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## The Historical Source of an Irregular Mixtec Tone-Sandhi Pattern

Barbara E. Hollenbach

### Introduction

The Mixtec people of Oaxaca, Mexico, trace their history perhaps as far back as the late seventh century A.D. in their pictorial codices, and their language has been written using the roman alphabet since at least 1567, when the Dominican friar Benito Hernández published a Mixtec catechism containing 189 folios. Two other Dominican friars contributed heavily to our knowledge of sixteenth-century Mixtec; in 1593, Francisco de Alvarado published a vocabulary, and in the same year, Antonio de los Reyes published a grammar.

Both Alvarado and De los Reyes were clearly aware that there were tone contrasts in Mixtec. In his prologue Alvarado stated: "In the accent many words vary their meaning, and some not only in having or losing a

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I would like to express my appreciation to Bruce Hollenbach, John Daly, Mike Cahill, and Inga McKendry for reading earlier drafts of this chapter and suggesting improvements in it.

written accent, but even in pronouncing a word with softness or with the voice full."<sup>1</sup>

De los Reyes (1593) referred to tone in his chapters 17 and 18, which talk about otherwise homophonous pairs or groups of verbs. He said it was necessary to look at the accents, and if there were none, to understand that the pronunciation was *llana*, literally, 'flat', but also used in Spanish for a word with penultimate stress (p. 54). One of his example pairs is *sānu* for 'grow, present tense', and *sānu* for 'break, present tense'. These two roots continue to show a tone difference in modern Mixtec; they have the following forms in Mixtec of Magdalena Peñasco, shown in (1). (In this study, high tone is marked with an acute accent, mid tone with a macron, and low tone with an underline, for example, á ā ā.)<sup>2</sup>

- (1) a. *jā'nū* 'grow'  
 b. *jā'nū* 'fold, break'<sup>3</sup>

Farther down on page 54, De los Reyes gave a tone triplet: "*Yosacundi*, with the voice low, means 'to laugh', and *yosacundi*, higher, means 'to cry'; *yosacundi*, with mid voice, means 'wear around the neck, like beads' and 'to make noise (wind)', all of which have the future tense form *quacu*, with the difference placed in the pronunciation."<sup>4</sup>

Apart from the above intriguing references to tone, however, no one who wrote in or about Mixtec during the Colonial period made any serious attempt to write tone, or to analyze it. It remained for linguists of the twentieth century to analyze the tonal systems that form an integral part of this language family. The pioneer study of Mixtec tone was carried out by Kenneth Pike in the 1930s and 1940s in San Miguel el Grande, and presented on pages 77-94 of his book *Tone Languages*, published in 1948. Using the techniques for tone analysis developed by Pike, a number of other linguists working with SIL International analyzed tonal systems in

<sup>1</sup>In the original Spanish this is: "En el acento varian muchas palabras la significacion, y algunas no solamente en tener o perder una tilde pero aun en pronunciar el punto con blanda o con la voz llena."

<sup>2</sup>Throughout this study Mixtec examples are adapted to the orthography adopted by *Vé e Tu'un Savi (Academia de la Lengua Mixteca)*, the Mixtec language academy. The letter *j* represents a velar fricative, the letter *x* represents an alveopalatal sibilant, the raised vertical stroke (´) represents glottal stop, and the letter *n* at the end of a word represents nasalization. Glottal stop is not written at the beginning of a word.

<sup>3</sup>I have chosen to adhere closely to the phonetic facts and write the tone that is pronounced on each syllable. Tone can, of course, be viewed in more abstract ways, but my goal has been simply to present the raw material clearly, and let linguists who have more interest in theory analyze it in the way that they prefer.

<sup>4</sup>In the original Spanish this is: "*Yosacundi*, la voz baxa, q. d. reirse y *yosacundi*, mas alta, q. d. llorar, *yosacundi*, media voce. q. d. traer al cuello como cuentas y hazer ruido el viento, los quales todos hazen en futuro quacu, con la diferencia puesta en la pronunciacion."

various languages of Mesoamerica, including several other variants of Mixtec.

### Tone Sandhi in San Miguel el Grande Mixtec

The San Miguel tonal system has three levels: high, mid, and low. Perhaps the most salient characteristic of this system is the way in which some words raise the tone of the following word. Pike described this by positing an apparently arbitrary classification of words into those which do not cause tone changes (subclass a) and those which do (subclass b) (1948:77–81). More recent approaches to the study of tone posit an unattached (floating) high tone at the end of the words in subclass b, which moves to the following word and affects its tone pattern.

The examples in (2), which Pike gives on pages 77, 80, and 81, show this progressive tone sandhi.

- (2) a. *yūkū* (b) 'mountain' + *vīnā* 'now' → *yūkū vīnā* 'mountain now'  
 b. *kēē* (b) 'eat (future)' + *súchí* 'child' → *kēē súchí* 'the child will eat'  
 c. *kēē* (b) 'eat (future)' + *kōō* 'snake' → *kēē kōō* 'the snake will eat'

In each of the words given so far, the floating high tone replaces the first tone of the following word. In a few cases, however, the change is somewhat less straightforward. The most difficult case is found in words with a mid-low tone pattern and a (C)VCV syllable pattern.<sup>5</sup> The mid-low pattern is changed to mid-high following a word of subclass b, as seen in this example given on page 81.

- (3) *kēē* (b) 'eat (future)' + *īso* 'rabbit' → *kēē īso* 'the rabbit will eat'

Note that mid-low changes to high-low in words with other syllable patterns, as in the example with 'snake' in (2c), which has the syllable pattern (C)VV. What appears to be happening in words like 'rabbit' is that the high tone jumps over the mid tone, leaving it unaffected, and changes the low tone in the second syllable to high.

Even though Pike described this irregular change clearly, he did not offer any explanation for it, and it has remained puzzling to subsequent

<sup>5</sup>Pike points out that words with a (C)VV pattern that have dissimilar vowels act like (C)VCV words, rather than like (C)VV words with identical vowels (1948:81). This can be explained historically: San Miguel words like *yāu* 'hole' developed from (C)VCV words; the Magdalena form of 'hole' is *yāvī*.

generations of linguists working to develop a theory of tonal systems. Goldsmith, for example, in his book on Autosegmental Phonology (1990), presents a theory claiming that tones are on a separate tier from the segments, but that they are associated with one or more segments by rules, and that tone rules can change these associations. The correctness of this formulation is certainly not in doubt. It is essentially a return to Pike's claim that tone is suprasegmental, made in 1945 in his book *The Intonation of American English*. (This return came after a period in which mainstream linguistic theory tried without success to handle tone as a feature of vowel segments.)

One of Goldsmith's major principles is, "Association lines in a given representation may not cross" (1990:47). And yet, when he considered the San Miguel data (1990:20–26), they seemed to violate this principle, and he posited a tonal metathesis rule to associate the high tone to the second syllable of words like *iso* 'rabbit', rather than to the first syllable (1990:24–26).

Chalcatongo de Hidalgo, a Mixtec town located about five kilometers east of San Miguel el Grande, shares this same irregular tone change. In the description of tone in her grammar of Chalcatongo Mixtec, Macaulay (1996:32–39) cited both Pike and Goldsmith, and she essentially adopted Goldsmith's device of a tonal metathesis rule (1996:37).

Tranel (1995), working in Optimality Theory, tried to account for the irregularity by positing that mid tone is transparent to the association of floating high tones. He recognized, however, that not all instances of mid tone are transparent, and he therefore proposed various ranked constraints that interact with this principle.

In this essay I offer a historical explanation for this irregular tone change, based on my study of the Mixtec of Magdalena Peñasco, a town about twenty-three kilometers north of Chalcatongo. I claim that the irregularity is a result of tone movement to the right. Furthermore, based on the tonal behavior of certain loanwords, it seems clear that this movement took place after Spanish contact in the sixteenth century.

### Tone Sandhi in Magdalena Peñasco Mixtec

The Mixtec spoken in Magdalena Peñasco (sometimes referred to simply as Magdalena) shows sandhi similar to San Miguel, but the patterns are somewhat more complex. Not only are there floating high tones (*h*), but there are also floating low tones (*l*); and both kinds appear to subdivide

depending on how far their influence extends. Some of these features provide clues to the historical development of the current irregular forms.

As in San Miguel, there are words in Magdalena that end with a floating high tone that causes a tone change in the following word. Some of these words have a mid tone followed by the floating high. Just as in San Miguel, the mid-low tone pattern becomes mid-high in following words with a (C)VCV syllable pattern, and high-low in words with other patterns, as shown in (4).

- (4) (C)VCV *yūū* (h) 'mouth' + *īso* 'rabbit' → *yūū īso* 'the rabbit's mouth'  
 (C)VV *yūū* (h) 'mouth' + *mā'ā* 'raccoon' → *yūū mā'ā* 'the raccoon's mouth'  
 (C)V'CV *yūū* (h) 'mouth' + *ndū'vā* 'valley' → *yūū ndū'vā* 'the edge of the valley'  
 (C)VV *yūū* (h) 'mouth' + *kōo* (h) 'snake' → *yūū kōo* (h) 'the snake's mouth'

Other words have a low tone followed by a floating high. In these words, the mid-low tone pattern of the following word changes to low-high, rather than mid-high. One way to view this is that the low tone spreads to the first syllable of the next word and takes the place of a default mid.

- (5) (C)VCV *kāā* (h) 'will eat' + *īso* 'rabbit' → *kāā īso* 'the rabbit will eat'

There is strong evidence in Magdalena that the two forms of 'rabbit' that result from the sandhi rules end with a floating low tone, and that they should therefore be written *īso* (l) and *īso* (l). This floating low tone can be identified historically with the low tone on the final syllable of the basic form of the word. I posit the following scenario.

At some point in the history of Mixtec, words of all syllable patterns with the mid-low tone pattern changed to high-low following a floating high tone. At this stage, the word for 'rabbit' was changed from \**īso* to \**īso*. Words with the (C)VCV syllable pattern like 'rabbit' then underwent a second change, which involved the movement of the high tone one syllable to the right, i.e., the high tone lagged behind the segments, and it was pronounced with the following syllable. This movement left the first syllable without a tone, and the low tone without a syllable. To supply a tone for the first syllable, either the low tone on the final syllable of the previous word was spread to the right, or a default mid tone was supplied. The "orphaned" low tone that was pushed off the end of the word became a floating low, with the power to effect certain changes in following words.

I turn now to the evidence supporting my claim that there is a floating low tone at the end of these two forms in present-day Magdalena Mixtec. This floating low tone surfaces only in restricted environments, two of which we will consider here.

One environment that shows the effect of this low tone is a possessive phrase with an enclitic pronoun as the possessor. A pronoun like *sá* 'I, me, my' with basic high tone is lowered to low following words with mid-high or low-high that result from this sandhi rule. The original high tone of this pronoun is not, however, lost, but is retained as a floating high tone following the low tone, and it has the power to affect the tone of a following word. Example (6) gives a derivation that shows the results of two rules that move tones to the right (UR = underlying representation; SF = surface form):

(6)	UR	<i>yū'ū</i> ( <i>h</i> )	‘mouth’	+	<i>īso</i>	‘rabbit’	+	<i>sá</i>	‘my’
		<i>yū'ū</i>			<i>īso</i> ( <i>l</i> )		+	<i>sá</i>	
	SF	<i>yū'ū</i>			<i>īso</i>			<i>sā</i> ( <i>h</i> )	
			‘the mouth of my rabbit’						

First, the floating high tone on *yū'ū* (*h*) effected a change from *īso* to *īso* (*l*), and then the floating low tone on *īso* (*l*) effected a change from *sá* to *sā* (*h*).

The derivation shown in example (7) includes a further change effected by the floating high tone at the end of the changed form *sā* (*h*), giving three stages of tone movement to the right.

(7)	UR	<i>ndūkū</i> ( <i>h</i> )	‘will look for’	+	<i>īso</i>	‘rabbit’	+	<i>sá</i>	‘my’	+	<i>dē</i>	‘him’
		<i>ndūkū</i>			<i>īso</i> ( <i>l</i> )		+	<i>sá</i>		+	<i>dē</i>	
		<i>ndūkū</i>			<i>īso</i>			<i>sā</i> ( <i>h</i> )		+	<i>dē</i>	
	SF	<i>ndūkū</i>			<i>īso</i>			<i>sā</i>			<i>dé</i>	
			‘my rabbit will look for him’									

(The chain of tone changes ends with *dé*, which does not affect the tone of other words that could occur in this sentence, and therefore does not appear to have a floating low tone.)

Pronouns with high tone in their basic form, like *sá*, are not changed to low following an overt low tone on the final syllable, only following a floating low.

(8)	<i>īso</i>	‘rabbit’	+	<i>sá</i>	‘my’	→	<i>īso</i>	<i>sá</i>	‘my rabbit’
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The second environment that shows the effect of the floating low tone at the end of words like *isó* (l) is in a noun phrase that contains an adjective with a high-high tone pattern. These adjectives have the high-high pattern following high<sup>6</sup> or mid tone, and they are changed to low-high following any low tone, including the floating low tone at the end of the mid-high and low-high patterns that result from the sandhi rule. The examples in (9) and (10) show the adjective *kujín* 'white' in its basic high-high tone pattern. The examples in (11) and (12) show the adjective *kujín* 'white' in its changed low-high tone pattern.

(9) Following high tone:

*ná'nú* 'grandmother' + *kujín* 'white' → *ná'nú kujín* 'white grandmother'  
*vílú* 'cat' + *kujín* 'white' → *vílú kujín* 'white cat'

(10) Following mid tone:

*vě'ě* 'house' + *kujín* 'white' → *vě'ě kujín* 'white house'

(11) Following a low tone on the final syllable:

*isó* 'rabbit' + *kujín* 'white' → *isó kujín* 'white rabbit'  
*mā'a* 'raccoon' + *kujín* 'white' → *mā'a kujín* 'white raccoon'

(12) Following a floating low tone:

a. UR *yū'ū* (h) 'mouth' + *isó* 'rabbit' + *kujín* 'white'  
           *yū'ū*                            *isó* (l)           + *kujín*  
 SF *yū'ū*                            *isó*                    *kujín*  
   'the white rabbit's mouth'

b. UR *kāā* (h) 'will eat' + *isó* 'rabbit' + *kujín* 'white'  
           *kāā*                            *isó* (l)           + *kujín*  
 SF *kāā*                            *isó*                    *kujín*  
   'the white rabbit will eat'

These examples containing enclitic pronouns and adjectives show that the low tone on the second syllable of the basic form of nouns like *isó* 'rabbit' was not changed to high tone, as it appears to have been from

<sup>6</sup>The study of Magdalena Mixtec tone is not yet complete, but it appears that all words that end in a high tone have some sort of floating tone associated with them. The floating tones are not marked in the present study, except for the low tone that follows the mid-high and low-high tone patterns.



synchronic data in San Miguel, but has rather moved to the right to become a floating tone that surfaces under certain conditions.

### Tone Patterns in Spanish Loanwords in Magdalena Peñasco Mixtec

Many Spanish words have entered Mixtec since the sixteenth century, and in the process they have undergone a variety of phonological adaptations. One of these adaptations is that each stress pattern found in Spanish source words correlates with a Mixtec tone pattern. Even though these correlations are quite consistent, they are not what we might logically expect. Consider the examples of Spanish words with penultimate stress and their Mixtec form in (13).

(13)	<i>mesa</i>	'table'	<i>mēsá</i>
	<i>lápiz</i>	'pencil'	<i>lāpí</i>
	<i>barato</i>	'inexpensive'	<i>vārātú</i>
	<i>presidente</i>	'president'	<i>prēsīdēndé</i>

In that stressed syllables in Spanish tend to have a higher pitch than unstressed syllables, we might expect the stressed syllable of the Spanish word to have a high tone in Mixtec, but this is not the case. Instead, we find a high tone on the syllable following the stressed syllable. Other syllables in the word have mid tone.

A similar pattern is found on words with antepenultimate stress:

(14)	<i>báscula</i>	'scale'	<i>vāskúla</i>
	<i>lámina</i>	'corrugated roofing'	<i>lāmína</i>
	<i>máquina</i>	'machine'	<i>mākína</i>

As in words with penultimate stress, a high tone occurs on the syllable to the right of the original stress, and syllables preceding the high have mid tone. The final syllable has low tone.

When Spanish words that have stress on the final syllable enter Mixtec, the vowel of the final syllable is doubled, and it takes a high-low tone sequence. Syllables preceding the final syllable take mid tone.

(15) <i>mīl</i>	'thousand'	<i>mīl</i>
<i>fiscal</i>	'a church official'	<i>vēskáal</i>
<i>camarón</i>	'shrimp'	<i>kāmārōon</i>

Note that there is a low tone at the end of Mixtec words corresponding to two of the three Spanish stress patterns. Only words with penultimate stress lack this final low tone. There is evidence, however, that loanwords with penultimate stress have a floating low tone at the end, because they have the same lowering effect on pronouns and adjectives as the words with the mid-high and low-high patterns that result from tone sandhi. Compare the examples in (16) with those in (6) and (12).

(16) <i>mēsá (l)</i> 'table'	+ <i>sá</i> 'my'	→ <i>mēsá sá (h)</i> 'my table'
<i>mēsá (l)</i> 'table'	+ <i>kujín</i> 'white'	→ <i>mēsá kujín</i> 'white table'

The underlying representation of such loanwords should therefore include a floating low tone: *mēsá (l)*, *lāpí (l)*, *vārátú (l)*, *prēsídēndé (l)*.

Note that the tone pattern found in two-syllable loanwords like *mēsá (l)* and *lāpí (l)* is identical to that found as a result of the tone-sandhi rule described in the previous section. Note also that these words have a (C)VCV syllable pattern. I propose that both groups of words have undergone the same movement of high tone to the right, and I posit the following scenario for loanwords.

Originally, all loanwords entered Magdalena Mixtec with a high tone on the syllable that was stressed in the Spanish source word. All preceding syllables received mid tone (perhaps a default), and the following syllables received low tone. In the case of words with stress on the final syllable, the final vowel was lengthened and received a high tone followed by a low tone. These words had the same form that they now have, but the examples given above with penultimate and antepenultimate stress had the following forms.

(17) With penultimate stress:		
<i>mesa</i>	'table'	* <i>mēsá</i>
<i>lápiz</i>	'pencil'	* <i>lāpí</i>
<i>barato</i>	'inexpensive'	* <i>vārátú</i>
<i>presidente</i>	'president'	* <i>prēsídēndé</i>

## (18) With antepenultimate stress:

<i>báscula</i>	'scale'	* <i>váskula</i>
<i>lámina</i>	'corrugated roofing'	* <i>lámīna</i>
<i>máquina</i>	'machine'	* <i>mákīna</i>

A subsequent sound change moved the high tone in these two groups of words from its original position to the CV syllable to its right. A default mid was placed on the syllable that formerly had the high tone. In the words with antepenultimate stress, the low tone at the end was reduced from two syllables to only one. In the case of words with penultimate stress, the low tone was pushed off the end of the word and became a floating low.

Given that this is exactly the same thing that happened to words with a (C)VCV syllable pattern and a high-low tone pattern that resulted from the tone-sandhi rule described above, it seems highly probable that words from both sources changed together, which means that the change took place since Spanish contact in the first half of the sixteenth century, probably after a corpus of loanwords had become established during the sixteenth and seventeenth centuries.

Another similarity between these loanwords and the forms that result from the tone-sandhi rules is that loanwords undergo a change from mid-high to low-high following a word with a final low tone. This seems to be part of a general process of low-tone spread.

(19) *ĩũ* 'six' + *mēsá* (l) 'table' → *ĩũ mesá* (l) 'six tables'

Loanwords with the mid-high tone pattern appear to be the only roots in the language that have this pattern in their basic form. Other words with this form are the result of the sandhi described in the third section. (There are also a few forms with mid-high that appear to be compounds, such as *nāsá* 'lest'.)<sup>7</sup>

<sup>7</sup>One fact that provides further support for the explanation offered in this study is that loans with the mid-high tone pattern do not undergo a tone change following a floating high tone. Even though they might be expected to become high-high, they do not. In this respect, they behave like words that already have high tone on the first syllable, which are not further changed by the sandhi rule.

## Evidence from Other Towns

Published descriptions of Mixtec tone systems include several towns in the western part of the highland Mixtec region. In addition to San Miguel el Grande and Chalcatongo de Hidalgo, which have already been mentioned, there are descriptions for San Esteban Atatlahuca, Santo Tomás Ocotepec, and San Pedro Molinos. A comparison of these five towns with Magdalena reveals a correlation between the existence of the irregular sandhi pattern and the tone pattern found in loanwords. In four of the six towns, the irregular sandhi pattern occurs, and in the other two it does not. In the same four towns that have the irregular sandhi, Spanish loanwords with penultimate stress have a high tone on the syllable following the stress. In the other two towns, Spanish loanwords do not have this pattern.

The four towns that have the irregular sandhi pattern are San Miguel (K. L. Pike 1948), Chalcatongo (Macaulay 1996:34–39), Molinos (Hunter and E. V. Pike 1969), and Magdalena. All four of these towns are located in the Achiutla valley, which is an area of rather broken terrain running north to south, bounded by two ridges, each over 3,000 meters high. Chalcatongo and San Miguel are in the southern part of the valley, Magdalena is in the northern part, and Molinos lies about fifteen kilometers south of Magdalena, and about eight kilometers north of Chalcatongo.

The following examples show the sandhi pattern in which words with a mid-low tone pattern and a (C)VCV syllable pattern become mid-high.

- (20) San Miguel (K. L. Pike 1948:78):  
*kēē* 'will eat' + *īso* 'rabbit' → *kēē īso* 'the rabbit will eat'
- (21) Chalcatongo (Macaulay 1996:34–35):  
*kūun* 'four' + *īnā* 'dog' → *kūun īnā* 'four dogs'
- (22) Molinos (Hunter and E. V. Pike 1969:36):  
*sívi* 'name' + *xīxí* 'aunt' + *sán* 'my' → *sívi xīxí sán* 'my aunt's name'
- (23) Magdalena:  
*yū'ū* (*h*) 'mouth' + *īso* 'rabbit' → *yū'ū īso* (*l*) 'the rabbit's mouth'

(Note that, unlike in Magdalena, the tone of the pronoun *sán* 'my' in Molinos does not lower following the form *xīxí*.)

In all four of these towns, loanwords from Spanish words with penultimate stress regularly have high tone on the final syllable.

- (24) San Miguel (Dyk and Stoudt 1973:20, 33; Mak 1953:92):

<i>arado</i>	'plow'	<i>lātú</i>
<i>pañó</i>	'shawl'	<i>pāñú</i>
<i>cuento</i>	'story'	<i>kuēndú</i>

- (25) Chalcatongo (Macaulay 1996:25):

<i>primo</i>	'cousin'	<i>přimú</i>
<i>pañó</i>	'shawl'	<i>pāñú</i>
<i>fuerza</i>	'force'	<i>fuērsá</i>

- (26) Molinos (Hunter and E. V. Pike 1969:26, 29):

<i>veinte</i>	'twenty'	<i>vēntí</i>
<i>peso</i>	'monetary unit'	<i>pēsú</i>
<i>vara</i>	'staff'	<i>vārá</i>

- (27) Magdalena:

<i>mesa</i>	'table'	<i>mēsá</i>
<i>cuento</i>	'story'	<i>kuēndú</i>

(A few loans have different patterns. For example, Spanish *cordero* 'lamb' is borrowed into San Miguel as *lélú* [Dyk and Stoudt 1973:20] and into Magdalena as *lélū*.)

The two towns that do not have the irregular sandhi rule are Ocotepéc and Atatlahuca. Both are located to the west of the Achiutla valley, but Ocotepéc is considerably farther away than Atatlahuca.

Ocotepéc has sandhi rules that change mid-low words to high-low following certain other words. The words that are changed to high-low include those with the (C)VCV syllable pattern, as well as those with the (C)V'V and (C)VV patterns (Mak 1958:65).

- |             |                           |                      |                                     |
|-------------|---------------------------|----------------------|-------------------------------------|
| (28) (C)V'V | <i>yáá</i> 'tongue'       | + <i>ñú'ú</i> 'fire' | → <i>yáá ñú'ú</i> 'flame'           |
| (C)VV       | <i>yú'ú</i> 'mouth, edge' | + <i>ñúú</i> 'town'  | → <i>yú'ú ñúú</i> 'edge of town'    |
| (C)VCV      | <i>n̄t̄k̄i</i> 'horn'     | + <i>ísu</i> 'deer'  | → <i>n̄t̄k̄i ísu</i> 'deer's horns' |

Likewise, Ocotepéc borrows Spanish words with penultimate stress with a high-low pattern (Mak 1958:63–64).

- |                  |                    |              |
|------------------|--------------------|--------------|
| (29) <i>lado</i> | 'side'             | <i>ládo</i>  |
| <i>calle</i>     | 'street'           | <i>káyī</i>  |
| <i>marco</i>     | 'door frame, case' | <i>márku</i> |

In other words, what I have claimed was the original result of the tone-sandhi rule, and the original form of the borrowing, are both found at the present time in Ocotepéc. Apparently, the changes that took place in the Achiutla valley to the east did not affect Ocotepéc in any way.

Atlatlahuca has a four-level tone system, and the tones are written with numbers. The number 1 is used for high tone, and the number 4 is used for low tone. Tone 3 has a limited distribution, and therefore tone 1 generally corresponds to high, tone 2 to mid, and tone 4 to low. The word for 'egg' (*ndi2vi4*) is equivalent to mid-low. This word does not become mid-high following a class b morpheme, as it does in the Achiutla valley, but rather high-low, as in Ocotepéc (Mak 1953:88-89, 91).

(30) *ta4ka1* (b) 'each' + *ndi2vi4* 'egg' → *ta4ka2 ndi1vi4* 'each egg'

Note that the tone of *ta4ka1* 'each' is changed to *ta4ka2* preceding the word for 'egg'.

Spanish loanwords with penultimate stress take the tone pattern high-high when they enter Atlatlahuca Mixtec (Mak 1953:91-92).

(31) *escuela* 'school' *skue1la1*  
*cuento* 'story' *kue1ndu1*

Mak states that these words cause tone lowering on the first syllable of the following word (1953:93), but, unfortunately, no example is included in the article. This fact provides evidence for a former high-low pattern. The high tone on the first syllable was apparently spread to the second syllable, and the low tone was pushed off the word to the right, where it causes changes in the next word, as it also does in Magdalena.

This pattern may well be an intermediate stage between the original high-low pattern found in Ocotepéc, and the mid-high pattern seen in the Achiutla valley to the east, which accords with its intermediate geographical location.

The question naturally arises about tone changes in other parts of the Mixtec region. A preliminary study of available sources shows that the irregular sandhi pattern described in this paper does not extend to towns in other parts of the Mixtec region.

I looked at two studies of tone in towns in the lowland Mixtec region, Huajuapán in western Oaxaca, northwest of the Achiutla valley, and Ayutla in the coastal area of Guerrero at the southwestern extreme of the Mixtec region.

E. V. Pike and Cowan's description of tone for Huajuapán (1967:9) shows a change from mid-low to high-low in (C)VCV words.

(32) *komí* 'four' + *chíkā* 'banana' → *komí chíkā* 'four bananas'

In Pankratz and E. V. Pike's description of tone in Ayutla, Guerrero (1967:296), certain words cause the first syllable of a mid-low word to become high.

(33) *yá'á* 'brown' + *nā́mā* 'soap' → *yá'á nā́mā* 'the soap is brown'

In the eastern part of the highland Mixtec region, on the other hand, words that have a mid-low tone pattern in the Achiutla valley have rather different underlying tones. In Daly's unpublished study of Santa María Peñoles, near the eastern boundary of the Mixtec region, words that have the mid-low pattern in the Achiutla valley have either a high-high tone pattern with a floating low, or a mid-high pattern.

(34) <i>dútú</i> (l)	'priest'
<i>ní'í</i> (l)	'find'
<i>īdú</i>	'deer'
<i>ñūú</i>	'town'

Inga McKendry is currently carrying out research on the Mixtec of Southeastern Nochixtlán, which is located about halfway between Peñoles and the Achiutla valley. When she compared words with their cognates in San Miguel el Grande, she noted that the tones appear to have shifted one syllable to the right in Southeastern Nochixtlán, leaving many words with toneless initial syllables (personal communication).

Apparently, the shifting of tones one syllable to the right that takes place in limited contexts in the Achiutla valley has taken place in a more general way throughout the eastern part of the highland Mixtec region. The hypothesis that a high tone has moved to the right can perhaps help to account for the rather odd correspondence between Peñoles *dútú* (l) 'priest' and Magdalena *sūtu*. If the mid tone on the first syllable of the Magdalena form shifted to high, this high tone could have spread to the right, leaving the original low tone on the second syllable as a floating low at the end of the word.

A further confirmation of movement is found in the fact that Peñoles has a high tone on the syllable following the stress in Spanish loans, just as

towns in the Achiutla valley do; an example from Daly's study is *latú* 'plow', from Spanish *arado*.

### Closing Remarks

In this section I give a few suggestions for future research, followed by some general musings on the workings of tone languages.

From the tone descriptions that are currently available, I have been able to draw a general picture of certain tone processes that have taken place in Mixtec. This general picture raises many questions that are, unfortunately, not likely to be answered. The nature of tonal systems, with relative levels that shift from speaker to speaker, makes them difficult to analyze, and few linguists choose to take on this arduous task. It is also clear that each town in the Mixtec region differs from its neighbors in tone, as in other respects, and a separate study is needed for each town in order to get a complete picture. To complicate the matter, many variants of Mixtec are now endangered, and they are likely to become extinct before they have been studied.

One question that I have not tried to address in this study is the role of syllable patterns in facilitating and blocking tone movement. There are four different syllable patterns in Mixtec disyllabic couplets: (C)VCV, (C)V'V, (C)V'CV, and (C)VVV. Of these, only the (C)VCV pattern shows movement of high tone to the right in the Achiutla valley. The glottal stop in the (C)V'V and (C)V'CV patterns is a laryngeal element closely related to tone, and it could easily have blocked the movement of high tone to the right. What is not clear is why high tone did not move to the right in words with (C)VVV, which have no glottal stop. I leave this puzzle to future generations of linguists.

Another topic for research is to what degree the historical process I have described should be reflected in a synchronic description of languages that have it. Should a description of the languages try to recapitulate the historical sequence, or would a completely arbitrary rule result in a simpler description?

Perhaps the most astonishing thing about tonal systems (in addition to their complexity) is the fact that they are managed expertly by native speakers, but in a completely unconscious fashion. My husband and I have studied two languages in the Mixtecan family, Copala Trique and Magdalena Mixtec, and our studies included both an analysis of their tonal systems, and a serious attempt to learn to speak the languages. We



have also participated in the process of orthography design for both languages.

The orthography we proposed for Copala Trique included symbols to mark tone, and we have tried to teach native speakers to read and write them. This attempt was largely unsuccessful. It slowly became clear to us that the problem was not that the symbols we had chosen were less than ideal, but rather that Copala Trique speakers did not have any conscious awareness of the tonal system of their language, even though it is used to distinguish among dozens of sets of lexical items, and also grammatical categories like verb tense. Although this should perhaps not have surprised us, it did. But what surprised us even more is that, when we tried to teach them the system, they not only consistently found it hard to learn, but also seemed to resist any attempt on our part to make them bring it to conscious awareness.

This attitude toward tone is not limited to speakers of Copala Trique. Two native speakers of Mixtec who have published grammars of their language have chosen to give tone only minimal attention, and not to write it regularly on their examples. These authors are Gabina Aurora Pérez Jiménez, who has written a grammar of Chalcatongo Mixtec (1988), and Rodrigo Vásquez Peralta, who has written a grammar of the variant spoken in Xayacatlán de Bravo, in the lowland Mixtec region of the state of Puebla (1997). Vásquez Peralta's treatment of tone in his language is limited to the following paragraph on page 1.

Its peculiar musicality represents another serious obstacle for those who do not have their ears educated to be able to perceive the tone changes that frequently occur; if a different tone is applied to a word that is formed with the same letters, its meaning will change. For such reasons very special attention to its orality is required for the correct understanding.<sup>8</sup>

My husband and I have also watched small children learn to speak Trique, and there is good reason to believe that they learn the tonal system before they learn vowels and consonants. We have heard them track things that are said to them, automatically mimicking the correct tone. And we have heard Trique children say things with little of the segmental structure correctly formed, but with the tone patterns correct, and their mother can usually understand them. Evelyn Pike carried out a study with one of her own children when they were located in San Miguel, away from

<sup>8</sup>In the original Spanish this is: "Su peculiar musicalidad representa otro serio obstáculo para quienes no tienen educado el oído y poder percibir los cambios de tono que frecuentemente se presentan; a una palabra que esté formada con las mismas letras, si le aplicara un tono diferente, cambiará de significado, por tales razones se requiere de atenciones muy especiales en su oralidad para su apropiada comprensión."

other speakers of English. By controlling the intonation pattern that they used in speaking to the child, she was able to verify that the pattern learned was an imitation of her own pronunciation (1949).

I stand amazed at the complexity of the tone-sandhi changes described in this short study, which form only a very small part of the full—and exceedingly intricate—tonal system of each Mixtec variant. I stand even more amazed at the way the patterns and rules are transmitted to new generations, and the way changes in them take place and slowly spread from town to town, without speakers having any awareness of what is happening. We are truly surrounded by mystery.

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