

TONE CONTRAST ON THE PENULTIMATE SYLLABLE  
IN TATALTEPEC CHATINO

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0. Introduction. Although four published studies treat Yaitepec Chatino tone<sup>1</sup> nothing yet has been published about tone in the Tataltepec de Valdez dialect of Chatino.<sup>2</sup> This article is an attempt to fill that gap. And, in doing this, we highlight a solution to a problem of which we have been conscious in previous analyses of Yaitepec Chatino tone and in our own unpublished analysis of Tataltepec Chatino tone - a solution made possible through a significant discovery made in the course of the present analysis. The problem was: the nature and relation of certain onset consonants of the ultima (or tonic syllable) to their preceding and following environments.<sup>3</sup> It was discovered, in fact, that our analytical difficulty was in recognising contrastive tone on the penult, and that this gave an illusion of length on elements of the ultimate.

1. Discussion of Chatino analyses.

In the most recent analysis, contrastive tone glides were discovered on the penults of the Tataltepec dialect. Contrastive tone on the penult, when associated with the ultima in morphophonemic tone patterns, was known before, but it was always assumed to be in level tones: high, mid and low, because, in the analysis of Yaitepec speech and all the other dialects of Chatino where shortened or very contracted speech forms are used, it is hard to hear tone on any other syllable but the ultima.

Glides are not new to Chatino; they occur with great frequency on the ultima. Many Zapotecan languages, to which Chatino is related, have tone glides. The consultant for our original Yaitepec work in 1962 (R. Longacre) commented on the incredible number of tone glides, and that even the so-called 'level' tones seemed to always end with up- or downdrift. But it was only the employment of a different analytical technique that uncovered the presence of glides as well as levels on the penults.

1.1. Previous analysts of Chatino have established the phonemic segments of the language. (These are summarized in section 2 below.) The tonemes of Yaitepec were established (McKaughan 1954, J. Upson 1960, L. Pride 1963) as consisting of four phonemic levels, with six glides - upglides and downglides between contiguous levels. McKaughan briefly described pitch on penults and antepenults as a neutral 'carrier tone' - which perhaps distracted our attention from the real nature of the pitch in these syllables. L. Pride stated that 'the phonetic actualization of the tones may be affected by the presence of glottal stop, nasalization, semi-vowels,

laterals and stops." He also made an analysis of the system of tone changes on the verb stem for person, and of some of the tone sandhi. J. Upson in 1968 reduced the toneme inventory to three levels and four glides in basic forms, by analysing the glides down and up from the lowest level as allomorphic sandhi variants only, i.e., :'nonbasic forms of the allomorphs'. Upson also showed that all tonemes except the high to mid glide have allotones corresponding to each long vowel.

All these analyses, and an unpublished one we did in Tataltepec in 1975, used conventional fixed-frame phrases or sentences, as introduced by K. Pike in 1948.<sup>4</sup> In that method, substitution lists of each similar word form (subclassed by word class and CV pattern) are methodically passed through different positions in the frame - sentence initial, sentence medial, sentence final, etc. The problem for the analyst of Chatino has always been finding a frame sentence where the preceding or following tones are totally unaffected by sandhi, and in formulating enough frame sentences to find all the changes in all tonal environments.

1.2. The present analysis was made using a different approach which we will call 'process analysis'.<sup>5</sup> 'Process analysis' is a method of analysing tone by first determining the number of phonetic tone patterns of words in free natural combination and then using these patterns to analyse the phonological relations of the segments in pattern, and so determine the correct number and description of phonological tones, before positing the number of tone levels. The same body of data brings into focus all the sandhi rules and any other tone variation.

In this analysis, approximately 250 monosyllabic and polysyllabic words were selected from all the major word classes of Tataltepec Chatino and were combined into some 1100 two-word utterances, some with the capacity of being reversed, some without that capacity.<sup>6</sup> The tone patterns of these utterances were recorded on tape, then transcribed and grouped. In all of these two-word units, the prominent phonological stress was the same - on the ultima of the second word, irrespective of word class or position in the grammatical unit.<sup>7</sup> After successive sortings and refinings, these utterances eventually formed a matrix showing clearly all the contrastive patterns. Repeatedly hearing the data in this way (from live speaker and from recording) resulted, in the opinion of this researcher, in a fantastic sharpening of perception.

## 2. Segments and syllables.

2.1. Consonants. The consonants of Tataltepec Chatino are the following:

bilabials:	p, m, w
alveolars:	t, d, c, s, n, r, l
palatals:	tʲ, dʲ, č, ʃ, hʲ, nʲ, lʲ, y
velars:	k, g
labialised velars:	kʷ, gʷ, hʷ
glottals:	h, ʔ

Palatalised and labialised consonants are hereafter written on the line in all examples, e.g., as Cy or as Cw.

The following consonants occur as word initial syllabics: p, m, w, t, c, s, n, r, l, č, ʃ, y, k, and h. (For an explanation of syllables and syllabicity, see section 2.3.) The only final consonant is the glottal closure ʔ.

## 2.2. Vowels.

## 2.2.1. Of the ultima.

The following vowels (listed in order of common occurrence in the ultima: oral vowels a, i, u, o, e and nasalised vowels a, i, and u. All vowels occur lengthened in this syllable, indicated by a colon following the vowel, V:.

## 2.2.2. Of the penult.

The following vowels occur regularly: a, i, and u; e and o occur much less frequently. They follow the same order of common occurrence as the vowels in the ultima, and exhibit no co-occurrence restrictions with particular tone glides.<sup>8</sup> Nasalised vowels occur in the penultimate only as a kind of prosodic feedback to an analogous vowel in the case of word final V?V, e.g.: ndya<sup>4</sup>?a<sup>32</sup> *walking*, tyi<sup>4</sup>?i<sup>23</sup> *will be there*, and in a few compounds not included in this study. In certain words there is a strong appearance of vowel length in this position, and length on the penult seems to correlate with the rising and falling tones (21, 45). J. Suarez does not consider that vowel length occurs on the penult in Chatino,<sup>9</sup> but his information is based on the more 'closed' or contracted forms of Chatino in the main area,<sup>2</sup> where the penult is hard to hear. In any case, it is not possible to prove length contrastive on the penult, and only a close acoustic study of the type undertaken by Healey would establish if and how much vowel length is there.<sup>10</sup> Examples of tone glides and accompanying length on the penult are:

ndya:21|a<sup>4</sup> *is opened*, ndu:21|na<sup>4</sup> *is weeping*, tya:45|a<sup>2</sup> *fierce*, tyu:21|a<sup>23</sup> *male (animal)*, kwa:21|ya<sup>23</sup> *gopher*, ndya:21|ta<sup>2</sup> *bathing*, ndya:45|ti<sup>2</sup> *entered*, la:45|sa<sup>23</sup> *light, soft*, and ka:21|?ya<sup>4</sup> *flour*.<sup>11</sup>

(Length on the penult is not marked on subsequent examples.)

## 2.3. Syllable construction.

A fuller description is given elsewhere,<sup>12</sup> but a brief summary of the criteria for setting up syllable types and some illustrations are necessary for an understanding of the tone system. The chief criteria were pattern pressure, phonetic pitch, and word stress.

The tonic syllable, as a monosyllable, is the minimal phonological word, and is a syllable constructed of the patterns: CV, ?CV, or CV?. There are three types of pretonic syllable (PT) which are of the following construction:

CV, CVC, or C. The tonic syllable may be preceded by one to three other syllables. All three syllable types occur in the first and second optional slots before the tonic, though only syllable type C occurs word initially and in the third optional slot.

In other words, the Tataltepec word may be constructed according to the following formula, which is verbalised in this way:

(i) One or two C syllables may occur before the tonic syllable (examples 1 and 2), or before a CV syllable followed by the tonic syllable (examples 3 and 4).

(ii) Only one C syllable may occur before two CV syllables followed by the tonic (example 5), or before a CVC syllable followed by a CV syllable followed by the tonic (example 6).

## FORMULA FOR PRETONIC AND TONIC SYLLABLES IN THE WORD

	<u>± PRETONIC III</u>	<u>± PRETONIC II</u>	<u>± PRETONIC I</u>	<u>+ TONIC</u>			
	C	C, CVC, CV	CV	CV, CV?, ?CV			
(1)		s-		ka	s <sup>4</sup> ka <sup>2</sup>	one <sup>13</sup>	
(2)	n-	k-		lya	n <sup>4</sup> k <sup>1</sup> ya <sup>32</sup>	be born	
(3)	n-		gu-	ti	ngu <sup>4</sup> ti <sup>23</sup>	rubbish	
(4)	n-	č-	ki-	ya?	nčki <sup>4</sup> ya <sup>?32</sup>	calzones	
(5)	n-		gu-	sa-	?we	ngusa <sup>2</sup> ?we <sup>45</sup>	divided
(6)	n-	guš-	ku-	we?		ngušku <sup>4</sup> we <sup>?2</sup>	up punished

## 3. Tones.

The tone system of the Tataltepec dialect consists of seven contrasting tones on the nucleus of the tonic syllable, and four of these contrasts can also be found on the penult. Basically there are two level tones: high (2) and low (4); a level pitch 3 is allophonic. The contour tones are identified with reference to five phonetic pitch levels. The three rising glides, from lowest to highest, are: 43, 32, and 21. The two falling glides, from highest to lowest, are: 23 and 45.

## 3.1. Contrasts found in the ultima.

High tone is indicated by pitch level 2. It is not as high as the end point of the high rise glide 21.

[ ndyatá: ]	ndya <sup>45</sup> ta: <sup>2</sup>	crushed
[ tása ]	ta <sup>45</sup> sa <sup>2</sup>	sheet
[ yaká ]	ya <sup>2</sup> ka <sup>2</sup>	wood, tree

Low tone is indicated by pitch level 4. It is not as low as the end point of the low fall glide 45.

[ kusí: ]	ku <sup>4</sup> si: <sup>4</sup>	daughter in law
[ tasá ]	ta <sup>2</sup> sa <sup>4</sup>	cup
[ táhá ]	ta <sup>4</sup> ha <sup>4</sup>	lazy

The low rise glide is indicated by pitch levels 43. It actually begins at a level between 4 and 5 and rises to a level between 2 and 3.

[ kye: ]	kye: <sup>43</sup>	flower
[ kuna <sup>?a</sup> ]	kuna <sup>4</sup> ?a <sup>43</sup>	woman
[ śná ]	s <sup>4</sup> na <sup>43</sup>	three

The mid rise glide is indicated by pitch levels 32. It is a more gradual glide from mid to no higher than high.

[tyukwi:]	tyu <sup>4</sup> kwi: <sub>32</sub>	<i>trail, road</i>
[ndyanu]	ndya <sup>4</sup> nu <sub>32</sub>	<i>remains</i>
[knyá]	k <sup>4</sup> nyá <sub>32</sub>	<i>work</i>

The high rise glide is indicated by pitch levels 21. It begins at high and ends higher than high.

[ngwiš:]	ngwi <sup>4</sup> š: <sub>21</sub>	<i>wrap around</i>
[nginyá]	ngi <sup>4</sup> nyá <sub>21</sub>	<i>moves, shakes</i>

The high fall glide is indicated by the pitch levels 23. It begins at high or slightly above and descends approximately one level.

[kut:]	ku <sup>4</sup> ti: <sub>23</sub>	<i>carry in loads</i>
[wilyá]	wi <sup>21</sup> lyá <sub>23</sub>	<i>not yet</i>

The low fall glide is indicated by pitch levels 45. It begins at low or slightly above and ends lower than low.

[kišú:]	ki <sup>2</sup> šú: <sub>45</sub>	<i>avocado pear</i>
[talyá]	ta <sup>21</sup> lyá <sub>45</sub>	<i>night</i>

### 3.2. Contrasts found on the penult.

Fewer phonemic tone contrasts can be found on the penult. Low rise, mid rise, and high fall glides are never found in this position. The following contrasts are found:

high tone	[tyaká?]	tya <sup>2</sup> ka <sub>?4</sub>	<i>can see</i>
low tone	[kwányá?]	kwa <sup>4</sup> nyá <sub>?2</sub>	<i>meat</i>

The descriptions for these two tones are identical with the same tones in the ultima. The rising glide and the falling glide are shorter than those in the ultima and conform more strictly to the pitch levels in their designation.

The rising glide is indicated by pitch levels 21. It begins at high and terminates at higher than high.

[nšasú]	nša <sup>21</sup> su <sup>4</sup>	<i>turns over</i>
[tyaká?]	tya <sup>21</sup> ka <sub>?4</sub>	<i>will tie up</i>

The falling glide is indicated by the pitch levels 45. It begins at low and terminates at lower than low.

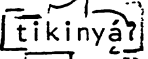
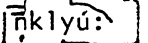
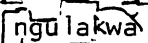
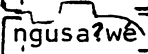
[kwinyá?]	kwi <sup>45</sup> nyá <sub>?2</sub>	<i>deer</i>
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### 3.3. Pitch in other syllables.

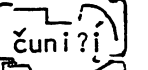

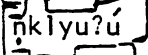

Only two phonetic pitch levels, high and low, can be distinguished on the antepenult or the proantepenult. All nonstressed voiceless syllables, including voiceless syllabic consonants, are unambiguously given a pitch when an utterance is whistled by a native speaker. ('Whistle speech' is used as a speech surrogate in some dialects of Chatino, although not in Tataltepec at the present time.) In ordinary speech pitch levels can be distinguished on such voiceless syllables as part of the phonetic tone pattern, and are probably actualised as a combination of the rhythmic intensity and aspiration.

The pitch of the syllables before the penult is either high or low in a pattern of alternating high and low pitches determined by the pitch of the penult, so that:

(i) When the pitch of the penult is high or rising, that of the antepenult will be low and on four-syllable words the pitch of the proantepenult will be high.

	tiki <sup>2</sup> nya <sup>?45</sup>	<i>candle</i>
	nk <sup>2</sup> lyu: <sup>45</sup>	<i>growing</i>
	ngula <sup>2</sup> kwa <sup>45</sup>	<i>counted</i>
	ngusa <sup>2</sup> ?we <sup>45</sup>	<i>divided up</i>

(ii) When the pitch of the penult is low or falling, the tone on the antepenult will be high, and on four-syllable words the pitch of the proantepenult will be low.



	čuni <sup>4</sup> ?i <sup>23</sup>	<i>scorpion</i>
	nk <sup>4</sup> lyu: <sup>43</sup>	<i>digging</i>
	nklyu <sup>4</sup> ?u <sup>32</sup>	<i>teaching</i>
	ndya <sup>45</sup> ta: <sup>2</sup>	<i>crushed</i>

Therefore, pitch is completely predictable on syllables preceding the antepenult and is not written elsewhere in this paper.

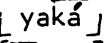

### 3.4. Allophones of tone phonemes.

#### 3.4.1. Allotones of the ultima.

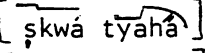
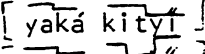
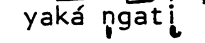
A high tone after a low or falling tone is pitch level 2.

	ku <sup>4</sup> š <sup>i</sup> <sup>2</sup>	<i>bad</i>
	ta <sup>45</sup> sa <sup>2</sup>	<i>sheet</i>

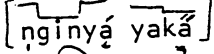
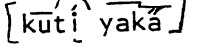
A high tone after another high tone is slightly lower in pitch. The sequence of two high tones in which the second is lowered in pitch is called a downstep.

	ya <sup>2</sup> ka <sup>2</sup>	<i>wood, tree</i>
	s <sup>2</sup> kwa <sup>2</sup>	<i>stew, cooked meal</i>

The phonetic downstep in the sequence of two high tones occurs before all words except those which end in a 45 tone or which have a sequence of low tones (which have their own phonetic downstep, see below.)

	s <sup>2</sup> kwa <sup>2</sup> tya <sup>4</sup> ha <sup>23</sup>	<i>tortilla stew</i>
	ya <sup>2</sup> ka <sup>2</sup> ki <sup>2</sup> tyi <sup>4</sup>	<i>fig tree</i>
	ya <sup>2</sup> ka <sup>2</sup> nga <sup>4</sup> ti <sup>2</sup>	<i>white tree</i>

The phonetic downstep of the sequence of two high tones also takes place following words of tone sequences 4-21 and 4-12:

	ngi <sup>4</sup> nya <sup>21</sup> ya <sup>2</sup> ka <sup>2</sup>	<i>wood moves (tr.)</i>
	ku <sup>4</sup> ti <sup>12</sup> ya <sup>2</sup> ka <sup>2</sup>	<i>carry load of wood</i>

A phonetic upstep takes place in a sequence of two high tones if the following word ends in a 45 glide or has a sequence of two low tones.

[yaka kišú:]	ya <sup>2</sup> ka <sup>2</sup> ki <sup>2</sup> šú: <sup>45</sup>	avocado pear tree
[škwa škwa]	s <sup>2</sup> kwa <sup>2</sup> s <sup>4</sup> kwa <sup>4</sup>	stew of dough

The phonetic upstep of two high tones also takes place following words of the tone sequences 2-4, 4-2, and 4-4.

[tasa škwa]	ta <sup>2</sup> sa <sup>4</sup> s <sup>2</sup> kwa <sup>2</sup>	cup of stew
[nkwi yaka]	n <sup>4</sup> kwi <sup>2</sup> ya <sup>2</sup> ka <sup>2</sup>	is-rotten tree
[tukwa yaka]	tu <sup>4</sup> kwa <sup>4</sup> ya <sup>2</sup> ka <sup>2</sup>	small basket of wood

The low tone is pitch level 4 after the high or rising tone:

[kityi]	ki <sup>2</sup> tyi <sup>4</sup>	paper
[katya]	ka <sup>2</sup> tya <sup>4</sup>	flour

A sequence of two low tones has a phonetic downstep in which the second low tone is lower than the first.

[taha]	ta <sup>4</sup> ha <sup>4</sup>	lazy
[škwa]	s <sup>4</sup> kwa <sup>4</sup>	corn dough
[kuci:]	ku <sup>4</sup> ci: <sup>4</sup>	son-in-law
[tyoho]	tyo <sup>4</sup> ho <sup>4</sup>	squash

The low downstep takes place also when a sequence of two low tones occurs before or after another word.

[tasa tyoho]	ta <sup>2</sup> sa <sup>4</sup> tyo <sup>4</sup> ho <sup>4</sup>	cup of squash
[nda <sup>4</sup> ku tyoho]	nda <sup>4</sup> ku <sup>23</sup> tyo <sup>4</sup> ho <sup>4</sup>	eats (hab.) squash
[škwa škwa]	s <sup>2</sup> kwa <sup>2</sup> s <sup>4</sup> kwa <sup>4</sup>	stew of corn dough
[taha kuci:]	ta <sup>4</sup> ha <sup>4</sup> ku <sup>4</sup> ci: <sup>4</sup>	lazy son-in-law
[tukwa yaka]	tu <sup>4</sup> kwa <sup>4</sup> ya <sup>2</sup> ka <sup>2</sup>	basket made of wood

The high fall tone is between pitch levels 2 and 3 when it follows a low, falling or rising tone in the word:

[kišú]	ki <sup>4</sup> šú <sup>23</sup>	rope bag
[lihya]	li <sup>45</sup> hya <sup>23</sup>	sugar cane
[kwaná:]	kwa <sup>21</sup> na: <sup>23</sup>	mirror

After a low tone, when the syllable nucleus is the high front nasalised vowel *i*, and on loan words like m<sup>2</sup>su<sup>45</sup> *servant* in some morphophonemic allo-patterns (see sandhi rule 3 for examples), the beginning of the fall is much higher, more like 12.

[ni <sup>4</sup> i:]	ni <sup>4?</sup> i <sup>23</sup>	house
[kut <sup>4</sup> i:]	ku <sup>4</sup> ti <sup>23</sup>	carry in loads

After a falling tone, even though the vowel nucleus is i, the pitch range of the high fall remains in the normal range, 23.

[ <u>sa</u> t]	ša <sup>45</sup> t <sub>i</sub> 23	<i>nest</i>
[ <u>cumi</u> ]	ču <sup>45</sup> m <sub>i</sub> 23	<i>cat</i>

The low fall tone has only one allotone and it has the phonetic range from pitch level 4 to level 5. It occurs after a high or a rising tone.

[lu <u>wi</u> ]	lu <sup>2</sup> wi:45	<i>clean</i>
[ya <u>ni</u> ]	ya <sup>2</sup> ni45	<i>neck</i>

3. The low rise also has only one allotone, a rise from pitch level 4 to level 3.

[č <u>kwá</u> ]	č <sup>4</sup> kwá43	<i>metal</i>
[yá:]	ya:43	<i>nopal cactus</i>
[k <u>kwí</u> ʔ]	ku <sup>4</sup> kwiʔ43	<i>armadillo</i>

The mid rise moves from level 3 to level 2.

[ty <u>ku</u> ]	tyu <sup>4</sup> ku32	<i>foul</i>
[k <u>wi</u> čáʔ]	kwi <sup>4</sup> čaʔ32	<i>make wet</i>

The high rise moves from pitch level 2 to level 1.

[ <u>ngu</u> s]	ngu <sup>4</sup> ši21	<i>tomato</i>
[š <u>lyá</u> :]	š <sup>4</sup> lyá:21	<i>meal, dinner</i>

A characteristic of the high rise tone is that it does not invert as does the mid rise (32 to 23) in sandhi rule 1 (4.1).

### 3.4.2. Allotones of the penult.

High tone is consistently level 2.

[l <u>aká</u> ʔ]	la <sup>2</sup> kaʔ <sup>4</sup>	<i>leaf</i>
[t <u>asá</u> ]	ta <sup>2</sup> sa <sup>4</sup>	<i>cup</i>
[t <u>yaká</u> ʔ]	tya <sup>2</sup> kaʔ <sup>4</sup>	<i>can see</i>
[h <u>o</u> ʔ]	ho <sup>2</sup> o <sup>4</sup>	<i>saint</i>

Low tone is consistently level 4.

[k <u>wanyá</u> ʔ]	kwa <sup>4</sup> nyáʔ <sup>2</sup>	<i>meat</i>
[t <u>onú</u> ]	to <sup>4</sup> nu23	<i>big</i>
[h <u>a</u> ʔwa]	ha <sup>4</sup> ʔwa23	<i>banana</i>
[ <u>nkwí</u> ]	n <sup>4</sup> kwi2	<i>rotten</i>

The rising tone has two allotones. The pitch rises from mid to high before a high tone; it rises from high to extra high (21) before a low or falling tone.

<u>ndya</u> tá	ndya <sup>21</sup> ta <sup>2</sup>	<i>bathing</i>
<u>ndya</u> tá	ndya <sup>21</sup> ta <sup>23</sup>	<i>sowing</i>
tyaká?	tya <sup>21</sup> ka <sup>?4</sup>	<i>will be tied up</i>
<u>nsasú</u>	nša <sup>21</sup> su <sup>2</sup>	<i>turns over</i>
<u>nšacu</u>	nša <sup>21</sup> cu <sup>4</sup>	<i>makes warm</i>

The falling tone falls from pitch level 4 to level 5.

<u>kwi</u> nyá?	kwi <sup>45</sup> nyá <sup>?2</sup>	<i>deer</i>
<u>cumi</u>	ču <sup>45</sup> mi <sup>23</sup>	<i>cat</i>
<u>hatya</u>	ha <sup>45</sup> tya <sup>23</sup>	<i>wait</i>

### 3.4.3. Higher level conditioning of the allotones.

The phonetic contrast of the allotones of both the penult and the ultima are maximised or minimised, depending on whether the word in which they occur is initial or final in the utterance.

1. On the first word of a two-word utterance, the phonetic pitch contrast of all patterns is minimised; the distance between registers is lessened.
2. On the second word of a two-word utterance, the phonetic pitch contrast of all patterns is maximised; the distance between registers is greater, as well as the pitch being lower on the ultima.
3. When two words of a similar tone pattern follow each other, the general shape of the tone pattern of the second word is the same as that of the first, but the distance between registers is greater.
4. Two words of the pattern low plus high in sequence retain the general contour moving from low to high, but the word-final high tone may glide slightly up or down: it has a slight down glide on the first word and it has a slight upglide on the second word. (This is similar to the process in sandhi rule 1 except that in the case of the high tone the phonetic upglide or downglide is subphonemic.)
5. If one of a pair of words of the same tone pattern is an adjective or a stative verb, it is possible for the adjective or stative verb to occur on either side of the noun. After the noun it modifies the noun in the noun phrase; before the noun it predicates that quality of the noun in a clause. In each case the two words retain their tone sequence and the utterance stress is on the second word, just as described above, but the distance between registers remains greatest on the adjective or stative verb whether or not it follows the noun. Although this is grammatical conditioning it is grouped with the higher level phonetic conditioning at this point.

<u>ka</u> tyu <u>tyukwi</u>	ka <sup>4</sup> tyu <sup>32</sup> tyu <sup>4</sup> kwi <sup>32</sup>	<i>the long gun</i> (N + ADJ)
<u>tyukwi</u> <u>katyu</u>	tyu <sup>4</sup> kwi <sup>32</sup> ka <sup>4</sup> tyu <sup>32</sup>	<i>the gun is long</i> (STA + N)
<u>tyaha</u> <u>suwe</u>	tya <sup>4</sup> ha <sup>23</sup> su <sup>4</sup> we <sup>23</sup>	<i>the small tortilla</i> (N + ADJ)
<u>suwe</u> <u>tyaha</u>	su <sup>4</sup> we <sup>23</sup> tya <sup>4</sup> ha <sup>23</sup>	<i>the tortilla is small</i> (STA + N)

### 3.5. Distribution of tones within words.

This tone study would not be complete without considering the phonological

features in relation to the word, since the study has been based on sequences of disyllabic words.

There are fifteen different sequences of tones on disyllabic morphemes and these are the same patterns that occur on the final two syllables of three- and four-syllable words also. All the tones exhibited on monosyllabic morphemes are also found on the final syllable of polysyllabic words. Examples of the tone combinations on pretonic and tonic syllables are given in the following chart. There are twenty-eight possible combinations of the four contrastive tones on the pretonic syllable and the seven contrastive tones on the tonic syllable, but only fifteen combinations actually occur.

After a high or rising tone on the penult, only a high, low or low fall occurs on the ultima. A high fall on the ultima occurs only after a rising tone on the penult. A rising tone of any degree does not occur on the ultima except after a low tone on the penult or if the word is a monosyllable.

After a low or falling tone on the penult a low fall does not occur on the ultima. Otherwise, after a low tone on the penult, the whole range of tone contrasts appears on the ultima.

After a falling tone on the penult, only a high or a high fall tone occurs on the ultima. A high rise tone may occur after a falling tone as a result of sandhi rule 4. (ii). A low tone or either of the other rising tones does not occur after a falling tone on the penult.

#### 4. Tonal morphophonemics.

Four main types of phonologically conditioned sandhi take place. They are conditioned by preceding and/or following tone patterns. Sandhi rules 1 and 2 are phonetically conditioned: any word of a given tone sequence that is placed in the given tone environment is subject to the rule. Sandhi rules 3 and 4 are grammatically conditioned: only certain words undergo the change.

##### SANDHI RULE 1

Words of the sequence 4 - 32 change to the sequence 4 - 23 before a word of the pattern 4 - 2, 4 - 21 or 45 - 2. Compare the following pairs of utterances in which the control example does not undergo the sandhi as opposed to the example of the rule.

- |           |                       |                   |   |                      |                     |     |                       |                      |                                   |
|-----------|-----------------------|-------------------|---|----------------------|---------------------|-----|-----------------------|----------------------|-----------------------------------|
| (Control) | $n^4\check{s}na_{32}$ | <i>is running</i> | + | $kwa^2\dot{y}u_{45}$ | <i>horse</i>        | --> | $n^4\check{s}na_{32}$ | $kwa^2\dot{y}u_{45}$ | <i>the horse is running</i>       |
| (Sandhi)  | $n^4\check{s}na_{32}$ | <i>is running</i> | + | $kwi^4hi^2$          | <i>skunk</i>        | --> | $n^4\check{s}na_{23}$ | $kwi^4hi^2$          | <i>the skunk is running</i>       |
| (Control) | $nga^4ta_{32}$        | <i>black</i>      | + | $?i^2kye^4$          | <i>head</i>         | --> | $nga^4ta_{32}$        | $?i^2kye^4$          | <i>his head is black</i>          |
| (Sandhi)  | $nga^4ta_{32}$        | <i>black</i>      | + | $ta^4sa^2$           | <i>sheet</i>        | --> | $nga^4ta_{23}$        | $ta^4sa^2$           | <i>the sheet is black</i>         |
| (Control) | $ndya^4nu_{32}$       | <i>remain</i>     | + | $ku^2\dot{?}ma_{23}$ | <i>you (pl)</i>     | --> | $ndya^4nu_{32}$       | $ku^2\dot{?}ma_{23}$ | <i>you (pl) are remaining</i>     |
| (Sandhi)  | $ndya^4nu_{32}$       | <i>remain</i>     | + | $ku^4\dot{?}ma_{21}$ | <i>large parrot</i> | --> | $ndya^4nu_{23}$       | $ku^4\dot{?}ma_{21}$ | <i>(the) large parrot remains</i> |

TONE COMBINATIONS ON PRETONIC AND TONIC SYLLABLES

PRETONIC / TONIC	HIGH <sup>2</sup>	LOW <sup>4</sup>	HIGH FALL <sup>23</sup>	LOW FALL <sup>45</sup>	HIGH RISE <sup>21</sup>	MID RISE <sup>32</sup>	LOW RISE <sup>43</sup>
MONO-SYLLABLE	to? at edge of	ti only	lo on top of	č <u>u</u> ? back of	č <u>e</u> ? rough	cu? side	kwa broom
	ku? piece	kye head	č <u>a</u> sharp	kye: stone	kye: tomorrow	ki: grass	kwa? maid
		tya? will be made	ti: aware	tya:? will be torn	kwi: star	ka: nine	la: church
				na: named	na: named	tya:? above	kye: flower
LOW <sup>4</sup>	kwan <u>y</u> a? meat	taha lazy	kiš <u>u</u> rope bag		nguš <u>i</u> tomato	tyukwi: trail	inkye? cocked
	wata cow	kuš <u>i</u> : daughter-in-law	indyalu spilling		kala: twenty	tyukwi long	inklyu: digging
	inkwi rotten	skwa corn dough	nda: beams		katya edible greens	kaha? will sleep	kuše:? racoon
	kuš <u>i</u> bad		yu?wa cargo		ku?ma large parrot	knya work	čkwa metal
	ngla: peach		tonu big		nginya shakes		
			tyaha tortilla				
HIGH <sup>2</sup>	yaka wood	kaya? wage		kiš <u>u</u> : avocado			
	skwa meal	kityi paper		kwiya:? soap			
	ngulu? bullet	tyaka? can see		katya: tobacco			
		?ikye head		tyikye: chest			
		ho?o saint		ta?a fiesta			

	HIGH <sup>2</sup>	LOW <sup>4</sup>	HIGH FALL <sup>23</sup>	LOW FALL <sup>15</sup>	HIGH RISE <sup>21</sup>	MID RISE <sup>32</sup>	LOW RISE <sup>43</sup>
RISING <sup>21</sup>	ndyata <i>bathing</i> n̄sas̄u <i>turns over</i>	tyaka? <i>will be tied</i> kwana <i>thief</i> ndyala? <i>touching</i> laca? <i>wet</i> katya <i>flour</i>	kwinya? <i>honey</i> kwana: <i>mirror</i> ndyata <i>sowing</i> kwa?ya <i>gopher</i> ku?ma <i>you (pl)</i>	katya <i>bottle</i> nyati <i>person</i> talya <i>night</i> kwaya? <i>mushroom</i> ndyalu <i>growing</i>			
	ndyata: <i>smashed</i> kwana <i>back load</i> tasa <i>sheet</i> n̄s̄tyakwi <i>turn around</i> klyati <i>mosquito</i> kwaya? <i>fly</i> ngula <i>strong</i>		čumi <i>cat</i> lasa <i>easy</i> kwaya? <i>measure</i> čati <i>nest</i> tya?we <i>divide</i>		PRODUCT OF SANDHI RULE 4		
FALLING <sup>45</sup>							

## SANDHI RULE 2

Words of the sequence 21 - 2 change to 45-2 before words of the patterns 2 - 4, (4) 21-23, (4) 21-4, and 4-2.

nša<sup>21</sup>su<sup>2</sup> *turns over* + ki<sup>2</sup>tyi<sup>4</sup> *paper* --> nša<sup>45</sup>su<sup>2</sup> ki<sup>2</sup>tyi<sup>4</sup>  
*the paper turns over*

ndya<sup>21</sup>ta<sup>2</sup> *bathing* + nu<sup>4</sup> pi<sup>21</sup>ti<sup>23</sup> *child* --> ndya<sup>45</sup>ta<sup>2</sup> nu<sup>4</sup> pi<sup>21</sup>ti<sup>23</sup>  
*the child is bathing*

ndya<sup>21</sup>ta<sup>2</sup> *bathing* + nu<sup>4</sup> kwa<sup>21</sup>na<sup>4</sup> *thief* --> ndya<sup>45</sup>ta<sup>2</sup> nu<sup>4</sup> kwa<sup>21</sup>na<sup>4</sup>  
*the thief is bathing*

nša<sup>21</sup>su<sup>2</sup> *turns over* + kwi<sup>4</sup>hi<sup>2</sup> *skunk* --> nša<sup>45</sup>su<sup>2</sup> kwi<sup>4</sup>hi<sup>2</sup>  
*the skunk turns over*

Words of the sequence 21 - 2 do not change before words of the patterns 2 - 2, 4 - 4, 4 - 32, 4 - 23, and 45 - 23.

nša<sup>21</sup>su<sup>2</sup> *turns over* + ya<sup>2</sup>ka<sup>2</sup> *tree* --> nša<sup>21</sup>su<sup>2</sup> ya<sup>2</sup>ka<sup>2</sup>  
*the tree is turning over*

ndya<sup>21</sup>ta<sup>2</sup> *bathing* + ku<sup>4</sup>ši<sup>4</sup> *daughter* --> ndya<sup>21</sup>ta<sup>2</sup> ku<sup>4</sup>ši<sup>4</sup>  
*-in-law the daughter-in-law is bathing*

nša<sup>21</sup>su<sup>2</sup> *turns over* + ki<sup>4</sup>šu<sup>23</sup> *rope bag* --> nša<sup>21</sup>su<sup>2</sup> ki<sup>4</sup>šu<sup>23</sup>  
*the rope bag is turning over*

ka<sup>21</sup>ta<sup>2</sup> *will bathe* + ču<sup>45</sup>mi<sup>23</sup> *cat* --> ka<sup>21</sup>ta<sup>2</sup> ču<sup>45</sup>mi<sup>23</sup>  
*the cat will bathe*

After words of the pattern 21-23, a word of the pattern 21 - 2 changes to the pattern 45 - 2. It does not change after words of other patterns.

(Control) č<sup>4</sup>kwa<sup>43</sup> *metal* + nša<sup>21</sup>su<sup>2</sup> *turns over* --- č<sup>4</sup>kwa<sup>43</sup> nša<sup>21</sup>su<sup>2</sup>  
*it's the metal that turns over*

(Sandhi) ko<sup>21</sup>lo<sup>23</sup> *turkey* + nša<sup>21</sup>su<sup>2</sup> *turns over* --- ko<sup>21</sup>lo<sup>23</sup> nša<sup>45</sup>su<sup>2</sup>  
*it's the turkey that turns over*

(Sandhi) wi<sup>21</sup>lya<sup>23</sup> *not yet* + ka<sup>21</sup>ta<sup>2</sup> *will bathe* --- wi<sup>21</sup>lya<sup>23</sup> ka<sup>45</sup>ta<sup>2</sup>  
*it will not bathe yet*

## SANDHI RULE 3

Some words of the pattern 2 - 45 become 4 - 23 after a word of the pattern 2 - 45 or the pattern 2 - 4. The two examples of words that undergo this change are m<sup>2</sup>su<sup>45</sup> *servant* (Spanish *mozo*) and m<sup>2</sup>sta<sup>45</sup> *offering* (Spanish *limosna*). Both words are early borrowings from Spanish, and even though they have been completely assimilated into regular Chatino phonological patterns and are common words, no purely native words were found to undergo this type of change.

(Control) ku<sup>4</sup>ši<sup>2</sup> *is bad* + m<sup>2</sup>su<sup>45</sup> *servant* --> ku<sup>4</sup>ši<sup>2</sup> m<sup>2</sup>su<sup>45</sup>  
*the servant is bad*

la<sup>45</sup>sa<sup>23</sup> *light (weight)* + m<sup>2</sup>sta<sup>45</sup> *offering* --> la<sup>45</sup>sa<sup>23</sup> m<sup>2</sup>sta<sup>45</sup>  
*the offering is light*

(Sandhi) ndyu<sup>2</sup>ci:<sup>45</sup> *is frightened* + m<sup>2</sup>su<sup>45</sup> *servant* --> ndyu<sup>2</sup>ci:<sup>45</sup> m<sup>4</sup>su<sup>23</sup>  
*the servant is frightened*  
 čka<sup>2</sup>ti<sup>4</sup> *will be whitened* + m<sup>2</sup>sta<sup>45</sup> *offering* --> čka<sup>2</sup>ti<sup>4</sup> m<sup>4</sup>sta<sup>23</sup>  
*the offering will be whitened*

## SANDHI RULE 4

Some words of the pattern 45 - 23 change to the pattern 21 - 45 before words of the pattern 4 - 21 and the pattern 45 - 23.

(Control) ka<sup>45</sup>lu<sup>23</sup> *will grow* + kwi<sup>4</sup>ci<sup>32</sup> *lion* --> ka<sup>45</sup>lu<sup>23</sup> kwi<sup>4</sup>ci<sup>32</sup>  
*the lion will grow*  
 (Sandhi) ka<sup>45</sup>lu<sup>23</sup> *will grow* + ngu<sup>4</sup>si<sup>21</sup> *tomato* --> ka<sup>21</sup>lu<sup>45</sup> ngu<sup>4</sup>si<sup>21</sup>  
*the tomato will grow*  
 ka<sup>45</sup>lu<sup>23</sup> *will grow* + ču<sup>45</sup>mi<sup>23</sup> *cat* --> ka<sup>21</sup>lu<sup>45</sup> ču<sup>45</sup>mi<sup>23</sup>  
*the cat will grow*

These same words of the pattern 45 - 23 change to the pattern 45 - 21 after words of the pattern 4 - 23 and the pattern 4 - 4.

(Control) ngu<sup>4</sup>si<sup>21</sup> *tomato* + ka<sup>45</sup>lu<sup>23</sup> *will grow* --> ngu<sup>4</sup>si<sup>21</sup> ka<sup>45</sup>lu<sup>23</sup>  
*it's the tomato that will grow*  
 (Sandhi) kwi<sup>4</sup>ci<sup>23</sup> *lion* + ka<sup>45</sup>lu<sup>23</sup> *will grow* --> kwi<sup>4</sup>ci<sup>23</sup> ka<sup>45</sup>lu<sup>21</sup>  
*it's the lion that will grow*  
 ku<sup>4</sup>si:<sup>4</sup> *his daughter-* + ka<sup>45</sup>lu<sup>23</sup> *will grow* --> ku<sup>4</sup>si:<sup>4</sup> ka<sup>45</sup>lu<sup>21</sup>  
*in-law it's his daughter-in-law that will grow*

Two examples of words that undergo this sandhi rule are ka<sup>45</sup>lu<sup>23</sup> *will grow* and tya<sup>45</sup>we<sup>23</sup> *will be divided*. Both these words are verb forms in the intensitive aspect, which is possibly a factor limiting the changes undergone in this sandhi rule.

## 5. Tone morphemes.

Changes of tone were noted on some verb stems between the intensitive and non-intensitive aspects.<sup>14</sup> The intensitive form is considered to be the base form of the stem tone. Changes exhibited in this study were:

Verbs with the patterns 21 - 4 or 21 - 2 in the intensitive aspect change to 45 - 23 and 45 - 2, respectively, in the nonintensitive aspects.

<i>intensitive</i>	<i>nonintensitive</i>
tya <sup>21</sup> ka? <sup>4</sup> <i>will be tied up</i>	ndya <sup>45</sup> ka? <sup>23</sup> <i>is tied up</i>
sa <sup>21</sup> su <sup>2</sup> <i>will turn over</i>	nsa <sup>45</sup> su <sup>23</sup> <i>is turning over</i>
tya <sup>21</sup> ta: <sup>4</sup> <i>will be crushed</i>	ndya <sup>45</sup> ta: <sup>2</sup> <i>is crushed</i>

Verbs with the pattern 45 - 23 in the intensitive change to 21 - 45 in the non-intensitive aspects.

ka <sup>45</sup> lu <sup>23</sup> <i>will grow</i>	ndya <sup>21</sup> lu <sup>45</sup> <i>is grown</i>
--	---

Some verbs do not change the basic tone pattern of the intensive aspect in the nonintensive aspects.

tya <sup>4</sup> ki <sup>23</sup>	will be burned	ndya <sup>4</sup> ki <sup>23</sup>	is burning
ka <sup>45</sup> ku <sup>23</sup>	will eat	ndya <sup>45</sup> ku <sup>23</sup>	is eating

In 1971 I did a study of the tone behavior of representative verbs from each of the verb classes set up at that time for the grammar.<sup>15</sup> It was noted that the basic tone on the verb stem often changed on the intensive aspect, but did not change across the other three aspects. There was possibly a slight lowering of the tone on the completive and/or habitual aspects, but the basic pattern remained the same. The present study conforms to that observation.

The tone of the verb stem is not influenced by the tone of the person pronouns which follow them. The only change that the tones of the pronouns themselves exhibit is a phonetic raising of a low tone to mid pitch.

The following monosyllabic pronouns have low tone and occur after a verb stem or an innately possessed noun: na<sup>?4</sup> I, yu<sup>4</sup> he, ya<sup>4</sup> we exclusive, na<sup>4</sup> we inclusive, ni<sup>?4</sup> it (animal) and ni<sup>4</sup> it (divinity), and ma<sup>4</sup> you plural.<sup>16</sup>

The disyllabic pronouns nu<sup>2?u</sup><sup>4</sup> you singular and n<sup>4</sup>gu<sup>?4</sup> they do not exhibit change. In the case of nu<sup>2?u</sup><sup>4</sup>, the tone pattern of the preceding word appears to be forced higher by the initial high tone (i.e., perceptually the pitch of the preceding word is higher) though the phonological tone remains the same.



kula<sup>2</sup>ha<sup>45</sup> s<sup>4</sup>ti<sup>23</sup> nu<sup>2?u</sup><sup>4</sup>  
your father will sweep



kula<sup>2</sup>ha<sup>45</sup> s<sup>4</sup>ti<sup>23</sup> yu<sup>4</sup>  
his father will sweep

The first person singular pronoun has a variant which drops the pronoun and replaces it by a change of tone on the stem, accompanied by an allomorph of vowel length and nasalisation. In stems ending with o, the vowel also changes to .

ndya <sup>21</sup> ta <sup>23</sup> na <sup>?4</sup>	→ <sub>OPF</sub>	ndya <sup>21</sup> ta <sup>:43</sup>	I am planting
n <sup>4</sup> šna <sup>23</sup> na <sup>?4</sup>	→ <sub>OPF</sub>	n <sup>4</sup> šna <sup>:43</sup>	I am running

This is also true of innately possessed nouns.

klyo <sup>4?o</sup> na <sup>?4</sup>	→ <sub>OPF</sub>	klyo <sup>2?u</sup> <sup>43</sup>	my wife
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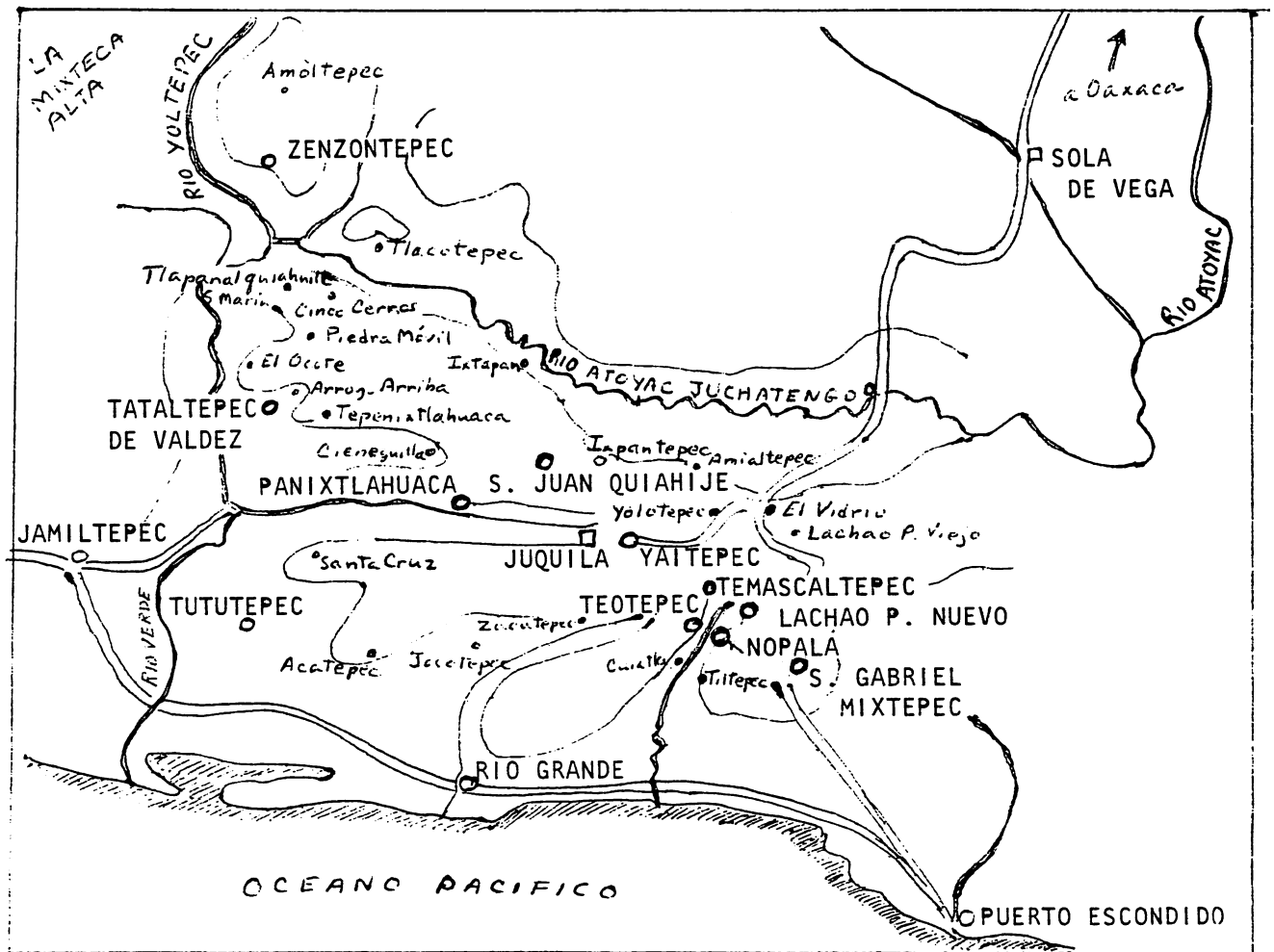
There are contracted forms of other pronouns in fast speech (as observed in Yaitepec, L. Pride 1963), but they are not included in this study because they proved difficult to elicit from the Tataltepec informants, who had become accustomed to using the full form of the pronouns in writing the language.

## 6. Conclusion.

The tone system of Tataltepec Chatino is best described in terms of two level tones and five contour (glide) tones. The phonetic characteristics of the tones can be conveniently described in relation to five phonetic levels, similar to a music staff. Previous analyses of Chatino have tried to work within the notion of a register tone system and have postulated first four and then three emic levels

in terms of which the tone glides could be identified. Neither system was found completely satisfactory, because they did not accurately describe the phonological realities of the language.<sup>17</sup>

The present study in addition to asserting the essential contour nature of the tone system has discovered that four of the seven distinctive tones found on the stressed ultimate syllables contrast on the pretonic penultimate syllables. The analysis of the contrastive tones on the penult resulted from an improvement in the analytical procedure for investigating tone, which I have termed Process Analysis.



THE CHATINO LANGUAGE AREA

## FOOTNOTES

<sup>1</sup> Howard P. McKaughan, Chatino formulas and phonemes, IJAL 20, 23-27 (1954); Jessamine Upson, A preliminary structure of Chatino, AL 2.6, 22-29 (1960); Leslie G. Pride, Chatino tonal structure, AL 5.2, 19-28 (1963); Jessamine Upson, Chatino length and tone, AL 10.2, 1-7 (1968). All these papers describe the Chatino dialect spoken in Santiago Yaitepec, Juquila, Oaxaca.

<sup>2</sup> The dialect of Chatino spoken in Tataltepec de Valdez, Juquila, Oaxaca, is spoken by some 2,500 people, centred in the one municipal town. It has a mutual intelligibility of less than 20% with Tepenixtlahuaca and Panixtlahuaca, the nearest towns in the Yaitepec dialect. (See the report on mutual intelligibility surveys carried out in 1968, 1972, and 1973 by Ed Farris and Leslie Pride: Steven Eglad, *La inteligibilidad interdialectal en Mexico*, Mexico, D.F., Instituto Linguístico de Verano 1978, pp. 10-11. But note that Pride was not quoted correctly on page 11 with respect to Yolotepec, Zacatepec, Juquila and Lachao Viejo.) Historically Tataltepec probably represents a stage of transition somewhere between the 'open' or noncontracted speech forms of the Zenzontepec-Tlapanalquiahuitl dialects and the closed or contracted speech forms of the Panixtlahuaca-Yaitepec-Nopala dialects (which form the main nucleus of the Chatino area). A brief explanation of 'open' and 'closed' would be useful here. 'Closed' or contracted Chatino forms may be defined as those in dialects where the vowels of the penultimate syllable are either absent altogether or where the vowel of the penult is uttered at great speed and is barely perceptible, sometimes appearing as a voiceless vowel.

OPEN	CLOSED	
ʃu <sup>2</sup> ne? <sup>4</sup>	ʃne? <sup>4</sup>	dog
ya <sup>2</sup> ka <sup>2</sup>	yka <sup>2</sup>	wood, tree
čuni <sup>2</sup> ?i <sup>45</sup>	ʃE?e <sup>2</sup>	scorpion
tya <sup>4</sup> ha <sup>23</sup>	kyIha <sup>3</sup>	tortilla
kwa <sup>4</sup> ci? <sup>2</sup>	kUci? <sup>4</sup>	iguana lizard

In some cases the non-final syllables are reduced to formidable consonant clusters:

nty <sup>2</sup> ho <sup>4</sup> la <sup>4</sup> ki <sup>21</sup>	hwa <sup>4</sup> ki <sup>2</sup>	pull
ngula <sup>2</sup> kwa <sup>45</sup>	mlkwa <sup>4</sup>	counted
kwa ntyikwi? (Zen)	mykwi? <sup>23</sup>	spoke
ndya <sup>45</sup> ku <sup>23</sup>	yku <sup>23</sup>	eaten
somelu (Zen)	m <sup>4</sup> slu <sup>4</sup>	hat

Some of the towns where such contracted forms are spoken are Nopala, Cuixtla, Temascaltepec, Teotepec, San Juan Quiahije, Yaitepec and Panixtlahuaca. Examples are cited from Yaitepec. Towns where 'open' or noncontracted forms are spoken are Zenzontepec, Tlacotepec, Tlapanalquiahuitl, and a small, not well unified subdialect which cuts through the middle of the main area, comprising the villages of Zacatepec, Yolotepec, San Juan Lachao Viejo and the aboriginal Chatino population of Juquila. Examples cited of noncontracted forms are from Tataltepec, except those identified as coming from Zenzontepec.

Linguistic data from Tataltepec were collected under the auspices of the Summer Institute of Linguistics during field trips between 1964 and 1980, more particularly in the period from October 1978 to April 1979, working with several lan-

guage assistants: Eleuterio López (35 yrs.), Vicencio Hernández (30 yrs.), Salomé Hernández (29 yrs.), and Petra Mejía (29 yrs.). I appreciate very much the consultant advice of Barbara Hollenbach, John Alsop, John Daly, and Doris Bartholomew.

<sup>3</sup>Yaitepec final syllable onset consonants t, l, ʔ, and y, sometimes suggest the presence of an extra heavy stress beyond the main stress of the phonological word. Back in 1963, while working on the published tone study, we wondered whether that 'stress' should be interpreted as lengthened consonants (CC), or as ballistically stressed, or whether there was a delay in rhythm, or whether the vowel nucleus of the penultimate syllable was lengthened. It has turned out that we were hearing something of the contrastive tone on the penult, but thought we were hearing stress distinctions on the ultima.

<sup>4</sup>Kenneth L. Pike, *Tone Languages*, Ann Arbor: University of Michigan Press, 1948.

<sup>5</sup>The following is a fuller description of Process Analysis (perhaps better titled, *Natural combination matrix procedure*, Ed.).

Words are selected from all word classes and are joined into lists of two-word utterances where both words in the utterance have the same phonological shape, apart from tone. The criteria for joining them in utterances is that of natural speech construction. The utterances may be of any grammatical construction or lexical meaning. That does not matter initially. All that is important is that the utterance is the same phonological shape and is a legitimate natural speech form. All that is in focus is the tone pattern of the two-word utterance when said naturally. If the language permits, words should be selected which can also be reversed syntactically, albeit with a change of meaning, to test the effect of preceding or following tones. Reversibility is helpful, but not crucial, however, because the frequent use of a limited number of words in many combinations will expose them to all kinds of tests anyway. So, the test utterances are natural speech frames which are interchangeable or reversible, exposing the data to every kind of environmental situation which might cause change. The aim is to get examples of all possible combinations of tone patterns in two-word sequences and to fill as many cells as possible in a matrix of the theoretically possible combinations.

Monosyllabic words are used first, then disyllables, of each different canonical shape in turn. The test can be extended ad infinitum to trisyllables and to three or more word utterances, and to the whole inventory of the language. (This is also true of the fixed frame analysis of Pike.)

The tone patterns of the utterances in each list are then recorded in strictly phonetic configurations, drawn according to the subjective auditory impressions of the investigator. No attempt is made at this point to mark tone more exactly by using tone numbers or diacritic marks or to determine the relative height of the tone contours; it is the contrastive tone contours that are important. Then the lists are successively grouped and regrouped into lists having similar tone patterns, until the maximal number of different tone patterns has been identified. Once the contrastive patterns have been established, phonological analysis of them can be done and the tone phonemes can be described in terms of fixed points of reference.

The end result of Process Analysis in terms of phonological tones, levels and sandhi rules could also be arrived at via a fixed frame analysis. The difference is that a Process Analysis (natural combination matrix procedure) brings together all the pertinent information in one moderately-sized test-bed (matrix), but the success of a fixed frame analysis depends on establishing a sufficient number of frames to cover all word classes, phonological types and environmental situations and it is difficult to find a small number of fixed frames to do this. Because Process Ana-

lysis is based on all naturally occurring combinations of two words, it is able to give the same attention to all word classes in the language. The temptation of a fixed frame analysis is to work almost exclusively with nouns in establishing the basic tone contrasts. The procedure of using natural combinations and of reversing sequences where possible involves the investigator in the study of the tone behavior of verbs from the very start.

This method of using naturally occurring word combinations in a matrix of possible combinations was introduced by John Alsup to a SIL workshop on Zapotecan languages held at the Jaime Torres Bodet Linguistic Center in Mitla, Oaxaca, in December, 1976, and the credit for its development and use belongs to him. He used it with success on the tone systems of a number of Zapotec languages.

<sup>6</sup>Where the lexical meaning demands it, some small words which appear to be phonologically minor words are also included in these two-word sequences. Their tone does not affect the tone of the major words they precede or follow. (The two-word utterances turn out to be phonological phrase units and this is true of such sequences with an interspersed minor word.)

?i <sup>2</sup> k <sup>4</sup> ye <sup>4</sup> nu <sup>4</sup> kuna <sup>4</sup> ?a <sup>4</sup> 3	the woman's head
tya <sup>21</sup> ta: <sup>4</sup> na <sup>4</sup> lku <sup>4</sup> ti <sup>2</sup>	the soft thing will be crushed
s <sup>2</sup> kwa <sup>2</sup> hi <sup>2</sup> ?i <sup>4</sup> ku <sup>4</sup> ʃi: <sup>4</sup>	the stew of the daughter-in-law

<sup>7</sup>Word stress is predictable in Chatino, and very strong - always on the ultima. It is one of the main factors in defining word boundaries.

<sup>8</sup>Of five examples of i occurring with a pitch glide on the penult, all were rising glides except one; of eight examples of u with a pitch glide on the penult, all were rising except one.

<sup>9</sup>Jorge Suarez, abstract of Rensch "Comparative Otomanguan Phonology" (1976), IJAL 46. 49-56 (1980).

<sup>10</sup>Alan Healey, *Telefol Phonology*, Linguistic Circle of Canberra Publications, Series B, Monographs, no. 3 (1964).

<sup>11</sup>In a concurrent study by Kitty Pride on the phonemic system pressure on borrowed words in Tataltepec Chatino, she points out that two Spanish loans show pronounced length in their penultimate syllables, due to dropping of an existing or supposed middle syllable:

sa: <sup>21</sup> ru <sup>4</sup>	from	sábado	Saturday
lo: <sup>21</sup> ra <sup>4</sup>	from	libra via *liwira	one pound weight

<sup>12</sup>Kitty and Leslie Pride, Tataltepec Chatino syllables, unpublished manuscript (November, 1964).

<sup>13</sup>Although tone is only marked on the penult and the ultima, if the penult is a syllabic consonant (Pretonic syllable type III), pitch is written as in a normal tone pattern, but neither falling nor rising tones occur.

<sup>14</sup>The term 'intensive' is used here for the future in preference to 'potential', not because it is a more apt term than the latter - both terms are capable of greater connotational differences than 'future' - but because it was the term used by K. Pride, 1971.

<sup>15</sup>Kitty Pride, Tataltepec verb stems, unpublished manuscript (1971). The tones of the data recorded on that occasion were not sufficiently clear for any definite conclusions. In spite of the inadequate data it is in general agreement with the present study.

<sup>16</sup>Tataltepec pronouns are grammatically free forms (in a limited sense), but are phonologically minor words: they are clitics rather than suffixes and have some phonological dependence on the preceding major word.

<sup>17</sup>Douglas Biber contrasts Chatino tone with Mazatec tone as an example of a tone system which requires contour distinctive features rather than a sequence of level tone features: The lexical representation of contour tones, IJAL 47. 271-82 (1980).