position on length in milliseconds, shown in Figure 8:

Figure 8

2 Factor ANOVA : Vowel Length & Finality ADULT

Anova table for a 2-factor Analysis of Variance on Y_1: MS

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
Length (A)	1	64576	64576	16.1	.0025
Final/Non (B)	1	34721.3	34721.3	8.7	.0147
AB	1	7448	7448	1.9	.2027
Error	10	40071.5	4007.1		

There were no missing cells found.

2 Factor ANOVA : Vowel Length & Finality

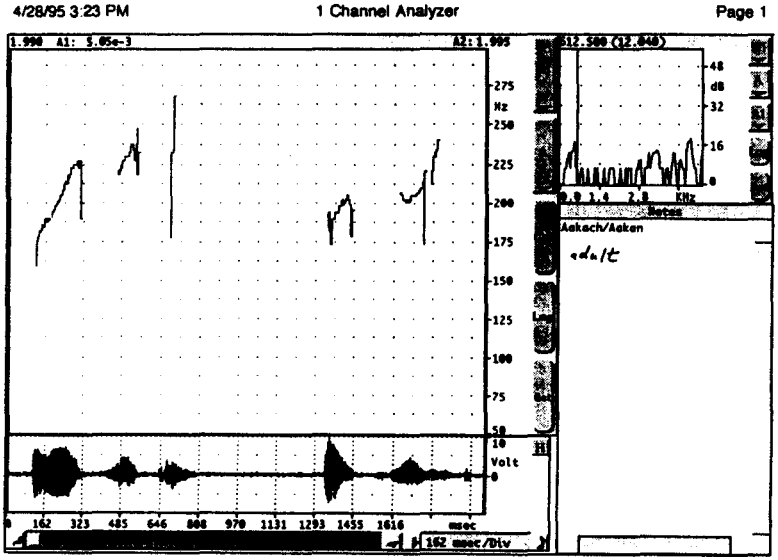
Anova table for a 2-factor Analysis of Variance on Y_1: MS

Source:	df:	Sum of Squares:	Mean Square:	F-test:	P value:
LENGTH (A)	1	91320	91320	9.9	.0077
FINAL/NON (B)	1	486.4	486.4	.1	.822
AB	1	1.6	1.6	1.7E-4	.9897
Error	13	119943.4	9226.4		

There were no missing cells found.

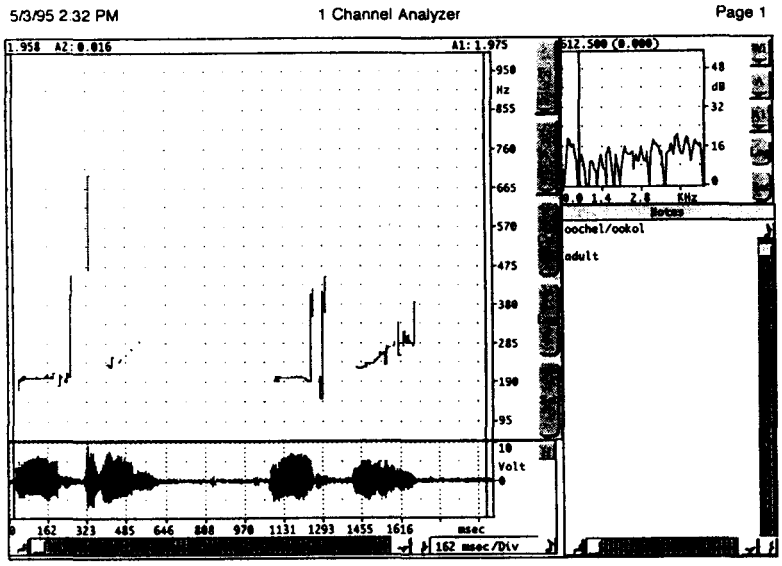
I also did some F_0 contours of adult forms to see if there was any predictable effect on the supposed high tone vowels. Figure 9 shows the pitch contour for the forms *áakach* and *áakan* both of which are said to have a high tone on the first syllable.

Figure 9



If there is any difference, it looks as if the second syllable is higher in pitch. This is in fact the same pattern we see on words that do not have High tone markings, as shown in Figure 10. These are the words *oochel* and *ookol* where we see the same rising pitch.

Figure 10

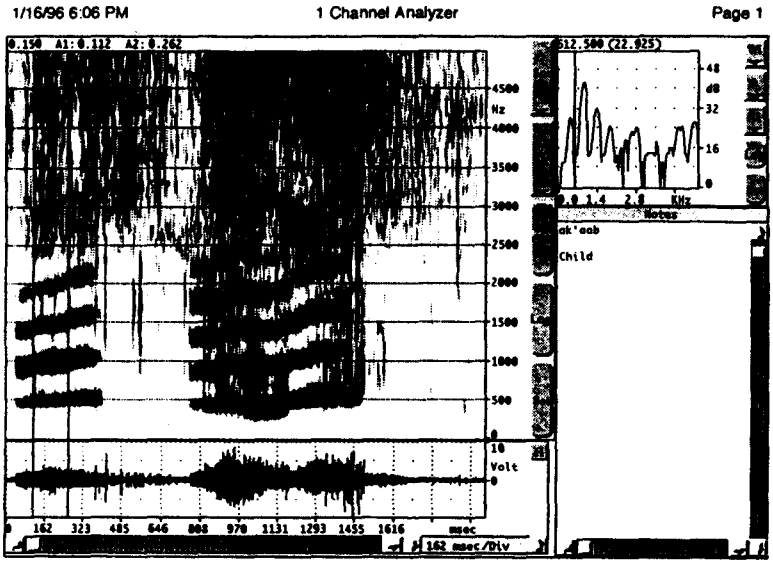


My analysis of the adult forms then, suggests that items which are traditionally marked as having high tone are not phonetically distinct from those vowels which are supposed to have low tones. The phonological distinction of long versus short vowels is, however, borne out phonetically.

4.0 The Child: Instrumental Analysis

I have also conducted an acoustic analysis on a number of the child's words. A complete listing of the words from this session can be found in the appendix. I found that the child appears to have acquired the distinction between long and short vowels, as shown in Figure 11 (*akaab*).

Figure 11



Again a two factor ANOVA indicated that the difference was significant (p=.0077). The child did not show the same final lengthening effect that the adult did (p=.822). These tendencies can be seen in Figure 12:

Figure 12

Means

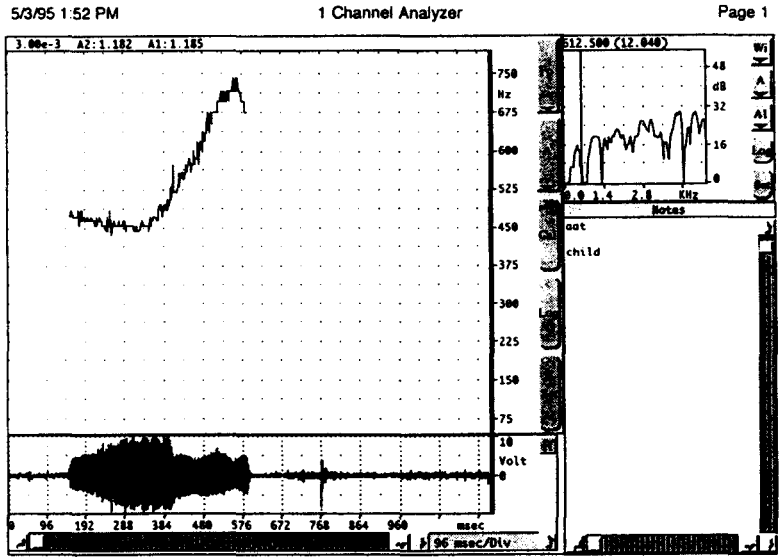
Child Short: 194.9 ms Child Long: 391.6 ms
Ratio (Long/Short) = 2.01

Child Final: 315.1 ms Child Non-final: 204 ms
Difference (Final - Non-final) = 111.1 ms
Ratio (Final/Non-final) = 1.54

Adult Short: 147.7 ms Adult Long: 269.3 ms
Ratio (Long/Short) = 1.8

The child clearly shows a pattern of a rising pitch contour at the ends of words, as shown in Figure 13 (*aat*). Even on a one syllable word we see that the child is increasing the pitch.

Figure 13

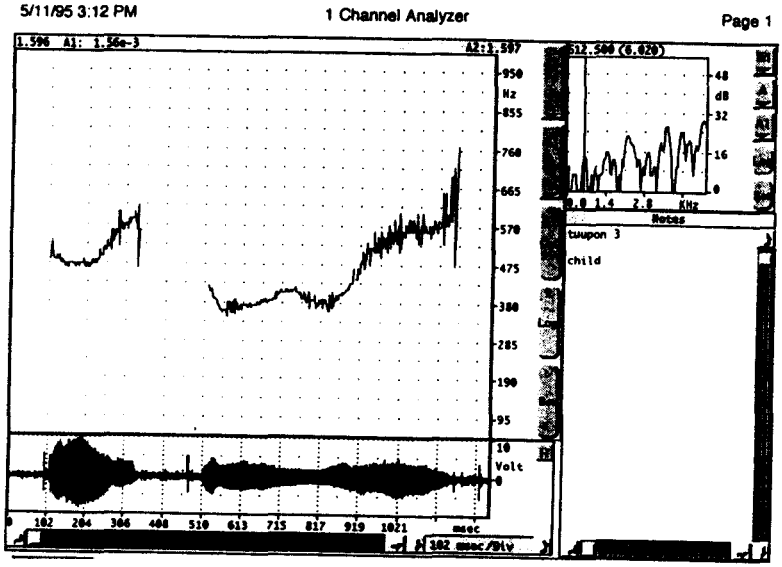


This pattern is also seen on the adult words (e.g. Figure 7 - *chak/chaak*). While it is possible that the adult pitch rise is an artifact of list intonation, this is not the case for the words from the child sample. I would argue that this boost in frequency on the final syllable is evidence of the acquisition of final stress. This can be seen in Figure 13 (*maami*). So, while final lengthening is not significant for the child, an increase in pitch on the final syllable is clear.

That this two-year old is so consistent in her final stress suggests one of two things: (1) it could be evidence against the claim of a universal trochaic foot (Allen & Hawkins, 1980; Archibald, 1995; Fikkert, 1994) or (2) it could be that the child is just reflecting the input and is merely storing individual lexical items and has not yet started to generalize a computational system for stress. It could also be argued, though, that if the language is still a pitch accent one, then the child is just learning the accent placement as part of the lexical entry.

There were only two words in the session that the child produced that had a high tone as part of the adult form (*túumben* & *áak'ab*). We already saw in Figure 10 that the child was not making a distinction in the pitch of the two vowels of *áak'ab*. We see the same in Figure 14 for the word *túumben* (which is realized as *tuupon*).

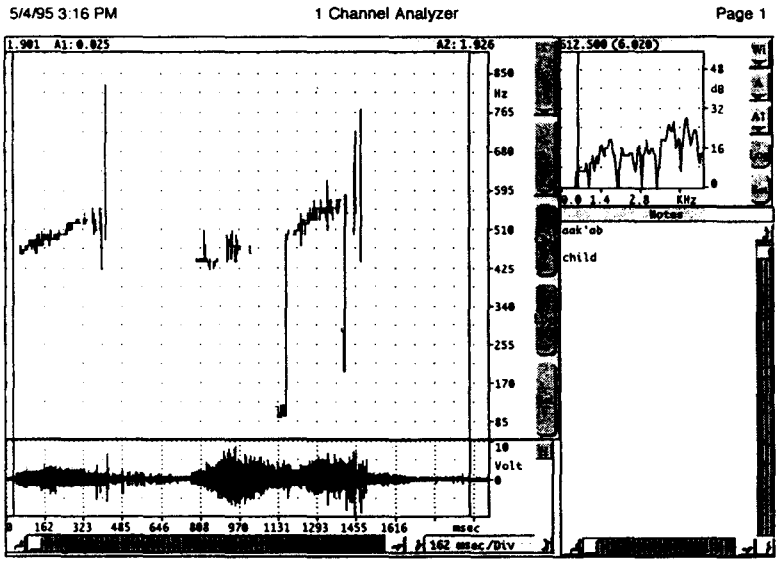
Figure 14



When I did these analyses I was assuming that the adults were making a pitch distinction in the supposed high and low vowels and that the child was not (which would suggest overgeneralization and hence computation and not just lexical storage). Unfortunately, I do not have recordings of an adult saying these words. However, given the lack of pitch distinction on the vowels of words like *áakach* (shown in Figure 9) I would think it likely that the input to the child does not contain a higher pitch on the first syllable. As a result, the evidence of overgeneralization is weakened.

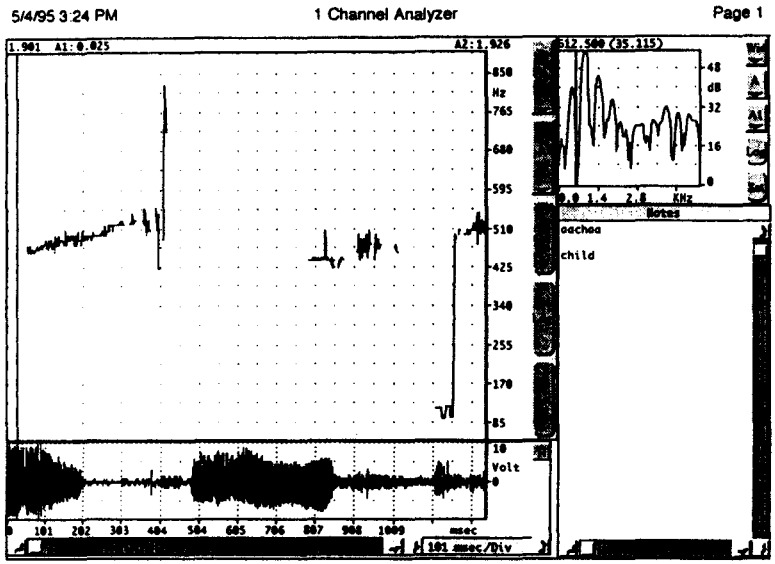
The child (like the adult) does not seem to be treating vowels that are supposedly high tone any differently from vowels that are low tone. In Figure 15 you see the F_0 contour of the word *áakab* (with a high tone).

Figure 15



Note that the two vowels are at almost exactly the same pitch (about 510 Hz), and we see the pitch rise on the final vowel. Compare this with Figure 16 which shows the F_0 contour for the word *aachaa* which does not have any high tones. Again, both vowels are at about 500 Hz with a bit of a rise on the second one.

Figure 16



4.1 A Possible Explanation

One thing that occurs to me by way of possible explanation of the iambic pattern seen in child speech has to do with Hayes' (1995) Iambic/Trochaic Law. Hayes suggests that humans have a built-in perceptual mechanism that sometimes imposes an iambic structure on the input and sometimes a trochaic structure. Seemingly, when humans hear alternating patterns of prominence we tend to impose a head-initial (or trochaic) structure as shown in Figure 17. But when we hear alternating patterns of duration, we tend to impose an iambic structure:

Figure 17

á ă á ă á ă á ă á ă -> ă (á ă) (á ă) (á ă) (á ă) (á ă)
a aa a aa a aa a -> (a aa) (a aa) (a aa) a

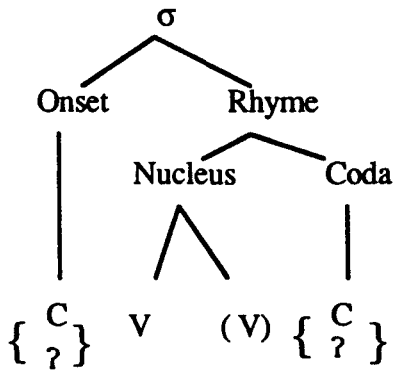
The fact that the input contains alternating long and short vowels with the only significant pitch rise at the end of a word, might well lead the child to impose an iambic structure on the data. As I

argued in my (1995) paper, I think it highly likely that these non-linguistic perceptual abilities are crucial in the child's setting up a metrical system.

5.0 A Quick Comment on Syllable Structure

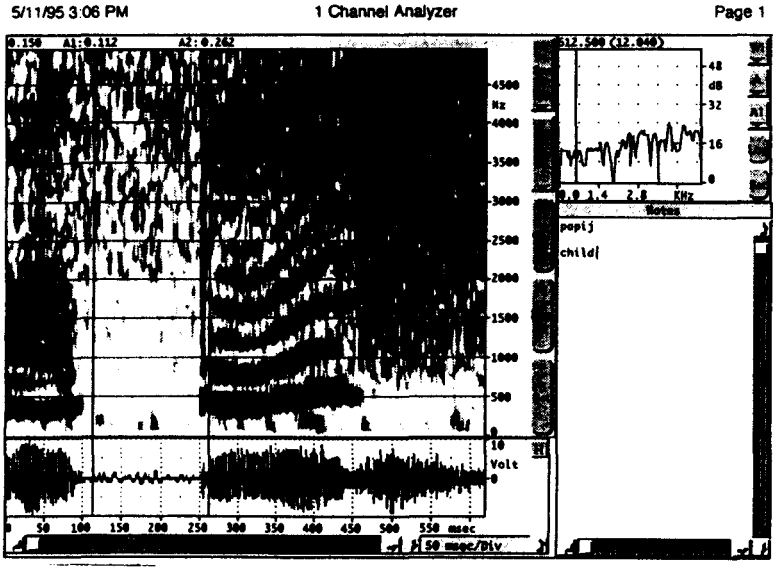
I'd just like to say a couple of things quickly about the syllable structure of YM. The basic structure is shown in Figure 18:

Figure 18



The child allows both branching rhymes and branching nuclei which is consistent with Fikkert's (1994) claims but we have no evidence as to whether the branching rhyme parameter was reset before the branching nucleus parameter. The child seems to have acquired the YM constraint which determines that word final syllables must be CVC. This can be seen in Figure 19 which is the spectogram for the word *paapii*.

Figure 19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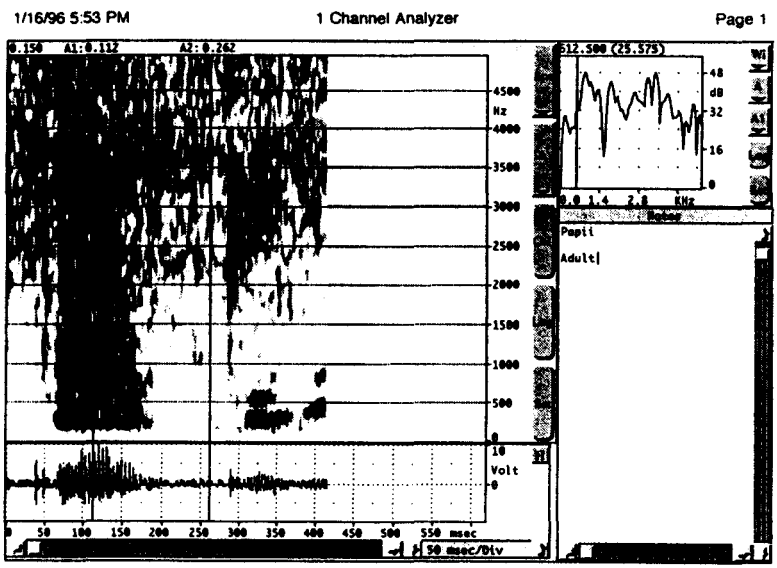
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Notes
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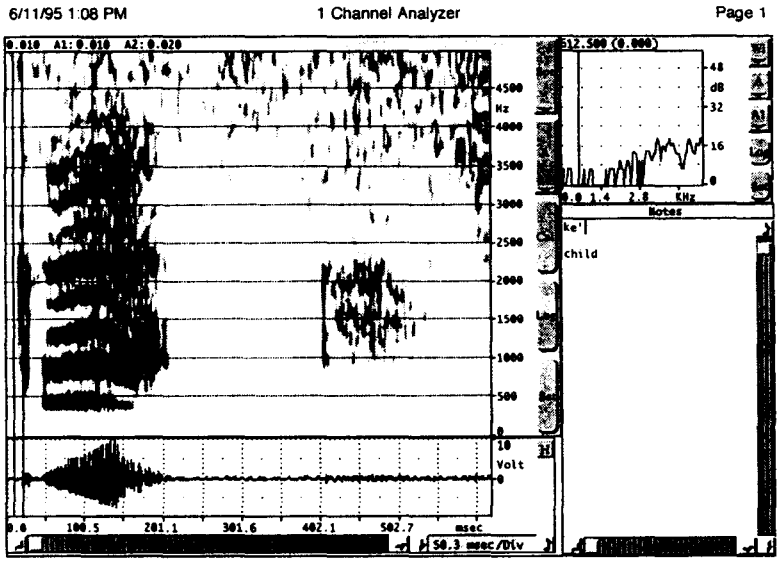
10
Volt
0
0 50 100 150 200 250 300 350 400 450 500 550 msec
50 msec/Div

In the adult versions of this word that I heard, there was no evidence of a consonant at the end (an exception to the CVC constraint). However, the child was clearly producing a voiceless palatal fricative at the end of this word. Figure 20 also shows some data that suggest the child is epenthetically inserting a glottal stop to fulfill the CVC constraint.

Figure 20



You see a spectrogram of the word *ke'* which shows the markedly shortened (or clipped) vowel at the end of the word. The mean short vowel length for this child was 194 ms; the length of this vowel is about 160 ms. The abrupt onsets that we see in the waveforms of vowel-initial words would seem to suggest that the child (like the adult) has initial glottal stops.

The fact that word-final syllables must be closed (with final stress) combined with the fact that non-final stresses (if they, in fact, exist) can only occur on long vowels, suggests that stress can only go on heavy (bimoraic) syllables. This would seem to fit in with a stress analysis of adult YM rather than a tone or a pitch accent analysis in which high tone could only fall on long vowels.

6.0 Conclusion

In this paper , I have argued that:

(1) Yucatecan Maya is best thought of as a stress accent language (perhaps with some aspects of a pitch accent language). This is a relatively recent historical development, and (following Salmons) probably the result of the high contact with Spanish.
(2) The adults have phonemic vowel length but the status of phonemic tone is questionable.
(3) The child has acquired the long/short vowel distinction and does not seem to be distinguishing pitch phonemically.
(4) The child shows evidence of productive final stress, arguing against a universal trochaic bias in early child language.
(5) The child appears to be able to insert epenthetic glottal stops in both onset and word-final positions.
(6) The child allows both branching rhymes and branching nuclei.

While there are still many unresolved questions, I look forward to trying to sort out some of the intricacies of Yucatecan Maya by collecting further child and adult data.

Acknowledgments

I would like to acknowledge the following people for helping me to get this paper to this preliminary state: Barbara Pfeiler for her hospitality and generosity while I was in Merida, Maria Mercedes Cruz Bojorquez for help with the Maya data, Rada Radakrishna for freely lending me his Maya sources, and Michael Dobrovolsky for helping me with the acoustic software.

Curses

To the bozo, DF, whose criminal activity in my home caused me to return early and bring my fieldwork to an early end.

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Appendix A:
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Appendix B:
Data

San Andrés X-Bac, Valladolid, Yucatan
4 February 1995

Child Form		Adult Target	English Gloss
1:	hook'	hook'	knot
2:	Maamfi	maamii	mommy
3:	Taki'	saki'	Valladolid
4:	Ch'a'aj	ch'a'ahi	I grab
5:	Beya'	beya'	like this
6:	Yaan	yaan	have
7:	Taki'	saki'	Valladolid
8:	Paapii	paapii	daddy
9:	Anti'i	yan ti'	yes, it has
10:	Beya'	beya'	like this
11:	Tatej	sateh	I lost (it)
12:	Tatej	sateh	I lost (it)
13:	Chuy	chuuy	to sew
14:	T'ook'	nook'	clothes
15:	Ook' At'	nook' Adela	Adela's clothes
16:	Cha'an	cha'an	see
17:	Cha'an	cha'an	see
18:	Taki'	saki'	Valladolid
19:	Cha'an	cha'an	see
20:	Cheen	cha'an	see
21:	taki'	saki'	Valladolid
22:	Paapfi	Paapii	daddy
23:	Paapij	Paapii	daddy
24:	Paapij	Paapii	daddy
25:	Taki'	saki'	Valladolid
26:	Manaj	manaj	
27:	Maami	maamii	mommy
28:	Tuupon	túumben (H)	new thing
29:	Tumben	túumben (H)	new thing
30:	Tuupen	túumben (H)	new thing
31:	Taki'	saki'	Valladolid

Child Form		Adult Target	English Gloss
32:	Taki'	saki'	Valladolid
33:	Oyoch	nohoch	big thing
34:	Oyoch	nohoch	big thing
35:	Papij -- Paapíij	Paapii	daddy
36:	Chuku'um	suku'un	big brother
37:	Ook' At'	nook' Adela	Adela's clothes
38:	Ook' At'	nook' Adela	Adela's clothes
39:	Ook' At'	nook' Adela	Adela's clothes
40:	Maami	maamii	mummy
41:	Ook' Aachaa	nook' Benita	Benita's clothes
42:	Peek'	peek'	dog
43:	Peek'	peek'	dog
44:	Peek'	peek'	dog
45:	Poyech	flores (Sp)	flowers
46:	Potech -- poyech	flores (Sp)	flowers
47:	Peek'	peek'	dog
48:	Mami	maamii	mummy
49:	Mami	maamii	mummy
50:	Chuuy	chuuy	to sew
51:	Chuuy	chuuy	to sew
52:	Oee	woje	
53:	Pata'ach	pak'ach	to make tortillas
54:	Jaana	Liana	
55:	Jaana	Liana	
56:	Jana	Liana	
57:	Aak'aam	áak'ab (H)	of the night
58:	Watech ak'aan	ts'o'ok in wa'alik ti'	I told you already,
		teech, aak'ab	of the night
59:	Ak'aan	áak'ab (H)	of the night
60:	Papíi	paapii	
61:	Baak	baak	bone
62:	Tuku'um	suku'un	big brother
63:	Mami	maamii	mommy
64:	Jum pek	Hm, p'eek	I don't want
65:	Aacháa	Benita	
66:	Aacháa	Benita	

Child Form		Adult Target	English Gloss
67:	Jachàa	Benita	
68:	Liá	Lilia	
69:	Aacha	Benita	
70:	Ke'	ki'	nice thing
71:	Ke'	ki	nice thing
72:	Ke'	ki	nice thing

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