Vowel Length and Phonation Contrasts in Chuxnabán Mixe

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1. Introduction

Chuxnabán Mixe is a previously undocumented Mixe-Zoque language spoken by about a thousand people in one village in the Mexican southern state of Oaxaca. The Mixe region is composed of two hundred and ninety communities divided into nineteen municipalities (Torres Cisneros 1997). Chuxnabán belongs to the municipality of Quetzaltepec. Each village speaks a different variety of Mixe, some of which are mutually unintelligible. The varieties differ mostly in their vowel systems (Suslak 2003). For instance, while Totontepec Mixe has nine phonemic vowels (Schoenhals 1982), only six are reported for Coatlán Mixe (Hoogshagen 1959, 1997).

It is unclear at this point to what extent the different Mixe varities constitute distinct languages or dialects, due to insufficient sources of information. While some linguists divide Mixe into four main varities: Lowland Mixe, Midland Mixe, South Highland Mixe, and North Highland Mixe, the Ethnologue lists ten different Mixe languages divided into three larger branches: Eastern Mixe with six languages and Veracruz Mixe and Western Mixe with two languages each (Gordon 2005). Chuxnabán Mixe has been identified by its speakers as Midland Mixe, and is assumed to correspond to Quetzaltepec Mixe in the Ethnologue entry.

Currently, there are only a few published grammars and dictionaries for the many different Mixe languages and dialects spoken (De la Grasserie 1898; Hoogshagen 1997; Ruiz de Bravo Ahuja 1980; Schoenhals 1982; Van Haitsma 1976). The scarce documentation has led to a very small number of studies concerned with the unique and typologically interesting linguistic features of these languages. In particular their rich vowel systems have not been well researched.

The goal of this paper is to describe a previously undocumented variety of Mixe and to lay the ground for future phonetic analyses of the complex vowel systems found in Mixe languages. For this purpose, I will first examine the phonemic phonation contrast between plain, aspirated, and glottalized vowels, which has been reported for other Mixe languages (Hoogshagen 1997; Schoenhals 1982; Van Haitsma 1976). Second, I will measure vowel duration to explore a possible three-way phonemic length distinction. Such a distinction is typologically rare (Ladefoged and Maddieson 1996), and has been attested for Coatlán Mixe (Hoogshagen 1959). The data for this paper stems from weekly two-hour elicitation sessions with a female speaker living in Los Angeles for about four months. It consists of mainly nouns. In addition, published documentation of other Mixe varieties has been consulted.

2. Chuxnabán Mixe Phonemes

Chuxnabán Mixe has seven phonemic vowel qualities. It remains unclear whether schwa is a phoneme or merely an allophone of either the mid front vowel /e/or the central high vowel /ï/. Schwa appears in verbal suffixes and word-finally, but no

minimal pair has been found so far. Another vowel of unclear status is the central rounded [ɵ]. It has been identified only in *yö'öpy* 'to walk' so far, and may be the result of dialect borrowing. The vowel phonemes are summarized in TABLE 1 and represented in the newly established orthography[1]. The corresponding IPA symbols are included to the right in square brackets.

TABLE 1: Chuxnabán Mixe Vowel Phonemes

i [i]	ï [ɨ]	u [u]
e [e]		o [o]
ä [æ]	a [a]	

The following examples illustrate the phonemic contrasts:

(1)	i ~ ï	*tsip*	'war'	*tsïp*	'plant name'		
(2)	a ~ u	*kam*	'field'	*kum*	'sweet fruit'		
(3)	ä ~ u	*tsäk*	'dull'	*tsuk*	'mouse'		
(4)	o ~ u ~ ï	*joon*	'bird'	*juun*	'hard'	*jïïn*	'fire'

Vowel length is phonemic. This is illustrated in examples (5) to (7).

(5)	o ~ oo	*mox*	'stomach'	*moox*	'knot'
(6)	a ~ aa	*kam*	'field'	*kaan*	'salt'
(7)	e ~ ee	*kepy*	'tree'	*keepy*	'bream'

A possible three-way length distinction will be examined in 5. In addition to vowel length, Chuxnabán Mixe shows a phonemic contrast between modal, aspirated, and glottalized vowels. Overall, the following types of syllable nuclei are found[2]: V, VV, Vh, VVh, V^{ʔ}, V^{ʔ}V. These will be described in detail in 3.

Chuxnabán Mixe has fifteen consonantal phonemes, although the rhotic and lateral occur only in loans. The consonants are summarized in TABLE 2.

TABLE 2: Chuxnabán Mixe Consonants

	Bilabial	Alveolar	Postalveolar	Palatal	Velar	Glottal
Plosives	p [p]	t [t]			k [k]	' [ʔ]
Nasals	m [m]	n [n]				
Fricatives		s [s]	x [ʃ]			j [h]
Affricates		ts [ts]	ch [tʃ]			
Rhotic		r [r]				
Lateral		l [l]				
Glides	w [w]			y [y]		

Except for the rhotic, lateral, and the two glides, all consonants can be palatalized[3]. Palatalization functions as a suprasegmental phoneme affecting adjacent vowels. Its

phonetic realization is described in 4. The glottal stop has only been identified as a phoneme when it forms part of a syllable nucleus, hence in V^{ʔ} and V^{ʔ}V.

Allophonic variations similar to those found in other Mesoamerican languages (Campbell et al. 1986) have also been observed. Obstruents, i.e. plosives, fricatives, and affricates, are voiced following a nasal in word-medial position and in intervocalic position, but are always voiceless in word-final position. Nasals are devoiced after voiceless obstruents word-finally. The alveolar nasal /n/ is velarized before a velar plosive /k/. These allophonic variations are illustrated in the following examples[4].

(8)	/atääm/	-> [aˈdæːm]	‘lip’	/jaˈanchuks/ -> [ˈhaʔanˌdʒuks]	‘ant’
(9)	/pätn/	-> [pætn̥]	‘broom’		
(10)	/maank/	-> [maːŋ̊k]	‘son’		

3. Phonation contrasts

Chuxnabán Mixe shows a phonemic phonation contrast between plain, aspirated or breathy, and glottalized or creaky vowels. Phonation contrasts have been associated with various phonetic properties, such as differences in periodicity, intensity, spectral tilt, fundamental frequency, formant frequencies, duration, and airflow (Gordon and Ladefoged 2001). Non-modal vowels generally correlate with increased duration when compared to their modal counterparts (Gordon 1998). Furthermore, breathiness and creakiness are often confined to a portion of the vowel (Gordon and Ladefoged 2001). The phonetic correlates and timing of the non-modal phonation in Chuxnabán Mixe will be examined by looking at waveforms and spectrograms. The duration effects are analyzed in 5.

The phonemic contrast between plain and aspirated vowels is illustrated in the following examples.

(11)	a/aa ~ aaj	*taak*	‘mother’	*taajk*	‘police’
		pak	‘pigeon’	*paajk*	‘bone’
(12)	ï/ïï ~ ïïj	*mïït*	‘they went’	*mïïjk*	‘year’
		mïk	‘strong’	*xïïjk*	‘bean’

Phonetically, the aspirated vowels are characterized by a decay in intensity, especially during the second half of the vowel, and by post-vocalic aspiration, as can be observed by comparing Figures 1 and 2. Similar characteristics have been described for the so-called ballistic syllables: a) a fortis release of the onset consonant, b) a gradual surge and rapid decay in intensity, and c) post-vocalic aspiration. However, Chuxnabán Mixe aspirated vowels show no gradual surge in energy, rather a gradual decay throughout, as in Figures 2 and 3. Unlike in Jalapa Mazatec where non-modal phonation is most prominent in the first portion of the vowel (Silverman 1995, 1997), aspiration in Mixe is confined to the last part of the vowel. Contrary to Mixe languages, though, Jalapa Mazatec has contrastive tone. It has been argued (Silverman 1997) that non-modal phonation in Jalapa Mazatec is realized in the first portion of the vowel for tonal contrasts to be retrieved from the second portion.

Figure 1: Plain VV *taak* ‘mother’

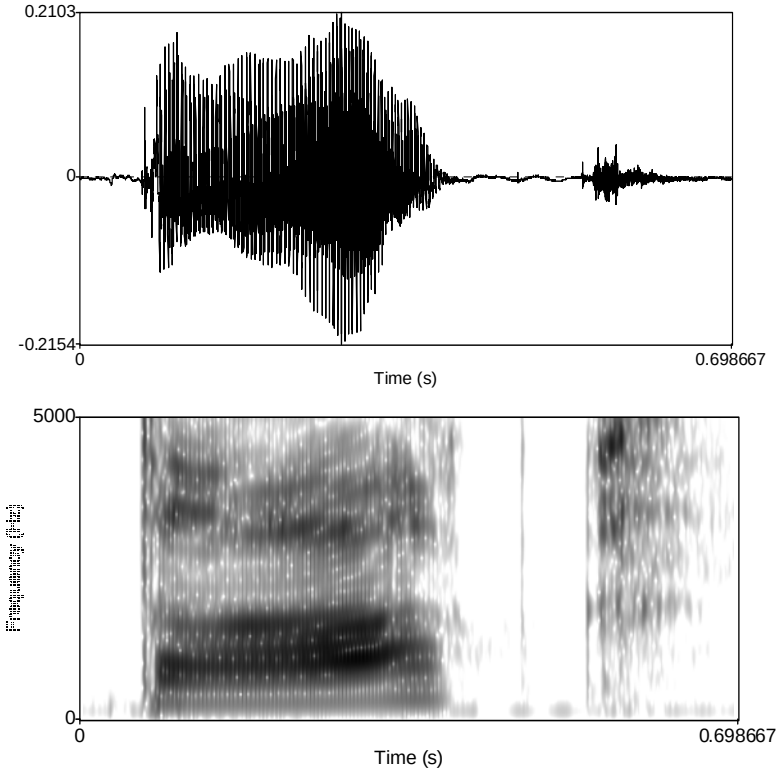


Figure 2: Aspirated VVh *paajk* ‘bone’

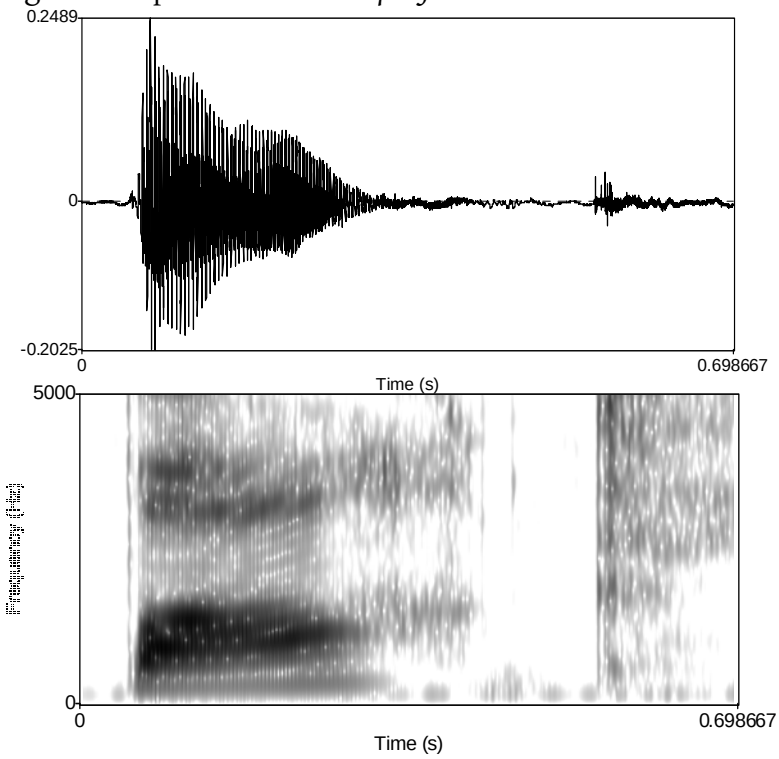


Figure 3: /h/ as onset *jiijp* nose’

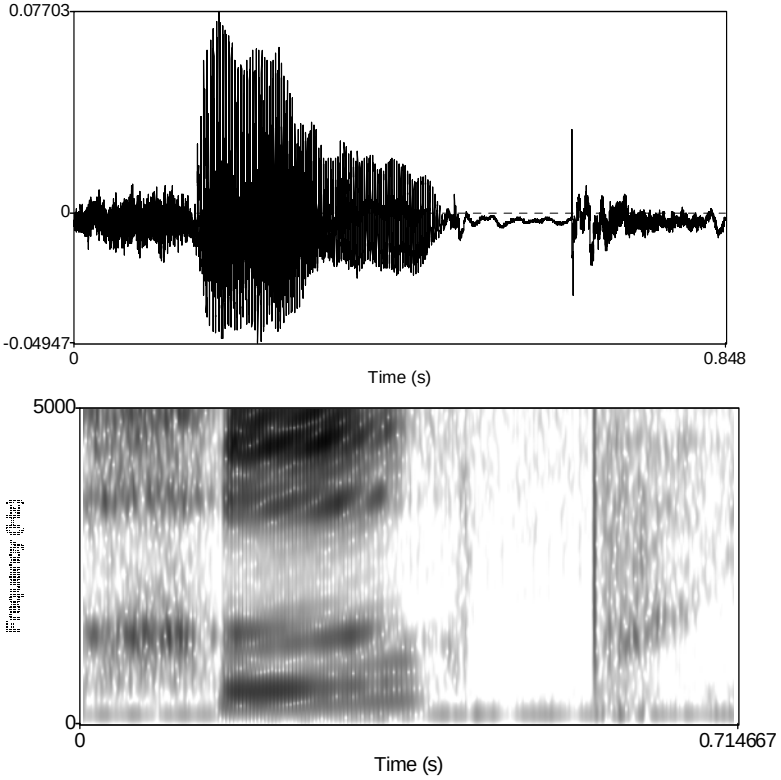
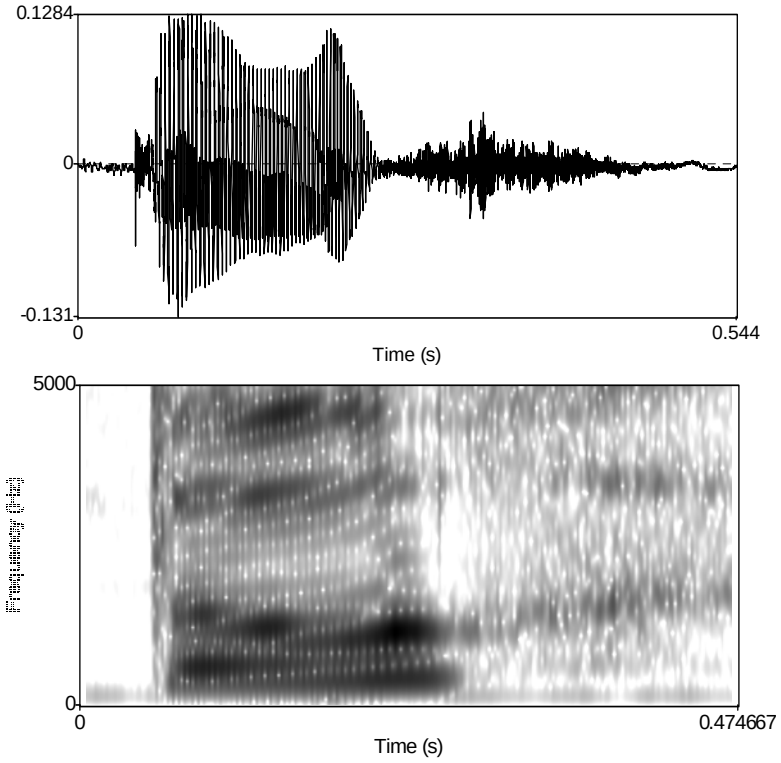


Figure 4: /h/ as coda *tuj* ‘shoot!’



In addition to being a part of the nucleus, [h] can also function as an onset or a coda. Its phonetic realization, nevertheless, is different. The turbulence in airflow is clearly stronger if [h] belongs to the onset or coda; it is also longer in duration. This is shown in Figures 3 and 4. Furthermore, in syllables where [h] functions as a coda, the preceding vowel does not exhibit a steady decay in intensity as in aspirated nuclei.

While non-modal phonation in the form of aspiration occurs only in the last portion of the vowel, glottalization or creakiness can be found in 1) the last, 2) the middle, or 3) the first portion of a vowel. The timing differences are related to differences in function. The first two involve a phonemic contrast between plain, glottalized, and interrupted vowels. This is illustrated in the following examples.

Plain V versus glottalized V^{ʔ}

(13)	a ~ a^{ʔ}	*täp*	'you have'	*käˈp*	'scorpion'
(14)	u ~ u^{ʔ}	*tsuk*	'mouse'	*juˈk*	'owl'
(15)	ï ~ ï^{ʔ}	*mïk*	'strong'	*mïˈt*	'mother-in-law, father-in-law

Plain V or VV versus interrupted V^{ʔ}V

(16)	ii ~ i^{ʔ}i	*kiix*	'woman'	*piˈix*	'tail'
(17)	uu ~ u^{ʔ}u	*puuy*	'seat'	*puˈuy*	'table'
(18)	ï ~ ï^{ʔ}ï	*tsïp*	'plant name'	*tsïˈïp*	'plant when getting cut'

Glottalized V^{ʔ} versus interrupted V^{ʔ}V

(19)	u^{ʔ} ~ u^{ʔ}u	*puˈts*	'yellow'	*puˈuts*	'infection'

Aspirated Vh versus interrupted V^{ʔ}V

(20)	aaj ~ a^{ʔ}a	*paajk*	'bone'	*paˈak*	'sweet'

In glottalized vowels, the glottal stop is a part of the nucleus, and it is realized phonetically as creakiness during the last portion of the vowel. This can be observed by comparing Figures 5 and 6. The creakiness correlates with a decay in intensity. Interrupted vowels, as in Figure 8, are characterized by creakiness, as well as a decay in intensity, during the middle portion of the vowel, followed by a re-articulation of the vowel. Glottalized and interrupted vowels have also been reported for Copala Trique, a Mixtecan language. Interestingly, Copala Trique also exhibits interrupted vowels of the form VhV (Silverman 1997:236), not found in Chuxnabán Mixe.

Vowel-initial words insert a glottal stop at the beginning to function as an onset. The glottal stop is phonetically realized as creakiness during the first portion of the vowel. It seems that syllable onsets are obligatory in Chuxnabán Mixe, the same as in other Mixe languages (Crawford 1963, Schoenhals 1982, Van Haitsma 1976). However, whether this is a general rule in Chuxnabán Mixe, still needs to be examined. Glottal stops in coda position have not been found. Hence, a contrast between a vowel-final glottal stop that forms part of the nucleus and one that represents a coda has not been observed, such as for the aspirated vowels where coda [h] is different from nucleus [h].

Figure 5: Plain V *täp* ‘you have’

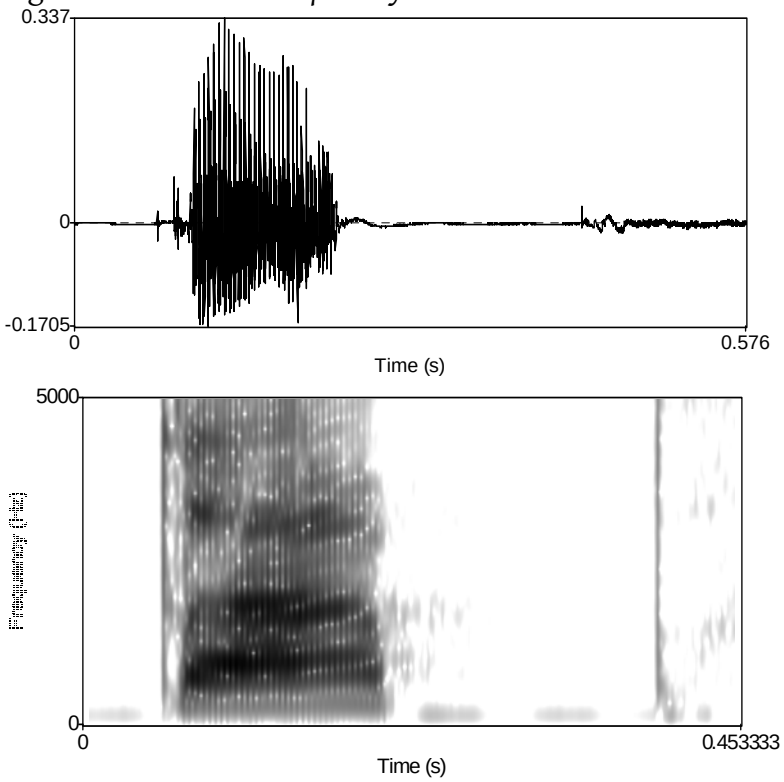


Figure 6: Glottalized V^{ʔ} *kä'p* ‘scorpion’

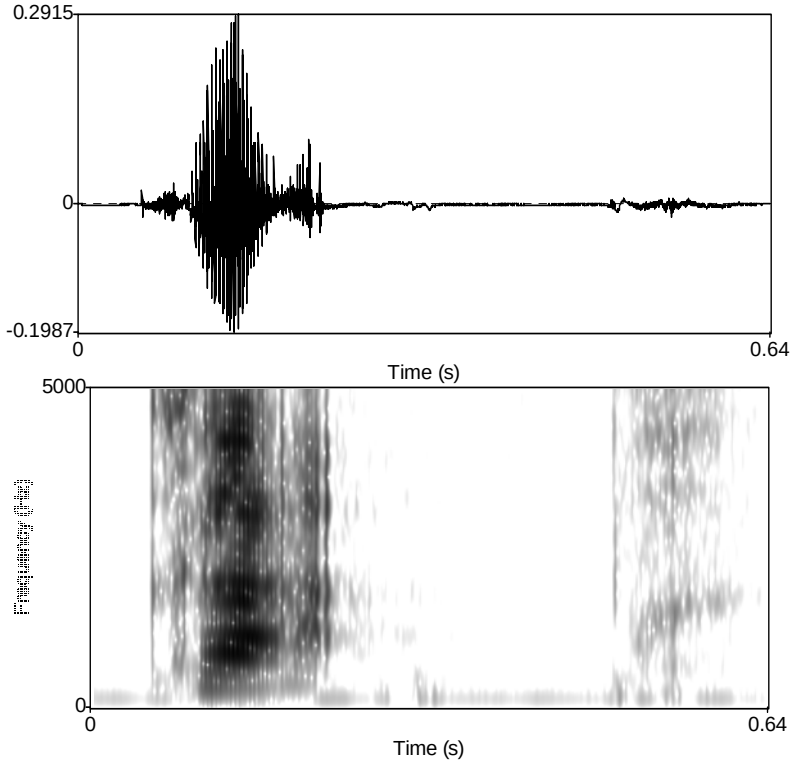


Figure 7: Plain VV *puuy* 'seat'

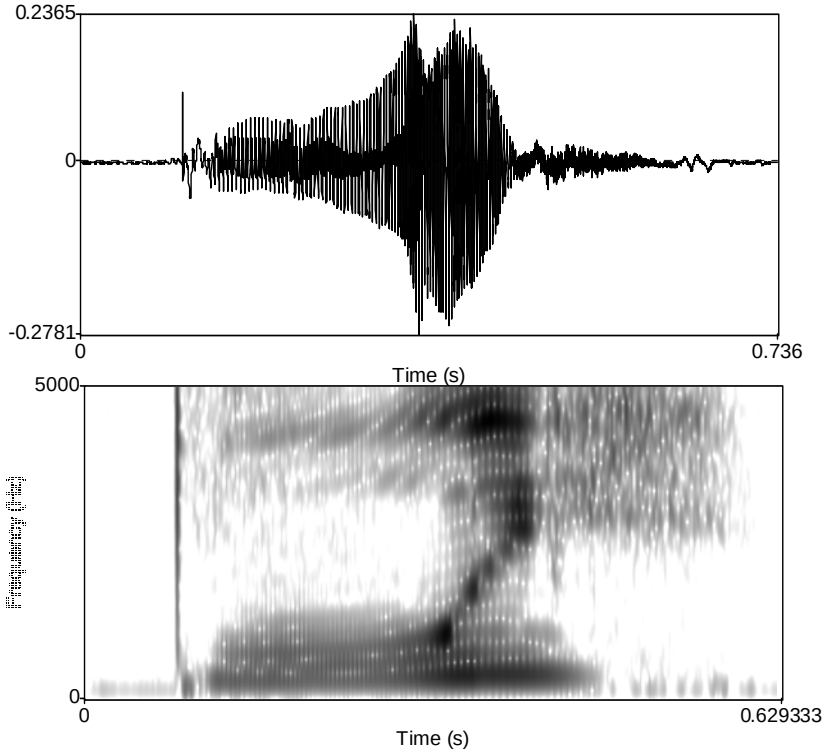
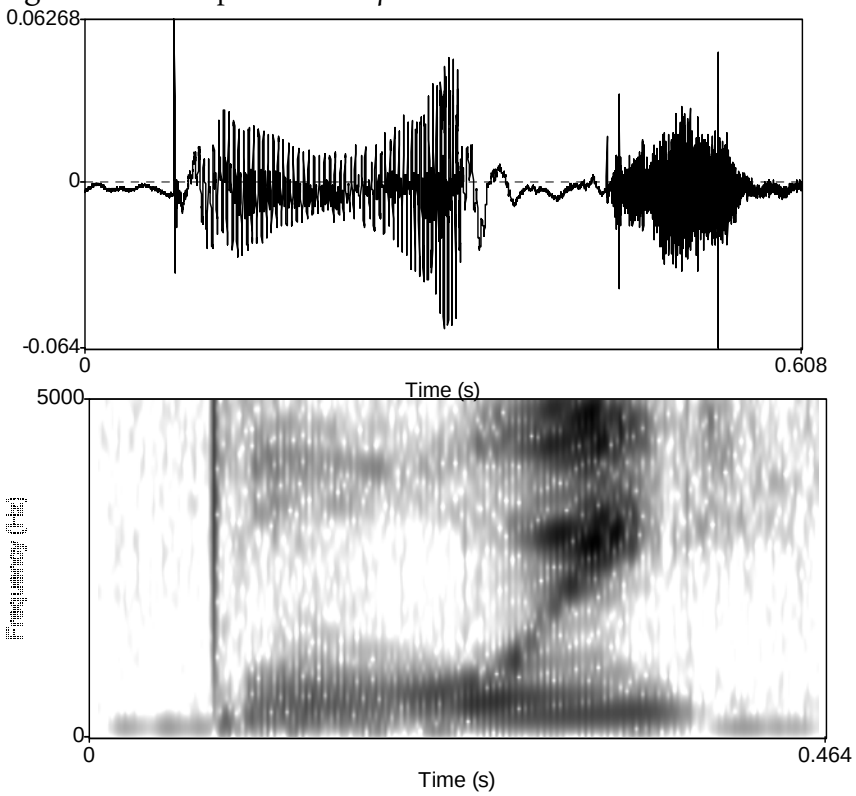


Figure 8: Interrupted V^{ʔ}V *puˈuts* 'infection'



4. Palatalization

Palatalization in Chuxnabán Mixe, as in other Mixe languages (Hoogshagen 1997; Schoenhals 1982; Van Haitsma 1976), is a suprasegmental phoneme affecting not only the palatalized consonant, but adjacent vowels as well. This is manifested by an onglide and an offglide, if the palatalized consonant occurs word-medially. Phonetically, these changes in vowel quality can be characterized by a lowering of the first formant and a raising of the second formant before a palatalized consonant. Raising of the second formant can be seen in Figure 10. Fronting and raising are characteristic of high front vowels. The following examples illustrate the effects of palatalization.

(21)	kachy	[kajtʃ]	'rip'
	paajk	[pa:hk]	'bone'
	kachypaajk	['kajtʃ'pja;hk]	'rip bone'

In addition to a change in vowel quality, the release burst in a palatalized consonant is different. While it shows an even distribution of turbulence in a non-palatalized consonant, the distribution of the release burst of a palatalized consonant stays in the higher frequencies. This can be observed by comparing Figures 9 and 10.

Figure 9: Non-palatalized coda consonant tsuk 'mouse'

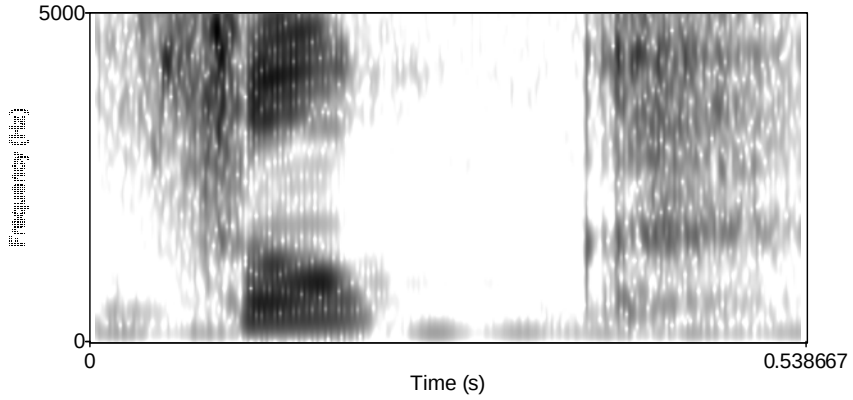
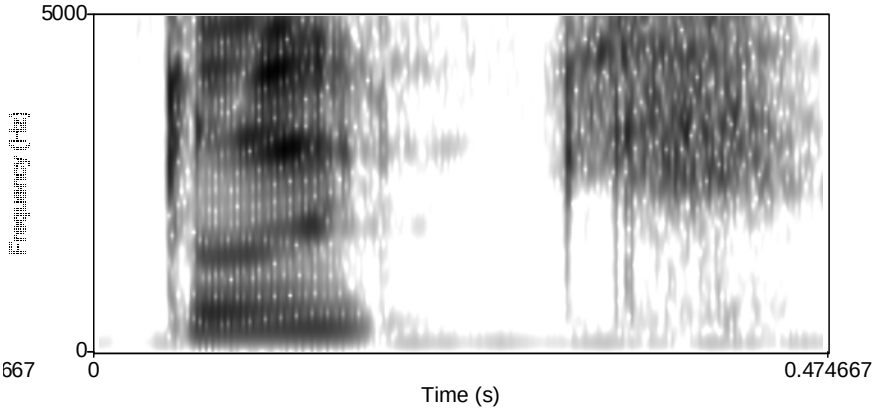


Figure 10: Palatalized coda consonant tuky 'to cut'



5. Vowel length

Coatlán Mixe and San José El Paraíso Mixe, both closely related to Chuxnabán Mixe, have been described as having a three-way phonemic vowel length distinction (Hoogshagen 1959; Van Haitsma 1976), which is typologically rare. Such a phonemic distinction has also been reported for Estonian (Lehiste 1970) and Yavapai (Tomas and Shaterian 1990). In Estonian, however, the third degree of vowel length is dependent on syllable structure and word patterning (Lehiste 1970). Thomas and Shaterian (1990) conclude that in Yavapai vowel length is not predictable from other phenomena present in the language, such as pitch factors or syntactic category.

Vowel duration can be influenced by a number of factors, such as vowel position and the number of syllables in a word, vowel quality, and the following consonant, among others. Hoogshagen (1959) examined possible effects on vowel length for Coatlán Mixe and found that the three-way distinction does not depend on syllable structure, vowel quality, preceding or following consonants, stress, or intonation. However, the three-way contrast is hard to hear for speakers, according to Hoogshagen (1997), and is, therefore, not represented in the orthography. A phonemic distinction between short and long vowels has been attested for all Mixe varieties, and is represented in their orthographies.

For the purpose of examining a possible three-way phonemic length contrast in Chuxnabán Mixe first the minimal triplets cited in Hoogshagen (1959) for Coatlán Mixe were elicited. Second, a pilot study has been conducted with data from one female speaker. For this study a list of a hundred and ninety-five words has been assembled with all possible syllable nuclei, i.e. all vowel qualities in all phonation contrasts, and codas, i.e. all consonants in simple and palatalized form, as well as combinations thereof, where examples were available. Each target word was recorded three times in a carrier phrase. To avoid any influencing factors, such as syllable structure, vowel quality, or coda consonant, these are kept constant in the comparisons. Thus, only monosyllabic words were recorded, length ratios were examined rather than duration across vowel qualities, and codas were split into groups considering voicing and palatalization, i.e. voiced or voiceless and palatalized or not. While low vowels may be longer than other vowels, it is expected that length ratios for all vowel qualities are equal. Given that voiced codas may trigger vowel lengthening and that palatalization affects surrounding vowels, hence might also affect vowel length, only data sets with codas in the same group were compared.

The elicitation results for the possible triplets are summarized in TABLE 3.

TABLE 3: Minimal triplets from Coatlán Mixe in Chuxnabán Mixe

	V		VV		VVV	
Coatlán	*pox*	‘guava’	*poox*	‘spider’	*pooox*	‘knot’
Chuxnabán	*pox* 0.239 s	‘guava’	*poxm* 0.202 s	‘spider’	*moox* 0.365 s	‘knot’
Coatlán	*pet*	‘climb’	*peet*	‘broom’	*peeet*	‘Peter’
Chuxnabán	*pät* 0.139 s	‘climb’	*pätn* 0.132 s	‘broom’	*päät* 0.281 s	‘Peter’

Only two of the triplets found in Hoogshagen (1959) have yielded comparable results in Chuxnabán Mixe. From TABLE 3 it is apparent that they do not show a three-way length distinction. While there is a clear difference between short and long vowels, in accord with short and extra-long vowels in Coatlán, the words with long vowels in Coatlán *poox* 'spider' and *peet* 'broom' correspond to words with complex codas in Chuxnabán, *poxm* and *pätn* respectively, having the shortest vowels of the three, i.e. with a duration of 0.202 and 0.132 seconds accordingly. Overall, the elicitation of possible triplets has not provided any proof for a three-way length contrast in Chuxnabán Mixe.

Even though no triplets with a phonemic three-way contrast could have been identified, duration measurements might give some insights into vowel length. The pilot study with a hundred and ninety-five different words has revealed that contrary to expectations coda voicing and palatalization do not have any effects on vowel length. Rather, vowel-initial words and words having a postalveolar fricative /x/ as coda have longer vowels. This is illustrated in the graphs in Figures 11 and 12.

Figure 11: Measurement results for /u/ by syllable structure VC versus CVC

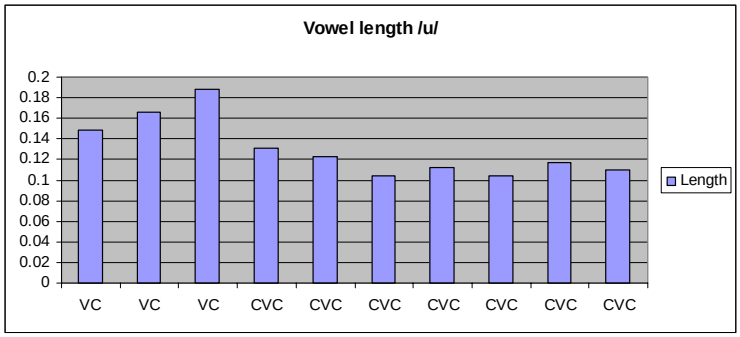
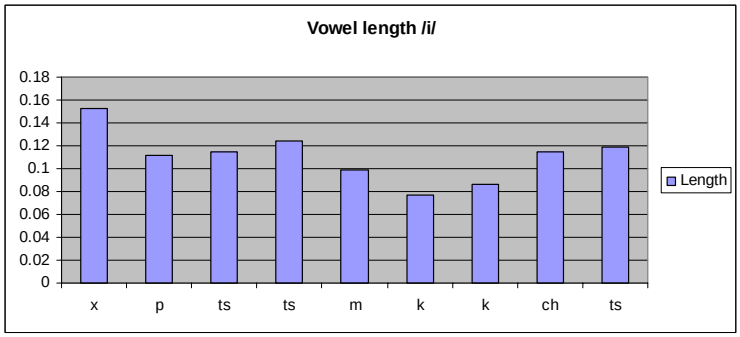
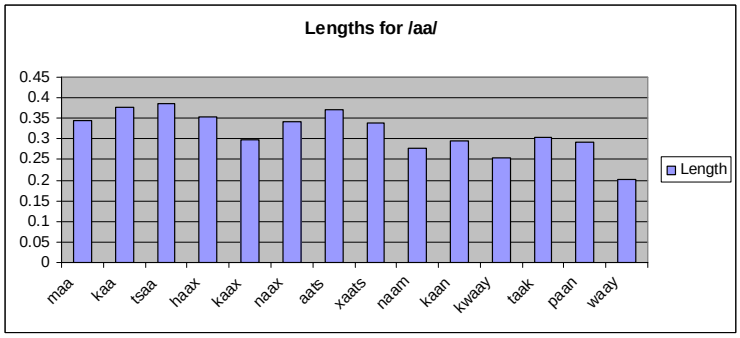


Figure 12: Measurement results for /i/ by coda



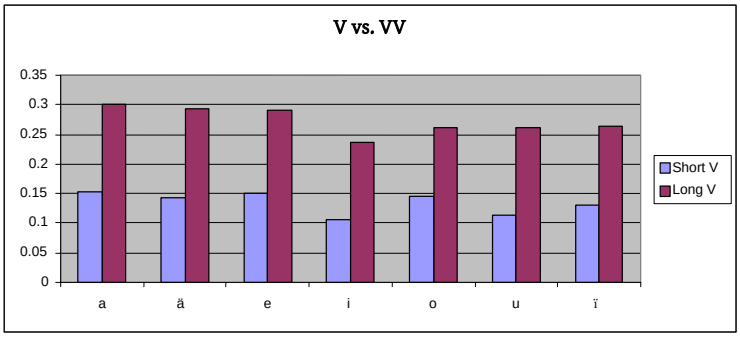
The long vowels show more variation than the short vowels. In addition to lacking onsets or having a coda /x/, the absence of a coda seems to affect vowel length. If words with any of these three confounding factors are excluded, there is still some variation for the long vowel /aa/, as in Figure 13. Whether this stems from a three-way length contrast remains to be examined. It has to be noted that some words have glides as onsets or codas, making it difficult to find the boundaries for the measurements.

Figure 13: Measurement results for /aa/



Overall, the length ratios for each vowel quality remain constant when all confounding factors are excluded. This is illustrated in Figure 14.

Figure 14: Length rations V / VV for all vowels



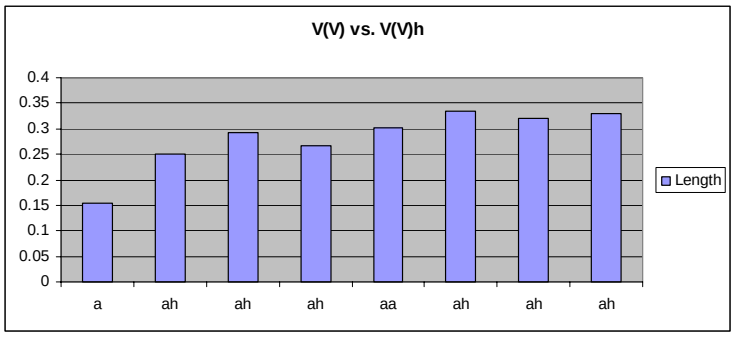
The duration effects of non-modal phonation have only been examined to a limited degree, as there are not enough examples for a detailed study. In general, the glottalized vowels are longer than their short modal counterparts, but the interrupted vowels are shorter than their long modal counterparts. Hence, non-modal phonation does not always correlate with increased duration as in other languages (Gordon and Ladefoged 2001). Nevertheless, these results are not confirmed across vowel qualities and the duration effects of glottalization need further investigation.

The results for the aspirated vowels are equally inconclusive. While there seems to be a distinction between short and long aspirated vowels, no examples have been found where this proves to be phonemic. The duration of aspirated vowels circles around long modal vowels rather than the short ones, as is summarized in Figure 15.

To sum up, a three-way phonemic length contrast has not been found for Chuxnabán Mixe. Vowel lengthening is triggered by either lack of onset, lack of coda, or by having a coda /x/, rather than by palatalization or voiced codas. The modal long vowels show some variation even after determined influencing factors have been excluded. The duration results for modal versus non-modal phonation can be

summarized as follows. Short modal vowels as always shorter than long vowels and any corresponding non-modal vowels, i.e. short glottalized, interrupted, and aspirated counterparts. Interrupted vowels are longer that short modal vowels, but shorter than long modal vowels. A phonemic difference between short and long glottalized vowels V$^{?}$ and VV$^{?}$ and short and long aspirated vowels Vh and VVh, both attested in other Mixe languages, still needs to be examined.

Figure 15: Duration of aspirated vowels compared to modal vowels for /a/



6. Conclusions

In this paper I have shown that phonation contrasts in Chuxnabán Mixe, the same as in other Mixe varieties, are phonemic resulting in at least the following syllable nuclei: V, VV, Vh, V$^{?}$, and V$^{?}$V. In non-modal vowels, non-modal phonation is realized at the end or in the middle portion of the vowel if it forms part of the nucleus. Laryngeal timing for creakiness is dependent on the function of the glottal stop.

No evidence has been found for a three-way phonemic vowel length contrast. While the duration of long vowels shows at least some variation, it seems unlikely to result from a three-way length contrast. The duration measurements have revealed certain factors, such as syllable structure and coda type, that can trigger vowel lengthening. Further investigation is needed to determine whether short and long glottalized and short and long aspirated vowels are in phonemic contrast.

By describing and examining Chuxnabán Mixe vowels, this work intends to lay the ground for future phonetic analyses of the complex and typologically interesting vowel system found in this and other Mixe languages.

Notes

[1] A practical orthography has been established in collaboration with the speaker, based on local literacy efforts (INEA 1994 and 1997), descriptions of other Mixe varieties, and Spanish.
[2] Evidence for a phonemic distinction between Vh and VVh still needs to be found.
[3] Palatalization is represented in the orthography by a palatal glide /y/ following the palatalized consonant.
[4] The voiced plosives [b, d, g] are represented in the orthography.

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