STUDIES IN OTOMANGUEAN PHONOLOGY

William R. Merrifield
editor

SUMMER INSTITUTE OF LINGUISTICS

UNIVERSITY OF TEXAS AT ARLINGTON

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INTRODUCTION

This volume of phonology papers, treating languages of the Otomanguean group, includes materials from three of its major families: Mixtecan, Popotecan, and Zapotecan.

The Mixtecan family is represented by two quite diverse approaches to Mixtec languages and a contrastive analysis of two Trique dialects. Daly provides an innovative and detailed discussion of a Mixtec tone problem for Peñoles Mixtec which challenges the kind of traditional interpretation that has dominated much of Mixtec phonological analysis. North and Shields, in contrast, present a traditional description, combining an analysis of segmental and tone phonemes with a few morphophonemic observations. Hollenbach takes a different tack altogether in her topological comparison of two Trique dialects by first inquiring into the details of the two phonological systems and then speculating upon the kinds of adjustments the speaker of one must make to understand a speaker of the other.

The Popotecan family is here represented by descriptions of both a Popolocan and a Mazatecan language. Stark and Machin highlight the roles of stress and tone in their description of the phonological word and phrase in a northern Popolocan language, while Jamieson provides a description--divided into two papers because of its thoroughness and careful attention to phonetic detail--of Chiquihuitlan Mazatec segments and tone.

Finally, the Zapotecan family is represented by two papers. Larry and Rosemary Lyman bring the fruits of several years of research to bear upon a hierarchical study of Coapan Zapotec phonology, dealing with phoneme through sentence levels, including a discussion of an extensive system of tone sandhi; and Jones collaborates with consultant Knudson to give us a first look at Guelavía Zapotec with a traditional analysis of segmental phonemes and tone, highlighting contrastive features and distribution.

Although two or three papers in this collection do address interesting theoretical questions or innovative approaches, the volume finds its major strength and usefulness in the presentation of a wide range of phonological facts which will stand us in good stead for many years to come as we seek a greater understanding of an important group of Meso-American languages.

William R. Merrifield

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A PROBLEM IN TONE ANALYSIS

John P. Daly

1. Peñoles Mixtec presents a problem in tone analysis that demonstrates the need to balance morphophonemic and phonetic considerations in determining tone phonemes. An overreliance on phonetic similarity of tone levels leads to an unnecessarily complicated account of morphophonemic processes, while a simple account of morphophonemic processes is consistent with a relatively simple account of the phonetic manifestation of tones, including a natural explanation of tone terracing and tone neutralization.

Placing words in tone frames to aid in determining the phonetic levels of tone leads naturally to positing three phonemic tones. Close attention to morphophonemic processes, however, leads to positing four phonemic tones. In the four-tone analysis there is some unexpected phonetic overlap in the tones, but the analysis makes possible a simple statement of morphophonemic processes which would otherwise be very complex, and leads to a simple and natural explanation of tone terracing and tone neutralization.[1]

Disyllabic nouns carry nearly all the combinations of tone, both basic and derived, which occur in Peñoles Mixtec and can readily be placed in a variety of tone frames. In a frame ending in a high tone, such as the word for *he sees*, the basic tones of the nouns occur. Three tones, high (H), mid (M), and low (L), are all that are needed to account for the basic tone patterns with one tone to a syllable, except in one pattern where two tones are needed to account for a glide from mid to low on a single syllable (1).[2]

(1a)	ši^{L}ni^{M}-de^{H} ča^{H}ka^{H}	*he sees fish*
(1b)	ši^{L}ni^{M}-de^{H} ča^{H}kwa^{M}	*he sees the wood chips*[3]
(1c)	ši^{L}ni^{M}-de^{H} sa^{H}nu^{L}	*he sees the daughter-in-law*
(1d)	ši^{L}ni^{M}-de^{H} ta^{M}ta^{H}	*he sees father*
(1e)	ši^{L}ni^{M}-de^{H} di^{M}to^{M}	*he sees the uncle*
(1f)	ši^{L}ni^{M}-de^{H} mi^{M}či^{L}	*he sees the cat*
(1g)	ši^{L}ni^{M}-de^{H} kwa^{L}žu^{M}	*he sees the horse*
(1h)	ši^{L}ni^{M}-de^{H} kɨ^{L}tɨ^{L}	*he sees the animal*
(1i)	ši^{L}ni^{M}-ce^{H} čį^{L}ų^{ML}	*he sees (knows) the work*

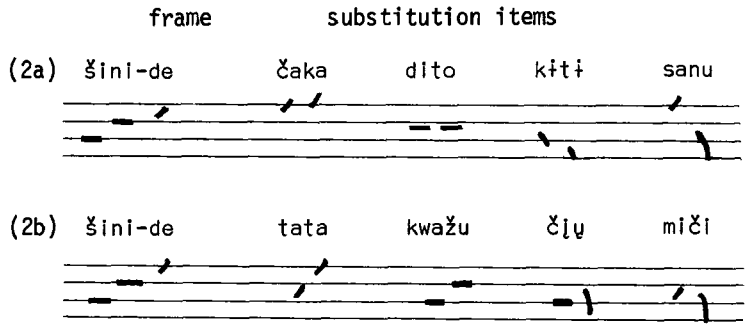
Comparing the nine nouns, one finds obvious contrast for the three tones. The three tones contrast following high and following mid, and they contrast before mid and before low. Only one of the nine theoretically possible tone patterns of one tone to a syllable is missing: low high.

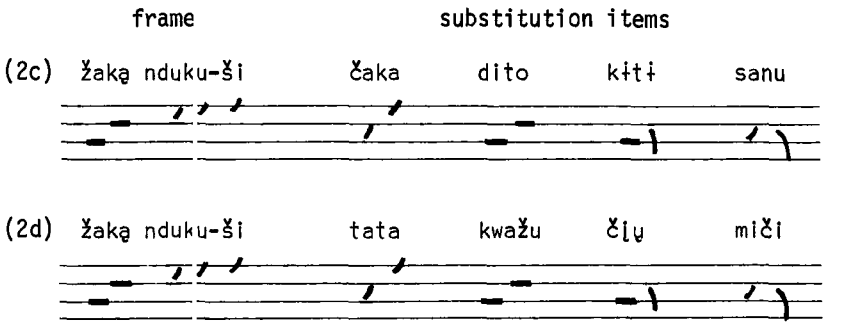
The analysis to this point is not too different from what the linguistic investigator might be expected to arrive at in his beginning work, but as more of the language is brought into focus it becomes more difficult to maintain this phonemicization of tone or a modification of it. A completely new approach is needed.

2. The most direct approach to determining the tones of Peñoles Mixtec is to look for a phonemicization that will make possible a simple statement of the morphophonemic relations between tone patterns, while at the same time making possible a simple statement of the phonetic manifestation of the tones.

2.1 To show the morphophonemic relations between tone patterns, I have placed disyllabic nouns in one frame which gives their basic tone patterns and in a second frame which gives the same nouns with one kind of their derived tone patterns. Comparing the basic and derived patterns aids in determining the tone phonemes, which facilitate the description of the change of each of the basic tone patterns to each of the corresponding derived ones.

In (2), I have placed eight of the nine nouns in the two kinds of frames, leaving the noun for *wood chips* until later, since it brings in a complication not found in the other eight nouns. In (2a) and (2b), each of the eight nouns occurs in a frame (the word for *he sees*) which gives the eight basic tone patterns. In (2c) and (2d), the eight nouns occur in a frame (the phrase for *over there she is looking for*) that gives four derived patterns (2c) and four basic patterns (2d).





The basic tone patterns of (2a) are replaced by the derived tone patterns of (2c). Note that the derived patterns of (2c) are identical to the basic patterns of (2b) and that the basic patterns of (2b) occur unchanged in (2d). In other words, no new pattern is produced in tone sandhi, but the eight basic patterns fall together into four. Comparing the tone patterns of (2a) with those of (2b)-(2d) leads to a new phonemicization of tone and to a simple description of the change from the basic patterns to the derived ones.

Two tones, high (´) and low (unmarked), are sufficient to differentiate the patterns in (2a). Assigning these two tones in the most obvious way gives čáká, kɨtɨ, and sánu, with the remaining pattern, low high, assigned to ditó, even though it is not immediately obvious that this is correct. The feature specifications [+High] and [-High] can now be assigned to the tones high and low, respectively, and to the corresponding forms in (2b)-(2d).

To account for the difference between (2a) and (2b)-(2d), an additional binary feature [Modify][4] is posited for each noun. The first syllables of the nouns in (2a) are specified as [-Modify], and the first syllables of the nouns in (2b)-(2d) are specified as [+Modify][5]. There are now four tones: high [+High, -Modify], modified high [+High, +Modify], low [-High, -Modify], and modified low [-High, +Modify].

With the additional two tones, modified high (ˇ) and modified low (ˆ), the basic tone patterns of the nouns in (2) are as in (3).

	frame	substitution items			
(3a)	šĭnĭ-dé	čáká	dɪtó	kɨtɨ	sánu
(3b)	šĭnĭ-dé	tătá	kwàžú	čɭᵩ	mĭčɨ
(3c)	žàkᵩ ndúkú-šĭ	čăká	dĭtó	kɨ̆tɨ	sănu

(3d) žàką́ ndúkú-ší tǎtá kwàžú čįų mʸǐči[6]

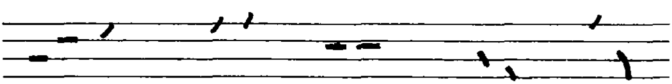
The kinds of morphemes which form the condition for the tone changes from those of (3a)-(3b) to those of (3c)-(3d) are arbitrary subclasses of morphemes with basic high high tones (e.g., níʔí *to find* conditions the changes, but kúdú *to sleep* does not), arbitrary subclasses of morphemes with basic low low tones (e.g., nʸuši *chicken* conditions the changes, but kɨtɨ *animal* does not), and all morphemes with derived high high tones (see (12) below). In order to differentiate the morphemes which condition the tone changes from those which do not, [+Modify] can be introduced in the underlying or, in the case of the derived high tones, in the derived structure on the last syllable of the morphemes which condition the changes. Informally, the rule which accounts for tone modification is:

(4) TONE MODIFICATION RULE: Tone modification on the last syllable of a morpheme is shifted to the next following syllable.[7]

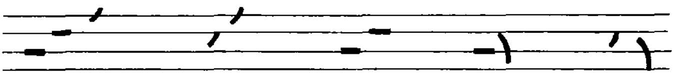
2.2 Rule (4) accounts for one kind of tone derivation. A second kind, in which each of the modified tones becomes unmodified (i.e., the opposite change), takes place following the frame ndùku-ši *she looks for*. The basic patterns of (5a) remain unchanged in (5c), while the tone patterns of (5b) are replaced by the tone patterns of (5d). The changes of the tones in (5b) to those in (5d) are conditioned by a preceding modified low tone.

frame substitution items

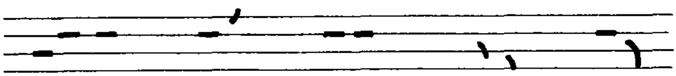
(5a) šìní-dé čáká ditó kɨtɨ sánu



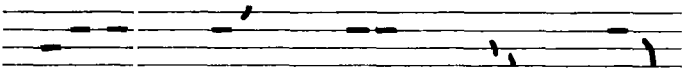
(5b) šìní-dé tǎtá kwàžú čįų mʸǐči



(5c) ndùku-ši čáká ditó kɨtɨ sánu



(5d) ndùku-ši tátá[8] kwažú čɨu mǐči



Any number of low tones may intervene between the modified low tone which conditions a change and the tone which loses its modification (6).

(6) ndùku žɨɨ-ši kwàžú > ndùku žɨɨ-ši kwažú *her husband is looking for a horse*

The modified low tone causes the loss of modification on every modified low tone up to the first high tone (7) or modified high tone (8). The modification of the modified high tone is also lost.

(7) ndùku-ši čɨu kwèndá nǎná-ši > ndùku-ši čɨu kwendá nǎná-ši *she is looking for work for her mother*

(8) ndùku-ši naña kwìi ndèku ndɨ?ɨ nǎná-ši > ndùku-ši naña kwii ndeku ndɨ?ɨ náná-ši *she is looking for the green chayote her mother has*

The rule which accounts for these changes is:

(9) LOSS OF TONE MODIFICATION RULE: Following a modified low tone plus any number of low tones, tone modification is lost.

2.3 There is another important kind of tone sandhi. Within a word, contiguous low or modified low tones (i.e., those with the feature [-High]) sometimes become high. The changes shown in (10) are conditioned by an immediately preceding high tone and are restricted to certain syntactic classes. For example, adjectives but not nouns, and verbs in the continuative aspect but not verbs in the potential aspect, undergo this kind of change.

(10a) tutú tɨu > tutú tűű *black paper*

(10b) tutú kwìi > tutù kwíí *green paper*

(10c) žàkǫ́ ndùku-ši-dɨ > žàkǫ́ ndúkú-ší-dɨ *she is looking for it (animal) over there*

The rule which accounts for the changes following high tone is:

(11) TONE ASSIMILATION RULE: Following a high tone, subject to syntactic constraints, contiguous tones specified as [-High] within a word become high.

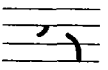
An addition must be made to rule (11) since tone modification is introduced following the last high derived by it. The rule must specify that the last derived tone is marked as modified so that this tone may form the condition for the modification of the next following tone by the TONE MODIFICATION RULE (4), as in (12).

(12) tutú tụụ-dé (underlying form)
tutú tṵ́ụ̰-dé (by the TONE ASSIMILATION RULE)
tutú tṵ́ụ̰-dě (by the TONE MODIFICATION RULE)
his black paper

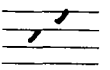
3. The foregoing four-tone analysis makes possible a simple statement of tone sandhi, but what of the phonetic consequences?

3.1 The statement of the phonetic manifestation of the two modified tones is simplest: a modified high tone is a short, upward glide, ending at mid pitch (13); a modified low tone is a low level tone, always followed by a tone beginning at a higher pitch (14).[9]

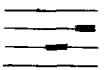
(13a) mǐčí *cat*



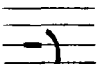
(13b) nǎná *mother*



(14a) kwàžú *horse*



(14b) čɭụ *work*

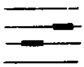


A modified low tone, and to a lesser degree a modified high tone, is often more readily recognized by its effect on following unmodified tones than it is by its own phonetic pitch, as can be seen in the following discussion of the conditioned variants of unmodified tones.

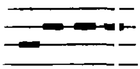
3.2 A high tone immediately following a modified low tone is lowered to mid pitch (15). The same lowering of high to mid takes place following a modified low tone plus any number of intervening low tones (16). Only the first high tone in a sequence of high

tones is lowered to mid (17).

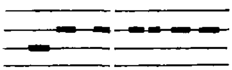
(15) kwàžú *horse*



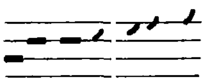
(16a) č]ų dltá *uncle's work*



(16b) ndùku-š ɨ̨ɨ̨ žučí *she is looking for a knife*

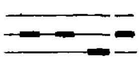


(17) č]ų tátá méé-ší *the work of that very girl's father*

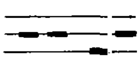


There is a second kind of lowering from high to mid. Following pause (18) or following one or more low tones not immediately preceded by a modified low tone (19), each high tone of one or more contiguous high tones is lowered to mid.

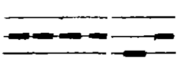
(18) žɨʔɨ́ žàką́ *the wolf over there*



(19a) žučí žàką́ *the knife over there*

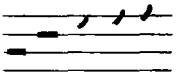


(19b) ɨ̨ɨ̨ kútú žàką́ *one musical instrument over there*



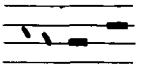
An unlowered high tone or string of unlowered high tones begins at a pitch between high and mid and ends at high.

(20) sɪ̀nɪ́-dé čáká *he sees the fish*

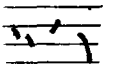


A low tone or a string of low tones begins at a pitch between mid and low and ends at low when preceding a modified tone (21), or begins at a pitch between mid and low and ends at extra-low when preceding pause (22). Each low tone of one or more contiguous low tones is mid when preceding high tone (23).

(21a) ɨɨ kwàžú *one horse*



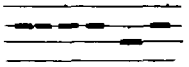
(21b) ɨɨ mɪ̌̀čɪ *one cat*



(22a) kɨtɨ *animal*

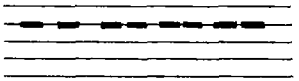
(22b) sánu *daughter-in-law*

(23) ɨɨ čáká žàkᾴ *one fish over there*

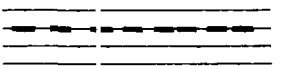


3.3 Inasmuch as one or more low tones followed by one or more high tones are all at mid pitch, there is neutralization of high and low tones. It is impossible from the phonetic data alone to say at which point the low tones end and the high tones begin.[10] In (24) all tones are on the same phonetic level: there is no contrast between the high tone of dɪtó and the low tones of kɨtɨ, and there is no contrast between the high tones of úní and the low tones of ɨɨ. Of course, in a different environment there is contrast between high and low in these morphemes (25).

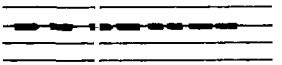
(24a) ka?nɪ dɪtó úní ñáñá *uncle will kill three coyotes*



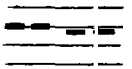
(24b) ka?ni kɨtɨ únî ñáñá *the animal will kill three coyotes*



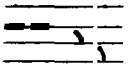
(24c) ka?ni kɨtɨ ɨɨ ñáñá *the animal will kill one coyote*



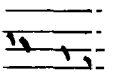
(25a) únî dɨtó *three uncles*



(25b) únî kɨtɨ *three animals*

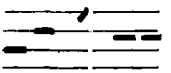


(25c) ɨɨ kɨtɨ *one animal*

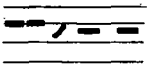


3.4 The high and low tones which were said to be at mid pitch are actualized on a slightly lower pitch when they follow an unlowered high tone (26) or a modified high tone (27). They are actualized on successively lower pitches when they form a series of alternating high and low tones. Each low tone or string of low tones is lower than the immediately preceding high tone(s), and each high tone or string of high tones is on the same pitch as the immediately preceding low tone(s) (28). However, a nonfinal word ending in a high tone is slightly higher than a low tone of the preceding word, but does not return to the level of an earlier high tone (29).

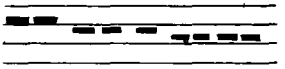
(26) šînî-dé dɨtó *he sees the uncle*



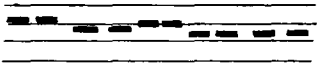
(27) úú mǐčí-dé *two of his cats*



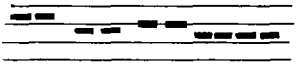
(28) kiní kolo-dé ɨɨ kóó *his turkey will see one snake*



(29a) kiní dɭ?ą úní kolo ditó *the hawk will see three of the uncle's turkeys*

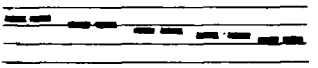


(29b) kiní kolo ditó ɨɨ kóó *the uncle's turkey will see one snake*



The lowering of high to the same pitch as a preceding low occurs at morpheme boundaries and within morphemes. Thus the low plus high of ditó are on the same pitch,[11] and in a sequence of morphemes like ditó, each successive morpheme is on a lower pitch than the immediately preceding morpheme (30).[12]

(30) kiní ditó didí šɨtɨ itú *the uncle will see the aunt in the cornfield*



This phenomenon, known as tone terracing, has a different explanation in Peñoles Mixtec than that for any other language I know about. Tone terracing has been accounted for elsewhere by positing a low tone which causes a lowering of high to mid with the subsequent deletion of the low tone (McCawley 1970), but in Peñoles Mixtec the low tone actually occurs as part of the tone pattern of the lowered morpheme. Tone terracing has also been accounted for by positing a tone phoneme of 'drop', which is defined as a tone lower than the immediately preceding tone (Welmers 1959), but in Peñoles Mixtec the tone which brings about the lowering has other

phonetic manifestations as well. A third way tone terracing has been accounted for is by positing 'non-automatic downstep' where its only phonetic manifestation is found in the lowering of a following high tone (Stewart 1964), but 'non-automatic downstep' is unnecessary for Peñoles Mixtec since the tone phonemes needed in any case are sufficient to account for terracing.[13]

4. The analysis developed to this point receives further confirmation from the tone sandhi which occurs before ža *(3pl, human)*. This sandhi is accounted for by positing a high tone before the low tone of ža in underlying structure: ´ža. If the conditions for the TONE MODIFICATION RULE are met, the high tone becomes modified. The high tone or modified high tone is never actualized on ´ža but always shifts to the immediately preceding syllable. If the high tone becomes modified, it replaces the immediately preceding tone; and if it remains unmodified, it follows the immediately preceding tone to make two tones to one syllable (31).

(31a) šĭnĭ-dé čáká-´ža > šĭnĭ-dé čákǎ-ža *he sees their fish*

(31b) šĭnĭ-dé dító-´ža > šĭnĭ-dé dító´-ža *he sees their uncle*

(31c) šĭnĭ-dé kɨtɨ-´ža > šĭnĭ-dé kɨtɨ´-ža *he sees their animal*

(31d) šĭnĭ-dé sánu-´ža > šĭnĭ-dé sánu´-ža *he sees their daughter-in-law*

(31e) šĭnĭ-dé tătá-´ža > šĭnĭ-dé tătǎ-ža *he sees their father*

(31f) šĭnĭ-dé kwàžú-´ža > šĭnĭ-dé kwàžú´-ža *he sees their horse*

(31g) šĭnĭ-dé čɭɥ-´ža > šĭnĭ-dé čɭɥ´-ža *he sees their work*

(31h) šĭnĭ-dé mĭ̌či-´ža > šĭnĭ-dé mĭ̌čɪ´-ža *he sees their cat*

(31i) šĭnĭ-dé nǰuši-´ža > šĭnĭ-dé nǰušĭ̌-ža *he sees their chicken*

In čákǎ-ža, tătǎ-ža, and nǰušĭ̌-ža the high tone of ´ža becomes modified and then replaces the immediately preceding tone. In sánu´-ža and mĭ̌čɪ´-ža the high tone immediately follows the preceding low tone to produce a level mid tone, in accordance with the foregoing description of the conditioned variants of low and high. In kwàžú´-ža the high tone immediately follows the high of kwàžú to produce a mid-high glide, the first of the two high tones being lowered to mid following the modified low (3.2).

The basic tone pattern seen in the noun for *wood chips* can now be accounted for, since its pitch contour is identical to that of sánu in sánu´-ža. The noun for *wood chips* is phonemically čákwá, having a high tone in the first syllable and a low tone followed by a high tone in the second syllable.[14]

By analogy with kwàžú´-ža, sánu´-ža, and mĭ̌čɪ´-ža, we may assume that the high tone of ´ža immediately follows the preceding tone of

the remaining examples, but whether the high tone immediately follows or replaces the preceding tone, the phonetic results are the same.

The rule which accounts for the changes before ´žu is:

(32) TONE SHIFT RULE: The first tone of ´žu is shifted to the immediately preceding syllable. If the tone of ´žu is modified it replaces the tone of the preceding syllable, and if it is unmodified it follows the tone of the preceding syllable.

Two additional patterns of two tones to a syllable are found in enclitics.

An enclitic which becomes modified high by the Tone Modification Rule subsequently becomes modified high plus high under the influence of following ´žu, as in (33).

(33) žàką́ ní?í-dé-´žu (underlying form)

žàką́ ní?í-dě-´žu (by the TONE MODIFICATION RULE)

žàką́ ní?í-dě´-žu (by the TONE SHIFT RULE)

over there he will find them (human)

Following high, the low tone of the enclitic ndo *(2pl)* becomes high by the TONE ASSIMILATION RULE, and subsequently a following high tone becomes modified by the TONE MODIFICATION RULE. If the modified high comes from the high of ´žu, it is shifted to ndó to give high plus modified high,[15] as in (34).

(34) žàką́ ní?í-ndo-´žu (underlying form)

žàką́ ní?í-ndó-´žu (by the TONE ASSIMILATION RULE)

žàką́ ní?í-ndó-ˇžu (by the TONE MODIFICATION RULE)

žàką́ ní?í-ndóˇ-žu (by the TONE SHIFT RULE)

over there you (pl) will find them (human)

5. That the description of tone sandhi would be more complex in a three-tone analysis should be obvious. In the three-tone analysis morphophonemic rules amount to little more than a listing of each tone pattern and its corresponding derived pattern. For example, some of the changes before ´žu would be: high high becomes high low-mid, low low becomes mid mid, low mid becomes low mid-high, low mid-low becomes low mid, and high low becomes high mid. Instead of the TONE MODIFICATION RULE, there would be a rule which lists the changes of high high to mid high, mid mid to low

mid, high low to mid low, and low low to low mid-low, or some similar listing. Instead of the LOSS OF TONE MODIFICATION RULE, there would be a rule which would have the same degree of complexity as the previous one. In the three-tone analysis there would be a slight loss of generality in describing tone assimilation. Instead of being able to refer to the two tones, low and modified low, by [-High], it would be necessary to refer to two patterns, low low and low mid-low, as undergoing change.

The advantage of paying careful attention to tone sandhi in determining the number and kinds of tones in Peñoles Mixtec is thus clear. Giving morphophonemic and phonetic considerations equal weight results in an analysis that is cohesive and simple. A few simple morphophonemic rules, along with a few well-motivated definitions of the phonetic variants of the tones, account for the surface complexity of tone.

Morphophonemic and phonetic considerations combine in Peñoles Mixtec to make stringent demands on the analysis. Tone phonemes which make possible a simple description of morphophonemic processes should not lead to undue phonetic complexity, and tone phonemes which have simple phonetic correlates should not lead to undue morphophonemic complexity. The fact that a satisfactory explanation of phenomena as different as tone sandhi on the one hand and tone terracing and tone neutralization on the other results from the phonemic analysis developed here gives us good reason to believe that the analysis is basically correct.

REFERENCES

McCawley, James

1970 "A Note on Tone in Tiv Conjugation," Studies in African Linguistics, The University of California, pp. 123-29.

Pike, Kenneth L.

1947 Phonemics. Ann Arbor: The University of Michigan Press.

1948 Tone Languages. Ann Arbor: The University of Michigan Press.

1970 Tagmemic and Matrix Linguistics Applied to Selected African Languages. Norman: Summer Institute of Linguistics.

Schachter, Paul

1961 "Phonetic Similarity in Tonemic Analysis," Language 37:231-38.

Stewart, John

1965 "The Typology of the Twi Tone System" (with comments by Paul Schachter and William E. Welmers). Reprint from the Bulletin of the Institute of African Studies I. Lego: The University of Ghana.

Welmers, William E.

1959 "Tonemics, Morphotonemics, and Tonal Morphemes," General Linguistics 4:1-9.

Woo, Nancy

1969 Prosody and Phonology. Unpublished Ph. D. Dissertation, Massachusetts Institute of Technology.

NOTES

1

Peñoles Mixtec is spoken in the municipality of Santa María Peñoles, Etla, Oaxaca, by about two thousand speakers and, with dialect variation, in another ten communities by an additional eight thousand speakers. It is mutually unintelligible with other Mixtec languages (often called dialects) spoken throughout the state of Oaxaca and in parts of the states of Puebla and Guerrero. The data for this paper are based on field work begun in 1957 and carried on intermittently since then.

In the techniques for determining tone phonemes given by Pike (1948), morphophonemic considerations enter into analysis only to the extent of determining whether a tone frame remains unchanged or not and whether any new tone classes result from placing substitution lists in a variety of frames. My experience in the analysis of Peñoles Mixtec convinces me that in some cases much more attention must be given to morphophonemic processes if a wrong analysis is to be avoided. In principle, Pike is not in disagreement with the position I have taken here. He states (1947:viiib): '...many phonemic conclusions are based, not upon absolute data as such, but upon the correlation and interrelationships of data or upon the observation of the effect of a total structure exerting a pressure upon the interpretation of some one point of that system.'

Compare Schachter (1961) who takes into account tone morphophonemics in determining the tones which account for tone terracing in Twi.

2

The phonemes of Peñoles Mixtec, not including tone, are: voiceless stops /p t č k kw ʔ/, prenasalized stops /mb nd nǰ ngw/, voiceless fricatives /f s š h/, voiced fricatives /b d ž/, nasals /m n ñ/, liquids /l r/, vowels /ɪ e ɨ a u o/, and nasalization. Stress occurs on the first syllable of disyllabic nouns. In the orthography employed here, enclitics are set off by hyphens.

3

I have found only the two nouns $\check{c}a^{H}kwa^{M}$ and $mɪ^{M}\check{c}ɪ^{L}$ with these basic tone patterns, but the patterns are common in tone sandhi.

4

I have adopted the feature [Modify] from Woo (1972). This feature has the advantage of keeping the feature analysis of the tones in focus, since the tones can be referred to as high versus modified high and low versus modified low. The phonetic correlates of [Modify] in Peñoles Mixtec are given on page 13 in terms of the phonetic height of tones with the feature. It remains to be seen whether the feature [Modify] as I have used it in Peñoles Mixtec

has some one of the phonetic correlates described by Woo. She states (1972:125): 'A modified sound is one produced with the vocal cord and larynx configuration of either a high-toned sound or a low-toned sound and is one in which either the configuration of the pharynx has been changed, or the manner in which the vocal folds vibrate has been changed, or some other mechanism has been employed to change the "normal" waveform of the pitch produced.'

5

It might at first appear that [+Modify] could just as well be assigned to the morpheme as a whole, but it will be seen in 5 that it can occur on both syllables of a disyllabic morpheme.

6

Some tones which are allotones of one phoneme in the three-tone analysis are allotones of different phonemes in the four-tone analysis. Instead of the first tone of kwàžú being an allotone of the same phoneme as the two tones of kɬtɬ, they are allotones of different phonemes; and instead of the first tone of tătá and the first tone of dító being allotones of the same phoneme, they are allotones of different phonemes. Conversely, some tones which were analyzed as allotones of different phonemes are allotones of the same phonemes: the glide on the second syllable of čl̥u, both tones of kɬtɬ, and the first tone of dító are allotones of the same phoneme; and the second tone of dító and the two tones of čáká are allotones of the same phoneme.

7

There are some exceptions to the rule: nouns with basic high high tones do not condition the introduction of modification on disyllabic morphemes with basic low low tones, whereas morphemes with basic low low tones and derived high high tones do condition this change; nouns with modified high high tones condition the introduction of modification only on enclitics of high tone; and modification passes over low-tone enclitics to the first high-tone enclitic, or if there is no high-tone enclitic, to the first tone of the next word.

[+Modify] on the last syllable of a morpheme is never actualized there unless it shifts to the next syllable by the Tone Modification Rule and then shifts back again (see 6). To minimize confusion, I will indicate [+Modify] in the tone of the last syllable of morphemes in the examples only when this feature reappears there in sandhi and thus is actualized there.

8

The phonetic difference between tătá in (5b) and tátá in (5d) is difficult to detect, and except for pattern pressure exerted by morphophonemic processes more clearly seen elsewhere, the difference

between the two tones could easily be missed or wrongly attributed to subphonemic conditioning by adjacent tones. For the condition under which a high tone is lowered as it is in (5d), see page 13 .

9

These claims about the phonetic manifestations of the tones are supported by evidence from sound spectograms.

10

It should be noted that in deliberate speech a down glide may appear on one or more low tones before word boundary but never within a word ending in high tone.

11

It is not uncommon in tone languages for high to be lowered following low, sometimes even to the level of low. For example, in Degema of Nigeria, Pike (1970:99) reports that high is lowered to the same pitch as low, but not within words or morphemes as in Peñoles Mixtec: "Between words (but not within them, under penalty of collapsing some of the system) a word-final low despresses a following word-initial high to its own low phonetic pitch, but a following word-initial low to lower than the first low."

12

The difference in pitch between the first and last morphemes is commonly two whole steps of the musical scale. By contrast, the difference between a high tone lowered to mid and a modified low tone is commonly three whole steps. The change in register brought about by alternating low and high tones does not have a noticeable effect on the pitch of a following modified tone. The modified tone tends to retain a constant pitch relationship to the first lowered high tone regardless of how many intervening high and low tones there are, and it tends to reestablish the beginning register.

13

The three alternatives rejected for Peñoles Mixtec are all found in Stewart (1964), except that he speaks of a zero tone bearing unit instead of a deleted low tone. The tone of 'drop' is also known as downstep, step-down, mid, middle-tone, and high-change in descriptions of this phenomenon in various tone languages. 'Non-automatic downstep' as described by Stewart is called a 'process phoneme' by Pike (1970:102).

14

An alternate pronunciation for čákwa´ is ´čakwá, where the low tone appears on the first syllable instead of the second, and in combination with the first high tone produces a down glide.

15

The modified high tone follows the high of ndó rather than replacing it as it would in a disyllabic form. An alternate treatment is to posit two underlying low tones on ndo, both of which become high with the subsequent replacement of the second high by a modified high.

SILACAYOAPAN MIXTEC PHONOLOGY

Joanne North
Jăna Shields

1. Consonants
2. Vowels
3. Tones
4. Morphophonemics

In the Silacayoapan dialect of Mixtec,[1] as in other Mixtec languages thus far described, the couplet is the nucleus of the phonological word as well as the grammatical word (Pike 1948, Mak 1953, Longacre 1957). The couplet is significant in this dialect for at least three reasons: 1) It is the main unit of tone contrasts; 2) certain allophones are conditioned by placement in the couplet; and 3) certain phonemes occur in restricted environments in the couplet.

A couplet consists of two syllables, each with a nucleus of vowel plus tone. The nucleus is optionally preceded by a consonant or consonant followed by /y/, and may be followed by /ʔ/ when couplet medial. Syllable patterns therefore are V (word or couplet initial, this pattern is always preceded by [ʔ]), CV, or CyV, or any of these followed by /ʔ/. The couplet consists of any two of these syllable patterns with the exception that Vʔ, CVʔ, and CyVʔ occur only as the first syllable of the couplet.

CVV	ːàà	*man*	CVʔV	vàʔa	*good*
CVCV	hǐtà	*tortilla*	VʔCV	ɭʔnɽ	['ʔɭʔnɽ] *hot*
CyVCV	vyahá	*wet*	CyVʔCV	kyàʔva	*brother*

The phonological word, with the couplet as its basis, may have several syllables either preceding or following the couplet. Word stress is on the first syllable of the couplet. In examples, the couplet precedes space or hyphen (-).

káha *do*

káha-vaʔató *it (machine) does good*

kǫ̀nąkąląą-ñą́ *she didn't do it*

1. There are 21 consonant phonemes:

   voiceless stops: /p t č k kw ʔ/

   prenasalized stops: /mb nd nǰ ng/

   fricatives: /v s š ž h/

   nasals: /m n ñ/

liquids: /l r/

semiconsonant: /y/

1.1 The consonants may be described as follows:

Voiceless (unaspirated) stops are bilabial, alveolar, alveopalatal, velar, labio-velar, and glottal.

/p/ pą̀ą̀ *bread*
pəʔɨa *floppy*
čòpì *king*

/t/ tàà *man*
tʉtʉ *paper*

/č/ čʉ́ʔʉ *cook*
ndìčì *green beans*

/k/ kàà *metal*
ndíkì *horn*

/kw/ is considered a unit since it can be palatalized.

kwíi *green*
kwą́ą́ *yellow*
kwyàà *year*

/ʔ/ lʔnɪ́ *hot*
vàʔa *good*

/t/ may be slightly aspirated couplet initially. In post-couplet enclitic position, it is softened to [ɗ].

vàšɪ-tò ['vàšɪɗò] *it (rain) comes*

kíʔvì-ta ['kíʔvìɗa] *he is sick*

Because of the limited number of lexical forms that occur in enclitic position, the phone [ɗ] has been observed in only a few morphemes and only before /a/ or /o/.

/k/ has an allophone [g] that fluctuates with [k] in a non-stressed position outside the couplet, and mostly in rapid speech.

àkʉ́šʉ-kandì [à'kʉ́šʉgandì ~ à'kʉ́šʉkandì] *we (excl.) won't eat more*

Prenasalized stops are bilabial, alveolar, alveopalatal, and velar. They tend to be voiced except couplet medially, when the stop may be voiceless. /mb ng nǰ/ are rare; /ng nǰ/ have been observed only couplet medially.

/mb/ mbàà *compadre*
lámbà ['lámbà ~ 'lámpà] *bladder*
mbòʔlà *dirt clod*

/nd/ ndʉ́é *thick*

ʉ́ndó ['ʔʉndó ~ 'ʔʉ́ntó] *animal fat*

tovìʔndá *nopal cactus*

/nǰ/ lánǰí *sheep*

lénǰó *Lorenzo*

/ng/ íngá *another*

kòžángí [kò'žángí ~ kò'žánkí] *rainbow*

Fricatives are voiced bilabial, voiceless grooved alveolar, voiceless grooved alveopalatal, voiced grooved alveopalatal, and voiceless glottal. The voiced grooved alveopalatal /ž/ alternates with /y/ in rapid speech in couplet-medial position.

/v/ veʔe *house*

hava *half*

kíʔvì *I'm sick*

/s/ sáko *possum*

ndʉ̀sa *sandal*

sʉ́ʔrį́ *to milk*

/š/ šòò *comal*

viši *cold*

ndʉšʉ́ *hen*

šʉ̨ʔę́ *with you (familiar)*

/ž/ žáʔà *chile*

káží (also káyí) *cough*

ndàʔžì (also ndàʔyì) *mud*

/h/ háà *fever*

vìhì *sweet*

hą̀ʔą *lard*

Nasals are bilabial, alveolar, and alveopalatal.

/m/ mą́ʔę̀ *raccoon*

kįmį *star*

hą́ʔmą̀ *clothes*

/n/ nąmę̀ *soap*

tįnę *dog*

ką́ʔrʉ̨ *big (sg.)*

/ñ/ ñę́ʔą̀ *lady*

ñʉ̨̀ñʉ̨̀ *honey*

įñʉ̨̀ *injection*

Liquids are alveolar lateral and alveolar flap. With a few exceptions, /r/ occurs only in words of Spanish origin.

/l/ lìvi *pretty*
váĺí *small (pl.)*
lá?lá *mucus*

/r/ čiróní *crackling (Spanish chicharrón)*
aros *rice (Spanish arroz)*
čurú *leather lash*

The semiconsonant is alveopalatal. It has been observed alone in only two words thus far:

yàhá *day after tomorrow*
yáhà *young ear of corn*

It has a wider distribution as the second member of consonant clusters in couplet-initial position.

/ty/ tyà?va *witch*
/ky/ kyà?vų́ *your (fam.) brother*
/ndy/ ndyava *huaje (a certain leguminous fruit)*
/vy/ vyahá *wet*
/šy/ šyàà *spoiled*
/žy/ žyáà *tongue*
/my/ tl̀myą́?ą́ *demons*
/hy/ hyų̀?ų́ *money*

The only examples observed so far of /y/ as the second member of a cluster in couplet-medial position are:

ndà?žyà *peach*
vàžya žílì *squash flower*

1.2 Consonant contrasts are as follows:

At the bilabial position:

p/v	pą́ñų́	*shawl*	váĺí	*small (pl.)*
	lípé	*Felipe*	lìvi	*pretty*
	čòpì	*king*		

v/mb	vàá	*(a direction)*	mbàà	*compadre*
	hava	*half*	lámbà	*bladder*
m/mb	mą̀lʃ	*comadre*	mbàà	*compadre*
	nąmą̀	*soap*	lámbà	*bladder*
m/v	mą́ʔą̀	*raccoon*	và?a	*good*
	nąmą̀	*soap*	hava	*half*

At the alveolar position:

t/nd	tʉ̀čʉ	*nerves, wire*	ndʉ́čʉ̀	*beans*
	kotó	*shirt*	kúndó	*toad*
n/nd	nąʔą	*come!*	ndáʔà	*hand*
	ų̀nà	*eight*	úndó	*fat*
l/t	láʔva	*frog*	táʔndá	*torn*
	kolo	*turkey*	kotó	*shirt*
l/n	lálá	*urine*	nąnąᷤ	*mother*
s/l	są́ʔnų	*old person*	laʔlá	*mucus*
	lásá	*bone*	lálá	*urine*

At the alveopalatal position:

č/nǰ	čìčì	*knee*	línǰí	*cricket*
č/š	číká	*over there*	šíká	*far*
	čìčì	*knee*	vìšì	*cold*
š/ž	šíká	*far*	žìvì	*people*
	vašì	*is coming*	kàží	*cough*
č/ž	čʉ́ʔʉ	*cook*	žʉ́ʔʉ̀	*mouth*
	ndʉ́čʉ̀	*beans*	ndʉžʉ	*chilacayote*

At the velar position:

k/ng	tìká	*grasshopper*	íngá	*another*
	tìžàká	*fish*	kožángí	*rainbow*

k/kw	kàčì	*cotton*	kwàčí	*change*
	kàží	*cough*	kwážì	*horse*

At the glottal position:

?/h	?ává	*last year*	hava	*half*
	ndó?ò	*tail*	ndóhò	*breast*

Within articulatory classes:

s/š	tìsą?ą̀	*bowl*	ñą̀kąšą́?ą	*things to eat*
	ndù̀sà	*sandals*	šíši	*eat*
n/ñ	ną?ą	*come!*	ñą́?ą̀	*lady*
	ñų́nù̀	*hammock*	ñù̀ñù̀	*honey*

There is no contrast between n/ñ before /i/.

m/my	mą́?ą̀	*raccoon*	tì̀myą́?ą́	*demons*
v/vy	válí	*small (pl.)*	vyahá	*wet*
t/ty	nà̀tą̀?vì-a	*broken*	tya?ví	*I know how*
nd/ndy	ndàva	*poles in house*	ndyava	*huaje*
	ndó?ò	*tail*	tìndyó?ó	*Puebla*
k/ky	ndìkava	*fell down*	tikyàva	*butterfly*
h/hy	hókó	*ant hill*	hyókò	*San Andres (a town)*
	hą̀?ą	*lard*	tíhyą?ą	*hawk*
ty/č	tya?ví	*I know how*	ča?ví	*charge*
ky/č	kyà?vų́	*your brother*	ča?ví	*I charge*

1.3 The distribution of consonants is as follows:

The following consonants and consonant clusters have been found in couplet-initial position only: /kw y ty ky ndy vy hy my/. The following consonants have been found in couplet-medial position only: /nǰ ng/.

Consonant clusters are rare and occur only with /y/ and /?/. Across syllable boundaries, /?/ followed by consonant occurs couplet medially with /nd v ž m ñ n l/. There may or may not be a vowel release after the /?/ and before the consonant in these clusters. The vowel release is the same quality as the vowel preced-

ing the glottal stop. This release is most noticeable in the cluster /ʔnd/ and when the preceding vowel is /a/ or /ɥ/.

są́ʔndá [ˈsą́ʔą́ndá] *cutting* ɪ́ʃʔmą́ *scorpion*

nątą̀ʔndà [nąˈtą̀ʔą̀ndà] *cut* ką́ʔnɥ *big*

kɥʔndo [kɥʔɥndo] *knuckle* ɻʔñɥ *third day hence*

ɪáʔvà *frog* ɪeʔɪe *dried beans*

kòʔžó *Mexico City*

Consonant clusters (other than the above mentioned) have been found only in rapid speech alternating with the pattern CV in a pre-couplet position.

štoʔoɪ̀ ~ šɪ̀toʔoɪ̀ *my boss*

skwaá ~ sə̀kwaá *night time*

2. There are nine vowel phonemes:

	ɻ		ʉ	ɥ
o	ę	a	ą	o

2.1 The vowels may be described as follows:

Front vowels are high close unrounded and mid open unrounded. /e/ has a close allophone that occurs in the second syllable of the couplet after consonants other than /ʔ/.

kɪ̀vɪ̀ *name* veʔe [ˈveʔe] *house*

čʃɻ *fingernail* čéɪe [ˈčéɪɛ] *rooster*

/a ą/ are low open unrounded.

ɪaa *bird* tąą *forehead*

/ʉ ɥ/ are high close rounded; but while /ʉ/ is central, /ɥ/ is back.

tʉtʉ *paper* tɥ̀ʔɥ *word*

žákʉ̀ *mountain* čɥɥ *work*

žásɥ̀ *your (fam.) gourd*

/o/ is back mid close rounded and has no nasal counterpart.

ndòò *cane* kotó *shirt*

tɪ̀ndyóʔó *Puebla*

2.2 Vowel contrasts are as follows:

Oral:	ndìžìì	*badger*	žɨ́ʔɨ̀	*mouth*
	žèʔè	*I*	žóʔò	*palm rope*
	žáʔà	*chile*		
Nasal:	tą̀ą̀	*forehead*	tį̀į́	*mouse*
	tę̀ę̀	*sweat*	tų̀ų́	*black*
Oral/Nasal	kwíì	*green*	kwį́į̀	*thin*
	kwéé	*slow*	kwę̀ę̀	*I will buy*
	tàà	*man*	tą̀ą̀	*forehead*
	čɨ́ʔɨ	*cook*	čųų	*work*

2.3 The distribution of vowels is as follows:

Back and central vowels /o ɨ ų/ do not follow the labialized consonant /kw/. Front vowels /e ę i į/ do not follow the consonant clusters with /y/. Consonant clusters are rare and have been found mostly with the vowel /a/, which has the widest distribution.

Only nasal vowels precede and follow the nasal consonants /m n ñ/ within the phonological word. Though they occur with non-nasal consonants as well, they are perceived as more strongly nasal when occurring with non-nasal consonants. In monomorphemic words, nasal vowels mostly follow voiceless consonants. Only one example has been found of a nasal vowel following a voiced consonant in a monomorphemic word: vìtì žų́ų̀ *large glass jug*. Nasal vowels not preceding and following /m n ñ/ are restricted in their distribution in the couplet. In patterns CVV and CVʔV, if the first vowel is a nasal, the second one is always nasal also.

čį́į̀ *fingernail*

The second vowel may be a nasal, even though the first one is not, but only in bimorphemic couplets.

ndáʔų́ *your hand*

Very few nasal vowels have been found in CVCV and CVʔCV patterns, except when a nasal consonant is also present.

3. There are three tones, high (marked ´), mid (unmarked), and low (marked `).

á[ļ tátá	*Is the father here?*
á[ļ tata	*Is there seed?*
á[ļ tàtà	*Is there medicine?*
và?a čá tátá-ndó	*Your father is good.*
và?a čá tata	*The seed is good.*
và?a čá tàtà	*The medicine is good.*

3.1 The tones may be described as follows:

High tone is a high level tone, except that it glides downward before a low within the morpheme.

nąñą̀ ['nę^{13}ñę^{3}] *chayote* kwážĭ [kwa^{13}žĭ^{3}] *horse*

One or more high tones at the end of a phonological phrase may be lowered.

žúžú váĭ[['žu^{1}žu^{1} 'va^{1-}ĭ[$^{1-}$] *small bottles*

Mid tone is a medium-height level tone. It is lower in height following a low tone within the morpheme than in other contexts, and pronouncedly so when followed by at least one bisyllabic morpheme in the phonological phrase.

žūta ['žu^{3}ta^{2-}] *river*

va?a ['va^{3}?a^{2-}] *good*

ndò?o váĭ[['ndo^{3}?o^{3+} va^{1}ĭ[$^{1-}$] *small adobes*

Low tone is a level low tone. One or more low tones at the end of a phonological phrase may be lowered.

kàà ['ka^{3}a^{3-}] *metal*

nų̀nĭ *corn*

žúžú ndàà *straight bottle*

3.2 Tone contrasts are as follows:

High and Mid:	tĭvĭ-ta *he is blowing*	tĭvi-ta *he will blow*
	tĭ?vĭ-ñą́ *she is sweeping*	tĭ?vį-ñą́ *she is sucking*
High and Low:	žúkú *yoke*	žūkù *weeds*
	ndá?žĭ *black*	ndà?žĭ *mud*
	táká *woodpecker*	tákà *nest*

	ǰčǰ	*dry*	ǰčì	*road*
	ndó?ò	*tail*	ndò?ò	*straw basket*
Mid and Low:	sati	*muslin pants*	sàtì	*picante*
	žoo	*clay water jug*	žòò	*moon, month*
	hǐko	*twenty*	hìkò	*neck*
	žó?o	*here*	žó?ò	*rope*
	čéle	*rooster*	čélò	*calf*

4. In this final section of the paper, a few morphophonemic observations are made regarding vowels, stress placement, and tone.

When the enclitic person marker ǔ *second singular (familiar)* is postposed to a couplet, the last vowel of the couplet is elided, and its tone is actualized together with that of the enclitic as a glide.

čélē	*rooster*	čélǔ	*your (fam.) rooster*
nu̯nǐ	*corn*	nu̯nu̯	*your (fam.) corn*

This loss of vowel may be characterized as in Rule 1.

Rule 1. Vowel → ∅ / ___u̯ + [2]

When the enclitic person marker à *third person (respect)* is postposed to a couplet with final vowel /ʉ/, a /y/ is introduced as a transition between the vowels.

žʉ?ʉ	*month*	žú?ʉ-yà	*her (resp.) month*

This intrusion of /y/ may be characterized as in Rule 2.

Rule 2. ∅ → y / ʉ___a +

When the enclitic person marker i *first singular* is postposed to a couplet with final vowel /e/, the vowel of the suffix assimilates to that of the couplet.

ve?e	*house*	ve?éè	*my house*

This assimilation may be characterized as in Rule 3.

Rule 3. i → e / e___ +

These three rules have the effect of avoiding certain sequences of vowels. A few sequences of different vowels do occur, however. There are two examples of such a sequence in what are apparently

monomorphemic words.

kèá *is* ñąų *eagle*

All other examples involve the postposing of an enclitic person marker. In such contexts /a ɯ ų o/ are attested before /i/, and /i e o/ are attested before /a/.

One further morphophonemic process takes place when /i/ or /e/ are postposed to a nonverbal couplet. When these vowel clusters are formed by the postposing of single-vowel enclitic person markers, the stress of the couplet is shifted to the syllable immediatly preceding that of the enclitic, and the tone of the syllable receiving the stress becomes high.

This has the effect of reformulating the last syllable of the original couplet as the first syllable of a new couplet with the enclitic as its second syllable.

hàtà	*back*	hàtáĭ	*my back*
hà?žĭ	*offspring*	hà?žíĭ	*my offspring*
hé?è	*ring*	he?éè	*my ring*

This shift of stress and tone change may be characterized as in Rule 4.

Rule 4. $'V_1V_2V_3 + \rightarrow V_1'\acute{V}_2V_3 +$

Because of the limitation mentioned above that the second vowel is always nasal following a nasal first vowel in CVV couplets, an enclitic vowel becomes nasal after a nasal vowel in the context of Rule 4.

čį̆į̆ *fingernail* čį̆į̆ę̀ *her (resp.) fingernail*

A further kind of tone morphophonemics appears to be limited to certain syntactic contexts. Specifically, a low tone on the last syllable of a noun becomes low-high when preceding a low tone on the first syllable of a following noun or adjective.

žɯ́čɯ̀	*knife*	tàà	*man*	žɯ́čɯ̀ tàà	*man's knife*
kĭtĭ̀	*animal*	sàá	*new*	kĭtĭ̌ sàá	*new animal*
nų̀nĭ̀	*corn*	sàá	*new*	nų̀nĭ̌ sàá	*new corn*

This change is optional when the tones on the second couplet are high-low, mid-mid, or mid-high.

kʃtì *animal*

ɨoʔo *little*

kʃtǐ ɨoʔo or kʃtì ɨoʔo *little animal*

When the first couplet is a verb rather than a noun, however, there is no change.

kwɐ̀ɐ̀ *will buy* kwɐ̀ɐ̀ tàà *the man will buy*

A sequence high low-high that results from the above contexts (where low becomes low-high before a low) may undergo some further change in fast speech, causing the sequence to be perceived as mid tones.

žʃtò *tree* ndàà *straight* žɨto ndàà *straight tree*

REFERENCES

Longacre, Robert E.

1957 Proto-Mixtecan. Indiana University Research Center Publications 5. Bloomington.

Mak, Cornelia

1953 "A Comparison of Two Tonemic Systems," International Journal of American Linguistics 19:85-100.

Pike, Kenneth L.

1948 Tone Languages. University of Michigan Publications, Linguistics IV. Ann Arbor.

NOTES

1

The data upon which this analysis is based were collected from May 1972, through April 1973, in the town of San Jerónimo Progreso (population ca. 1100), Municipio of Silacayoapan, Oaxaca. Various informants were used, but the principal ones have been Ricardo Durán Zarate and Lorenzo Martínez Ramírez. We gratefully acknowledge the counsel of Ruth Brend at a linguistic workshop held in the spring of 1973 at the Centro de Estudios Manuel Gamio, Ixmiquilpan, Hidalgo, Mexico, and the help of John Daly, who helped work out the final detail of tone allophonics and morphophonemics.

2

The symbol + is here used to indicate phonological word boundary.

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PHONETIC VS. PHONEMIC CORRESPONDENCE IN TWO TRIQUE DIALECTS

Barbara E. Hollenbach

1. SJC Trique Phonology
2. SAC Trique Phonology
3. Comparison
4. Conclusions

Because of the remarkable ability of the human brain to make topological adjustments rapidly and, to a large degree, unconsciously, a linguistically naive native of Chicago experiences only a short period of disorientation when first hearing a speaker of Australian English. He soon catches on to the shifts between phonological systems and begins to understand most of what he hears. He may think the Australian sounds funny and be perplexed by an occasional lexical item or grammatical construction, but with repeated linguistic contact, he soon learns to understand the new dialect.

If we were to compare the phonology of these two English dialects, significant differences would appear, yet the human brain has the ability to pass over these differences. The ear picks up only sound waves, but the brain interprets them according to a phonological system. We can compensate fairly well for noise or error on the part of a speaker using our own phonological system. (This would be impossible if phonology were quite as exact as the structural model of the 1940's would have led us to believe.) We can also compensate for speakers of other dialects up to the point where the load of making adjustments becomes too heavy for the brain and communication approaches zero. One way of looking at this ability is to posit that, at some level of structure, the systems are more similar to each other and that the differences are a result of low-level rules.

In this paper, I examine the relationship between two dialects of Trique, an Otomanguean language spoken in Oaxaca, Mexico. The dialects discussed are those spoken in and around the villages of San Juan Copala (hereafter SJC) and San Andrés Chicahuaxtla (hereafter SAC). The divergence between these two dialects is greater than that between the English dialects cited above, but there is some degree of mutual intelligibility between them.[1]

In the first two sections of the paper, I present the surface phonological systems of SJC and SAC. Because this is the first publication of SJC phonology,[2] it is given in somewhat greater detail than that of SAC, which has been described in several works by Longacre (1949, 1952, 1957, 1959).[3] In Section 3, I compare the systems of these two dialects typologically. In the final section, I suggest the sorts of topological correspondences that might account for a speaker's ability to understand the other dia-

lect and comment briefly on some of the implications of the Trique situation for orthography design.

1. The phonology of SJC Trique is conveniently described with reference to the phonological WORD (hereafter simply word) as a descriptive matrix. This description is restricted mainly to phonological structure at and below this level. The word consists of from one to four syllables. Monomorphemic words are common, but a word may contain up to five morphemes.

There are two basic types of word: EXCLAMATORY and ORDINARY. The final word of any uninterrupted utterance is exclamatory; all nonfinal words are ordinary. Thus, a one-word utterance has one exclamatory word, and a ten-word utterance has nine ordinary words and one exclamatory word. Exclamatory words have a different prosodic structure from ordinary words; they are considered in detail in 1.3. (Some response words and onomatopoeic words do not fit into either system; they are outside the scope of this paper.)

In an ordinary word, the ultima is the nucleus. The ultima carries tone and has a much greater potential for consonant, vowel, and prosodic contrasts that does a nonultima. For many words, only the ultima carries tone. For other words, however, one nonultima syllable carries a contrastive tone. Such words are often either fused compounds or Spanish loanwords. Thus, there are three kinds of syllables, distinguished by the distributional potential of phonological units within them: ultimas, tone-carrying nonultimas, and non-tone-carrying nonultimas.

1.1 There are 22 consonants in SJC Trique: fortis stops /p t k/, lenis stops /b d g/, affricates /c č ʦ/, fortis sibilants /s š ʂ/, lenis sibilants /z ž r/, resonants /m n l y w/, laryngeals /ʔ h/. Of these consonants, fortis stops, affricates, fortis sibilants, and laryngeals are restricted to ultimas; the remainder occur in all three syllable types.[4] Only laryngeals may check a syllable, and only ultimas may therefore be checked.

Fortis stops are voiceless, slightly lengthened, and unaspirated. /d g/ are voiced fricatives between vowels in the onset of ultimas, and lenis stops varying from voiced to voiceless in nonultimas or in cluster with other consonants. They are voiced lenis stops word-initial in ultimas (i.e., in monosyllabic words). /b/ does not occur between vowels in the onset of ultimas and therefore is never a fricative. Bilabial stops are a recent innovation, found in Spanish loanwords and a few onomatopoeic forms.

gopa̱^{32} *goblet*
nataʔ^{3} *to explain*
rakaʔ^{3} *twig*
bah^{21} (~ wah^{21}) *co-father*
rodaʔ^{3} *muller (mano de metate)*
agaʔ^{3} *metal*
bala̱^{32} *shovel*
dakaˌ^{3} *crest (of bird)*
gakaˌ^{34} *to burn (completive)*

Affricates and sibilants are alveolar, palatal, or retroflex. Affricates are voiceless and unaspirated. /s š/ are voiceless and slightly lengthened. /s̈/ varies freely between a voiceless retroflex trill and a voiceless, slightly lengthened retroflex sibilant. /ž/ is a lenis affricate utterance-initial in nonultimas. (Affricates are restricted to ultimas.) /r/ is a voiced retroflex flap utterance-medial between vowels, in cluster with stops, or word-initial between /ʔ/ (at the end of the preceding word) and a vowel. With the exception of these two nonsibilant allophones, lenis sibilants vary from voiced to voiceless word-initial in nonultimas, or in cluster with other consonants. They are voiced word-medial between vowels or word-initial in ultimas (i.e., in monosyllabic words).

acĩh^{21}	*to sneeze*	zoʔ^{3}	*he*
ačĩh^{21}	*to break wind*	žoʔ^{3}	*it (inanimate)*
ac̈ĩh^{21}	*to cough*^{5}	roʔ^{5}	*we two (inclusive)*
lasọ^{32}	*braid*	zoʔọ^{3}	*deaf person*
gešọ^{32}	*garlic*	žoʔo^{21}	*swamp*
s̈oh^{34} (~ žlc̈oh^{34})	*wrap-around pants (calzones)*	roʔoh^{21}	*rash*

/m n/ are voiced nasals. /n/ is velar immediately preceding /g/. /l/ is a voiced lateral. /y w/ are semivowels, except that /w/ is a bilabial fricative unless contiguous to a consonant or a low vowel.

má?	*(negative)*	maʔą̃^{53}	*self*
ná?	*(interrogative for yes-no quesions)*	naʔã^{3}	*to burn, sting*
zala^{3}	*crate of bent poles*	leʔeh^{53}	*young*
yaʔ^{3}	*fiber of century plant*	weʔeh^{53}	*red*
wa^{34}	*to be (used with adjectives)*	yaʔãh^{34}	*saint*

/y w/ contrast with /ž b/, respectively.

yoʔ^{3} *it (animal)*

wah^{21} *tc grind*

bah^{21} (~ wah^{21}) *co-father*

Fortis stops, fortis sibilants, and resonants are all lengthened preceding a short vowel.

/ʔ/ is a glottal stop. /h/ is a palatal or labial fricative following /l ʊ/, respectively; elsewhere, it is a voiceless vocoid without audible friction.

ya?^{3} *fiber of century plant*

yah^{3} *ashes*

ra?ą^{3} *hand*

rehą^{32} *metal plow point*

Clusters of two and three consonants occur in syllable onsets. Four types occur in native words. One type is nasal plus lenis stop: /mb nd ng/. /mb/ occurs in one morpheme only, where it varies with /m/ and /w/. /nd/ is also rare in native words; it sometimes varies with /n/ or /d/.

kã^{3}mba?^{3} (~ ma?^{3} ~ wa?^{3}) *furrowed green squash*

zindi?^{5} *calf (of leg)*

nda^{53} (~na^{53}) *until*

ndah^{34} (~ dah^{34}) *how much?*

nga^{3} *cloud*

Another type is /?/ plus resonant: /?m ?n ?l ?y ?w/.

a?mã^{3} *to be hot*

a?nã?^{3} *to be hurt*

da?lu^{21} *malaria*

la?wa^{34} *toothless*

da?ya^{34} *door*

A third type is velar stop plus /w/: /kw gw/.

nukwah^{53} *strong*

dugwah^{21} *to twist*

Two clusters of three consonants occur in native words: /?nd ?ng/. /?nd/ occurs in one morpheme only, where it varies with /?n ?l ?y/.

yuwę^{32} zigu?ndu?^{5} (~ zigu?nu?^{5} ~ zigu?lu?^{5} ~ zigu?yu?^{5}) *eyelash*

a?nga^{34} *to be born*

These two clusters merely combine patterns already found in two-consonant clusters; they do not introduce any new patterns.

Certain clusters are restricted to ultimas because they contain a fortis consonant or a laryngeal. Others are theoretically possible in nonultimas, but not all of them occur there. In nonultimas, consonant clusters in native words are limited to /nd gw/.

ndo?ǫ^{34} *very much*

gwa?ah^{34} *vapor bath*

dugwanę^{34} *to bathe (someone)*[6]

Consonant clusters which occur in Spanish loanwords considerably complicate this fairly simple picture.[7] There are sequences /nč nz/.

zančǫ^{32} *orphan*

manzanę^{32} *apple*

There are sequences of stop plus /r/: /tr br dr/.[8]

litrǫ^{32} *liter*

abril^{32} *April*

badrę^{32} *priest*

There are sequences of nasal plus stop plus /r/: /mbr ndr/.

lambrę^{32} *wire*

landrǫ^{32} *coriander*

Spanish loanwords also stabilize the /mb/ cluster mentioned above.

dembǫ^{32} *long ago*

There are sequences of various consonants plus semivowel: /zw hw dy sy zy ry ry ly wy/.

zwetę^{32} *sweater*

gahwe^{32} (~ agwe^{32}) *coffee*

dyǫ^{32} *season*

basya^{32} *to take a walk*

zyendǫ^{32} *hundred*

maderyą^{32} *flashlight battery*

danyą^{32} *litany*

gulyą^{32} *Julia*

wyarinǫ^{32} *government*

There are also sequences of two consonants plus semivowel: /ndy nsy/.

zindyo^{32} *July*

nansyą^{32} *Venancia*

Certain rare clusters are used only by some speakers, e.g., /bl/ and /lp/.

bleč̣a^{32} (~ waleč̣a^{32}) *bus*

alpa^{32} (~ alapa^{32} ~ lahwa^{32}) *alfalfa*

Some of the clusters introduced by Spanish loanwords occur only in ultimas, some occur in both ultimas and nonultimas, and some occur only in nonultimas. These restrictions seem to be a function of two factors. The first is the phonological constraint restricting fortis stops, affricates, fortis sibilants, and laryngeals to ultimas. The second is the chance occurrence of clusters in various positions within the corpus of about 300 loanwords.

Spanish loanwords have changed the distribution of /h/. In native words, /h/ occurs only as the coda of ultimas. In loanwords, it occurs as the onset of ultimas, alone or in cluster with /w/.

lihą^{32} *sandpaper*

gahwe^{32} (~ agwe^{32}) *coffee*

For some speakers, /h/ occurs in a nonultima in a few words, which violates the phonological constraint mentioned in the preceding paragraph.

lehwandę^{32} (~ lawandę^{32}) *elephant*

There is considerable free variation among certain consonants in various morphemes. Consonants that show this variation are: /g~l c~z č̣~ṣ̌ ṣ̌~r r~n r~l m~w n~l n~l~y/.

gančǫ^{32} ~ lančǫ^{32}	*hook*	ra?wa^{34} ~ la?wa^{34}	*toothless*
acĩ^{3} ~ azĩ^{3}	*to jingle*	ru?mi?^{3} ~ ru?wi?^{3}	*charcoal*
gač̣a?^{5} ~ gaṣ̌a?^{5}	*wide*	gu?nu?^{3} ~ gu?lu?^{3}	*to be hooked on*
maṣ̌e^{35} ~ mare^{35}	*green*	yuwę^{32} zigu?nu?^{5} ~ zigu?lu?^{5} ~ zigu?yu?^{5}	*eyelash*
naro?^{3} ~ nano?^{3}	*to look for*		

In some instances, a cluster varies with one of its members: /gw~w mb~m~w nd~n nd~d/.

rugwah^{3} ~ ruwah^{3} *hearth stones*

kã^{3} mba?^{3} ~ ma?^{3} ~ wa?^{3} *furrowed green squash*

zigu?ndu?^{5} ~ zigu?nu?^{5} *eyelash* (see other variants above)

ndah^{34} ~ dah^{34} *how much?*

There is also variation between word-initial /y/ and its absence before vowel /u/ plus nasalization.

yũ^{32} ~ ũ^{32} *again*

A further type of variation involves vowels and semivowels surrounding /ʔ/.

gu?we^{34} ~ gweʔe^{34} *next younger sibling*

daʔyũh^{34} ~ diʔũh^{34} *to deceive*

raʔyũh^{34} ~ riʔɾh^{34} *to mistreat*

A few restrictions in the distribution of consonants across syllable boundaries appear to be systemic. /z/ cannot occur in a penult if the ultima contains /č ç̌/, nor can /ž/ occur in a penult if the ultima contains /c/.

zicɾʔ^{3} *to be torn*

žičeʔ^{32} *our spouse's younger relative*

žiç̌aʔ^{3} *to be shattered*

In one morpheme loss of a medial syllable results in a form that violates this constraint for some speakers:

ziç̌ą^{32} (~ žiç̌ą^{32} ~ zigiç̌ą^{32}) *acorn woodpecker (Melanerpes formicivorus)*

/r/ has no co-occurrence restrictions with affricates because /r/ in nonultimas is a recent development in fused phrases by reduction from /ç̌/ (Longacre 1957:68-70).

racɾ^{3} *tomato*

račiʔ^{3} *pine (tree)*

riç̌uh^{3} *oak (tree)*

Only one labial consonant may occur within a word. This has been violated by some recent loanwords.

bazikwą^{32} ~ mazikwą^{32} (~ gazikwą^{32}) *Easter*

wíwàh *(exclamation of approbation)*

1.2 There are eight vowels in SJC Trique: five long vowels /i u e o a/ and three short vowels /ę ǫ ą/.[9] Long vowels occur in all syllable types; short vowels occur only in unchecked ultimas. Short vowels therefore seem to be more highly marked than long ones. There are no dipthongs; when two vowels occur in sequence, each is the nucleus of a separate syllable. Sequences of two vowels occur only in the final two syllables of a word. There are

no sequences of three or more vowels.

A long vowel is extra-long in an unchecked ultima, the position in which it contrasts with short vowels. In a checked ultima, or nonultima, it is fairly short. In a nonultima, a front vowel is slightly backed following /r/, and /a/ is raised and fronted following /y/.

kɨ^{3} *yesterday*	ne?eh^{3} *baby*
zih^{21} *to total up*	to^{34} *milk*
gɨɨ?^{3} *prickly pear*	oh^{21} *to shell (corn)*
lu^{3} *cat*	gopa̱^{32} *goblet*
nuh^{3} *skin*	x̌a̱^{3} *tortilla*
ux̌a̱^{21} *to vomit*	x̌a̱?^{3} *song*
ne^{34} *knife*	yatɨ?^{3} *star*
ne?^{3} *rope*	

A short vowel is notably shorter when it receives a phrase stress (see 1.4). /e̱ o̱/ have a more open articulation than /e o/.

ne̱^{3} *to be sitting*

to̱^{34} *grindstone (metate)*

gata̱^{53} *to carry (potential)*

Although all five long vowels occur in nonultimas, it is almost possible to reduce the number of contrasts in this position to three. In words of native origin, the occurrence of /ɨ u/ or /e o/ respectively, is to a large degree predictable from the ultima vowel, but in Spanish loanwords, the contrast clearly occurs in a few sets of words for some speakers.

mesa̱^{32} (~ misa̱^{32}) *table*

misa̱^{32} *mass*

In both Spanish loanwords and native words, however, nonultima vowels vary freely in many morphemes, both between speakers and even for the same speaker.

ra^{3}to̱^{4} ~ ro^{3}to̱^{4} *blanket*

In addition, nonultimas are articulated so rapidly that the vowel is often reduced and/or devoiced.

The following generalization can be made about the near-complementation of /ɨ u/ with /e o/. /e o/ are uncommon in nonultimas.

They occur mainly when the ultima vowel is itself mid. /e/ often precedes /e ẹ/, and /o/ often precedes /o ọ/. This is particularly true when the intervening consonant is /ʔ/ or the onset of the nonultima is /r/. Before all ultima vowels, /i u a/ are common in nonultimas, except that /u/ does not precede /o/.

ne^{3}eh^{3} *baby*
ne^{3}ẹ^{3} *to see*
roko^{34} *custard apple*
no^{3}ọ^{34} *man (woman speaker)*
riki^{21} *grasshopper*
uci^{3} *to nurse*
gaki^{21} *nail*
nitu^{34} *face down*
guku^{32} *Inca dove (Scardafella inca)*
dakuh^{21} *sty*
ni^{3}ke^{5} *chocolate*
uǰe^{34} *to get wet*
gaǰe^{21} *to walk (completive)*
žiko^{35} *groove*
dako^{21} *foot*
žitah^{21} *to sting (insect)*
utah^{21} *to annoint*
ata^{3} *to take a vapor bath*
nikẹ^{53} *poor*
yuwẹ^{5} *hidden*
anẹ^{34} *to bathe*
zinọ^{32} *native skirt*
unọ^{34} *to sow*
akọ^{32} *to sob*
misạ^{32} *mass*
utạ^{3} *to gather*
gatạ^{53} *to carry (potential)*

When no consonant intervenes, vowel sequences are restricted to /iu ie io ia iọ iạ ai au ao/.

riu^{34} *whistle*
diêh *aunt (man speaker)*
rio^{34} *trough*
ria^{3}ʔ^{3} *to shoot*
zeriọ^{32} *match*
žiạ^{32} *neck*
yaih^{3} *stone*
yauʔ^{3} (~ yuʔ^{3}) *armadillo*
aoʔ^{3} *to hit*

Although there are no vowel sequences with /u/ as the first member, there are sequences /uwi uwe uwa uwẹ uwạ/.

yuwi^{35} *people*
žuwe^{3} *dog*
yuwa^{5} *angry*
yuwẹ^{32} *hair*
ruwạ^{32} *squash seed*

There are very few distributional restrictions between consonants and vowels. Front vowels /i e ẹ/ do not immediately follow /y/. Back vowels /u o ọ/ do not immediately follow /w/. Front vowels do not precede /ẏ/, but back vowels do precede /w/. See examples in preceding paragraph.

Simple /k g/ do not occur following a back vowel and preceding a nonback vowel. /kw gw/, however, are common in this environment.

dukwą^{32} *possessed house*

žugwah^{21} *to be twisted*

/m/ does not precede back vowels except in loanwords.

dɪmọ^{32} *plow beam*

In some cases, vowels vary freely in ultimas. Pairs of vowels that show this variation are often nasalized. /i~e ɪ~u u~o ẹ~ọ ẹ~ą/.

yuwɪ^{21} ~ yuwe^{21} *palm mat*

gatɪ̃^{5} ~ gatũ^{5} *narrow*

nuh^{21} ~ noh^{21} *we (exclusive)*

retẹ̃^{34} ~ retọ̃^{34} *vegetable pear (Sechium edule)*

yanẹ^{3} ~ yąną^{3} loft

Sometimes a sequence of two vowels varies with a single vowel: /aɪ~e au~u/.

lelaɪ̃h^{21} ~ lelẽh^{21} *sling*

yau?^{3} ~ yu?^{3} *armadillo*

A further variation involves the sequences /aya/ and /ɪa/.

naya^{21} ~ nɪa^{21} *to diminish*

1.3 The SJC system of tones is analyzed as a contour system similar to those reported for Asian languages, rather than as a register system, such as those reported for various Middle American languages, including SAC Trique. Because of their mnemonic value, however, and to facilitate comparison with SAC, tones are symbolized by numbers which reflect their phonetic composition (1 is high, and 5 is low). There are eight tones in SJC Trique: mid-high gliding to high /$_{21}$/, mid gliding to mid-high /$_{32}$/, mid /$_{3}$/, mid gliding to mid-low /$_{34}$/, mid gliding to low /$_{35}$/, mid-low

/4/, low /5/, low (or mid-low) gliding to mid /53/.

yã^{21}	*to be sitting*	yã^{35}	*scar*
yã^{32}	*corncob*	yã^{4}	*unmarried*
yã^{3}	*he is sitting*	yã^{5}	*one (in certain number phrases)*
yã^{34}	*salt*	yã^{53}	*Spanish moss*

Only /21 3 4/ occur in nonultimas.

ya^{21}nuh^{53} *drum*

gwe^{3}se^{5} *judge*

ga^{4}yã^{21} (~ gayã^{21}) *to sit (potential)*

In this position, /3/ has a variant /35/ preceding /m/.

žu^{3}mẹ^{32} *barn owl (Tyto alba)*

/4/ is phonetically intermediate between /4/ and /5/ in ultimas, and seems to represent a neutralization of these two tones; it is here assigned arbitrarily to /4/. It occurs contrastively only when the ultima tone is /21 32 3 34 35/. Non-tone-carrying nonultimas, when not devoiced, have a carrier tone around level 3 when the following tone is /21 32 3 34 35/, and around level 4 when the following tone is /4 5 53/. Tone-carrying nonultimas with /3/ are more prominent than non-tone-carrying nonultimas.

In ultimas, all eight tones occur with long unchecked vowels. See examples above. All but /21 35/ occur in ultimas with short vowels.

ganọ^{32}	*to grab (completive)*	gunọ^{4}	*to sow (potential)*
gunọ^{3}	*to hear (completive)*	ganọ^{5}	*to grab (potential)*
gunọ^{34}	*to sow (completive)*	gunọ^{53}	*to hear (potential)*

All but /32/ occur in ultimas checked by /h/, but /35/ is very rare.

ya?ah^{21}	*gourd*	nuh^{4}	*generous*
ya?ah^{3}	*chili pepper*	nɨ^{3}nuh^{5}	*bean gruel*
ya?ãh^{34}	*god*	gä^{3}nuh^{53}	*shoe*
mayah^{35}	*yellow*		

All but /34/ occur in ultimas checked by /?/, but /21 35/ are very rare, and /32/ occurs only as a sandhi variant (see 1.4).

cɪ̃?^{21} (~ cɪ̃?^{3}) *tiny*

nã?^{32} zo?^{5} *you start for home*

nã?^{3} *to start for home*

ca?^{35} (~ a^{3}za?^{5}) *how? (with a component of surprise)*

rune^{34} nana?^{4} *large black beans*

mã?^{5} *two (tortillas)*

zaga?^{53} *spleen*

Nasalization is a word-level feature; a word is either nasalized or it is not. Nasalization is actualized mainly on the vowel of the ultima, but extends regressively to nonultimas until a consonantal barrier (any consonant other than /y w ?/) is reached.

/a ạ/ are raised to mid central when nasalized. /u/ has an extremely close variant, approaching a syllabic labiovelar nasal, when nasalized.

There are limitations on the distribution of nasalization with respect to consonants and vowels. A word with nasal plus stop as onset of its ultima is never nasalized.

nda^{53} *until*

nga^{3} *cloud*

If the onset of the ultima ends in a nasal, and the vowel of the ultima is /ɪ e ẹ u o ọ/, the vowel is always phonetically nasalized. I do not mark nasalization in such words.

ne?^{3} *rope*

nuh^{3} *skin*

In this same context with /a ạ/, the word may be either nasalized or not (although it is most often nasalized when the nasal is /m/).

nah^{3} *barrio of Yosoyuxi*

nãh^{3} *net bag*

da?nah^{34} *ghost*

ɣɪ?nãh^{34} *to abound*

nạ^{34} *water*

ɣɪnã̰^{32} *paint*

má? (~ mã́?) *(negative)*

amã?^{3} *to rain*

nimã̰^{32} *heart*

The same constraints apply to sequences of nasal-vowel-glottal stop -vowel.

ne?eh^{3} *baby*

gono?ọ^{32} *medicine*

na?ah^{21} *to be faint*

ɣɪna?ãh^{21} *language*

/e o/ occur in the ultima of nasalized words only in Spanish loanwords. Monolinguals usually replace /e/ by /ɪ/, and sometimes /o/ by /u. All other vowels occur with nasalization.

racɪ̃^{3} *tomato* natã^{3} *stringbean*

x̌ũ^{21} *box* retẽ̤ (~ retõ̤) *vegetable pear*

trẽ^{32} ~ trɪ̃^{32} *train* ačõ̤^{32} *to write*

rayõ^{32} ~ rayũ^{32} *stallion* ya?ã̤^{34} *fire*

Nasalization occurs with all eight tones.

yã^{21} *to be sitting* yã^{35} *scar*

yã^{32} *corncob* yã^{4} *unmarried*

yã^{3} *he is sitting* yã^{5} *one (in certain number phrases)*

yã^{34} *salt* ga?ãh^{53} *four*

A few words have nasalized and non-nasalized variants.

dãh^{53} ~ dah^{53} *thus*

ačẽ̤^{32} ~ ače̤^{32} *to pass*

In exclamatory words the distinction among long unchecked vowels, long vowels checked by /h/, and short vowels is lost. All these vowels show a breathy fade, which I have chosen to consider a manifestation of /h/.[10] Thus, in exclamatory words, there is a contrast only between those that end in /h/ and those that end in /?/.

The eight-contour tone system does not occur in exclamatory words. Instead, there is a set of five pitch-stress patterns, symbolized by diacritics over vowels: level mid-high or mid tone on the ultima /ˊ/, level mid-low or low tone on the ultima /ˋ/, a glide falling from mid to mid-low on the ultima /ˆ/, level mid or mid-high tone on the penult with a glide falling from mid-low to low on the ultima /ᷓ/, a glide rising from low or mid-low to mid on the ultima /ᷔ/. Each morpheme normally occurs with only one of these patterns in any one idiolect.

á̤h *(declarative in answer to a question)*

ží? *grandfather!*

gàh (~ gâh) *(interrogative for content questions)*

žà? *(interrogative for yes-no questions with affirmative answer expected)*

zitâh *relative's husband!*

mâ? (~ má?) *(negative)*

ž̌úwèh *dog!*

ž̌ókò? *relative's wife!*

dirě̌h *father-in-law!*

duwɪ̌? *aunt! (woman speaker)*

Certain morphemes occur only as exclamatory words. These comprise a few exclamations and some members of a set of particles with meanings similar to those carried by intonation contours in English. They occur only utterance-final. There are many morphemes which I have never observed as exclamatory words, e.g., verbs. There are also a large number of morphemes which may occur as either word type, depending on their syntactic function. Most nouns belong to this group. When a noun is used as a vocative, it occurs as an exclamatory word; when it is used within a clause, it occurs as an ordinary word.

The correspondences between the vowels and laryngeals in the two systems are fairly simple. All ordinary words checked by /?/ correspond to exclamatory words checked by /?/. All ordinary words checked by /h/ correspond to exclamatory words checked by /h/. All ordinary words ending in long unchecked vowels or in short vowels also correspond to exclamatory words checked by /h/. /ẹ ọ ạ/ in ordinary words correspond to /e o a/, respectively, in exclamatory words.

da?nu?^{32}	*our uncle*	lupẹ^{32}	*Lupe*
da?nú?	*uncle!*	lúpèh	*Lupe!*
ra?wlh^{34}	*woman's brother*	betọ^{32}	*Albert*
ra?wîh	*brother!*	bétòh	*Albert!*
žuwe^{3}	*dog*	lɪtạ^{32}	*Margaret*
ž̌úwèh	*dog!*	lɪ́tàh	*Margaret!*

Following a question, however, final /h/ in names and kinship terms used as vocatives becomes /?/.

bétò? *Albert!*

dɪ́nù? *man's brother! (from* dɪ́nùh*).*

The correspondences between the two tone systems are not entirely regular. A detailed listing of such correspondences is beyond the scope of this paper.

1.4 There appear to be at least two levels of organization above the word.

One of these is the phonological PHRASE, a level marked by a stress on the ultima of the word which functions as its nucleus. A phonological phrase may contain up to four words. Very often it contains only one. Some morphemes, mainly pronouns and particles, rarely or never occur as the nucleus of a phrase. Some of these are proclitic, and others are enclitic. All other morphemes occur only as the nucleus of a phrase. Whatever the number of words in a phrase, stress occurs on either the first or second word. Phrase stress /'/ is marked both by intensity on the ultima of the word receiving it and by a lengthening of unchecked long vowels or a shortening of short vowels. The latter is accompanied by compensatory lengthening of an immediately preceding fortis stop, fortis sibilant, or resonant.

'dã^{32} zo?^{5} âh *your pet*

zẹ^{34} la'pẹ^{32} zo?^{5} âh *your pencil*

'mą̃^{3} 'zo?^{3} âh *to him*

'mą̃^{32} zo?^{5} âh *to you*

The second level of organization is the UTTERANCE, which has been mentioned above in connection with the distribution of ordinary and exclamatory words. The final word of an utterance is always an exclamatory word. One phrase of an utterance, normally the final one, is marked by a slightly stronger stress /"/.

At the utterance level, there are some intonation-like phenomena. Strong emphasis can be expressed on an ordinary word by extra-strong utterance stress, by greatly lengthening consonants and vowels except for short vowels (which are, if anything, even shorter), and by raising the noncontrastive pitch on non-tone-carrying nonultimas.

ža"kã^{5} zo?^{5} âh *you are tall!*

Insistence can be expressed by greatly lengthening the utterance-final exclamatory word, by giving it utterance stress, and by nasalizing and laryngealizing it.

rí'kẹ^{4} zo?^{5} ní^{4}'?yah^{34} '?ũh^{5} "âh *come on now, give it to me to look at!*

Sympathy can be expressed by superimposing a falling pitch accompanied by increasing laryngealization on the tone system and lengthening the final syllable.

nɨ"kę^{32} dɨ?^{5} âh *poor you!*

Impatience or annoyance can be expressed by shifting the pitch of the utterance to a higher key.

nę^{3} ne'?eh^{3} "má? *I don't know!*

A further phenomenon within the phrase or utterance is tone sandhi. A group of five pronouns changes the ultima tone of any immediately preceding word ending in a vowel or /?/ and having tones /$^{3\ 35\ 53}$/ to /^{32}/. These pronouns also change the ultima tone of any immediately preceding word ending in /h/ and having /$^{3\ 53}$/ to /^{21}/ with loss of /h/.[11]

2. The WORD in SAC Trique is also well-marked. The ultima is the position of phonemic differentiation, and nonultimas are positions of neutralization. The contrast between fortis and lenis consonants, for example, occurs only in ultimas and is neutralized in nonultimas. In addition, a far greater range of tonal possibilities occurs in ultimas than in nonultimas.

Words have stress on the ultima. There is also a phonetic stress on a penult with tone ^{2}, and on a penult preceding an ultima with a medially-checked vowel (V?V or VhV).

2.1 There are 25 consonants in SAC Trique: fortis consonants /p t k s š m· n· ɨ· y· w·/, lenis consonants /b d g z ž m n ɨ y w/, and consonants undifferentiated as to fortis-lenis /c č r ? h/. The fortis-lenis contrast is found only in ultimas. Neutralized phonemes occurring in nonultimas have been identified with the lenis series. /m· n· ɨ· y· w·/ occur only in monosyllabic words. /c č/ occur only in ultimas, except that a few speakers substitute /č/ for /ž/ in non-ultimas in a few words. The only consonants which may close a word are /? h/.

Fortis stops and sibilants are voiceless and slightly lengthened. Fortis nasals, lateral, and semivowels are quite long.

ɨa^{3}pɨh^{3} *pencil*	m·i^{354} *bridge*
to^{343} *grindstone (metate)*	n·e^{5} *naked*
ko^{4} *twenty*	ɨ·ɨh^{3} *little*
me^{2}sa^{3} *table*	y·a^{34} *tongue*
šɨ^{3} *large*	w·ɨh^{5} *two*

/b/ is a voiced fricative in the onset of ultimas, except after nasals, where it is a stop. /d g/ vary from voiced fricatives to voiced stops to voiceless stops in most environments. They are stops after nasals. Lenis sibilants vary from voiced to

voiceless. Lenis nasals, lateral, and semivowels are short, and /n/ is velar immediately preceding /g/.

be?e^{5}	*(asseverative)*	mɪ̈^{21}	*yellow*
da^{3}	*plain*	nɨ?^{5}	*all*
gah^{2}	*to grind (completive)*	lu^{21}	*worm*
zãhã^{3}	*twelve and a half centavos*	yũ^{2}	*another time*
ža^{3}ɪ̈^{3}	*mosquito*	wah^{2}	*to grind*

Affricates are voiceless; /č/ is slightly retroflexed.[12] /r/ is a retroflexed grooved flap. It is voiceless utterance-initial or following /h/ and voiced elsewhere. /?/ is a glottal stop. /h/ is a voiceless velar fricative in the onset of a syllable; elsewhere, it is a voiceless vocoid.

cl^{5}	*tough*
ča^{12}	*canyon*
re?^{5}	*you (formal)*
?ɨ^{4}	*nine*
wah^{2}	*to grind*

Clusters of two and three consonants occur in syllable onsets. Several types occur in the ultima of native words. On type is /n/ plus lenis stop: /nd ng/.

nda^{43}	*until*
nga^{3}	*cloud*

Another type is /?/ plus resonant: /?m ?n ?l ?y ?w/.

ga^{3}?mã^{3}	*to be warm (completive)*
ga^{3}?nɨ^{21}	*to put in (completive)*
de^{2}?lohɔ^{54}	*rooster*
ga^{3}?yãh^{1}	*to blow (completive)*
du^{3}?wɪ̈^{3}	*thunder*

A third type is velar stop plus semivowel: /ky kw gy gw/. /ky/ occurs only across morpheme boundary. Some speakers do not have /gy/ but have simple /g/ in its place.

ga^{4}ta^{2} k-yũh^{5} a^{3} *carry you-me!*

kweh^{3} *pus*

nɨ^{3}gyã^{21} (~ nɨ^{3}gã^{21}) *town of Tlaxiaco*

gweh^{2} *to jump*

Other clusters of two consonants which occur in ultimas are: /dr zn nz/.

drã?^{34} yũ^{4}?ũh^{34} *to bother*

znah^{3} *language*

žu^{3}ku^{3} la^{3}nzɨhɨ^{43} *daddy-long-legs*

One cluster of three consonants occurs in ultimas: /?ng/.

?ngo^{4} *one*

Clusters are more common in ultimas than in nonultimas. Of the clusters listed above, the only ones which occur frequently in nonultimas are /ng ?n gw zn/.

ngu^{3}ya^{43} *roadrunner*

?na^{2}kɨhɨ^{54} *opossum*

du^{3}gwa^{3}ne^{34} *to melt*

znã^{3}?ãhã^{43} *conversation*

There are also several clusters which occur only in nonultimas: /hn žy zd ngw zgw/. Of these, /žy zgw/ each occurs in one morpheme only.

hna^{3}čl^{3} *to awaken (someone)*

žya^{3}čaha^{43} *duck*

zdu^{3}ku^{43} *necklace*

ngwã^{4}?ãh^{3} *four more*

a^{3}zgwa^{4}?a^{3} *earlier*

Clusters beginning with /z/ most frequently occur word-initial.

Many other consonant clusters occur in Spanish loanwords. There are sequences /nč nž/.

le^{3}nčuh^{3} *Lawrence*

nžl^{2}u^{3} *an old coin worth six centavos*

There are sequences of nasal plus stop plus /r/: /mbr ndr/.

dɪ²mbre³ *postage stamp*

la²ndru³ *coriander*

There are sequences of various consonants plus semivowels: /ry ly hw/.

de²ryu³ *Emeterio*

hu³lya³ *Julia*

ga³hwe² *coffee*

Other consonant clusters introduced through loanwords are: /mb nt st sk rk zg zy nsy nty skw/.

re²mbuhu⁴⁴ *top (toy)*

za²ntu³ *All Saints' Day*

kweh³ stah³ *mustard greens*

ska²³ *fiscal (a religious official)*

bo³rkeh³ *George*

zga³le²ra³ *ladder*

zye²ndu³ *hundred*

be²nsyu³ *Florencio*

za³ntyo² *Santiago*

ba²skwa³ *Easter*

Some of these clusters occur only in ultimas, some only in non-ultimas, and some in both.

Spanish loanwords have introduced two new distributions for /h/: in the onset of ultimas, alone or in cluster with /w/; and alone in the onset on non-ultimas.

a²hu³ *garlic*

ga³hwe² *coffee*

hu³lya³ *Julia*

In some morphemes, there is free variation in nonultimas between a consonant cluster and the second member of that cluster. Sets which show this variation are: /zd~d nz~n ng~g dr~r/.

zda³ne⁴³ ~ da³ne⁴³ *goat*

zna²du³ ~ na²du³ (also ʔna²du³) *soldier*

ngu³nɬʔɬ¹³ ~ gu³nɬʔɬ⁴³ *prickly pear*

druh³ ~ ruh³ *clay pot*

There is one restriction on the distribution of consonants across syllable boundaries. The onsets of two contiguous syllables (in native words) cannot each contain a labial consonant (Longacre 1957:28)

2.2 There are thirteen vowels in SAC Trique: oral vowels /ɪ ɨ u e o a/, nasalized vowels /ɪ̃ ɨ̃ ũ ẽ õ ã/, and undifferentiated vowel /ʌ/. Nasalized vowels occur only in ultimas unless the onset of an ultima is /ʔ/, in which case the preceding vowel is usually also nasalized (Longacre 1957:25). A few morphemes such as ra^{3}ʔã^{3} *mushroom* do not have nasalization on a vowel followed by /ʔ/ plus nasalized vowel. The contrast of /ɪ ɨ/ with /ɪ̃ ɨ̃/, respectively, is neutralized immediately following nasals. In ultimas, only the nasalized vowels are considered to occur. /ẽ õ/ are rare. There are no dipthongs; when two vowels occur in sequence, each is the nucleus of a separate syllable.

/ɨ ɨ̃/ are high central. /ʌ/ is mid central. Other vowel symbols have their usual phonetic values. /e/ is more open immediately following /ɪ·/, and in nonultimas between /r/ and any consonant other than /ʔ/. /ã/ is higher than /a/ (Longacre 1957:21, 23).

cɪ^{5} *tough*	kɨ̃^{3} *river*
dɨ^{21} *calm*	dũ^{3} *palm tree*
čǔ^{343} *powder*	žu^{3}gwẽh^{34}-ẽ^{3} *brother! (honorific, woman speaker)*^{13}
n·e^{354} *meat*	zõ^{343} *work*
čo^{354} *soot*	kã^{43} *seeds*
ča^{12} *canyon*	yʌh^{3} *stone*
cɪ̃^{3} *a drop*	

Vowels in ultimas may be unchecked, medially-checked by /ʔ h/, or finally-checked by /ʔ h/. When unchecked, they are longer; when medially-checked, they are interrupted; and when finally-checked, /ʔ h/ close the word. Medially-checked ultimas have the phonetic stress on the first mora when checked by /ʔ/, or when checked by /h/ with a nonrising tone sequence or level tone; and on the second mora when checked by /h/ with a rising tone sequence.

y·a^{34} *tongue*

yoʔo^{3} *year*

yaha^{3} *flower*

yãʔ^{34} *teeth*

yah^{3} *ashes*

Medially-checked ultima vowels are in contrast with disyllabic sequences having /ʔ h/ in the onset of the second syllable.

yã^{3}ʔã^{53} *twins*

a^{2}hu^{3} *garlic*

The distribution of vowels across syllable boundaries is restricted. /ɪ u a/ occur in nonultimas before all ultima vowels. /e o/ occur in nonultimas only before restricted lists of ultima vowels. /ʌ/ occurs in nonultimas only when followed by /ʔʌ/. /ɨ/ never occurs in nonultimas. Nasalized vowels occur contrastively in nonultimas only if the ultima vowel is also nasalized. When no consonant intervenes, vowel sequences are restricted to /ɪu ɪo ɪa ɪũ ɪã eu ai au aĩ/ (Longacre 1957:25).

There are two distributional restrictions between consonants and vowels: /w w·/ cannot immediately precede /u o/, and /y y·/ cannot occur contiguous to /ɪ/ within the same word (Longacre 1957: 16).

2.3 SAC Trique is analyzed as a highly asymmetrical five-tone register system (1 is high, and 5 is low). All syllables carry tone, although ultimas have the greatest potential for tonal contrast.

Penults may carry level tones /2 3 4 5/; antepenults may carry only /3 4 5/.

re^{2}ta^{3} *rope*

ɮɪ^{3}ɪu^{3} cat

ga^{4}ta^{3} *she'll carry*

gã^{5}ʔã^{3} *four*

na^{3}gɪ^{3}ʔyah^{2} kwã^{4} nĩh^{3} *they made it purple*

na^{4}du^{4}na^{4} zɪ^{3} *he'll change it*

gu^{5}du^{5}ʔwe^{5} kã^{3} *I'll sell squash*

In ultimas, level tones /2 3 4 5/ (but not /1/) occur.

yo^{2} *palm basket*

kã^{3} *squash*

ʔɨ^{4} *nine*

ɮã^{5} *eleven*

Sequences of two tones in ultimas are: /12 13 21 23 32 34 35 43 45 51 52 53 54/. Of these, /13 32 51 52/ each occur in one morpheme only.

ga^{3}kɨ^{12} *nail*

ã^{13} *yes*

ni^{3}gyã^{21} *town of Tlaxiaco*

dũ^{23} *person in charge of religious festival (mayordomo)*

ma^{3}ka^{32} *Mexico City*

a^{3}ne^{34} nɪ̃h^{3} *they're bathing*

to^{35} ga^{5}cɪ^{53} *white milk*

na^{3}to^{43} *banana*

a^{3}ʔi^{45} nɪ̃h^{3} *they're heavy*

ga^{3}wɪ̃^{3} yo^{51} *I was quick*

ga^{3}wɪ̃^{3} yo^{52} re^{ʔ5} *you were quick*

za^{34} ǰe^{5}ʔe^{53} *long stuff*

za^{34} na^{2}ko^{54} *dried stuff*

Only two sequences of three tones occur: /^{343} ^{354}/.

cɪ^{343} *roasting ear*

to^{354} *milk*

All the above tones and tone sequences occurring in ultimas are found in unchecked syllables. In medially- or finally-checked syllables, restricted sets of tones and tone sequences occur. Syllables checked medially by /ʔ/ occur with /^{3} ^{43} ^{53}/.

mˑɪ̃ʔɪ̃^{3} *soap*

a^{3}tãʔã^{43} *foam*

ga^{3}ǰũʔũ^{53} *shadow*

Syllables checked medially by /h/ occur with /^{3} ^{43} ^{53} ^{54}/.

kaha^{3} *log*

zã^{3}ʔãhã^{43} *money*

rɪ^{3}uhu^{53} *reed*

yã^{2}ãhã^{54} *musical instrument*

Syllables checked finally by /ʔ/ occur with /^{2} ^{3} ^{4} ^{5} ^{34} ^{35} ^{45}/.

dɪ^{3}ʔnɨʔ^{2} *our corn*

gɨʔ^{3} zɪ^{3} *he stinks*

čɪʔ^{4} *ten*

zɪ^{3}-ga^{5}kɨʔ^{5} *our nails*

da^{3}rãʔ^{34} nɪ̃h^{3} *all of them*

u^{3}taʔ^{35} zɪ^{3} *he's fighting*

zdu^{3}kũʔ^{45} *nephew*

Syllables checked finally by /h/ occur with /^{2} ^{3} ^{4} ^{5} ^{23} ^{34} ^{45} ^{43} ^{53}/.

zɨ^{3}-neh^{2} *my meat* žu^{3}gweh^{34} zɨ^{3} *his sister*

ruh^{3} *clay pot* ru^{3}gu^{3}cɨh^{45} *armpit*

čɨh^{4} *seven* nɨ^{3}kah^{43} *her husband*

žu^{5}wɨh^{5} *twelve* zɨ^{3}-neh^{53} *her meat*

tah^{23} *dad!*

There are some restrictions on combinations of tones across syllable boundary. Most of these restrictions involve the high tones /^{1}/ and /^{2}/.

2.4 The phonological structure of SAC Trique above the level of the word has not been studied in detail. One feature of interest, however, is the replacement of tone by intonation contours on certain kinship terms functioning as vocatives at the end of either a dialogue or hortatory paragraph. There are three contrasting contours, which involve final laryngeals as well as tone. One contour ends in open vowel or /h/ and has a level tone around levels /^{2}/ or /^{3}/ of the regular tone system. This contour means 'casual'. The second ends in /ʔ/ plus reduplicated final vowel and has a level tone around level /^{3}/ of the regular tone system. This contour means 'insistent'. The third has no laryngeal and a falling tone from around level /^{2}/ to around levels /^{4}/ or /^{5}/ of the regular tone system. This contour means 'calling'. Examples of these contours on the word dɨ^{3}nɬ^{21} *man's brother*: dɨ^{3}nɬ^{3}, dɨ^{3}nɬʔɬ^{3}, dɨ^{3}nɬ^{25}. These vocatives are preceded by one or more of a set of ten particles which have meanings giving emotional coloring. These particles belong to the regular tone system (Longacre 1964:143).

In SAC Trique, a group of four pronouns is accompanied by tone changes in an immediately preceding word of the proper phonological and grammatical description. The application of such changes is not automatic, and Longacre has analyzed these tone changes as a separate morpheme (1959:22-27).

3. In this section, I compare the phonological systems of the two dialects as systems. My orientation is typological, not comparative in the sense of reconstructing a proto-language. Nevertheless, historical considerations will be mentioned when relevant, including the comparison of cognate morphemes.

3.1 Both Trique dialects have the same sets of fortis and lenis stops /p t k b d g/ and the same two laryngeals /ʔ h/. Both have the same five resonants /m n l y w/, but SJC lacks the corresponding fortis resonants of SAC /m· n· l· y· w·/. The greatest difference between the consonant systems of the two dialects is in the patterning of affricates, sibilants, and flap. SJC has nine phonemes in this area, in a symmetrical three by three pattern.

There are three points of articulation--alveolar, palatal, and retroflex--and three manners of articulation--affricate, fortis sibilant, and lenis sibilant. The lenis retroflex sibilant has a flap allophone. SAC, however, has only seven phonemes. There are affricates, fortis sibilants, and lenis sibilants at alveolar and palatal points of articulation, and a flap with a retroflex sibilant quality. The palatal affricate has a somewhat retroflex articulation. (See footnote 12.)

SAC fortis resonants developed mainly by a lengthening of simple resonants to compensate for the loss of a penult (Longacre 1957:18).

SJC yumę^{34}, SAC m·ɪ̈^{343} *sweet potato*

SJC yanạ^{3}, SAC n·a^{3} *loft*

SJC yuwe^{34}, SAC w·e^{343} *century plant*

Affricates and sibilants show fairly regular correspondences. SAC /č/ is phonetically intermediate between SJC /č/ and /ç̌/. (See footnote 12.)

SJC gačɨ^{3}, SAC ga^{3}čɨʔɨ^{43} *fever*

SJC ç̌o^{35}, SAC čo^{354} *soot*

SJC /ş̌/ has developed mainly from a fusion of /žiç̌/.

SJC ş̌a^{21} (~ žiç̌a^{21}), SAC žɨ^{3}ča^{21} *back*

The distribution of the consonant phonemes is similar in the two dialects. In SAC, however, /ʔ h/ sometimes occur in nonultimas.

The two dialects show different inventories of consonant clusters. SJC does not have clusters with a sibilant as the first member, but such clusters are quite common in SAC. This difference is more apparent than real, in that there is free variation in SJC among sibilant-vowel-consonant (stop or nasal) and sibilant-consonant sequences, e.g., zɨt- ~ zɨ̣t- ~ zə̣t- ~ z̧t- ~ zt-. Even though the forms without vowels are statistically more common, I have chosen to write the full forms with vowels. Such sequences correspond somewhat to SAC clusters with a sibilant as the first member, and sometimes to sequences of sibilant-vowel-consonant.

SJC a^{3}zigwaʔa^{53}, SAC a^{3}zgwa^{4}ʔa^{3} *earlier*

SJC žuku^{3}, SAC žu^{3}ku^{3} *animal*

Clusters introduced via Spanish loanwords differ largely because of chance differences in the phonological structure of the

words that happened to be borrowed.

A few clusters which belong to neither of the above two categories occur in only one dialect or the other. SJC has a rare /mb/ cluster. SAC has rare clusters /žy hn/ and /ky/ which occurs only across morpheme boundary. SAC also has clusters /ngw gy/ which correspond to SJC /gw Ø/, respectively.

SJC yu^{3}ʂwa?ăh^{ɔ}, SAC ngwã^{4}?ãh^{3} *four more*

SJC nĭã^{21}, SAC nɨ^{3}gyã^{21} *town of Tlaxiaco*

Note that SJC /y/ does not occur contiguous to /ĭ/.

3.2 The most obvious difference in the vowel systems as analyzed is the presence of a series of nasalized vowels in SAC and the lack of such a series in SJC. This difference is more apparent than real, in that nasalization functions almost identically in the two dialects. In SJC, nasalization is considered a word-level feature rather than a component of a series of vowel phonemes. Sporadic irregularities make such an analysis difficult in SAC.

Remaining differences in vowel systems are the long versus short opposition in SJC and the two extra tongue positions in SAC. SJC short vowels correspond to various SAC vowels: SJC /e/ corresponds to SAC /i ɨ e/, SJC /o/ to SAC /ɨ u o/, and SJC /ạ/ to SAC /a/.

SJC gačẹ^{32}, SAC ga^{3}čɪ^{23} *to pass (completive)*

SJC retẹ^{34} (~ retõ^{34}), SAC nɨ^{3}tɨ^{43} *vegetable pear*

SJC ganẹ^{32}, SAC ga^{3}ne^{23} *to chew (completive)*

SJC nanọ^{32}, SAC na^{3}nɨ^{23} *to tell*

SJC tõ^{31}, SAC tũ^{3} *blood*

SJC ?ngọ^{4}, SAC ?ngo^{4} *one*

SJC wa?ạ^{32}, SAC wa^{3}?a^{23} *to spin (thread)*

The short vowels of SJC are often preceded by lengthened allophones of consonants, some of which correspond to SAC fortis resonants. Note that SAC /e/ is more open after /ĭ·/.

SAC /ɨ/ usually corresponds to SJC /u/ when there is a nasal or nasalization in the syllable, but to SJC /ĭ/ elsewhere.

SJC wa?nuh^{5}, SAC wa^{5}?nɨh^{5} *three*

SJC dakŭ^{21}, SAC da^{3}kɨ^{21} *nose*

SJC kĭ^{2}, SAC kɨ^{12} *tree bark*

The SAC form is thus phonetically intermediate. SAC /ʌ/ corresponds to SJC disyllabic cluster /aɨ/ or to /ɨ/.

SJC yaih^{3}, SAC yʌh^{3} *stone*

SJC zigi?^{3}, SAC zɨ^{3}gʌ?ʌ^{43} *mud*

Note that SJC /a/ is raised and fronted following /y/ in nonultimas.

3.3 Probably the most outstanding difference between the two dialects is in their tone systems. At first glance, they would seem to be totally different, because one is analyzed as a register system and the other as a contour system. Again, the difference results largely from analytical choices by the investigators. The register system of SAC is highly asymmetrical, although not so asymmetrical that a contour analysis would be simpler. A contour analysis for SAC would have nineteen contrasting contours. A register analysis would be possible in SJC but quite inefficient. If fewer than five registers are posited, severe phonetic distortion is introduced when the level tones and the end points of glides are assigned to specific registers. If five registers are posited, the distortion disappears, but neither of the two highest registers occurs except in sequence with another register.

One historical fact largely accounts for the far greater range of tonal possibilities in ultimas in SAC: an unstressed particle of the form *V^{3}, meaning 'end of noun phrase', fused to the end of many words. Such words also have forms without the fused particle, which occur phrase-medial. In many cases, all that remains of the particle is its tone, which appears as the final member of a tone sequence, usually as /$_{3}$/. All of the following SAC tone sequences have this source: /$_{12\ 43\ 53\ 54\ 343\ 354}$/ (Longacre 1957:78-79). As soon as this fact is taken into account, the two systems begin to look similar, and the correspondences are fairly regular. SJC /$_{21\ 3\ 34\ 35\ 4\ 5}$/ correspond to the same tones in SAC.

SJC niã^{21}, SAC ni^{3}gyã^{21} *town of Tlaxiaco*

SJC kã^{3}, SAC kã^{3} *squash*

SJC anẹ^{34}, SAC a^{3}ne^{34} *to bathe*

SJC yuwi^{35}, SAC gwi^{35} *people*

SJC ũ^{4}, SAC ?ɬ^{4} *nine*

SJC gaci^{5}, SAC ga^{5}ci^{5} *white*

SJC /$_{32}$/ corresponds to SAC /$_{2}$/; SJC /$_{53}$/ to SAC /$_{4.3}$/ (disyllabic sequence).

SJC dã^{32}, SAC dã^{2} *possessed corncob*

SJC niça^{3}, SAC ni^{4}ča^{3} *full*

Four of the remaining SAC tones are of unique occurrence: /^{13} ^{32} ^{51} ^{52}/. The morphemes which have /^{13} ^{51}/ do not have cognate forms in SJC; /^{32} ^{52}/ correspond to SJC /^{21} ^{32}/, respectively.

SJC maka^{21}, SAC ma^{3}ka^{32} *Mexico City*

SJC yo^{32} zo?^{5}, SAC ga^{3}wī^{3} yo^{52} re?^{5} *you were quick*

The remaining two tones in SAC, /^{23} ^{45}/, correspond to SJC /^{32} ^{5}/, respectively.

SJC ganeٖ^{32}, SAC ga^{3}ne^{23} *to chew (completive)*

SJC ?e̥^{5} ni^{3}, SAC a^{3}?i^{45} nīh^{3} *they're heavy*

A further difference between the two dialects is the distribution of tone in nonultimas. Although tone does occur in all nonultimas in SAC, it has a fairly low functional load. In the cases where it carries meaning, the cognate forms in SJC usually show the significant tone also.

SJC gi^{4}?ya^{21}, SAC gi^{4}?ya^{21} *to make (anticipatory, sandhi form)*

Sometimes the tone is carried over to the ultima as the first part of a contour; SAC /$^{4 \cdot 3}$/ corresponds to SJC /^{53}/.

SJC nič̥a^{53}, SAC ni^{4}ča^{3} *full*

Other SJC words with tone in nonultimas are usually loanwords or recently fused compounds which are not cognate with single words in SAC.

SJC has nothing which corresponds to the medially-checked vowels of SAC. These vowels result, however, from the same historical fusion of a *V^{3} particle that resulted in six new tone sequences. When this particle fused to words with final /?/ or /h/, the result was a medially-checked vowel (Longacre 1957:77-79). All words with medially-checked vowels have phrase-medial forms with final laryngeal; Longacre analyzes the loss of the final mora as a morpheme meaning non-phrase-final (1959:14-15). Although there is no particle in SJC which means 'end of noun phrase', there is a particle âh *(statement)* used only sentence-final. This particle may be cognate with the fused *V^{3} of SAC (but note also cognate relation stated in 3.4).

3.4. SJC exclamatory words represent a broader phenomenon than SAC intonation contours, although SJC final /ʔ/ on kinship terms used as vocatives at the end of questions is probably cognate with the SAC insistent intonation contour.

SJC dɪ́nù?, SAC di^{3}nɨ?ɨ^{3} *man's brother!*

The set of particles which precede these kinship terms in SAC has meanings similar to the set of particles which occur as exclamatory words in SJC, and several pairs show a clear cognate relation.

SJC nɪ́? alternating with ni?^{3}, SAC nɪ̌?^{2} *(interrogative for yes-no questions)*

SJC âh, SAC a^{3} *(mildly asseverative)*

SJC má? (~ mã? ~ mâ? ~ m$\hat{\text{a}}$?) alternating with mą̄^{34}, SAC mãh^{3} *(negative).*

At the present time, SAC does not show any tendency to slur or drop nonultimas, while such a tendency is quite strong in SJC. The SAC development of fortis resonants and clusters with a sibilant as the first member, however, indicates that such a tendency existed in SAC at some time in the past.

4. In most cases, phonetic differences between cognate morphemes in the two dialects do not preclude morpheme recognition, especially in meaningful context. The speaker of one dialect hears the other and matches it to his own. Even where there are discrete phonemic differences, phonetic actualizations are often fairly close. For example, in the ultimas of SJC yanạ^{3} and SAC n·a^{3} *loft*, the phonemic length on SAC /n·/ is matched by phonetic length on SJC /n/, because it precedes a short vowel. Another example is found in words with sibilant-vowel-consonant sequences in SJC, which vary to sibilant-consonant and which correspond sometimes to one, and sometimes to the other, SAC sequence. A third example is SAC /ɨ/, which is phonetically intermediate between /ɪ/ and /u/, the two SJC vowels that correspond to it. SJC speakers have no trouble assigning the phonetically odd vowel to /ɪ/ or /u/, because of their phonological and lexical expectations. SAC speakers have more difficulty because their dialect has all three vowels, and they hear some words with a wrong vowel, not merely an odd one. They nevertheless learn to compensate.

I have attempted to show that two systems, which set side by side appear very different, can in fact seem quite similar when spoken. The phonetic actualization of the speaker's phonological system allows the hearer to reinterpret what is said in the direction of his own phonological system.

I believe that this has implications for the design of orthographies to be used by speakers of such dialects for practical communication. Because of the considerations mentioned above, spoken materials are likely to show greater intelligibility between Trique dialects than written materials. Any orthographies based on the phonological systems described will maximize the differences, because orthographies do not pass through a phonetic limbo between the writer and the reader. By this I mean that the nondiscreteness of phonetic actualizations allows a speaker of one dialect to reinterpret an utterance in the other dialect according to his own phonological system. The discreteness of written materials, on the other hand, makes such a reinterpretation difficult if not impossible.

It is quite possible to imagine a situation where the reverse would be true: very similar phonological systems with extreme phonetic diversity. In such a case, written materials would show greater intelligibility between dialects than spoken materials. This is apparently the case among many dialects of English, especially with respect to the vowels (cf. Smith 1967).

It might be possible to design a writing system which would serve for both Trique dialects by writing morphophonemically a sort of "Proto-Trique". There are considerations which make such a project impractical, however. One is the range of lexical difference between the two dialects, which alone seriously impairs communication. Another consideration is sociolinguistic: a certain degree of hostility between Trique villages makes people from SJC unwilling to accept anything associated with SAC.

A third, purely practical, consideration in orthography design is time. Government literacy programs often ask a linguist to design an orthography for some language in a few weeks, virtually forcing him to base it on a surface analysis.

REFERENCES

Casad, Eugene H.
1974 Dialect intelligibility testing. Publication 38 of Summer Institute of Linguistics Publications in Linguistics and Related Fields. Norman: Summer Institute of Linguistics.

Hollenbach, Barbara E. (Elena E. de)
1973 La aculturación lingüística entre los triques de Copala, Oaxaca. América Indígena 33:65-95.

1974 Reduplication and anomalous rule ordering in Copala Trique. International Journal of American Linguistics 40:176-181.

Longacre, Robert E.
1949 Distinctive features of Trique phonemes. Ms.

1952 Five phonemic pitch levels in Trique. Acta Linguistica 7:62-82.

1957 Proto-Mixtecan. Publication 5 of the Indiana University Research Center in Anthropology, Folklore, and Linguistics, published as Part 3 of Vol. 23, No. 4 of International Journal of American Linguistics.

1959 Trique tone morphemics. Anthropological Linguistics 1.4: 5-42.

1962 Amplification of Gudschinsky's Proto-Popolocan-Mixtecan. International Journal of American Linguistics 28:227-242.

1964 Grammar Discovery Procedures. The Hague: Mouton and Co.

Smith, Henry Lee, Jr.
1967 The concept of the morphoneme. Language 43:306-341.

NOTES

1

The percentage of shared cognates on the Swadesh 100-word list is 75. In January 1970, Eugene Casad and my husband, Bruce Hollenbach, carried out an intelligibility testing project among Trique dialects. The test procedure involved having subjects listen to sentences and answer content questions about them. Intelligibility, defined as average percentage of correct answers to the question, was approximately 79 percent for SAC subjects on material in the SJC dialect, and 58 percent for SJC subjects on material in the SAC dialect. On material in their own dialects, SAC subjects scored approximately 98 percent and SJC subjects scored approximately 99 percent. The lack of reciprocity in the scores is explained by the fact that intelligibility is not the same thing as relatedness between dialects; many factors are involved, including interdialectal learning. Intelligibility testing is described in detail in Casad (1974); the Trique project is described on pp. 78-81.

2

These data were collected on trips to Copala from 1962 to 1974 under the auspices of the Summer Institute of Linguistics. I am grateful to my husband Bruce for many helpful insights and for many fruitful discussions about various aspects of Copala Trique phonology.

3

The transcriptions used in these sources differ. I have converted them all to a transcription parallel to that used here for Copala. Longacre has also read this manuscript and supplied additional data beyond that in the above sources. Throughout the paper, I make specific reference only to the 1957, 1959, and 1964 works. Most examples in 2.1 and 2.2 are from the index of Trique forms on pp. 181-191 of the 1957 work, and most examples in 2.3 are from the 1952 and 1959 works.

4

It would be possible to interpret SJC neutralized obstruents, i.e., the ones that occur in nonfinal syllables and in cluster with nasals, as fortis rather than lenis. Such an analysis implies that fortis, rather than lenis, is the unmarked member of the opposition; it is parallel to the analysis of neutralized vowels as long rather than short, making length the unmarked member (see 1.2; but cf. also footnote 9). In favor of interpreting neutralized obstruents as fortis are the following considerations. Firstly, in intervocalic position, neutralized stops, like fortis stops, retain a stop articulation, while lenis stops are actualized as voiced fricatives. Secondly, an optional rule permits vowels to drop between a sibi-

lant and a fortis stop or nasal, and also between a sibilant and a neutralized stop. (These two points are related: the vowel drop rule is blocked before a stop actualized as a fricative.) A third consideration is that a fortis sibilant replaces a neutralized sibilant when a disyllabic word is contracted to a monosyllable by loss of a repeated vowel and a medial /ʔ/. A fourth consideration is that SJC Triques consistently prefer to write the neutralized stops by Spanish symbols for voiceless stops (p t c qu). (Reactions to symbols for sibilants are mixed, largely because Spanish has so few available symbols in this area.) There are also, however, strong considerations in favor of interpreting neutralized obstruents as lenis. Firstly, in word-initial position, neutralized obstruents (in polysyllabic words) and lenis obstruents (in monosyllables) have a very similar articulation. Secondly, in all positions, the lenis retroflex sibilant has the same articulation as the neutralized retroflex sibilant. A third consideration is that interpreting neutralized stops as lenis simplifies allomorphy. 'Noncontinuative' is sometimes expressed by /g/ replacing /w/, and 'possessed' is sometimes expressed by /d/ replacing /y/; both are actualized as lenis stops in monosyllables and as neutralized stops in polysyllabic words. In that the evidence is inconclusive, I take the conservative position and interpret neutralized obstruents as lenis. This fits both universal markedness conventions and probable historical development; cf. the allomorph example above. Both native reaction to orthography and the contraction example, on the other hand, perhaps show an emerging alignment of neutralized obstruents with the fortis series.

5

The semantic similarity (forcible expulsion of air) among the members of this minimal triplet invites speculation about the development of these forms from the same etymon. Longacre (1962:237) gives the Proto-Popolocan-Mixtecan cognate set underlying at least some of them; it includes forms glossed both 'cough' and 'sneeze'. These three words are, nevertheless, in clear contrast synchronically.

6

Clusters /gw nd/ are reflexes of Proto-Mixtecan unit phonemes /$*k^w$ $*n_d$/, respectively (Longacre, 1957:10). In addition, Longacre suggests that in Proto-Mixtecan, words with medial /ʔ/ were one syllable rather then two (1957:75-56).

7

A detailed treatment of the influence of Spanish on SAC Trique is given in Hollenbach (1973).

8

The existence of a /tr/ cluster from Spanish loanwords creates

a contrast between a cluster of stop plus retroflex sibilant and the retroflex affricate /ʈ̌/. There is no corresponding contrast, however, between the alveolar and palatal affricates, and such nonexistent clusters as /*tz/ and /*tž/.

9

A full set of five short vowels can be posited in underlying forms, because /ę ǫ/ sometimes become /ɨ u/ rather than /e o/ when a laryngeal suffix is added to the word.

mę^{3} *to ɬe*

mɨʔ^{32} *we (inclusive) are*

Word-final /ɨ u/ would then become /ę ǫ/ by a vowel lowering rule: V̨ (+high) → V̨ (-high) -#.

10

The following phenomenon supports the identification of the breathy fade on exclamatory words with /h/. Some Spanish names occur more commonly as exclamatory words than as ordinary words. These names are sometimes converted back to ordinary words with final /h/. Thus, the nickname 'Chila' would normally be borrowed into SJC Trique as an ordinary word in the form žɨlą^{32}. Sometimes, however, by back-formation from an exclamatory word it has the form žɨ^{3}lah^{3}.

11

A detailed description of SJC tone sandhi is given in Hollenbach (1974).

12

Claude Good recently discovered that some SAC speakers have a /č/:/ʈ̌/ contrast.

čę^{21} *brother-in-law*

ʈ̌ę^{21} *devil*

13

A few morphemes add a postultima syllable not described in this paper. The honorific morpheme in the example adds nasalization to the ultima, plus an additional postultima mora of nasalized vowel (set off by a hyphen), which reduplicates the vowel quality of the ultima (Longacre, personal communication).

[blank]

STRESS AND TONE IN TLACOYALCO POPOLOCA

Sharon Stark
Polly Machin

1. The Word

Tlacoyalco Popoloca,[1] like Eastern Popoloca (Kalstrom and Pike 1968), has two types of word stress, consonant stress and vowel stress. Every (phonological) word has one or the other, but never both. The predominant contrastive feature of stress is length. We have thus chosen to mark stress by a raised dot after the lengthened consonant or vowel.

sa^{2}k·o^{3}	*pineapple*	sa·^{21}ko^{2}	*jacket*
ko^{2}č·e^{2}	*louse*	ko^{2}če·^{3}	*fish*

All words of either stress type, regardless of number of syllables, tend to be pronounced in more or less the same length of time. A word of two syllables, therefore, is pronounced much more slowly than a word of four or five syllables.

ka^{2}t·e^{2} *sandal*

to^{3}kh·a^{3} *potato*

ko^{2}la^{1}n^{1}a^{1}čh·ą^{3} *small lizard*

Consonant stress is identified by length of the consonant of the stressed syllable.

hį^{2}n·ǫ^{2}	*rope*	ñi^{2}di^{2}ʔ·i^{2}	*I drink*

When the length of the consonant stress occurs on /s š ǯ h/ (as the only consonant of the syllable), the length frequently fluctuates to a hiatus (+) preceding that consonant.

ho^{2}h·a^{2} [Oo^{2}A·a^{2} ~ Oo^{2}+Aa^{2}] *egg*

tǫ^{3}s·ą^{1} [tǫ^{3}s·ą^{1} ~ tǫ^{3}+są^{1}] *orange (sour fruit)*

mę^{1}š·į^{2} [mę^{1}š·į^{2} ~ mę^{1}+sį^{2}] *therefore*

ǰi²ǰ·o³ [ǰi²ǰ·o³ ~ ǰi²+ǰo³] *a local vegetable*

In the case of phonetically complex consonants /c č ç/, the length occurs on the stop.

ha¹c·e³ [Aa¹t·se³] *red*

ko²mį¹č·į² [ko²mį¹t·šį²] *cat*

ka³ç·o² [ka³t·ǰo²] *maguey*

In a word with a consonant cluster, length follows these rules:

(1) If a cluster includes a laryngeal /ʔ h/, the laryngeal is lengthened.

koe¹ʔ·nǫ³ *I bought*

ta¹hi¹ři a²ʔ·nta² *it is hanging*

to³kh·a³ *potato*

ši¹čh·ǫ³ *boy*

h·nǫ² *mountain*

da²¹nch·e² *you (sg.) take off/take out*

(2) If a consonant cluster includes an /n/ but not a laryngeal, the /n/ is lengthened.

hi²n·ta² *water* hi³n·če³ *dirt*

či²n·ko¹ *claw/nail*

In nearly all words with consonant stress, the stress occurs on the ultima. When a suffix is added, the stress moves.

h·ye¹	+	ʔa²	→	hye¹ʔ·a²	*not big*
šo³t·i¹	+	čhǫ³	→	šo³ti¹čh·ǫ³	*small tomato*
di¹k·ǫ²	+	ši¹	→	di¹kǫ²š·i¹	*I see with*

There are three suffixes -- nǫ¹ *we/our*, ra¹ *you/your*, and ba² *(animal)* -- which do not cause this stress movement.

čo n·ta²	+	nǫ¹	→	čo³n·ta²nǫ¹	*we (excl.) have*
si²řo²ʔ·e²	+	ra¹	→	si²řo²ʔ·e²ra¹	*you will go and get*
h·ye¹	+	ba²	→	h·ye¹ba²	*big animal*

Certain siffixes -- such as čhǫ³ *small*, ʔa² *not*, and nǫ¹³ *my* -- cause vowel stress to move to consonant stress on the ultima.

sa·^{21}ko^{2}	+	čhą^{3}	→	sa^{1}ko^{2}čh·ą^{3}	*small jacket*
ya·^{2}o^{2}	+	?a^{2}	→	yao^{2}?·a^{2}	*not sharp*
šǫ·^{2}ą^{2}	+	ną^{13}	→	šǫą^{1}n·ą^{13}	*my medicine*

Vowel stress is identified by the lengthening of the vowel of the stressed syllable.

nčɨ·^{13} *female* nɬa^{2}sę·^{2} *coffee*

šɨ^{2}ɬą·^{2}ǫ^{1} *chair*

In a syllable with a two-vowel cluster, vowel stress occurs on the second vowel.

šǫę·^{13} *his medicine* šɨ^{2}ɬǫą·^{1}ą^{2} *your (sg.) chair*

As in the case of words with consonant stress, the addition of a suffix to a word with vowel stress may cause the stress to move. Vowel stress moves to the penult.

sa·^{21}ko^{2} + a^{2} → sa^{2}ko·^{1}a^{2} *your (sg.) jacket*

Certain suffixes -- such as a^{2} *your (sg.)* and e^{3} *his/their* -- cause consonant stress to change to vowel stress.

hɨ^{2}n·ǫ^{2}	+	a^{2}	→	hɨ^{2}nǫ·^{1}ą^{2}	*your (sg.) rope*
hɨ^{2}nǫ^{2}	+	e^{3}	→	hɨ^{2}nǫ·^{1}ę^{3}	*his/their rope*

A numerical comparison of consonant versus vowel stress shows consonant stress to be the most common; only about twenty to twenty-five per cent of the morphemes in our lexicon have vowel stress.

Consonant stress has limited distribution in that it does not occur in a syllable with a tone sequence. (A single exception to this rule will be discussed below in 7--Rule 6, dealing with suffix ną^{13} *my*.) A syllable with vowel stress, however, may have one or two tones.

ɬa^{2}ɬɨ·^{1}ta^{2} *man* nɬa^{2}sę·^{2} *coffee*

Non-stressed syllables also may have a single tone or a two-tone sequence, although such a tone sequence is rare.

šo^{3}t·ɨ^{1} *tomato* da^{21}nch·e^{2} *you (sg.) take off/take out*

2. *The Syllable*

In a word with consonant stress, syllable division occurs between a vowel and the following consonant; in a word with vowel

stress, however, syllable division may occur between vowels. Throughout this paper, tone is written at the end of a syllable.

i^{1}x̌·a^{1} *more*	to^{3}kh·a^{3} *potato*
ka^{2}t·e^{2} *sandal*	da^{21}nch·e^{2} *you (sg.) take off/take out*
o^{2}n·t̠a^{1} *why*	

In the case of a word medial-cluster beginning with /ʔ h n/, the phonetic border between syllables may vary, but tends to occur more frequently between the first and second consonant. Nevertheless, we consider the emic syllable break to occur between vowel and following consonant, since no consonant occurs pre-pause.

hi^{2}n·t̠a^{2} *water*	x̌e^{2}h·nạ^{3} *the day before yesterday*
ni^{3}ʔ·nko^{3} *church*	

The border between nonstressed syllables in a word with vowel stress also occurs between vowel and following consonant.

ko^{2}ka^{3}pi·^{1}o^{3} *butterfly*	nčạ^{3}nị·^{1}ạ^{3}nạ^{1} *our (excl.) house*

The syllable border which follows a syllable with vowel stress, however, occurs immediately following the stressed vowel. Thus a sequence of vowels may or may not have a syllable border between them.

s̠ọ·^{2}ạ^{2} *medicine*	s̠ọạ·^{12} *your (sg.) medicine*
x̌i^{2}nạ·^{2}ọ^{2} *he/they want*	x̌i^{2}nạọ^{2}ʔ·ạ^{2} *he/they do not want*
s̠o^{2}s̠a·^{2}o^{2} *glass*	s̠o^{2}s̠ao·^{1}a^{2} *your (sg.) glass*

Three syllable types have limited distribution. Two of these, V and VV, may occur only when word initial or when following a syllable with vowel stress.

i^{1}x̌·a^{1} *more*

ao^{1}hoe^{1}š·ị^{2} *are you (sg.) finished?*

s̠ọ·^{2}ạ^{2} *medicine*

čị·^{3}ạọ^{2} *nearby*

The third syllable type, CCCV, occurs only word medially or finally in our data.

s̠a^{3}ntho·^{2}a^{2} *pulque*

da^{21}nch·e^{2} *you (sg.) take off/take out*

za^{1}ntha·^{2} *I will open*

All other syllable types, CV, CCV, CVV, and CCVV, may occur initially, medially, or finally in the phonological word.

ka^{2}te^{1}n·ą^{13} *my sandal*	toe·^{13} *his/their hole*
nčį^{2}kh· į^{3}ną^{2} *loan me*	th·ao^{3} *wet*
to^{3}kh·a^{3} *potato*	to^{3}čh·ǫį^{2} *fruit*
toe^{1}čh·ą^{3} *small hole*	to^{3}čhǫį·^{1}ą^{2} *your (sg.) fruit*
šį^{2}ţąǫ^{1}čh·ą^{3} *small chair*	

With the exception of the syllable type VV, every syllable type may occur with every tone. Only one known morpheme occurs with the syllable pattern VV: čį·^{3}ąǫ^{2} *near by*. In addition, the morpheme a^{1}- (question marker) occurs on words such as o^{1}hoe^{1}š·į^{2} *you (sg.) are finished* to form the syllable pattern VV: ao^{1}hoe^{1}š·į^{2} *are you finished?*

With the exception of the syllable types V, CCCV, and VV, all syllable types may have either a single tone or a two-tone cluster.

šo^{3}t·į^{1} *tomato*

da^{21}nch·e^{2} *you (sg.) take off/take out*

nçį^{1}čh·ą^{3} *girl*

šįę^{3}s·ą^{1} *a local cactus fruit*

ş̌ǫą·^{12} *your (sg.) medicine*

ţ̌h·ao^{3} *wet*

to^{3}čhǫį·^{13} *his fruit*

3. Tone

There are three tones: high /$_{1}$/, mid /$_{2}$/, and low /$_{3}$/.

h·nǫ^{1} *thin*	h·ną^{2} *mountain*	h·ną^{3} *yesterday*
šo^{3}t·į^{3} *tomato*	ş̌ǫ^{3}ç̌·į^{2} *bar soap*	ho^{3}čh·į^{3} *spinning whorl*
ş̌ǫ^{3}ç̌·į^{2} *bar soap*	ş̌o^{2}ç̌·į^{2} *metate*	ş̌o^{1}th·a^{2} *grinding stone for metate*
ko^{2}nǫ^{3}c·e^{2} *star*	ko^{2}nį·^{2}ą^{2} *dog*	ko^{2}mį^{1}č·į^{2} *cat*

Useful frames to use for contrasting tones are hį·^{12} *it is*, ha^{1}c·e^{3} *red*, and nta^{1}ç̌·o^{2} *he/they said*. Each of these frames may either

precede or follow the items in contrast.

When there is one tone per syllable, all nine possible sequences occur with two-syllable words (the sequence /1-1/ is rare).

ɨ^{1}ǰ·a^{1}	*more*	sa^{2}k·o^{3}	*pineapple*
ʂo^{1}th·a^{2}	*grinding stone for metate*	tǫ^{3}s·ą^{1}	*orange (sour fruit)*
ha^{1}c·e^{3}	*red*	ka^{3}ç̌·o^{2}	*maguey*
ç̌ɻ^{2}n·ta^{1}	*snow*	ka^{3}n·ta^{3}	*nopal*
ka^{2}te^{2}	*sandal*		

Likewise, in words of three or more syllables there appear to be no restrictions governing tone sequences. The few combinations which are lacking are probably due to lack of data.

h·nɻ^{1} *eight*	h·nɻ^{2} *blood*	
ǰo^{2}ʔ·o^{2} *corn dough*	ǰo^{3}ʔ·o^{3} *chocolate*	
ǰɻ^{2}th·ǫ^{2} *my nose*	ǰɻ^{1}th·ǫ^{3} *your (sg.) nose*	ǰɻ^{3}th·ǫ^{2} *his/their nose*
nę^{2}h·ę^{2} *my tongue*	nę^{1}h·ę^{3} *your (sg.) tongue*	nę^{3}h·ę^{2} *his/their tongue*
to^{2}s·ɻ^{2} *my neck*	to^{1}s·ɻ^{3} *your (sg.) neck*	to^{3}s·ɻ^{2} *his/their neck*

A sequence of two tones may occur on a single syllable. All possible combinations of /1 2 3/ occur, but /31/ is rare (only one example has come to our attention).

ha^{2}ną·^{12}	*your (sg.) mother*	šą^{3}ǰo·^{23}	*your (sg.) /his/their sibling*
nʈo^{3}da·^{12}	*your (sg.) father*	ǰo·^{23}	*friend*
nç̌ɨ·^{13}	*female*	hą·^{31}	*yes*
šo^{3}tɨ·^{13}	*his/their tomato*	r̃ɨ^{1}thę·^{32}	*I wash*
nǰɻ·^{21}	*little*	ʂǫ·^{32}	*paper*
ną·^{21}goa^{2}	*skirt*		

Tone /1/ has a raised allotone when preceding tones /2 3/ within a syllable, word, or phrase. For example, tone /1/ of nç̌ɨ·^{13} *female*, ʂo^{1}th·a^{2} *grinding stone for metate*, and nę·^{21} ǰǫ^{3}h·nɻ^{2} *one person* is higher than the high tones of ɨ^{1}ǰ·a^{1} *more*. Phrase initially, a nonstressed tone /1/ has a lowered allotone. Thus, tone /1/ of the first syllable of ɨ^{1}ǰ·a^{1} la^{1}p·ɨ^{3} *more pencils* is lower than /1/ of the other syllables. In normal speech, in words with similar patterns, tone /1/ is successively lowered.

For example, in the clause ři^{2}nạ·^{1}ọ^{3} la^{1}p·i^{3} ha^{1}c·e^{3} *you (sg.) want a red pencil*, each /1-3/ tone sequence is lower than the preceding one.

The norm of tone /2/ is found in examples such as ho^{2}h·a^{2} *egg*, ş̌ọạ·^{12} *your (sg.) medicine* and ba·^{21}ho^{2} *a local stringed instrument*. Tone /2/ has a lowered allotone following tone /3/ within a syllable, word, or phrase.

ş̌ọ·^{32} *paper*

nta^{3}th·o^{2} *gun*

ha^{1}c·e^{3} š̌a^{2}h·oa^{3} *red ribbon*

When occurring with /i ị/, tone /2/ tends to be higher than with other vowels. ča^{2}n·ki^{2} *necklace* and hị^{2}n·ọ^{2} *rope* versus ho^{2}h·a^{2} *egg*. In a word-final syllable with /ʔ/ as onset, tone /2/ varies between its norm and a raised allotone.

ṭa^{2}r̃i^{2}ʔ·i^{2} *I am* ž̌o^{2}ʔ·o^{2} *corn dough*

Syllables with tone /3/ are normally lower in successive words, but within a word, a succession of syllables with tone /3/ are at the same level. In the following phrases each tone /3/ is lower than the preceding one:

ha^{1}c·e^{3} š̌o^{3}t·i^{1} *red tomato*

ko^{3}ʔ·a^{2} la^{1}p·i^{3} ha^{1}c·e^{3} *the red pencil is gone*

In the following examples, however, there is no downstep of pitch between syllables:

ka^{3}n·ta^{3} *nopal* to^{3}kh·a^{3} *potato*

4. Consonants

There are twenty-three consonant phonemes: stops /p (rare), ṭ t k ʔ/, affricates /c č ç̌/, voiceless fricatives /p s š ş̌ h/, voiced fricatives /b d z ž̌ g/, nasals /m n ñ/, oral resonants /l y/, flap /ř/, and trill /r̃/.

/p f b m/ are bilabial.

ko^{2}pi·^{12}to^{2} *whistle* lo^{2}ka^{3}pi·^{1}o^{3} *butterfly*

(the only native words in our data containing /p/),

(pinto) pị·^{21}ṭo^{2} *spotted* ṭa^{1}pa^{3}ři^{1}ç̌·ị^{3} *I'm going to sleep*

pi^{1}t·e^{3} *you (sg.) danced*

o²bi¹th·a² *it completes* h·mą² *beans*

/ṯ ḏ/ are interdental.

bi¹ṯǫ²n·a³na² *they ordered us to*
hi²do²n·į¹ba² *animal washes (its young)*
ṯa¹ṯ·e² *they are*
nṯo³de·¹³ *his father*

/t c s z n l r ř/ are alveolar.

bi¹tǫ²n·a³na² *we were delayed* ną·³ǫ³ *straight*
te²t·e¹ *they are dancing* h·ną² *mountain*
hi¹cǫ¹ṯą·¹ǫ³ *he's playing* ko²žo²n·į¹ *ant*
co²so¹s·o³ *simmer* šo²l·i¹ *scab*
ha¹c·e³ *red* hmą²to²lǫ¹c·į² *peas*
o¹se·¹² *a long time* ro¹t·e² *shawl*
sa²zo¹n·ka³ *straight ahead* řo³t·e² *he is dancing*
nṯa¹ze²ʔ·ę² *he's about to die*

/č š ž ñ y/ are palatal.

ša³čo·¹³ *your (sg.) sibling* lo²ža³ʔ·a³ *flea*
ko²ča²¹n·ko² *monkey* ñą·²ǫ² *center*
š·ą³ *child* ya·²o² *sharp*

/ç ş/ are retroflexed.

ka³ç·o² *maguey* ş·ą³ *hair*
ha³ş·o¹ *now*

/k g/ are velar.

si³ka¹ʔ·o² *I will get dressed* si³ga³ʔ·o³ *I will go and pat (tortillas)*
sa²k·o³ *pineapple* ną·²¹goa² *skirt*

/ʔ h/ are laryngeal.

ną³ʔ·ǫ³ *color* ra²h·ną² *town*
šą³ʔ·ną³ *my child* ša²h·oa³ *ribbon*
hye¹ṯ·o³ *thick*

/ɬ t c č ç k/ are voiced following /n/ when not preceding /h/.

hɪ²n·ɬa² [Iɪ²n·ɮa²] *water*

nɬo·¹e² [nɮo·¹e²] *tomorrow*

nta·³ [nda·³] *wood*

lo¹²n·to² [lo¹²n·do²] *clothes*

ko²te²¹n·co² [ko²te²¹n·dzo²] *large female goat* (the only example of /nc/ in our data)

nčɪ³ɬh·a³ [ndžɪ³ɬA·a³] *griddle*

čo³n·če³ [tšo³n·dže³] *peanuts*

nçɪ·¹³ [nʤɪ·¹³] *female* (the only example of /nç/ in our data)

nkɪ·¹³goa³ [ŋgɪ·¹³goa³] *Popoloca*

čɪ²n·ko¹ [tšɪ²ŋ·go¹] *nail/claw*

Preceding /h/, they are voiceless.

za¹ntha·² [za¹ntAa·²] *I will open*

da²¹nch·e² [da²¹ntsE·e²] *you (sg.) take off/take out*

/h/ assumes the point of articulation of a following consonant or the quality of a following vowel. Preceding a nasal, it is a voiceless nasal.

h·mą² [M·mą²] *beans*

hmą²k·o² [Mmą²k·o²] *my/his/their eye*

h·ną² [N·ną²] *mountain*

re²h·nkɪ¹ [ɾe²N·ŋgɪ³] *the day after tomorrow*

Preceding /y/, it is a voiceless alveopalatal fricative.

h·ye¹ [Y·ye¹] *big* hya·²o¹ [Yya·²o¹] *slow* (the only examples of the cluster /hy/ in our data)

Preceding a vowel, /h/ is a voiceless vocoid.

hɪ²n·ɬa² [Iɪ²n·ɮa²] *water*

ɾa³h·a³ [ɾa³A·a³] *green beans*

sa³ɾɪ¹th·ɪ³ [sa³ɾɪ¹tI·ɪ³] *I'm walking*

/n/ is velar when preceding /k/.

r̃i²di³n·ka² [r̃i²di³ŋ·ga²] *I'm knocking with my knuckles*

nl̨³n·ke³ [nl̨³ŋ·ge³] *a plow*

nki·¹³goa³ [ŋgi·¹³goa³] *Popoloca*

Every consonant cluster includes /h n ʔ/; a cluster may include both /n/ and /ʔ/ or /h/.

Stops and affricates /t̰ t k c č c̰/ may be preceded by /n/ or followed by /h/.

hi²n·t̰a² *water*

nǫ³n·te³ *down*

čі²n·ko¹ *claw/nail*

ko²te²¹n·co² *large female goat* (the only example of the cluster /nc/ in the data)

hi³n·če³ *dirt*

ti¹nc̰i·¹³ *woman*

di²t̰ha·¹² *it lacks*

o²bi¹th·a² *it completes*

to³kh·a³ *potato*

ch·e¹ *many*

ho³čh·i³ *spinning whorl*

ko²nta²c̰h·ę² *buzzard*

Except for /č c̰/ (which may both be due to lack of data), a stop or affricate may be preceded by /n/ and followed by /h/.

r̃i¹di³nt̰h·a³ *I knock with the palm of my hand*

za¹ntha·² *I will open*

hi¹to¹r̃a¹nkh·ę¹ *(bell) is ringing (nearby)*

da²¹nch·e² *you (sg.) take off/ take out*

/m n ñ/ may be preceded by /h/.

h·mę² *beans*

h·nę² *mountain*

hñę¹ʔ·ę² *devil* (the only example of the cluster /hñ/ in our data)

/n/ may also be preceded by /ʔ/.

r̃i²te¹ʔ·nę³ *I buy*

In addition to the clusters described above, the three-consonant clusters /hnt hnk ʔnt̰ ʔnk/ also occur.

to³h·nti¹ *onion*

te³h·nko² *eleven*

ta¹hi¹r̃ia²ʔ·nt̰a² *it's hanging* (the only example of the cluster /ʔnt̰/ in our data)

ni³ʔ·nko³ *church*

A cluster of three consonants usually occurs word medially; only one example of such a cluster has been observed in word-initial position.

h·nkí^{3}	*field*	da^{21}nch·e^{2}	*you (sg.) take off/ take out*
za^{1}ntha·^{1}	*I will open*	šĭ^{1}h·nta^{3}	*salt*

/y/ could be considered an allophone of /ñ/ occurring before oral vowels, but by analogy with the pattern established between /m/ and /b/, and /n/ and /l/, we consider it best to contrast /ñ/ and /y/ as well.

There are also restrictions governing which consonants may occur in syllables with consonant stress. /t̲ t k ʔ c č ç̲ s š ş̲ h m n l/ may be lengthened due to consonant stress.

hye^{1}t̲·o^{3}	*thick*	tǫ^{3}s·ą^{1}	*orange (sour fruit)*
ka^{2}t·e^{2}	*sandals*	mę^{1}š·l^{2}	*therefore*
sa^{2}k·o^{3}	*pineapple*	nǫ^{2}ş̲·a^{2}	*blanket*
ř^{2}dí^{2}ʔ·^{2}	*I drink*	ho^{2}h·a^{2}	*egg*
ha^{1}c·e^{3}	*red*	še^{2}m·ą^{1}	*dry*
ko^{2}č·e^{2}	*louse*	nąą^{2}n·ǫ^{1}	*year*
ka^{3}ç̲·o^{2}	*maguey*	šo^{21}l·a^{2}	*Tlacotepec (a town)*

The fact that /p f ñ/ do not occur with consonant stress may be due to lack of data, since other stops and nasals do. Other consonants without consonant stress are the voiced fricatives /b d z ž g/ and /y r ř/.

/ʔ/ is unique in that it occurs only in a syllable with consonant stress.[2] A shift in stress, therefore, causes /ʔ/ to be lost.

žo^{2}ʔ·o^{2}	*corn dough*	žo·^{1}a^{2}	*your (sg.) corn dough*

Any consonant may occur word initially or word medially except /ʔ/. /ʔ/, singly or in cluster, occurs only word medially.

žo^{2}ʔ·o^{2}	*corn dough*	t̲a^{1}hí^{1}řla^{2}ʔ·nt̲a^{2}	*it's hanging*
ř^{2}te^{1}ʔ·nąą^{3}	*I buy*		

5. *Vowels*

There are eight vowels: four oral vowels /i e a o/ and their nasalized counterparts /į ę ą ǫ/. /i į e ę/ are front vowels.

sa^{1}ch·i^{2}	*he goes*	ch·e^{1}	*many*
ch·į^{3}	*milk*	ch·ę^{2}	*honey/sugar*

/a ą/ are central vowels.

ha^{2}ʔ·a^{2} *you (sg.)* hą^{3}ʔ·ą^{3} *I*

/o ǫ/ are back vowels.

to^{3}kh·a^{3} *potato* ʈǫ^{1}kh·ą^{1} *(bell) is ringing (far away)*

All vowels are lengthened when they are the last vowel in a syllable with vowel stress.

šɿ·^{13}	*male*	tɿ·^{21}	*pain*
ʂe·^{13}	*his/their work*	se·^{2}	*brown*
ʂa·^{12}	*your (sg.) work*	čhą·^{32}	*frond of maguey*
čo·^{23}	*friend*	ʂǫ·^{32}	*paper*

When preceding a stop, affricate, or voiceless fricative, a nasalized vowel may be followed noncontrastively by lenis alveolar closure.

ką^{1}t·e^{3} [ką^{1}t·e^{3} ~ ką^{n1}t·e^{3}] *thirty*

hną^{2}čh·ą^{3} [Nną^{2}ts̬·ą^{3} ~ Nną^{n2}ts̬·ą^{3}] *small mountain*

tǫ^{3}s·ą^{1} [tǫ^{3}s·ą^{1} ~ tǫ^{n3}s·ą^{1}] *orange (sour fruit)*

čɿ^{3}th·ǫ^{2} [tšɿ^{3}tǫ·ǫ^{2} ~ tšɿ^{n3}tǫ·ǫ^{2}] *his/their nose*

A nasalized vowel with such lenis alveolar closure contrasts with a vowel plus /n/ and is followed by voiceless allophones of a stop or affricate, whereas a vowel plus nasal consonant is followed by voiced allophones.

ką^{1}t·e^{3} [ką^{1}t·e^{3} ~ ką^{n1}t·e^{3}] *thirty*

ną^{3}nʈa·^{13} [ną^{3}nɖa·^{13}] *right now*

The mid front vowels /e ę/ vary from a higher to a lower tongue position, the lower position tending to dominate with vowel stress or preceding /ʔn/. Thus, /e/ of ko^{2}če·^{3} *fish* and ři^{2}te^{1}ʔ·nę^{3} *I buy* tend more toward the lower tongue position than in ko^{2}č·e^{2} *louse* or ʈe^{2}t·e^{3}nę^{1} *we are dancing*. The same is true of /ę/ in chę·^{32} *I will wash* as opposed to ch·ę^{2} *honey/sugar*.

The mid vowels /a ą/ have a mid close allophone when preceding /nk/.

hi^{2}tsha^{1}n·ka^{2} [Ii^{2}tshe^{1}ŋ·ga^{2}] *he is crying*

ča^{2}n·ki^{2} [če^{2}ŋ·gi^{2}] *necklace*

nąˀn·kɨ¹ [nęˀŋ·gɨ¹] *under*

The back vowels /o ǫ/ vary from high close to mid open. The mid open allophone is most frequent following /h/ when it is stressed, or /b m t̲ d s ř/, whereas the high close allophone is more frequent elsewhere. For example, both řoˀˀ·aˀ *his/their mouth* and tǫˀ *fist*, tend more toward the high close position than do řo·ˀa¹ *white* or toˀ *furrow*. In a vowel cluster, the mid open allophone is most frequent in syllable-final position. Thus, /o ǫ/ tend toward the mid open position in yaˀ·oˀ *sharp*, šɨˀt̲ąˀ·ˀǫ¹ *chair*, nɨ·ˀǫˀ *tortillas*, and thaˀřɨo·¹aˀ *your (sg.) dishes*, whereas they tend toward the high close position in nąˀ·ˀ¹goaˀ *skirt* and šǫęˀ·¹ˀ *his/their medicine*.

/a ą/ have a back rounded on-glide following /aoˀ ąǫˀ/.

thaoˀˀ·aˀ [tAaoˀˀ·ᵒaˀ] *not wet*

řɨˀnąǫˀˀ·ąˀ [řɨˀnąǫˀˀ·ǫąˀ] *he/they don't want*

A sequence of contiguous vowels, whether monomorphemic or bimorphemic, is either all oral or all nasalized.

koˀčɨ·ˀa¹	*chicken*	šąˀ·ˀǫˀ	*you (sg.) are afraid*
šąˀ·ˀoˀ	*dew*	nǫˀ·ˀąˀ	*dry shelled corn*
yoˀ·ˀaˀ	*blue/green*	šǫˀˀčɨ·¹ąˀ	*your (sg.) bar soap*
šaˀˀčɨ·¹ąˀ	*my sibling*	hɨˀnǫˀ·¹ęˀ	*his/their rope*

In a sequence of vowels separated by /ˀ h/, nasalization moves forward past the laryngeal, but not backward.

hąˀˀˀ·ąˀ *I*

nęˀh·ęˀ *his/their tongue*

řɨˀnąˀ·ˀǫ̃ˀ + ˀaˀ → řɨˀnąǫˀˀˀ·ąˀ *he/they don't want*

koˀtɨeˀh·ąˀ *later*

Only a nasalized vowel may follow /m n ñ/.

h·mąˀ *beans*

h·nąˀ *mountain*

ñąˀ·ˀǫˀ *his/their center (liver)*

Conversely, a nasalized vowel may not follow /nt̲ nt nk nč/.

hi^{2}n·ɨa^{2} *water* čɨ^{2}n·ko^{1} *claws/nail*

ko^{2}ɨa^{2}n·ta^{1} *lizard* nčɨ·^{13} *female*

A nasalized vowel may, however, follow /nč d g/.

nčą^{2}ʔ·ǫ^{2} *sun/day* gǫ·^{3}ę^{1} *I hit him*

ɨa^{1}hi^{1}dą^{1}k·a^{3} *he's plowing*

(Having only one example of the cluster /nc/, ko^{2}te^{21}n·co^{2} *large female goat*, makes it difficult to consider here.) There are no examples in our data of the consonants /ɨ z ñ y/ preceding the vowels /i ɨ/. Except for the above restrictions, consonants may precede most vowels. The few examples which are lacking are probably due to lack of data.

Both within a syllable and across a syllable boundary, /i o/ may precede the other three vowels or follow /a/-- with or without nasalization.

There are many examples of /i ɨ/ before /a ą/, but only a few before /e ę o ǫ/.

ɨa^{1}hi^{1}ria^{2}ʔ·nɨa^{2} *it's hanging*

ko^{2}či·^{2}a^{1} *chicken*

šɨę^{3}s·ą^{1} *(a type of cactus fruit)*

ti·^{2}e^{1} *black*

tha^{2}rio·^{1}a^{2} *your (sg.) dishes*

nčɨ·^{2}ǫ^{1} *a little bit*

The possessive markers a^{2} *your (sg.)* and e^{3} *his/their* are the source of bimorphemic vowel clusters.

kie·^{13} *his/their fiesta* šo^{3}ti·^{1}a^{2} *your (sg.) tomato*

There are only a few examples of /o/ before /i e/, but many before /a/, both oral and nasal.

to^{3}čh·ǫi^{2} *fruit* gǫ·^{3}ę^{1} *I hit him*

yo·^{2}i^{1} *both* šǫą·^{12} *your (sg.) medicine*

nǫ·^{2}ɨ^{2} *up* yo·^{3}a^{3} *green*

to·^{2}e^{1} *hole* nǫ·^{3}ą^{3} *dry shelled corn*

toe·^{13} *his hole*

There are a few examples of /ɪ/ following /a/, but many of /o/ following /a/, both oral and nasal.

kąɪ^{1}šˑɪ^{1} *all* ṯhˑao^{3} *wet*

haˑ^{3}ɪ^{3} *today* sąˑ^{2}ǫ^{2} *bed*

The only monomorphemic vowel clusters of three vowels are /ɪaɪ ɪąǫ oaɪ ǫąǫ/ with one example of each.

kɪaˑ^{3}ɪ^{3} *fiesta* nṯa^{1}koaˑ^{2}ɪ^{1} *broken*

čɪˑ^{3}ąǫ^{2} *nearby* kǫąˑ^{3}ǫ^{2} *you (sg.) did sew*

In addition to the above clusters involving /ɪ o/, there are three words with the monomorphemic sequence /ea/. In each case, the word in question alternates with another form without this sequence.

ko^{2}nče^{2}ɛ^{2} ~ ko^{2}nčɪˑ^{2}a^{2} *owl*

ko^{2}nta^{3}nče^{2}a^{2} ~ ko^{2}nta^{3}nčɪˑ^{2}a^{2} *scorpion*

ro^{2}teˑ^{1}a^{2} ~ ro^{2}taˑ^{12} *your (sg.) leg*

There are several bimorphemic examples of /ea/, but only a few of /ęą/.

nṯa^{2}čeˑ^{1}ɛ^{2} *your (sg.) kerosene* nṯa^{2}sęˑ^{1}ą^{2} *your (sg.) coffee*

Three-vowel bimorphemic clusters are rare in occurrence. There is only one example each of /ɪoe ɪoa oɪa ǫɪą oea/ and only a few of /aoe ąçę aoa ąǫą/.

nta^{3}ř̆ɪoˑ^{1}e^{3} *his/their tree trunk*

nta^{3}ř̆ɪoˑ^{1}a^{2} *your (sg.) tree trunk*

s̆oɪˑ^{1}a^{2} *your (sg.) fire*

to^{3}čhǫɪˑ^{1}ą^{2} *your (sg.) fruit*

toeˑ^{1}a^{2} *your (sg.) hole*

s̆aoˑ^{1}e^{3} *his/their sprout of maguey*

šɪ^{2}tąǫˑ^{1}ę^{3} *his/their chair*

s̆aoˑ^{1}a^{2} *your (sg.) sprout of maguey*

šɪ^{2}tąǫˑ^{1}ą^{2} *your (sg.) chair*

6. Loanwords

Words borrowed from Spanish with the syllable patterns CVC, CVVC result in the addition of several different word-medial consonant clusters. These include /řt̪ řk řs řn ls bř sk/. For example:

(martes) mař^{1}t̪·e^{2} *Tuesday*
(miércoles) mieř^{1}k·o^{2}le^{2} *Wednesday*
(garza) ko^{2}kař^{1}s·a^{2} *heron*
(viernes) ble·ř^{21}ne^{2} *Friday*
(bolsa) bo·l^{21}sa^{2} *bag*
(abril) a^{2}bři·l^{12} *April*
(pescado) ko^{2}pes^{2}ka·^{21}o^{2} *fish*

In most words, the syllable which was stressed in Spanish receives vowel stress when the word is used in Popoloca. All non-stressed syllables have tone /^{2}/. When the stressed syllable occurs word initially or medially, it has tone sequence /^{21}/.

(coche) ko·^{21}če^{2} *car*
(adobe) a^{2}do·^{21}be^{2} *mud bricks*
(teléfono) te^{2}le·^{21}po^{2}no^{2} *telephone*

The only exception to this pattern in our data is (taza) ta·^{12}sa^{2} *cup*. When the stressed syllable occurs in word-final position, it has tone sequence /^{12}/.

(gis) hi·s^{12} *chalk*
(avión) a^{2}bi̱o̱·^{12} *airplane*
(arroz) a^{2}řo·^{12} *rice*

Six Spanish words in our data have a change in the placement of stress when used in Popoloca. The syllable stressed in Spanish has tone /^{1}/, and the following syllable receives consonant stress and (usually) tone /^{2}/ (tone /^{3}/ in a single example).

(lápiz) la^{1}p·l^{3} *pencil*
(martes) mař^{1}t̪·e^{2} *Tuesday*
(garza) ko^{2}kař^{1}s·a^{2} *heron*
(botica) bo^{2}tl^{1}k·a^{2} *pharmacy*

(columpio) ko^{2}lǫ^{1}p·lo^{2} *a swing*

(miércoles) mieɨ^{x1}ko·o^{2}le^{2} *Wednesday*

The difference between Spanish and Popoloca pronunciation of a word varies with the speaker's fluency in Spanish. With most speakers, three basic patterns occur: (1) A word-final consonant tends to be lost, as in (arroz) a^{2}ře·^{12} *rice*. (2) A syllable-final nasal is usually lost, and the preceding vowel or vowel cluster is nasalized as in (avión) a^{2}blǫ·^{12} *airplane*, (columpio) ko^{2}lǫ^{1}p·lo^{2} *a swing*. (3) Spanish /d/ in the onset of a word-final syllable is lost as in (candado) ka^{2}nɨa·^{21}o^{2} *a lock*, and (pescado) ko^{2}pes^{2}ka·^{21}-o^{2} *fish*.

7. *Morphophonemics*

The addition of a singular possessive marker to a noun causes morphophonemic changes to occur, and these changes vary according to whether the noun involved is a nonpersonal or a personal noun. The addition of a plural possessive causes only one minor change (Rule 3 below). The addition of the diminutive suffix čhą^{3} may also cause a morphophonemic change.

A nonpersonal noun names, for the most part, neither a body part nor a relative. Morphophonemic changes which occur with the addition of the singular possessive suffixes ną^{13} *my* and a^{2} *your (sg.)* and of the possessive suffix e^{3} *his/their* to nonpersonal nouns involve both phonemes and tonemes. Those which occur with the addition of the plural possessive suffix -nǫ^{1} *our* involve only tone. The phoneme changes follow these ordered rules:

Rule 1. The root-final /a/ of a noun assimilates to /e/ and root-final /ą/ to /ę/ when preceding -e^{3} *his/their*.

Rule 2. The morpheme -e^{3} *his/their* assimilates to -ę^{3} following root-final /ę/, to -ɨ^{3} following root-final /ɨ/, and to -į^{3} following root-final /į/; the morpheme -a^{2} *your (sg.)* assimilates to -ą^{2} following root-final /ą/.

Rule 3. All noun possessive suffixes add an initial /ʔ/ when immediately following tone /^{3}/.

Rule 4. Across morpheme boundaries two contiguous like vowels assimilate to one vowel with vowel stress.

The application of either Rule 1 or 2 requires the application of either Rule 3 or 4 as well. Rules 3 and 4 may be applied independently of the others.

Examples of the application of Rules 1 and 3 are:

ša²h·oa³	+	e³	→	ša²hoe³ʔ·e³	*his/their ribbon*
nčɪ³ɬh·a³	+	e³	→	nčɪ³ɬhe³ʔ·e³	*his/their griddle*
to³kh·a³	+	e³	→	to³khe³ʔ·e³	*his/their potato*

Examples of the application of Rules 1 and 4 are:

ka³č·a²	+	e³	→	ka³če·¹³	*his/their knee pants*
nta²č·a²	+	e³	→	nta²če·¹³	*his/their broom*
nǫ²ʂ·a²	+	e³	→	nǫ²ʂe·¹³	*his/their blanket*

Examples of the application of Rules 2 and 3 are:

nɬa·³sɻ³	+	e³	→	nɬa³sɻ³ʔ·ɻ³	*his/their market*
ho³čh·ɪ³	+	e³	→	ho³čhɪ³ʔ·ɪ³	*his/their spinning whorl*
nčɪ³ɬha³čh·ą³	+	a²	→	nčɪ³ɬhą³čhą³ʔ·ą²	*your (sg.) small griddle*

Examples of the application of Rules 2 and 4 are:

to³čh·ǫɻ²	+	e³	→	to³čhǫɻ·¹³	*his/their fruit*
ča²n·kɪ²	+	e³	→	ča²nkɪ·¹³	*his/their necklace*
řa²h·ną²	+	a²	→	řa²hną·¹²	*your (sg.) town*

Examples of the application of Rules 1,2, and 4 are:

tǫ³s·ą¹	+	e³	→	tǫ³sę·¹³	*his/their orange (sour fruit)*
ʂǫ·²ą²	+	e³	→	ʂǫę·¹³	*his/their medicine*

Examples of the application of Rules 2,3, and 4 are:

nǫ·³ą³	+	e³	→	nǫę³ʔ·ę³	*his/their dry shelled corn*
nčɪ³ɬha³čh·ą³	+	e³	→	nčɪ³ɬha³čhę³ʔ·ę³	*his/their small griddle*

Examples of the application of Rule 3 are:

sa²k·o³	+	ną¹³	→	sa²ko³ʔ·ną³	*my pineapple*
to³kh·a³	+	a²	→	to³kha³ʔ·a²	*your (sg.) potato*
nɻ³n·ke³	+	e³	→	nɻ³nke³ʔ·e³	*his/their plow*
sa²ko³čh·ą³	+	ną¹³	→	sa²ko³čhą³ʔ·ną³	*my small pine-apple*

Examples of the application of Rule 4 are:

nǫ^{2}ʂ·a^{2}	+	a^{2}	→	nǫ^{2}ʂa·^{12}	*your (sg.) blanket*
ną·^{21}goa^{2}	+	a^{2}	→	ną^{2}goa·^{12}	*your (sg.) skirt*
ɤo^{1}t·e^{2}	+	e^{3}	→	ɤo^{2}te·^{13}	*his/their shawl*

The corresponding tone changes governing the addition of possessive suffixes on nonpersonal nouns are:

Rule 5. Following the change in the placement of stress due to the addition of a suffix, a root-final noun syllable with tone /^{2}/ or a cluster including tone /^{2}/ becomes tone /^{1}/ preceding ną^{13} *my*, a^{2} *your (sg.)*, and e^{3} *his/their*. Also in a bisyllabic or a polysyllabic root, a tone /^{1}/ or a cluster including tone /^{1}/ on the next-to-last syllable, will become a tone /^{2}/:

ba·^{21}ho^{2}	+	a^{2}	→	ba^{2}ho·^{1}a^{2}	*your (sg.) stringed instrument*
tǫ^{1}h·ǫ^{2}	+	e^{3}	→	tǫ^{2}hǫ·^{1}ę^{3}	*his/their gourd*
lo^{12}n·to^{2}	+	ną^{13}	→	lo^{2}nto^{1}n·ą^{13}	*my clothes*

Two-syllable nouns with the syllable pattern CV^{3}ʔ·V^{3} become CVV^{31} ~ CVV^{1} preceding any possessive marker. (We have chosen to write this as CVV^{1}.)

ną^{3}ʔ·ǫ^{3}	+	ną^{13}	→	nąǫ^{1}n·ą^{13}	*my color*
ʂo^{3}ʔ·ɨ^{3}	+	a^{2}	→	ʂoɨ·^{1}a^{2}	*your (sg.) fire*

Likewise, the only noun with CV^{3}h·V^{3} syllable pattern in our data becomes CV^{3}hV^{1} preceding any possessive marker:

ɤa^{3}h·a^{3}	+	a^{2}		ɤa^{3}ha·^{12}	*your (sg.) green beans*

Rule 6. When ną^{13} *my* is added to a noun stem with a final syllable on tone /^{1}/ or /^{2}/, there is fluctuation between the tone sequences /$^{2\ 13}$/ /$^{21\ 3}$/ /$^{21\ 13}$/ and /$^{13\ 3}$/. The combination of noun stem and suffix fluctuates to the following pronunciations: ną^{2}goa^{2}n·ą^{13} ~ ną^{2}goa^{21}n·ą^{3} ~ ną^{2}goa^{21}-n·ą^{13} ~ ną^{2}goa^{13}n·ą^{3} *my skirt*. We have chosen to write *my* as ną^{13} and the tone of the preceding syllable as tone /^{1}/ in this environment. However, the addition of ną^{13} *my* to a noun stem with a final syllable on tone /^{3}/ results in the loss of the tone cluster on the suffix. The tone retained is tone /^{3}/.

sa²k·o³ + nę¹³ → sa²ko³ʔ·nę³ *my pineapple*

sa²ko³čh·ę³ + nę¹³ → sa²ko³čhę³ʔ·nę³ *my small pineapple*

The suffix a² *your (sg.)* becomes a³ preceding the suffix nę¹ *our*:

ba²ho·¹a² + nę¹ → ba²ho·¹a³nę¹ *our (incl.) stringed instrument*

nǫ²šę·¹² + nę¹ → nǫ²ša·¹³nę¹ *our (incl.) blanket*

The word nčɨ·³a³ *house* is the only exception in the data. Its forms are as follows:

nčɨ·³a³ *house* nča³nɻo·¹ɨ³ *your (sg.) house*

nča³nɻ·¹ę³ *my house* nča³nɻo²ʔ·a² *his/their house*

First and second personal plural possessives are regular, however:

nča³nɻ·¹ę³nę¹ *our (excl.) house*

nča³nɻo·¹ɨ³nę¹ *our (incl.) house*

nča³nɻo·¹ɨ³ř a¹ *your (pl.) house*

Some nouns, although they are names of body parts and relatives, add the same types of personal possessive suffixes as do nonpersonal nouns. Those in this category which are completely regular are:[3]

nɻa²chǫ·¹ę³ *his/their ear*

nta²řɨo·¹e³ *his/their chin*

nta²čę·¹³ *his/their shoulder*

ę²sę·¹³ *his/their heart*

čɨ²nko·¹e³ *his/their fingernail*

nɻo³de·¹³ *his/their father*

ha²nę·¹³ *his/their mother*

čɻ²nɻ·¹³ *his/their uncle*

Nouns which fit into this category but which have irregularities in some of the singular forms are:

řo²te¹n·ę¹³ *my foot/leg*

řo²te·¹a²/řo²ta·¹² *your (sg.) foot/leg*

řo²te·¹³ *his/their foot/leg*

ha¹n·ę¹³ *my head*

ha·¹² *your (sg.) head*

ha·³ *his/their head*

řa¹n·ę¹³ *my hand/arm*

řa·¹² *your (sg.) hand/arm*

řa·³ *his/their hand/arm*

Since the number of personal nouns is limited, we have listed them in the following chart, with the regular nouns listed first.

First and second person plural possessive forms have been omitted because they are regular.

Regular nouns:	Third (sg., pl.)	First (sg.)	Second (sg.)
nose	čɭ^{3}th·ǫ^{2}	čɭ^{2}th·ǫ^{2}	čɭ^{1}th·ǫ^{3}
tongue	nę^{3}h·ę^{2}	nę^{2}h·ę^{2}	nę^{1}h·ę^{3}
neck	to^{3}s·ɭ^{2}	to^{2}s·ɭ^{2}	to^{1}s·ɭ^{3}
eye[4]	k·ǫ^{2}	k·ǫ^{2}	k·ǫ^{3}
Irregular nouns:			
eye[4]	hmą^{2}k·ǫ^{2}	hmą^{2}k·ǫ^{2}	hmą^{1}k·ǫ^{3}
thigh	nta^{3}ca·^{3}o^{2}	nta^{3}ca·^{2}o^{2}	nta^{3}ca·^{1}o^{3}
nephew	ʂa^{3}kǫę·^{2}	ʂa^{3}kǫę^{3}ʔ·e^{3}	ʂa^{3}kǫę·^{13}
center (liver)	ñą·^{2}ǫ^{2}	ñą·^{2}ǫ^{2} ~ ñą^{3}ʔ·ǫ^{3}	ñą·^{1}ǫ^{3}
stomach	ce^{2}ʔ·e^{2}	ce^{3}ʔ·e^{3}	ce·^{13}
mouth	r̃o^{2}ʔ·a^{2}	r̃o^{2}ʔ·a^{2}	r̃o^{3}ʔ·a^{2}
sibling	ʂa^{3}čo·^{23}	ʂa^{3}čhɭ·^{1}ą^{3}	ʂa^{3}čo·^{23}

A regular personal noun may optionally add nę^{2} *my* to the first person singular form, but stress remains on the noun.

8. The Phrase

A phonological phrase indicates the attitude of the speaker. Its predominate contrastive features are intonation, phrase stress, pause, and initial lenis glottal stop.

Phrase stress occurs on the stressed syllable of the last phonological word. With the exception of the anger phrase, the phrase-stressed syllable has greater consonant or vowel length than any other syllable of the phrase. Thus, the vowel stress of ʇa^{2}-tɭ·^{12}ʇa^{2} *man* is longer in nę·^{21} ʇa^{2}tɭ·^{12}ʇa^{2} *one man* than in nę·^{21} ʇa^{2}tɭ·^{12}ʇa^{2} h·ye^{1} *one big man*.

Every phrase is followed by pause. The initial lenis glottal stop, however, occurs only preceding a noninitial phrase that begins with a V or VV syllable.

nit^{3}ʔ·i^{3} hi·^{12} šo^{3}t·i^{1}, nit^{3}ʔ·i^{3} i^{2}na·^{21} šo^{3}t·i^{1}, [ʔ]i^{1}č·a^{1} šo^{3}t·i^{1}, *here's a tomato, here's another tomato, more tomatoes,*

Six phrase types are presented here: two nonemotional and four emotional types.

The declarative phrase and the sequence phrase are nonemotional phrases.

The most common type phrase is the declarative phrase, symbolized by /./. The predominate contrastive intonation feature of this phrase is a gradual down-drift of tone, so that a phrase-final tone is lower than that same tone when phrase-initial.

ntɨ^{3}ʔ·ɨ^{3} yo·^{12} šo^{3}t·ɨ^{1} ha^{1}c·e^{3}. *here are two red tomatoes*

tɨ^{1}řo^{2}bę·^{12} koe^{3}ʔ·ną^{3} ną·^{21} to^{3}s·ą^{1}. *Ruben bought one orange*

The sequence phrase symbolized by /,/ in the following examples must always occur in a series of at least two. The final syllable of this phrase is raised approximately one level above the lexical tone in the word-final syllable, except in the final sequence phrase of a series where this raising is optional.

koe^{1}ʔ·ną^{3} šo^{3}t·ɨ^{1}, h·mą^{2}, ho^{2}h·a^{2}, *I bought tomatoes, beans, eggs,*

ǰɨ^{1}ną^{3}ʔ·ǫ^{3} ną·^{21} sa·^{21}ko^{2}, ǰɨ^{1}ną^{3}ʔ·ǫ^{3} ną·^{21} ba·^{21}ho^{2},
ǰɨ^{1}ną^{3}ʔ·ǫ^{3} žo^{3}ʔ·o^{3}, *I want one jacket, I want one stringed instrument, I want chocolate,*

The emphatic phrase, the coaxing phrase, the fear phrase, and the anger phrase are emotional phrases.

The emphatic phrase, symbolized by /!/, is characterized by increased force. Emphatic intonation causes the stressed syllable of the emphasized word to be raised approximately two lexical levels. Thus, in the following example, the stressed syllable of žo^{3}ʔ·o^{3} *chocolate* is raised approximately to the normal level of lexical tone /^{1}/.

sɨ^{2}řo^{2}ʔ·e^{2} žo^{2}ʔ·o^{2}. ną^{2}ʔ·ą^{2} ɨ^{1}š·ɨ^{2} sɨ^{2}řo^{2}ʔ·e^{2} žo^{3}ʔ·o^{3}! *You will go get corn dough. You will not go get chocolate!*

The coaxing phrase, symbolized by /.../, begins in a higher than normal key and gradually rises still higher. Longer than normal vowels and a slower word timing are also characteristic of this phrase.

te^{1}ną^{2}n·ą^{3} ną·^{21} sa·^{21}ko^{2}... *buy me a jacket...*

ša^{2}k·oɨ^{3} ntɨ^{3}ʔ·ɨ^{3}... *come here...*

Both fear and anger phrases are spoken in a raised key. In addition, phrases spoken in fear, symbolized by /:/, have shorter

normal vowels and faster word timing.

ną^{2}ʔ·į^{2} ři^{1}nąǫ^{3}ʔ·ą^{2}: sa^{1}ch·i^{3} nča^{3}nį·^{1}ą^{3}: *no, I don't want to: I'm going home:*

Along with a rise in key, an anger phrase, symbolized by /!!/, is spoken more loudly than normal. The final syllable of each phrase (even if it is nonstressed) ends in an extremely long vowel. The tone on this vowel begins at the normal lexical tone but rises considerably higher than lexical tone /^{1}/.

r̃o^{2}bę·$^{1'}$!! čhe^{2}ʔ·ə^{2} š·ą^{3} lo·^{21}bo^{2}!! *Ruben!! Give the child the balloon!!*

REFERENCES

Kalstrom, Marjorie R. and Eunice V. Pike
1968 "Stress in the Phonological System of Eastern Popoloca," Phonetica 18.16-30.

Williams, Ann F. and Eunice V. Pike
1968 "The Phonology of Western Popoloca," Lingua 20.368-380.

NOTES

1

San Marcos Tlacoyalco, located north of Tehuacán, Puebla, Mexico, is a village of about 2700 inhabitants. One other village of similar size, San Luis Temalacayuca, plus a few scattered hamlets speak a closely related dialect. Our principal informants have been Pedro Hernández Melchor and his wife Natividad Gámez Sánchez, aged 30 and 23, respectively. The data were gathered in 1971. For the most part, PM is responsible for the analysis of tone and SS for the segmental phonemes, syllable, and word, as well as for the presentation of the material. We wish to express our appreciation to Eunice V. Pike for her help and guidance in both analysis and presentation of the materials.

2

The reverse is true in the Western dialect of Popoloca (Williams and Pike 1968). In that dialect, glottal stop is the most frequent consonant.

3

Names of all body parts and relatives are obligatorily possessed. Therefore, the third person form has been listed here.

4

The words k·ʔ^2 *his eye* and hmą^{2}k·ʔ^2 *his eye* are synonyms.

CHIQUIHUITLAN MAZATEC PHONOLOGY

Allan R. Jamieson

1. Phonemes
2. Distribution
3. Interpretation

This paper describes the phonemes of Chiquihuitlan Mazatec,[1] an Otomanguean language of Southeastern Mexico. Consonants, vowels, and nasalization are introduced in the first section of the paper; their distribution within and between syllables is discussed in the second section; and the paper closes with a few remarks dealing with certain problems of interpretation that arose in the course of the analysis.

1. Phonemes

There are fifteen consonants: five plosives /t c ʈ č k/, two fricatives /s š/, six sonorants /m b n r ñ y/, and two laryngeals /ʔ h/. All consonants are normally realized with spread lips except preceding /o u/, when they are realized with slight to definite rounding.

Of the five plosives, three are stops--alveolar, alveopalatal, and velar--and two are affricates--alveolar and alveopalatal. They are voiceless except following /n/.

(1) tä^{3} [tæ^{v}] *ten* ntä^{4} [ndæ^{v}] *stair*
na^{4}ʈa^{2} [nąʈ^{y}a] *saliva* na^{4}nʈa^{4} [nąñg^{y}a] *town*
ba^{3}ki^{3} [ɓaki] *he nurses* ba^{3}nki^{3} [ɓaŋgi] *he searches*
ca^{4} [tsa] *cheek* nca^{3} [ndza] *my hand*
ča^{3}kų^{34} [ʈšakų] *citified* nca^{3}kų^{34} [ñgžakų] *godmother*

Both fricatives are grooved and voiceless, and are alveolar and alveopalatal retroflexed, respectively.

(2) sa^{2} [sa] *moon* ša^{2} [ʂa] *work*

Three sonorants are bilabial, alveolar, and alveopalatal nasals. The alveolar nasal assimilates in point of articulation to a following plosive.

(3) ma^{3} [mą] *is able* ña^{3} [ñ^{y}ą] *even*
na^{4} [ną] *she* nku^{2} [ŋgu] *one*
nʈa^{34} [ñg^{y}a] *there*

/b/ is normally a voiced bilabial flat fricative, but it fuses with a preceding /h/ to yield [ɸ] and is slightly nasalized when preceding a nasalized vowel.

(4) ba^{3} [ɓa] *sad*

hbä^{3} [ɸæ^{v}] *gets used up*

ʔbį^{21} [ʔɸ̥į.] *he doesn't know*

/y/ is normally a lenis voiced fronted alveopalatal grooved fricative with a palatal offglide, especially when preceding a high front vowel, varying freely to a voiced raised high close front unrounded vocoid; it fuses with a preceding /h/ to yield [ɧ̟], with or without slight aspiration, and is slightly nasalized when preceding a nasalized vowel.

(5) yä^{4} [ɧ̟^{ʏ}æ^{v}] or [ɧ̟$^{i^{\wedge}}$æ^{v}] *snake*

hyä^{3} [ɧ̟æ^{v}] or [ɧ̟ɐ̟æ^{v}] *big*

ʔyį^{21} [ʔɧ̟$^{į^{\wedge}}$į.] *you (sg) don't know*

/r/ is normally a voiced alveolar flap, but it is voiceless preceding /k/ and is a lateral when word-initial preceding a vowel.

(6) ču^{4}řä^{4} [ʈšuræ^{v}] *his animal*

rku^{4} [řku] *his head*

ra^{3}nka^{14} [laŋga] *little ones*

Both laryngeals are voiceless. /ʔ/ is a glottal stop. /h/ is normally the voiceless counterpart of a following vowel or sonorant, but it fuses with /b y/ as indicated above.

(7) ʔa^{3}nį^{1} [ʔanį] *red*

hį^{3}nə^{3} [Iinɛ^{v}] *he eats*

ho^{1} [Oo] *two*

čha^{4} [ʈšAa] *he speaks*

hma^{1} [Mmą] *black*

hne^{2} [Nnę] *palm leaf*

hña^{4} [Ñña] *chili pepper*

hbä^{3} [ɸæ^{v}] *gets used up*

hyä [ɧ̟æ^{v}] *big*

There are six vowels: /i e ä a o u/.

/i/ is a high close front unrounded vowel. It is a short glide when following /a/ or preceding another vowel within the syllable. /e/ is normally raised mid open front unrounded, but is lowered when nasalized. /ä/ is lowered low close front unrounded. /a/ is normally low open central unrounded. In some idiolects it is raised to mid before the offglide /i/. /o/ is mid close back

rounded. /u/ is high close back rounded. It is a short glide when following another vowel within the syllable, and in some idiolects is fronted in this context.

(8) sɪ^{3} [sɪ] *a dispute* — khæ^{31} [kÆæᵛ·] *not yet*
ʔaɪ [ʔaᶦ] *heavy* — sa^{2} [sa] *moon*
sɪu^{2} [sᶦu] *are* — ʔaɪ [ʔaᶦ] or [ʔʌᶦ] *heavy*
se^{2} [sɛ^] *you (sg) sing* — čo^{2} [ţšo] *woven cloth*
sę^{2} [sɛ̨ᵛ] *we (in) sing* — ču^{4} [ţšu] *animal*
sä^{2} [sæᵛ] *he sings* — sua^{2} [sᵘa] *he gives*

A vowel is lengthened when accompanying an upgliding tone cluster.

(9) sę^{21} [sɛ̨ᵛ·] *I don't sing* — kǫ^{21} [kǫ·] *I'll not grind*

A single vowel or the cluster /sɪ/ may be interrupted by a laryngeal. In such cases, the vowel is rearticulated after the interruption, with the whole sequence having a timing similar to that of a single vowel when accompanying an upgliding tone cluster. In the cluster /aɪ/, the interruption occurs between the /a/ and the /ɪ/.

(10) baʔ^{31} [ɓaʔɛ] *I carry* — bah^{31} [ɓaAa] *I hit*

Nasalization is a feature of the syllable rather than of individual vowels. The vowels of any given syllable are either all oral or all nasalized. A nasalized vowel is heavily nasalized following a non-nasal consonant. There is no contrast between nasalized and non-nasalized vowels following a nasal consonant; all such vowels vary between lightly to heavily nasalized forms. Preceding a nasal consonant, a vowel is slightly nasalized.

(11) skę^{2} [skɛ̨ᵛ] *he'll smoke* — sɪųʔ^{2} [sᶦųʔų] *we (in) grind*
suą^{21} [sᵘą·] *I don't give* — cɪ^{2}ʔñuaɪ^{21} [tsɪʔñᵞᵘąᶦ] *he doesn't tie up*
suaɪ^{21} [sᵘɛ̨ᶦ] *he doesn't give* — yu^{4}nkų^{4} [ˈųŋgų] *church*
cąʔ^{34} [tsąʔą] *mine* — ʔɪ^{2}nta^{2} [ʔɪ̨nda] *soft*
cąɪh^{31} [tsɛ̨ɪ̨ɪ̨] *there isn't any*

There are four tones: high /¹/, mid /²/, low-mid /³/, and low /⁴/. The complexity of the tonal system merits a completely separate discussion (see the following article, this volume).

(12) ho^{1} *two* ya^{2} *tree* tä^{3} *ten* cä^{4} *guayaba*

2. *Distribution*

With two known exceptions in the language,[2] every syllable begins with a consonant or a consonant cluster. Any consonant may enter into a cluster, but of the four classes of consonants--plosives, fricatives, sonorants, and laryngeals--only one member of each class may occur in any one cluster.

/h/ may follow any plosive or precede any sonorant except /r/.

(13) thä^{2} *an itch* hma^{1} *black*
ʈho^{2} *cornhusk* hni^{2} *blood*
khä^{31} *not yet* hñu^{1} *dark*
cha^{2} *badger* hbä^{2} *I go*
čha^{2} *difficult* hyä^{2} *complaint*

/ʔ/ may precede any sonorant except /r/.

(14) ʔma^{3} *hidden* ʔbä^{3} *I know*
ʔne^{2} *language* ʔya^{3} *then*
ʔñu^{2} *strong*

/n/ may precede any plosive.

(15) nta^{2} *watery* ncų^{14} *torn*
nʈa^{34} *there* nčä^{42} *boiled corn*
nku^{2} *one*

Most clusters are of two consonants, but there are five three-member clusters in which /ʔn/ precedes one of the plosives.

(16) ʔntä^{1} *thin* ʔncä^{4} *his brother*
ʔnʈu^{2} *cocoa bean* ʔnči^{4} *wet*
ʔnka^{3} *high*

/s/ may precede the plosives /t k/ or the sonorants /m n/.

(17) nta^{3}stu^{14} *at least* sme^{1} *I loose*
ska^{2} *crazy* sne^{4} *tepejilote palm*

/š/ may precede the plosives /t ʈ k/ or the sonorant /n/.

(18) šta^{1} *smooth* ška^{4} *leaf*
šʇa^{3} *salty* šnɨ^{2} *log*

/r/ may precede /k/, and in a common freely variant pronunciation of -rä^{4} na^{4} *of her*, it may precede /n/.

(19) rka^{14} *blind* ču^{4}rna^{4} *her animal*

Every syllable has one or more vowels; any vowel except /o/ may enter into cluster with other vowels. Clusters are almost exclusively of two vowels, with /i u/ as the first member. The exceptions are /a/ and nasalized /uą̈ɨ/. /i/ may precede /a u/ as an onglide or follow /a/ or /uą/ as an offglide.

(20) bɨ^{3}sɨa^{2}hmɨ^{2} *he converses* ʔaɨ^{2} *heavy*
sɨu^{2} *are* khuą̈ɨ^{41} *he will not grab*

/u/ may precede /i e ä a ą̈ɨ/ as an onglide. It does not follow another vowel as an offglide but does follow /i/ when the latter is an onglide, as mentioned above.

(21) khuɨ^{1} *he is going* khua^{4} *word*
khue^{3} *he will go* khuą̈ɨ^{41} *he will not grab*
khuä^{3} *it will get used up*

Any single vowel or /a/ may be interrupted by /ʔ/, and any single vowel may be interrupted by /h/ in the absence of nasalization.

(22) čɨʔ^{4} *he is drunk* ntɨh^{4} *grass*
čeʔ^{3} *you (sg) buy* nteh^{34} *sugar cane*
čäʔ^{3} *I am drunk* yäh^{3} *every*
čaʔ^{2} *a load* nʇah^{4} *cattle*
čoʔ^{3} *stingy* nʇoh^{4} *a rock*
cuʔ^{2} *huipil* ntuh^{4} *soap*
ʇhaɨʔ^{3} *clean*

Any single vowel except /ä/, or the cluster /aɨ/, may occur with nasalization in the presence or absence of the laryngeals /ʔ h/.

(23) cį^{2} *he gets born* nɨ^{3}čǫʔ^{2} *we (in) deny*
sę^{2} *we (in) sing* tų$^{?31}$ *you (pl) give*

šą^{2}	*sugar cane juice*	štą$^{?314}$	*mushroom*
kǫ^{21}	*I will not grind*	cị̈h^{34}	*ours (ex)*
sų^{2}	*you (pl) sing*	cęh^{2}	*visible*
hąi^{2}	*really*	cąh^{42}	*ours (in)*
tị̈$^{?314}$	*we (ex) give*	ni^{3}kǫh^{2}	*we (in) touch*
tę$^{?314}$	*stunted*	cųh^{41}	*yours (pl)*
tą$^{?31}$	*we (in) give*	cąih^{31}	*there is none*

The sequences /ia iu/ occur uninterrupted in the absence of nasalization, and uninterrupted or interrupted by /ʔ/ in its presence.

(24) bi^{3}sia^{2}hmi^{2}	*he converses*	sią^{42}	*we (in) drink*
siu^{2}	*are*	cią$^{?314}$	*person from Usila (Chinantec)*
chią^{2}	*cloth*	sią$^{?2}$	*we (in) grind*

The sequence /ai/ may occur uninterrupted or interrupted by /ʔ/ in the presence or absence of nasalization, or interrupted by /h/ in its presence.

(25) ʔai^{2}	*heavy*	štąi$^{?314}$	*mushroom*
hąi^{2}	*really*	čąih^{21}	*it does not get lost*
ʇhai$^{?3}$	*clean*		

In the absence of a laryngeal, /u/ occurs as an onglide before oral /i e ä a/ and nasalized /į ę ą ąi/.

(26) khui^{1}	*he is going*	khuį^{21}	*you (sg) will not go*
khue^{3}	*he will go*	khuę^{21}	*I will not go*
khuä^{3}	*it will get used up*	khuą^{21}	*I will not grab*
khua^{4}	*word*	khuąi^{41}	*he will not grab*

Interrupted by /ʔ/, /u/ occurs as an onglide before oral /i e ä a/ and nasalized /į ę ą/.

(27) sui$^{?2}$	*holiday*	khuį$^{?314}$	*we (ex) will arrive*
khue$^{?314}$	*you (sg) will arrive*	khuę$^{?314}$	*we (in) will arrive*
khuä$^{?314}$	*I will arrive*	kuą$^{?2}$	*clay dish*
khua$^{?31}$	*I will grab*		

Interrupted by /h/, /u/ occurs as an onglide before oral /e a/ and nasalized /ɻ ę ą ąi/.

(28) kueh^{2} *you (sg) will hit* kuęh^{314} *I will go up*
kuah^{41} *he will get dressed* kuąh^{21} *I will not get dressed*
kuɻh^{41} *he will not go up* kuąih^{41} *he will not get dressed*

From one to three consonants may occur in the syllable margin, and from one to three vowels may occur in the syllable nucleus--giving a total of nine potential syllable types. All of these are found to occur except the largest expansion of three consonants with three vowels.

(29) tä^{2} *wide* skuä^{3} *I will see*
ntä^{4} *stair* ʔncua^{3} *his mouth*
ʔntä^{2} *he hears* suąi^{21} *he does not give*
suä^{1} *hot* khuąi^{41} *he will not grab*

The following generalizations may be made for one-syllable words in isolation: Any single consonant except /ʈ/ and any cluster except /st/ may be found in the syllable margin, while all single vowels and all clusters except /ia ęʔ ęh/ occur in the nucleus.

All eight syllable types are found as the final syllable of two-syllable words which are not compounds. In the margin of such syllables, all single consonants except /ʔ/ and all clusters except /šʈ sn šn/ are found; in their nuclei, all single vowels except /uʔ ih uh/ and all clusters except /ui ua uɻ uą ue? uɻ? ueh uɻh iɏ ɻɏ? ąi ąih uąi uąih/ are found. If the nucleus is interrupted, however, consonants in the margin are limited to a single consonant or a cluster /nt čh/.

The first syllable of a two-syllable word which is not a compound has only one or two consonants in its margin and one or two vowels in its nucleus. Any single consonant except /m ñ/ may occur in the margin, but only /k/ has been found with two vowels in the nucleus. Of the consonant clusters, only plosives preceded by /n s š/ or followed by /h/ are found with a single vowel in the nucleus, and only /kh/ with two vowels.

Only uninterrupted vowels are generally found in the first syllable of two-syllable words which are not compounds. There are two apparent exceptions.

(30) šaʔ^{2}sę^{2} *heart* saʔ^{1}sę^{2} *will dawn*

Vowel clusters in the first syllable of a two-syllable word which is not a compound are never nasalized; they always have /u/ as their first member and /i e a/ as the second member.

The following generalizations may be made irrespective of the position of a syllable within a word:

(a) Of the alveolar consonants, only the single consonants /s c r/ and the cluster /ch/ may precede a vowel cluster whose first member is /i/.

(b) It is generally the case that only /k/ or a cluster with /k/ and /s š r h/ may precede a vowel cluster whose first member is /u/. The following exceptions have been noted: /č s š th ʔnc ʔnč hñ ʔñ/.

(c) If the margin of a syllable has /ţ/ as a single consonant or in cluster with /š n h/, it is generally the case that a non-front vowel /a o u/ or the sequence /ai/ is found in the nucleus. There are two verbs, however, in which /ţh nţ/ are found preceding a front vowel in second person singular and first person plural exclusive forms.

(31) bi^{2}thį^{24} *we (ex) shell* tį$^{?31}$ntį^{14} *we (ex) bother it*
bi^{2}ţhe^{2} *you (sg) shell* te$^{?31}$nţe^{1} *you (sg) bother it*

Most words, which may have up to six or seven syllables, are composed of various combinations of one and two-syllable words and have more or less the same distributional restrictions as those described above.

3. *Interpretation*

Of the plosives, /ţ c č/ and clusters with /n/ present certain problems of interpretation.

My first transcriptions of /ţ/ alternated between [ţ^{y}] and [k^{y}]. I now see that some speakers tend to [ţ^{y}], some to [k^{y}], and others to some intermediate point between the two. Still others seem to vary freely between the two. There was never any doubt as to its being different from /t/ and /k/, but the precise point of articulation was hard to pin down. [ţ^{y}] seems to be the most prevalent and is used throughout the paper, although one informant thought it should be written in our practical alphabet with the Spanish equivalents for /k/ rather than /t/.

The phonetic sequence could have been interpreted as a phonemic sequence /ty/ or /ti/, and since its occurrence was of relatively low frequency, my first inclination was to avoid setting up a special phoneme. Without belaboring the point, however, the decision to establish /ţ/ as a unit results in the following pat-

terns:

(a) /ʈ/ clusters almost as fully as the other stops /t k/; it may be aspirated or prenasalized (resulting in a voiced allophone and assimilation of the nasal), and it may be preceded by /š/. Two holes remain in the pattern; /ʈ/ may not be preceded by /s/, as in /st sk/, or by /ʔn/ in the speech of certain individuals, as in /ʔnt ʔnk/.

(b) /ʈ/ contrasts with /t/ in nearly identical environments.

(32) nta² *watery* tho⁴ *wind*

nʈa³⁴ *there* ʈho¹⁴ *wind instrument*

/c č/ could have been interpreted as /ts tš/, since the reverse sequences /st št/ occur. They were interpreted as units for the following reasons:

(a) There are no nonsuspect consonant clusters of more than two consonants. Sequences /ts tš/ would yield frequently occurring clusters of three and four consonants.

(b) They fit well as units in the pattern of a single consonant preceding aspiration, as opposed to sequences like /st šk/, which are never aspirated.

(c) They fit well as units in the pattern of a single consonant following a nasal or glottal stop plus nasal, yielding /nt nʈ nk nc nč/ and /ʔnt ʔnʈ ʔnk ʔnc ʔnč/.

The five clusters of prenasalized plosives /nt nʈ nk nc nč/ can be interpreted as a series of voiced plosives /d ɖ g z J/, thereby reducing the number of two-consonant clusters by five as well as all of the undesirable clusters of three consonants (with /ʔ/). Nevertheless, their treatment as clusters is preferred because of the following advantages:

(a) The phoneme inventory is, of course, reduced by five.

(b) The plosives pattern with /n/ as they do with other preceding consonants in that they are never aspirated in that context. Thus, /št/ but never /*šth/ occurs, and similarly /nt/ but never /*nth/.

(c) The nasal property of the clusters, which results in light allophonic nasalization of a preceding oral vowel, would be obscured if they were treated as a series of voiced plosives only.

/b y/ could be interpreted as /u i/, but such an interpretation would contradict the overwhelming pattern of all syllables beginning with a consonant. The phonetic sequence [ƀu] would yield the nonpermitted cluster /uu/; [ʲ̂ i] would yield /ii/. Phonetically, /y/ and /i/ are basically the same, but preceding a nasalized

vowel, a slight difference can be observed. /ɣ/ is only slightly nasalized in this context, whereas /i/ is heavily nasalized. Using this criterion, all occurrences of [i] before a vowel and following a consonant are interpreted as /i/ unless the consonant is /ɣ/.

The allophones of /r/, [ř ɾ l], are in complementary distribution except for one or two borrowed words and are of low frequency occurrence. Due to the low frequency of modern sounds in this phonetic range, some of which seem to be reflexes of *ntʸ or *t, Kirk (1966:66) posits neither *l nor *r for Proto-Mazatec. Chiquihuitlan -rä *(third person)* and -ri *(second person)* correspond to Huautla -le and -li respectively, perhaps indicating a longstanding relationship between the flap and the lateral which extends beyond the phonetics of Chiquihuitlan speech.

Sequences of /h/ and nasal consonant could be interpreted as a series of voiceless nasal consonants matching the simple voiced series, but this alternative is rejected since the nasals also occur in cluster with the other laryngeal /ʔ/ and with /s š/. Nor is there a voiced/voiceless contrast between pairs or groups of phonemes elsewhere in the phonological system of the language.

The sequences /hb hɣ/ present interesting cases of portmanteau realization as [p x̌]. The former is of very high frequency, the latter of low frequency;[3] but both are in clear contrast to /b ɣ/, respectively. /hɣ/ has a freely variant pronunciation [x̌ʰ], with slight aspiration, which could point to an interpretation as /šh/, but no such pattern of aspiration of fricatives otherwise exists in the language. The present interpretation does fit into the existing pattern of laryngeal and sonorant, and avoids setting up additional phonemes such as /ɣ p/, which would have unusual distributional limitations.

Kirk (1966:16, 29) considered the sounds here interpreted as /ä e/ to be /e ei/, respectively, and there is evidence that the two sounds are historically related. In the first place, the contrast between the two is neutralized in the presence of nasalization; there are only five nasalized vowels as opposed to six oral vowels. Nasalized /ę/ is realized about midway between oral /ä/ [æ˅] and /e/ [ɛ^]. In the second place, what has here been interpreted as /e/ is extremely rare except in verbs. As the last vowel of a verb form, /e/ often correlates with second person and /ä/ with third person. In Huautla (Pike 1948:110-117), the third person form of a verb often differs from the corresponding second person form by an additional /i/. Sound change in Chiquihuitlan has resulted in the reduction of the cluster and the emergence of the sixth vowel in oral contexts. In the third place, the sounds are seen to be related in grammatical forms of a common source: tä^{3} *ten* and ho^{1} *two*, but te^{2}ho^{1} *twelve*.

As the only vowel sequence ending in /i/, /ai/ could be in-

terpreted as a unit, but like /e/ above (which corresponds to Huautla /ei/) it is rare except in verbs and involves a complex morphological situation in which the /i/ is associated with a separate morpheme.

(33) sua^{2} *he gives* bah^{2} *he hits*

suąi^{21} *he does not give* bąih^{21} *he does not hit*

Vowel onglides tend to fall into the pattern in which /i/ is associated with a preceding alveolar consonant and a following nonfront vowel, while /u/ is associated with a preceding velar consonant and a following nonback vowel. A number of possible /i/-glides were eliminated by setting up /ʈ/, but a few remain. Although the majority of /u/-glides occur after /k/ or one of its clusters, there are enough cases with alveolar or alveopalatal consonants to reduce the incentive to set up a /kʷ/ phoneme.

Chiquihuitlan syllable nuclei are here interpreted as uninterrupted, interrupted by /ʔ/ , or interrupted by /h/. Slightly different interpretations (Kirk 1966) have been made for related languages; cognates of interrupted syllables are treated in Jalapa as consonant clusters, as in CʔV and ChV, and as two syllables in Soyaltepec, as in CVʔV and CVhV.

(34) Chiquihuitlan: meh^{31} *want*

Tɛlapa: mhé^{2} *want*

Soyaltepec: me^{3}hé^{1} *want*

(35) Chiquihuitlan: cäʔ^{314} *lazy*

Tɛlapa: cʔé *lazy*

Soyaltepec: ceʔé *lazy*

The following considerations led to the Chiquihuitlan interpretation of interrupted vowels:

(a) If one mora of length is assigned to an uninterrupted syllable, an interrupted one is about one and one-half mora--the same as a single vowel with an upglide. A sequence of two syllables is much longer.

(b) Tones always step from one syllable to the next; only within one syllable do phonetic tone glides occur. Many interrupted syllables have more than one tone; but when whistled by any informant, they are without exception whistled as a continuous uninterrupted upglide. Likewise, those with a steady tone are not whistled as an interrupted sequence of two like tones, but rather as a slightly longer steady single tone.

The words of (36) sound exactly alike when whistled, since an upglide also adds length to the vowel(s) of the syllable.

(36) khä^{31} *not yet* käh^{31} *I went*

(c) There is clear contrast between CVhV^{T}, CV^{T}hV^{T}, and ChV^{T}.

(37) ntoh^{4} *stone*
nko^{4}ho^{4} *hole*
khä^{13} *not yet*

There is contrast between CV?V^{T} and CV^{T}?V, but C?V^{T} does not occur at all. A vowel interrupted by /?/ shows signs of general instability in that in certain morphemes it may vary from /V?/ to /V/, even within the speech of one person.

REFERENCES

Kirk, Paul L.
1966 Proto-Mazatec Phonology. University of Washington unpublished doctoral dissertation.

Pike, Kenneth L.
1948 Tone Languages. Ann Arbor: University of Michigan Press.

NOTES

1
This description is based primarily on the speech of Mr. Ernesto Tejada Salvador, native speaker of Mazatec as spoken in Chiquihuitlan de Juarez, Cuicatlan, Oaxaca, Mexico. Mr. Tejada is in his early forties. Chiquihuitlan has about 6000 inhabitants, approximately ninety percent of whom are native speakers of Mazatec.

2
Both exceptions are bound morphemes: -ą *and how about___?* and -ua *until*. The latter is -kuą in some idiolects.

3
Data from unpublished concordance prepared by computer under NSF grant GS-932 (1971).

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CHIQUIHUITLAN MAZATEC TONE

Allan R. Jamieson

1. Tones

Chiquihuitlán Mazatec[1] has four tones: high /¹/, mid /²/, low-mid /³/, and low /⁴/. Contrast among the four tones is demonstrated in one-syllable words in isolation (1) and (2), in one-syllable words preceding a constant frame (3), in the final syllable of two-syllable words (4), and in the initial syllable of two-syllable words (5).

(1) čha¹ *I talk*
čha² *difficult*
cha³ *his hand* A287[2]
čha⁴ *he talks* A303

(2) tä̈¹ *he dances* A569
tä̈² *wide* A572
tä̈³ *ten* A570
thä̈⁴ *seed* A385

(3) ho¹ siu² *there are two* A128
ya² siu² *there are trees* A661
rkI³ siu² *there are medicines* A415
cä̈⁴ siu² *there are guayavas (fruit)* A451

(4) ni⁴šu̱¹ *you (pl) will dry it*
kI⁴šu̱ *landslide* A553
kuI⁴šu̱³ *you (pl) will marry*
ki⁴šu̱⁴ *charcoal* A209

(5) cI¹thä̈¹ *I cough*
chu²ñI¹ *you (sg) lie down*

ci^{3}tä̈^{1} *I will spin it*

ci^{4}tä̈^{1} *he will spin it*

A syllable may be realized with any one of the four tones or with a cluster of two or three tones. The tone clusters occurring in ChM are /$_{14\ 24\ 34}$/, /$_{11\ 21\ 31\ 41}$/, /$_{114\ 214\ 314\ 414}$/, and /$_{42\ 424}$/. The single tones and the tone clusters which begin with the same tone are contrasted in (6) to (9).

(6) Tone /$_{1}$/ and clusters /$_{14\ 11}$/:[3]

ʔyɥ^{1} *you (pl) drink*

ʔyɻ^{14} *we (ex) drink*

ho^{1} ʔyɥ^{11} *we (in) drink two* A128

(7) Tone /$_{2}$/ and clusters /$_{24\ 21\ 214}$/:

ʔyɥ^{2} *we (in)/you (pl) grind*

ʔyɻ^{24} *we (ex) grind*

ʔyɻ^{21} *you (sg) do not know/grind*

ʔyɻ^{214} *we (ex) do not know/grind*

(8) Tone /$_{3}$/ and clusters /$_{34\ 31\ 314}$/:

ʔyɥ^{3} *you (pl) know*

ʔyɻ^{34} *we (ex) know*

ʔyɥ^{31} *we (in) drink*

čɻh^{314} *we (ex) get dressed*

(9) Tone /$_{4}$/ and clusters /$_{41\ 414\ 42\ 424}$/:

čhą^{4} *obo (fish)*

čhąl^{41} *he will not speak*

čɻ^{414} *we (ex) will not see/buy/carry*

čhɥ^{42} *woman* A86

čʉ^{4}cɻh^{424} *we (ex) will look*

The tone clusters which end with the same tone are compared in (10) to (12).

(10) Tone clusters /$_{14\ 24\ 34}$/:

ʔyɻ^{14} *we (ex) drink* ʔyɻ^{34} *we (ex) know*

ʔyɻ^{24} *we (ex) grind*

(11) Tone clusters /11 21 31 41/:

ho^{1} ʔyɥ^{11} *we (in) drink two*

ʔyɥ^{21} *you (pl) do not know*

ʔyɥ^{31} *we (in) drink*

ʔyɥ^{41} *we (in) do not drink*

(12) Tone clusters /214 314 414 424/:

čɭh^{214} *we (ex) do not get dressed*

čɭh^{314} *we (ex) get dressed*

čɭh^{414} *we (ex) will get dressed*

nɨ^{4}čɭh^{424} *we (ex) will rob (it)*

2. *Allophones*

The four single tones are normally realized as level tones, while clusters of two tones are realized as a step from the level of the first to the level of the second when on different syllables, with or without a word break.

Tone /1/ is normally a high level tone. It is initiated with a slight upglide levelling to a high level when utterance initial on the first syllable of a two-syllable word with the tone sequence /1:1/, and is a raised high level tone when it precedes a tone /4/ on the same syllable. This may be expressed by rule (13). Examples are given in (14).

(13) /1/ → { [↑1] / #__:1 ; [1+] / __4 ; [1] }

(14) te^{1}ncɥ^{1} [tɛ̌ⁿdz̄ɥ̄] *goat* A568

šnu^{14} [ʂnɥ̀] *squirrel* A56

thɥ^{1} [tʊ̄ɥ̄] *first* A587, S15^{4}

Tone /2/ is normally a level mid tone, but is realized as a slightly raised level mid tone when it precedes /3 34 4/ on the same syllable, or an upgliding cluster beginning with /4/ (i.e., /41 42 414 424/).

(15) /2/ → { [2+] / ___3(4), 4(T(4)) ; [2] }

(16) sį^{24} [s↑↘] *we (ex) sing*

nʈu^{2} [ñg$^{i\hat{}}$ʉ] *cacao*

Tone /3/ is normally a level low-mid pitch, but is realized as a slightly raised level low-mid tone when it precedes tone /4/ on the same syllable or an upglide beginning with tone /4/ (i.e., /41 42 414 424/), and it may optionally be realized as a level raised mid tone when it occurs on a syllable interrupted by /ʔ h/ along with the cluster /14/.

$$(17)\quad /3/ \rightarrow \begin{cases} [3+] \;/\; \_\_\,4(T(4)) \\ ([2+] \;/\; ʔ,h \_\_\,14) \\ [3] \end{cases}$$

(18) čįʔ^{34} [ʈšįʔį] *we (ex) will buy*

čįʔ^{314} [ʈšTʔį↘] *we (ex) buy*

čįʔ^{3} [ʈšįʔį] *flat*

Tone /4/ is normally realized as a level low tone, but is a low falling tone when it is the only tone on a syllable which is utterance final, is realized as zero when it follows at least one other tone on the same syllable and precedes another syllable, and may optionally be realized as zero when it follows at least one other tone on the same syllable and is utterance final.

$$(19)\quad /4/ \rightarrow \begin{cases} [4\downarrow] \;/\; \_\_\,\# \\ \emptyset \;/\; (T)\; T\_\_:T(T)(T) \\ (\emptyset \;/\; (T)T\_\_\#) \\ [4] \end{cases}$$

(20) ti^{4} [tį] *fish* A485

rka^{14}ča^{4} [Řkā ʈšā] *he is blind* A622

rka^{14} [Řkā] *blind* A622

nti^{4}ya^{2} [ndį$^{i\hat{}}$ā] *road* A392

The tone clusters are normally realized as glides between the levels that their constituent tones would have on single syllables. The cluster /42/, however, has divergent realizations in two environments. It is a downglide beginning at [1+] and gliding down to [2-] with little or no upglide when it follows a syllable with the cluster /14/, and is a downglide beginning at [2+] and gliding down to [2-] with little or no upglide when it follows a syllable with the cluster /24/.

(21) $^{42} \rightarrow \begin{cases} [^{1+2-}]\ /^{14}:\_\_\_(^{4}) \\ [^{2+2-}]\ /^{24}:\_\_\_(^{4}) \end{cases}$

(22) nu^{14}hą^{42} [n̄ųAą̂˥˩] *we (in) say* S10

kue^{14}cę^{42} nɨ^{24}ʔña^{42} [kᵘε^tsę˥˩·nɨʔñˡą·] *we (in) will begin* S37

There is a tendency for a sequence of tones to drift downward in pitch. This affects the phonetics of tone in at least four ways.

The interval between the phonetic pitches of a downstepping sequence of tones is generally greater than that of its corresponding reverse upstepping sequence. The interval between a sequence of tones /^{1}:^{2}/, for example, is generally greater than that between a sequence /^{2}:^{1}/. Similarly, in successive occurrences of the same tone or tone cluster within a phrase, each successive occurrence of the tone is slightly lower in pitch than the preceding one. In (23), the second occurrence of /^{1}/ is slightly lower than the first occurrence of /^{1}/, the second occurrence of /^{14}/ is slightly lower than the first occurrence of /^{14}/, and the pitch of /^{2}/ at the end of the phrase is almost as low as that of /^{4}/ at the beginning of the phrase.

(23) sa^{4}ʔmi^{1} ču^{14} ho^{1} ntɨ^{14}ya^{2} *the animal will make two trips* S31

Downdrift of two successive occurrences of the same tone or tone cluster generally occurs only if the second occurrence of the tone cluster is unchanged by tone sandhi rules. If, however, the tone of the second syllable is changed by one of the tone sandhi rules to become like the tone on the preceding syllable, then the second occurrence of the tone will generally take the same absolute pitch as the first occurrence. This feature seems to be most pronounced on level /^{1}/, less so on level /^{2}/, and very slight on level /^{3}/. It does not operate on level /^{4}/. At the end of an utterance, however, there is generally a step down in pitch between successive occurrences of the same tone or tone cluster in the last two or three syllables regardless of the occurrence of tone sandhi. In the final syllable of an utterance, a single tone may optionally terminate with a slight downglide. Tone /^{4}/ always has a downglide in this context as indicated in (19) above.

Downdrift occurs throughout an atterance until the speaker pauses, at which time he may shift the absolute pitch of his voice up to a higher range to compensate for the gradual drift down. Although pauses do not necessarily correspond with grammatical sentences, raises in pitch of this sort usually correspond with pauses at the boundaries of grammatical sentences.

3. Distribution

The four tones may occur singly, or in combinations of two or three on a single syllable. Of the 16 possible slusters of two tones, only eight occur within a single syllable. These are presented in matrix (24).

(24)

11			14
21			24
31			34
41	42		

The sequence /11/ ordinarily would be considered a single tone. Because of tone sandhi which will be discussed below, however, the sequence /31/ becomes /11/ in some context. In such instances, /11/ is treated as a cluster.

Of the four upglides, three end in /1/; of the three downglides, all end in /4/.

In addition, there are five glides composed of one of the four sequences of two tones ending in /1/ or /2/ plus a downglide to /4/, yielding /114 214 314 414 424/.

A voiced consonant in the syllable margin tends to carry the pitch of the initial tone of the syllable. An exception to this rule is that when a nasal consonant is followed by a plosive, with or without a preceding /ʔ/, the nasal is generally pronounced with the pitch of the preceding syllable, with any step up or down being realized between the nasal and its plosive. Voiceless consonants do not carry tone. In the case of one-syllable words spoken in isolation, any single tone or any tone cluster may occur with a single uninterrupted vowel, whether nasalized or not, with the following exceptions:

(a) Cluster /314/ only occurs on a syllable with an interrupted vowel, and

(b) clusters /21 214 414/ only occur with nasalized vowels.

On one-syllable words spoken in isolation, any single tone or tone cluster may occur on a syllable with an interrupted vowel, whether nasalized or not,with the following exceptions:

(c) Tones /1 14/ do not occur with interrupted vowels;

(d) cluster /24/ only occurs with a nasalized vowel when interrupted by /ʔ/, and never occurs with a vowel interrupted by /h/;

(e) the clusters /21 214 414/ only occur with nasalized vowels when interrupted by /h/, and never occur with vowels interrupted by /ʔ/; and

(f) the cluster /41/ occurs only with vowels interrupted by /h/, whether nasalized or not, and never with vowels interrupted by /ʔ/.

On one-syllable words spoken in isolation, any single tone or tone cluster may occur with a vowel onglide within the syllable, with the following exception:

(g) The clusters /14 24 34 414/ do not occur with a vowel onglide.

4. Tone Sandhi

Unlike Huautla Mazatec (K. Pike 1948:95), Chiquihuitlan Mazatec has both tone sandhi and some subclassification according to arbitrary tonomechanical differences. Another Mazatec dialect reported to have tone sandhi is the Soyaltepec dialect (E. Pike 1956).

The tone sandhi rules apply to tones on different syllables, but not to the relationship of two or three tones that may constitute a cluster on the same syllable. Rule 1 must precede Rule 6; Rule 4 must precede Rule 7; and Rule 5 must precede Rule 8.

The rules should be applied in succession, syllable by syllable, over an entire utterance. That is, Rule 1 should be applied, if applicable, to the first syllable of an utterance, then to the second, third, etc., until a phonological pause is reached, at which time return to syllable one again and apply Rule 2. Once a rule has been passed in the sequence of rules, it can no longer be applied out of order. In the case of a native speaker, of course, the procedure is obviously different. Whereas the recommended procedure here is for earlier rules to apply to the basic tones of a morpheme and then for subsequent rules to apply to the changed tones until all the rules have been applied, a native speaker presumably applies any and all applicable rules to each syllable, or perhaps to small groups of syllables that may operate together, as he goes along.

The basic tone of a morpheme is that which occurs with the morpheme when spoken in isolation. In the case of a bound morpheme, its basic tone can be determined by observing it when following a tone /4/, since a tone /4/ never causes a following tone to change. Otherwise, a bound morpheme may be observed in several different environments and its basic tone deduced from the way it changes in each context.

Grammatical tone on a verb, marking person and aspect (C. Jamieson 1974), and the tone of some compound nouns made up of a

noun plus an adjective, are considered basic.

The tone sandhi rules apply to the tones of successive syllables regardless of whether those syllables belong to nouns, verbs, particles, etc. They also apply to the tones of successive syllables regardless of morpheme or word boundaries, with a few exceptions which will be mentioned below, of certain two-syllable word groups which have a tone /$_3$/ or /$_4$/ on the first syllable.

Tone Sandhi Rules 1 through 5 are progressive in their application, causing a following tone to change. Tone Sandhi Rule 6 is regressive in its application, causing a preceding tone to change. Tone Sandhi Rules 7 and 8 are negative environment rules in which the tone changes occur everywhere except in the environments stated.

The tone sandhi rules generally apply throughout an utterance until a pause which coincides with the end of a grammatical sentence is reached. A speaker may choose, however, to stop applying the rules at a longer pause even if it is not at the end of a grammatical sentence, in which case he resumes speaking on the basic tone of the next word without regard to whether it would be changed by juxtaposition with the preceding word or not. The speaker may also choose to join two or more grammatical sentences into a single phonological sentence with no pause, and may or may not stop the continuous application of the tone sandhi rules at the end of the grammatical sentences within the phonological sentence.

In Tone Sandhi Rule 1, a /$_3$/ is realized as /$_1$/ following a syllable with a tone /^{1}/, whether the /$_1$/ of the environment is a single tone or the final tone of a cluster, and whether the underlying /$_3$/ is a single tone or the initial tone of a cluster.

(25) TONE SANDHI RULE 1.

$_3 \rightarrow {}_1$ / :(T)$_1$:___(T)

sua^1 *I give* + rkĭ^3 *medicine* → sua^1 rkĭ^1 A415

kĭh^{31} *went* + -nka^3 *again* + mu^{3}su^{34} *hired worker* → kĭh^{31}nka^1 mu^{1}su^{14} S13

In Tone Sandhi Rule 2, tone /$_3$/ is realized as /$_2$/ following a syllable with a tone /$_2$/ when the latter is a single tone or the final tone of a cluster, and when the underlying /$_3$/ is a single tone or the initial tone of a cluster of 2 or 3 tones within the syllable.

(26) TONE SANDHI RULE 2.

$_3 \rightarrow {}_2$ / :(T)$_2$:___(T)(T):

nku^{2}ʔñu^{2} *rapidly* + hbä^{3} *it finishes* → nku^{2}ʔñu^{2} hbä^{2} S22

nku^{2} *one* + nʇa^{3}ʔnka^{34} *corncrib* → nku^{2} nʇa^{2}ʔnka^{24} S37

There are two kinds of context in which these tone sandhi rules do not apply. First, Rule 1 does not apply to the /^{3}/ of the first syllable of a two-syllable word whose second syllable has tone sequence /^{14}/ or /^{314}/, or to the /^{3}/ of the second syllable of a three-syllable word whose third syllable has the tone sequence /^{14}/. Note, however, that in this last case, the /^{3}/ of a first syllable does become /^{1}/.

(27) khui^{1} *it is going* + ni^{3}sę^{14} *mouse* → khui^{1} ni^{3}sę^{14}

hyu^{31} *quiet* + ka^{3}hbeʔ^{314} *you (sg) arrived* → hyu^{31} ka^{3}hbeʔ^{314}

Secondly, Tone Sandhi Rules 1 and 2 do not apply to the /^{3}/ of the following list of words:

ta^{3} *(cause)* S2
koh^{3} *with* S1, A189
cih^{3} *yours (sg)* A39
cų^{3} *your (pl) brother*
če^{3} *you (sg) will buy*
nuh^{3} *your (pl) tongue*
khue^{3} *he will go away*
khuä^{3} *it will get used up* S18
nce^{3} *your (sg) hand*
nca^{3} *my hand*
ncų^{3} *your (pl) hand*
šte^{3} *you (sg) dance*
štä^{3} *I dance*
štę^{3} *my forehead*
štį^{3} *your (sg) forehead*
štų^{3} *your (pl) forehead/ you (pl) dance*
škų^{3} *my/your (pl) face*
škųi^{3} *your (sg) face*
rku^{3} *my head*
rkų^{3} *your (pl) head*
rkui^{3} *your (sg) head*
čäʔ^{3} *I am drunk*
čųʔ^{3} *you (pl) will buy/are drunk*
sįuʔ^{3} *you (pl) drink*
neh^{3} *my tongue*
nih^{3} *your (sg) tongue*
čiʔ^{3} *you (sg) are drunk*
štį^{34} *our (ex) forehead*
škųi^{34} *our (ex) face*
rkųi^{34} *our (ex) head*
cąʔ^{34} *mine*
cįh^{34} *ours (ex)*
čįʔ^{34} *we (ex) are drunk*
ncį^{34} *our (ex) hand*
seʔ^{34} *scarcely/just* S6
šįʔ^{34} *man* A522
naa^{34} *mother* A253
nih^{34} *our (ex) tongue*
nteh^{34} *sugar cane*
nkąʔ^{34} *I* S6, A693
-ʔą^{34} *I*

(28) kue^{4}hña^{2}ya^{1} *will wait* + ta^{3} *(cause)* → kue^{4}hña^{2}ya^{14} ta^{3} S15

ka^{3}ma^{1} *became* + nką?^{34} *I* → ka^{3}ma^{14} nką?^{34} S6

In Tone Sandhi Rule 3, a tone /4/ is realized as a cluster /14/ following a syllable with a tone /1/, whether the latter is a single tone or the member of a cluster of two or three tones.

(29) TONE SANDHI RULE 3.

4 → 14 / :(T)1(T):___:

ho^{1} *two* + khua^{4} *word* → ho^{1} khua^{14} S1

le^{4}?ba^{14} *hoe* + ne^{4} *uh* → le^{4}?ba^{14} ne^{14} S13

In Tone Sandhi Rule 4, a tone /4/ is realized as a cluster /24/ following a syllable in which two is the highest tone, whether the latter is a single tone or the member of a cluster with tone /4/.

(30) TONE SANDHI RULE 4.

4 → 24 / :(4)2(4):___:

nu^{2} *year* + ne^{4} *uh* → nu^{2} ne^{24} S3

kui?^{42} *will drink* + me^{4} *they* → kui?^{42} me^{24} S18

In Tone Sandhi Rule 5, a tone /4/ is realized as the cluster /34/ following a syllable whose highest tone is /3/, whether the latter is a single tone or a member of a cluster within the syllable.

(31) TONE SANDHI RULE 5.

4 → 34 / :3(4):___:

koh^{3} *with* + me^{4} *they* → koh^{3} me^{34} S5

šu^{3}ma^{34} *poor* + hnu^{4} *corn plant* → šu^{3}ma^{34} hnu^{34} S20

Rules 3 through 5 apply only to a single tone /4/. When this tone is the initial tone of a cluster, it does not change except in the bound morpheme -nuh^{41} *your (pl)*, which is pronounced with tone /3/ as its highest tone. Thus, rki^{3}nuh^{31} *your (pl) medicine*.

There are also a few arbitrary exceptions to Rule 5. It does not apply to the /4/ of the first syllable of a two-syllable word whose second syllable has /1 2 3 14 24 424/.

(32) ta^{3} *(cause)* + šku^{4}sų^{14} *custom* → ta^{3} šku^{4}sų^{14} S18

Speakers seem to apply Rule 5 only optionally to the /⁴/ of the first syllable of a two-syllable word whose second syllable has /³⁴ ⁴² ⁴¹/.

(33) khue⁴ *will go* + -sa³ *more* + nɪ⁴štɨ³⁴ *day* → khue⁴sa³ nɪ³⁴štɨ³⁴ ~ khue⁴sa³ nɪ⁴štɨ³⁴ S28

Tone Sandhi Rule 5 does apply to the /⁴/ of all one-syllable words and of the first syllable of the remaining two-syllable words whose second syllable has /⁴/ or /⁴¹⁴/.

(34) ʔo³ *oɪ* + sa³ šɪ³ *if* + cä?⁴ *its* + na⁴hñu⁴ *turkey* → ʔo³ sa³ šɪ³ cä?³⁴ na³⁴hñu³⁴ S17

In Tone Sandhi Rule 6, a tone /¹/ is realized as a cluster /¹⁴/ in a set of complex environments which are indicated in the rule by the variable *x* and explained in detail below.

First of all, the tone /¹/ which changes may be a single tone or the second member of a cluster. It may also be separated from the relevant context by any number of syllables with tone /¹/ intervening in unbroken sequence. In such cases, each occurrence of /¹/ in the sequence is realized as the cluster /¹⁴/.

In the rule, the variable *x* stands for four environments:

(a) a syllable with a basic tone cluster /¹⁴/ which has not resulted from the operation of tone sandhi upon it,

(b) any of the forms listed above as constituting exceptions to the application of Sandhi Rules 1 and 2,

(c) a syllable with a tone cluster whose first member is /⁴/, or

(d) the bound morpheme -rä⁴ *its* or its fused compounds -rą⁴ *her*, -ru⁴ *its (animal)*, or -ra² *his*. (These bound morphemes are the only constituents of Class E forms. Note that the tone /⁴/ of these morphemes is realized as a cluster /¹⁴/ when serving as the context for the change of Tone Sandhi Rule 6 because of Tone Sandhi Rule 3.)

(35) TONE SANDHI RULE 6.

$1 \rightarrow 14 \;/\; : (T)\_\_\_(:1)^{n} : x$

ku⁴ma³ *will be able* + ča²yąɪ²¹ *not noticeable* + -nah⁴² *to us (in)* → ku⁴ma³ ča²yąɪ²¹⁴nah⁴² S25

saɪʔmeɪyaɪ *I work in company* + koh³ *with* → sa¹⁴ʔme¹⁴ya¹⁴ koh³ S21

Notice that the only syllables with tone /3/ that may occur after a single tone /1/ are the /3/ of the cluster /314/ and the /3/ of the first syllable of two-syllable words whose second syllable has /14 314/ and the /3/ of the second syllable of three-syllable words whose third syllable has /14/.

As mentioned above, Tone Sandhi Rule 7 is a negative environment rule which applies everywhere except in the stated environments which are therefore marked by an *. The rule states that a tone cluster /24/ is realized as a single tone /2/ in all environments except following a tone /2/ in the preceding syllable (whether or not /24/ is preceded within the syllable by /4/), or preceding either pause or a /2/ in the following syllable. The rule applies to any number of syllables with /24/ occurring in unbroken sequence.

(36) TONE SANDHI RULE 7.

$$24 \rightarrow 2 \;/\; * \begin{cases} 2{:}(4)\_\_ \\ \_\_\#,{:}2 \end{cases}$$

ba^{3}nkɻ^{24} *we (ex) go* + šɨ^{3} *to* → ba^{3}nkɻ^{2} šɨ^{3} S16

kue^{4}cɻ?^{424} *they will begin* + ku^{4}ma^{3}sɨ^{3}ne^{1} *will become yellow* → kue^{4}cɻ?^{42} ku^{2}ma^{3}sɨ^{3}ne^{4} S25

But: kue^{4}cɻ?^{424} *they will begin* + ?ñu^{2} *strong* + ku^{4}ma^{3}sɨ^{3}ne^{1} *will become yellow* → kue^{4}cɻ?^{424} ?ñu^{2} ku^{24}ma^{3}sɨ^{3}ne^{1} S26

Tone Sandhi Rule 8 is also a negative environment rule, as indicated by the *. It states that sequence /34/ is realized as single tone /3/ in all environments except when following a /3/ or preceding pause or /3/. As in the case of Rule 7, Rule 8 applies to any number of syllables with cluster /34/ occurring in unbroken sequence.

(37) TONE SANDHI RULE 8.

$$34 \rightarrow 3 \;/\; * \begin{cases} 3{:}\_\_\_\_ \\ \_\_\_\#,{:}3 \end{cases}$$

se?^{34} *then* + kue^{14}cę^{42} *we (in) will begin* → se?^{3} kue^{14}cę^{42} S37

ka^{3}ma^{1} *became* + nką?^{34} *I* + šɻ?^{34} *man* + cä?^{4} *of (3p)* + khua^{4}ta^{3}kų^{14} *mind* → ka^{3}ma^{14} nką?^{3} šɻ?^{3} cä?^{3} khua^{4}ta^{3}kų^{14} S6

But: nke?^{34} *here* + kuɨ^{3}čha^{1} *I will say* → nke?^{34} kuɨ^{3}čha^{1} S1

Having stated the tone sandhi rules, it is now possible to summarize the occurrence of tone patterns across syllable boundaries. Matrix (38) indicates the privilege of occurrence of tone patterns in the case of two successive one-syllable words.

(38)	1	14	11	2	24	21	214	3	34	31	314	4	41	414	42	424
1	OK	Σ	Σ	OK	Σ			1 6	1 6	1		3	6	6	6	X
11	Σ	Σ						1 6	1 6	1		3	6	6	6	X
21		Σ		OK				1 6	1 6	1	Σ	3	6	6	6	X
31	OK	Σ		OK				1 6	1 6	1	OK	3	6	6	6	X
41		Σ	Σ	OK				1 6	1 6	1		3	6	6	6	X
2	OK	Σ	(	OK	Σ	Σ	Σ	OK	OK	2	2	4			OK	X
42			(	OK	Σ					2	2	4				X
3	OK	Σ	(	OK	OK	OK		OK	Σ	OK	OK	5			OK	X
4			(	OK	OK	OK		OK	OK	OK	Σ	OK	OK			X
14	Σ	Σ	(	Σ	Σ			Σ	Σ	Σ	Σ	3			Σ	X
214		Σ	(					Σ	Σ			3				X
314		Σ	(	OK				OK	Σ		OK	3	Σ			X
414			(									3				X
24	Σ		(	Σ	Σ			Σ	Σ	Σ	Σ	4				X
424	X	X	(	X	X	X	X	X	X	X	X	X	X	X	X	X
34			(	OK	Σ	Σ		OK	OK	OK	Σ	5	Σ	Σ	Σ	X

Each cell of matrix (38) is coded to indicate the status of occurrence of the sequence of one-syllable words whose first member has the tone indicated directly to the left of the cell in question and whose second member has the tone indicated directly above that cell.

Forty-one cells contain an X to identify the sequences not permitted due to the fact that the clusters /11 424/ never occur as basic clusters on monosyllabic words.

Forty-eight cells of the matrix occur with the number of one or two tone sandhi rules, indicating that these sequence do not occur because of the automatic operation of these rules.

Forty-six cells of the matrix are coded with Σ to indicate that they have been observed in a corpus of 765 lines of text as the result of the operation of a tone sandhi rule. Most of these sequences could have occurred as basic sequences apart from tone sandhi. The exceptions are: (T)1 + 14, (T)1 + 11, and 11 + T(T). The first of these sequences may not occur as a basic sequence because of the operation of Tone Sandhi Rule 6. It occurs as a derived sequence by the operation of Tone Sandhi Rules 1 or 3. The other two sequences may occur only as the result of the operation of Tone Sandhi Rule 1 because of the fact that cluster /11/ does not occur as a basic tone sequence on any one-syllable words.

Thirty-six cells of the matrix are coded by OK to indicate that those sequences have been observed to occur in the 765 line corpus referred to above. The remaining 85 unmarked cells represent sequences that are permissible but which were not found in the text material reviewed. Many of these sequences will presumably be found in other texts. Some of the tones and clusters in question, however, occur on very few words and will therefore be rare (e.g., /42 214 414/). Other tones occur on words that are restricted to one grammatical category (such as the tone cluster /21/ which occurs only on negative verbs), and it is unlikely that two such words would ever be juxtaposed in a sentence.

In summary, of the 256 theoretically possible sequences of tones on two successive monosyllabic words, 89 do not occur either because of the restricted distribution of the clusters or because of tone sandhi rules. This leaves 167 permitted sequences, of which 82 have so far been observed in about 765 lines of text.

Matrix (39) is coded to indicate the occurrence of sequences of tone within two-syllable words.

(39)

	1	14	11	2	24	21	214	3	34	31	314	4	41	414	42	424
1	OK	Σ	Σ	OK	Σ			1 6	1 6	1		3	6	6	6	6
11	σ			σ				1 6	1 6	1		3	6	6	6	6
21	OK							1 6	1 6	1		3	6	6	6	6
31	OK			*OK*				1 6	1 6	1		3	6	6	6	6
41	OK							1 6	1 6	1		3	6	6	6	6
2	OK	Σ *OK*	X	OK	OK	OK	Σ *OK*	*OK*	*OK*	2	2	4	OK	*OK*	*OK*	
42			X	*OK*		*OK*	σ	*OK*	*OK*	2	2	4	*OK*	σ	*OK*	
3	OK	OK	X	OK	OK			OK	OK	OK	OK	5			OK	
4	OK	OK	X	OK	*OK*			OK	OK			OK	OK	OK	OK	OK
14	Σ	OK	X	Σ *OK*	Σ *OK*			OK	Σ *OK*			3	OK	Σ	OK	Σ
214		OK	X	Σ *OK*				*OK*	*OK*			3	*OK*	σ	*OK*	
314		OK	X	*OK*				OK	*OK*			3	OK	σ	OK	
414		OK	X	*OK*				*OK*	*OK*			3	*OK*	σ	*OK*	
24	Σ	Σ	X	Σ *OK*	Σ			Σ	Σ			4	Σ	Σ	Σ	σ
424			X	*OK*								4				
34			X						OK			5	σ	σ	σ	

The cells of matrix (39) are coded to indicate the status of two-syllable words whose first syllable has the tone indicated immediately to the left of the cell and whose second syllable has the tone indicated immediately above the cell.

Eleven cells are coded by X to indicate the non-occurrence of those sequences because of the fact that the cluster /11/ never occurs as the basic tone of any syllable.

Fifty-four cells are coded with one or two numbers to indicate that the sequences in question do not occur because of the operation of particular tone sandhi rules.

Forty cells are coded by OK to indicate that those sequences have been observed in two-syllable words within the corpus of 765 lines of text reviewed. An additional 31 cells are coded by *OK* to indicate that these sequences have been observed in elicited material but not within the particular extended text material reviewed.

Twenty-one cells of the matrix are coded by Σ to indicate that the sequences of tone in question were observed in the text material reviewed, but only as a result of the operation of a tone sandhi rule. Seven of these 21 sequences have also been observed on two-syllable words which have been independently elicited apart from text material.

An additional 11 cells of the matrix are coded by σ to indicate that the sequences in question have been observed as a result of tone sandhi operations in independently elicited material apart from the corpus of text material.

The remaining 95 unmarked cells of the matrix represent sequences of tones that have not been observed on two-syllable words either in the corpus or in other elicited material.

In summary, of the 256 theoretically possible sequences of tones on two-syllable words, 160 have not been observed. Of the 96 occurring sequences, 71 occur as basic sequences and 25 as the result of tone sandhi.

Of the more than 4,000 theoretically possible sequences of tone on three-syllable words, only around 100 are known actually as basic sequences. Upgliding tone clusters are rare in first and second syllables. Downgliding tone clusters, except /14/, are extremely rare in first and second syllables. Any tone or tone cluster, except /11 424/, may occur in the third syllable.

5. Relation to Grammatical Forms

Each word in my corpus has been assigned to a class on the basis of its basic tone or tone sequence. For example, the basic tone /1/ class consists of all the one-syllable words that are pronounced in isolation with a tone /1/, and the basic tone se-

quence /2:21/ class consists of all the two-syllable words that are pronounced in isolation with that tone sequence. There is also a tone cluster class /11/, and several tone sequence classes that occur only as result of tone sandhi. Only basic tone classes will be discussed in this section, since all of them can be pronounced in isolation and are included in the basic classes.

The basic tone /1/ class consists of about thirty words. None are nouns, except for personal names, e.g., /hųą^{1}/ *Juan*. The basic tone /2/ class consists of over one hundred words of all grammatical types. The basic tone /3/ class consists of over seventy words of all grammatical types. The basic tone /4/ class consists of over fifty words. Only about six are verbs, eight are adjectives, and the rest are nouns.

The basic tone cluster /14/ class consists of about ten words from various grammatical types. The basic tone cluster /24/ class consists of about ten words from various grammatical types. The four nouns are all Spanish loans. The basic tone cluster /34/ class consists of about twenty-five words from various grammatical categories.

The basic tone cluster /21/ class consists of about seventy words; all are negative verbs except for the negative adjective ntąih^{21} *not good*. The basic tone cluster /31/ class consists of about fifty words, none of which are nouns. These are the same words that make up the tone cluster /11/ class in the environment following a tone /1/ because of Tone Sandhi Rule 1. The basic tone cluster /41/ class consists of about fifty words, all of which are verbs, mostly marked for incompletive aspect, except for the adjective cųh^{41} *yours (pl)*.

The basic tone cluster /42/ class consists of fewer than twenty words from various grammatical categories.

The basic tone cluster /214/ class consists of about twelve words, all of which are negative first person plural exclusive verbs ending with -ị, except for two words which are negative first person singular verbs.

The basic tone cluster /314/ class consists of about thirty words from various grammatical types. The basic tone cluster /414/ class consists of less than ten words, all of which are negative first person plural exclusive verbs.

Basic tone sequence classes of two-syllable words are referred to according to size in the following way: less-than-ten-words, small (10-50 words), medium (50-100 words), and large (over 100 words).

Some classes contain only verbs. The following four basic tone sequence classes each contain less than ten words, all of which are verbs: /4:424/ (all have interrupted final syllable),

/14:24/ (only one word), /31:2/, and /414:2/.

The basic tone sequence /4:24/ class is small, and all words are incompletive aspect first person plural exclusive or incompletive aspect third person verbs.

Six basic tone sequence classes contain only one-syllable verbs plus suffixes: /31:1/ (e.g., /meh^{31}na^{1} *I want*) and /41:1/ are both medium classes; /414:14/ is small, all forms ending in -rä^{4} *to him*, -rą^{4} *to her*, or -ru^{4} *to it (animal)*; /414:34/ is less than ten words, all ending in -nih^{34} *to us (ex)*; /414:41/ is less than ten words, all ending in -nuh^{41} *to you*; and /414:42/ is less than ten words, all ending in -nah^{42} *to us (in)*.

Three basic tone sequence classes contain only negative verbs: /2:214/ is small, all first person plural exclusive, ending in -į; /2:414/ is under ten words; /42:21/ is under ten words, all marked for incompletive aspect.

Eight basic tone sequence classes contain only one-syllable negative verbs plus suffixes: /21:1/ is large; /214:2/ is less than ten words, all ending in -ra^{2} *to him*; /214:3/ is small; /214:14/ is small, all ending in -rä^{4} *to it*, -rą^{4} *to her*, or -ru^{4} *to it (animal)*; /214:34/ is small, all ending in -nih^{34} *to us (ex)*; /214:41/ is less than ten words, all ending in -nah^{41} *to you (pl)*; /214:42/ is less than ten words, all ending in -nah^{42} *to us (in)*; /414:3/ is small.

Eleven basic tone sequence classes contain mostly verbs: /1:2/ is small; /2:1/ is small, the verbs all ending with a directional suffix; /2:21/ is large, about three hundred forms, the most common tone pattern for negative verbs; /3:1/ is large, including only fifteen non-verbs; /3:24/ is small, including a few Spanish loan nouns; /3:31/ is medium, all non-verbs being nouns ending in -nuh^{41} *your (pl)*; /3:314/ is small, including only three nouns; /4:1/ is medium, all the verbs being incompletive, imperative, or both, and only six of the forms being non-verbs; /4:414/ is small, including only two nouns; /14:3/ is medium, all the verbs being first or second person; /42:2/ is small, all forms being one-syllable plus a suffix.

Seven basic tone sequence classes contain verbs and nouns: /4:41/ is large, about half being negative verb forms, and all the nouns being one-syllable with tone /4/ plus -nuh^{41} *your (pl)*; /4:42/ is medium, nearly all words being first person plural inclusive forms, and the nouns being nearly all bound or fused possessive forms; /14:14/ is less than ten words, mostly one-syllable words with tone /1/ or cluster /14/ plus -rä^{4} *its*; /14:34/ is small, all words being first person plural exclusive forms, the verbs being all positive, the nouns being all one-syllable nouns with the cluster /14/ plus -nih^{34} *our (ex)*; /14:41/ is under ten words, both

verbs and nouns being one-syllable plus -nuh^{41} *you (pl)*; /$^{14:42}$/ is small, all words being first person plural exclusive forms, all the nouns one-syllable plus -nah^{42} *our (in)*; /$^{2:41}$/ is small, almost all the verbs being negative, and all the nouns being one-syllable with tone /^{2}/ plus -nuh^{41} *your (pl)*.

Five basic tone sequence classes are all one-syllable words plus suffixes: /$^{314:3}$/ is small; /$^{314:14}$/ is small, and most forms end in -rä^{4} *its*, -rą^{4} *her*, or -ru^{4} *its (animal)*; /$^{314:34}$/ is small, all words ending in -na?^{34} *my* or -nih^{34} *our (ex)*; /$^{314:41}$/ is small, all ending in -nuh^{41} *you (pl)*; /$^{314:42}$/ is small, all forms ending in -nah^{42} *our (in)*.

Nine basic tone sequence classes contain words from various grammatical categories, including adjectives, adverbs, etc.: /$^{1:1}$/ is medium, and includes many first person singular verbs; /$^{2:2}$/ is large; /$^{2:14}$/ is under ten words; /$^{2:24}$/ is large, many of the words being positive first person plural exclusive neutral aspect verbs ending in -ą; /$^{3:2}$/ is large; /$^{3:3}$/ is large; /$^{3:14}$/ is medium; /$^{4:2}$/ is large, all the verbs being incompletive, imperative, or both; /$^{4:3}$/ is large, all the non-compound verbs being incompletive, imperative, or both, and many of the nouns being obligatorily possessed, consisting of a body part and a fused person marker (cf. C. Jamieson, 1974:2f).

Ten basic tone sequence classes contain mostly nouns: /$^{3:34}$/ is large, including about thirty Spanish loan nouns; /$^{4:4}$/ is large, including only two verbs; /$^{4:14}$/ is small, with only seven verbs; /$^{4:34}$/ is medium, including only two verbs; /$^{14:2}$/ is under ten words, one form nti^{14}ll^{2} *little bell* probably being a Spanish loan, and the rest being all one-syllable words with tone /^{1}/ or cluster /^{14}/ plus -ra^{2} *his*; /$^{24:2}$/ is small, all words being one-syllable with tone /^{2}/ plus -ra^{2} *his*; /$^{2:3}$/ is small, all the nouns being bound or fused possessive forms, and the bound forms being all one-syllable with tone /^{2}/ plus -rih^{3} *your (sg)*; /$^{2:34}$/ is small, all the nouns being one-syllable with tone /^{2}/ plus -na?^{34} *my* or -nih^{34} *our (ex)*; /$^{2:42}$/ is small, all words being first person plural inclusive forms, mostly one-syllable with tone /^{2}/ plus -nah^{42} *our (in)*; /$^{314:2}$/ is less than ten words, mostly one-syllable nouns with the tone cluster /^{314}/ plus -ra^{2} *his*.

Four basic tone sequence classes contain less than ten words each, and all are one-syllable words with the cluster /^{42}/, mostly nouns, plus the suffixes indicated: /$^{424:2}$/ with -ra^{2} *his*; /$^{42:34}$/ with -na?^{34} *my* or -nih^{34} *our (ex)*; /$^{42:41}$/ with -nuh^{41} *your (pl)*; /$^{42:42}$/ with -nah^{42} *our (in)*.

Three basic tone sequence classes contain all one-syllable nouns plus the suffixes indicated: /$^{34:34}$/ is small, ending in -na?^{34} *my* or -nih^{34} *our (ex)*; /$^{3:42}$/ is small, ending in -nah^{42} *our (in)*; /$^{42:3}$/ is less than ten words, ending in -rih^{3} *your (sg)*.

6. Text

The following text was originally recorded in early 1970 by Mr. Ernesto Tejeda Salvador, in his mid-forties, a native and present resident of Chiquihuitlan. After transcribing the actual text from the tape, Mr. Tejeda did minor editing to remove pause forms, etc. Then, in 1974 he re-recorded it, reading from the edited text, which, incidentally, was written in the popular orthography in which tones are not written. In addition, he re-recorded the text by whistling it all the way through. In my judgment the only undersirable effect obtained by this procedure was that Mr. Tejeda interrupted the application of the tone sandhi rules by inserting more than the normal number of phonological pauses, since he was reading a script rather than just speaking extemporaneously. However, the slower speed of speech and the more frequent pauses greatly facilitated the checking of the tones. The correspondence between the tones of the spoken and the whistled versions confirms the accuracy of the transcription here presented.

Abbreviations used in the text are the following:

(def)	definite article
(ex)	exclusive
(in)	inclusive
(pl)	plural
(pp)	a phonological pause that broke the continued application of the tone sandhi rules
(3p)	3rd person
14*4	basic tone 4, as spoken in isolation, has changed to 14, and similarly for other tone changes
....	more than one Mazatec word the equivalent of one gloss

CHIQUIHUITLAN MAZATEC TEXT

1. nke?^{34} kuI^{3}ča^{14*1} koh^{3}nuh^{31} nku^{2} ho^{1} khua^{14*4} sa^{3}kua?^{34}
here will-say-I with-you-(pl) one two word like

I will tell you something about when I was growing up with

nI^{4}štį^{34}na?^{34} šI^{3} ka^{2}ma^{2}ča^{2} koh^{3} šu^{34*4}ta^{34*4}ča^{2}na?^{34} (pp)
day-my which became-mature with parent-my

my parents.

2. he^{14*1}mu^{14*1} ñtah^{114*31} ka^{14*3}ba^{14}thu^{3} ka^{3}ma^{14*1} ta^{3}
very good passed-I happened for

I had it pretty good, for they did not make me work too

ka^{3}cI^{3}he^{2}ntąI^{21}na^{1} me^{14*4} 3. ?I^{3}ska^{3} šI^{3} ka^{3}be^{14}ču^{3} ţhų?^{2}nku^{2}
did-not-tire-(3p)-me they until ... reached-I sixteen

hard. It was not until I reached

nu^{2} ne^{24*4} se?^{34} ka^{3}be^{14}thu^{3} skue^{3}la^{34} (pp) 4. pe^{4}ru^{4} sa^{3}kua?^{34}
year , then left-I school but like

sixteen years of age that I quit school. However, on

sa^{3}ba^{3}du^{34} koh^{3} do^{3}mI^{3}nkų^{34} šI^{3} cąIh^{31} kIa^{1*3}se^{14*34}
Saturday with Sunday which there-is-not class

Saturdays and Sundays, when there were not any classes, I would

ne^{14*4} hbä^{2} koh^{3} šu^{34*4}ta^{34*4}ča^{2}na?^{34} nkI^{3}hña^{2} 5. me^{2} ša^{2}
, *go-I with parent-my field what work*

go to the fields with parents. I was already

šI^{2*3} sa^{2*3}?mI^{1} me^{24*4} ne^{24*4} (pp) ?a^{4} tI^{3}hba?^{31}kue^{14}nta^{3}
which do-(3p) they , already am-taking-notice-I

taking notice of all the various jobs they would do.

yäh^{3}nI^{2} koh^{3} me^{34*4} 6. ka^{3}be^{3}ču^{1} nu^{2} šI^{2*3} ka^{2*3}ma^{14*1}
everything with them arrived-(3p) year which became

The year that I reached manhood, then

nką?^{3*34} šį?^{3*14} cä?^{3*4} khua^{4}ta^{3}kų^{14} ne^{14*4} se?^{34} ka^{3}be^{14}cę?^{3}
I man of-(3p) mind , then began-I

I began to work just like my parents.

ne^{34*4} ?a^{2}ku^{2}thį^{2} ša^{2} šI^{2*3} sa^{2*3}?mI^{2} šu^{24*4}ta^{24*4}ča^{2}na?^{34} ne^{34*4}
, *how work which do-(3p) parent-my* ,

(pp) ʔa⁴kua⁴thɭ² ka²*³sa¹ʔme¹ (pp) 7. šį³ thų¹thų¹
just-like-that did-I *which first-first*

First of all, I would

ne¹⁴*⁴ ka³mu¹sų¹ (pp) 8. ka³hbä³ ne³⁴*⁴ se?³⁴
, *cleared-I* *was-finished-(3p)* , *then*

clear the land. *After that, then one would*

ʔį³skę¹⁴ šį³ na³nkį³⁴šta¹⁴ ne¹⁴*⁴ ka³bį³nčį³se¹⁴rä¹⁴ nʇah¹⁴*⁴
where .... ground-smooth , *were-looked-for-(3p) cattle*

look for oxen to plow where the ground was smooth (i.e., not

ka³ba³khę² ču²⁴*⁴ 9. ʔį³skę¹⁴ šį³ na⁴šį⁴nʇa³45 ne³⁴*⁴ koh³
broke-(3p) animal *where .... bouldery* , *with*

covered with boulders). *Where there were lots of boulders,*

ɭe⁴ʔba¹⁴ ka³ba²khɭ²⁴ (pp) 10. ʔa⁴kų¹⁴¹ hį²nku²hyä²
hoe broke-we-(ex) *not everywhere*

we would break up the ground with hoes. *We do not say that*

šį²*³ nu¹⁴hę⁴² šį²*³ su²*³ba¹ nʇah¹⁴*⁴ ka³ba³khę² ču²⁴*⁴ (pp)
that say-we-(in) that only cattle broke-(3p) animal

the oxen alone plowed everywhere.

11. ʔa⁴ču⁴ koh³ šu³⁴*⁴ta³⁴*⁴ ka³ba³khę² me²⁴*⁴ koh³ ɭe⁴ʔba¹⁴ ta³
still with person broke-(3p) they with hoe for

People still had to break up the ground with hoes, because

cä?³⁴*⁴ šį³ ʔį³skę¹⁴ na¹⁴*⁴šį¹⁴*⁴nʇa³⁴ ne³⁴*⁴ maɭh³¹ ba¹*³khę²
because ... where bouldery , *cannot break-(3p)*

the oxen cannot plow where there are a lot of boulders.

nʇah²⁴*⁴ 12. šį³ ka²hne²ta?² ka²*³ba²*³khę²*³rä²⁴*³⁴ ne²⁴*⁴
cattle when ended-(3p) was-broken-it ,

After the plowing was done, the plowed ground would

ka³hba³ña³ he³?ntu³ ʔį³skę¹⁴ ka³ba³khę³rä³⁴ hę² 13. nku² ho¹
lay-(3p) rotting where was-broken-it (def) one two

lie fallow. *For several*

nį¹⁴*⁴štɭ³⁴ ne³⁴*⁴ ?ya³ šį³ ka²ma²tį²ña² nį²⁴*⁴štɭ³⁴ šį³
day , *when.... became-near day which*

days, when the time to plant was near, then the oxen and the

šɪ^{4}nča^{1} thä^{14*4} ne^{14*4} se?^{34} ka^{3}bu^{3}ya^{2} klh^{21*31}nka^{1}
will-be-put-in-(3p) seed , then returned-(3p) went-(3p)-again

hired workers with hoes would go back again to replow.

nʇah^{14*4} ne^{14*4} klh^{31}nka^{1} mu^{1*3}su^{14*34} koh^{3} le^{4}?ba^{14} ne^{14*4}
cattle , went-(3p)-again hired-worker with hoe ,

šɪ^{3} khuɪ^{4}nɪ^{3}ya^{1} (pp) 14. ?a^{4} šky^{4} šɪ^{3} ka^{3}hbä^{3}
so will-be-moved when ..... was-finished-(3p)

When the replowing was finished,

ka^{3}hbɪ^{3}nɪ^{3}ya^{1} re^{14*4} se?^{3*34} kue^{4}hña^{2}ya^{14}rä^{14} cɪ^{2} šɪ^{2*3}
was-moved , then will-be-awaited-(3p) rain which

then one would wait for the rain.

kua?^{2*3} (pp) 15. pe^{4}ru^{4} sa^{3} šɪ^{3} nta^{1}hyɪ?^{1} nu^{2} ne^{24*4}
will-rain-(3p) but if.... good-looks year ,

But if it is a good year, one does not

(pp) ?a^{4} ?ɪ^{3}ska^{3} ?a^{4}kyɪ^{41} kue^{14*4}hña^{2}ya^{14*1} ta^{3} tu^{4}nku^{2}
even not will-be-awaited-(3p) for as-soon-as

even wait, for as soon as one finishes replowing, one plants,

kuɪ^{24*4}hne^{3}ta?^{2} khuɪ^{24*4}nɪ^{3}ya^{1} ne^{14*4} (pp) ?a^{4} nku^{3}thę^{34}nɪ^{2}
will-end-(3p) will-be-moved , right-away

for in a good year, it rains early.

šɪ^{24*4}nča^{1} thä^{14*4} ta^{3} ?ya^{3} šɪ^{3} nta^{1}hyɪ?^{1} nu^{2} ne^{24*4}
will-be-put-in-(3p) seed for when.... good-looks year ,

he^{1}mu^{1} thy^{1} ba?^{1*3} cɪ^{2} (pp) 16. ?ya^{3} šɪ^{3} ba^{3}nkɻ^{2*24}
very first rains-(3p) rain when.... go-we-(ex)

When we go to plant,

šɪ^{3} šɪ^{4}nča^{1} thä^{14*4} (pp) ?a^{4}kua?^{4} ma^{1} nku^{2}
so will-be-put-in-(3p) seed also happens one

there is a little matter (to be taken care of).

khua^{24*4}nʇa^{34} lɪ^{3}?ntɪ^{14} 17. ma^{1} nta^{2}hña^{24} ša^{24*4}?nta^{24*4}
bother little is-made <u>mole</u>-sauce chicken

One makes chicken <u>mole</u>, or else

ʔo^{3} sa^{3} šɨ^{3} cä?^{34*4} na^{34*4}hñu^{34*4} šɨ^{3} khue^{34*4} šɨ^{3}
or else... of-(3p) turkey which will-go-(3p) which

turkey <u>*mole*</u>[fn]*, to send out for the planters to eat.*

sɨ^{34*4}ne^{34*4} čа^{2} šɨ^{2*3} bɨ^{2*3}nča^{2} thä^{24*4} 18. šɨ^{3}
will-eat-(3p) they who put-in-(3p) seed when

After

khuä^{3} šɨ^{4}nča^{1} thä^{14*4} ne^{14*4} (pp)
will-be-finished-(3p) will-be-put-in-(3p) seed ,

finishing planting, all the helpers would go to my house,

khue^{4} yäh^{3}nɨ^{2} ko^{2*3}mpa^{2*3}ñe^{2*3}ru^{24*34} ta?^{2} nɨa^{24*4}na?^{34}
will-go-(3p) all companion to house-my

because the custom is to have a drink.

ta^{3} šku^{4}sų^{14} šɨ^{3} ta^{2}kų^{2} ne^{24*4} (pp) sa^{4}ku^{1} nku^{2}
for custom which is , will-be-found one

tra^{2*3}gu^{24*34} kuɨ?^{42} me^{24*4} (pp) 19. ʔa^{4}kųɨ^{41}
drink will-drink-(3p) they not

Not for them

ʔɨ^{1*3}ska^{1*3}šɨ^{1*3} ku^{14*4}ma^{3}čɨ?^{34} me^{34*4} ta^{3} ʔa^{2}ku^{2}thɭ^{2} šɨ^{2*3}
until ..... will-become-drunk-(3p) they but how .....

to get drunk, but just to take away their tiredness.

khua?^{42}ta?^{214}nɨ^{14}rä^{14} šɨ^{3} hbe^{3}nta^{3}rä^{34} me^{34*4}
will-be-taken-away-(3p) that are-tired-(3p) they

20. ka^{3}be^{3}ču^{1} nku^{2} nɨ^{2}štɭ^{2} šɨ^{2*3} ka^{2*3}be^{2*3}cɭ?^{24} ka^{2}ma^{2}thąɨ^{2}
arrived-(3p) one day that began-(3p) became-over-grown

When the poor cornfield became overgrown, one would

šu^{2*3}ma^{24*34} hnu^{24*4} ne^{24*4} ka^{3}be^{3}cɭ?^{2*24} ka^{3}thu^{3}nčɨ^{3}rä^{34} (pp)
poor corn-plant , began-(3p) was-weeded-(3p)

begin weeding it.

21. ʔa^{4}kua^{4}thɭ^{2} ka^{2}ma^{2}ta^{24}nkų^{2} nka^{24*4}yɭ^{34} (pp) me^{4} šɨ^{3}
like-that became-together we-(ex) they who

[fn] <u>Mole</u> is a type of sauce used with meats.

So then we would get together, those who were hired, and those

koh^{3} čhɩ^{2}rä^{24} (pp) me^{4} šɩ^{3} sa^{14*1}ʔme^{14*1}ya^{14*1} koh^{3}
with pay-(3p) *they who exchange-work-I* *with*

with whom I exchanged work.

22. nku^{2}ʔñu^{2} ɬbä^{2*3} thu^{2*3}nčɩ^{2*3}rä^{24*34} šɩ^{3} kua^{4}thɩ^{2}
quickly is-finished-(3p) is-weeded-(3p) *when like-that*

In that way one finishes the weeding quickly.

(pp) 23. kue^{4}cɩ$^{?42*424}$ ku^{2*4}ma^{3}thąɩ^{4}nka^{2}
will-begin-(3p) will-become-overgrown-again

When the weeds begin to overgrow (the field) again,

nkɩ^{2*3}hña^{2}nkɩ^{2}rä^{24} (pp) ʔa^{4}ču^{4}ba^{4} bä$^{?3*34}$nɩ^{2} ku^{24*4}ma^{3}
brush-its *way* *that-just* *will-be-done*

one does that same thing.

24. nku^{2}ʔñu^{2} ɬhuä^{3} ku^{4}ma^{3}rka^{3} (pp)
quickly will-be-finished-(3p) will-become-cleaned

It is quickly weeded.

25. ʔa^{4} bä$^{?34}$ hɩ^{3}ma^{3} ne^{34*4} kue^{4}cɩ$^{?42*424}$
that is-being-done , will-begin-(3p)

While that is being done, it begins to produce the

ku^{2*4}ma^{3}nta^{2}tɩ^{4} (pp) kue^{4}cɩ$^{?42*424}$ ku^{2*4}ma^{3}hyä$^{?34}$
will-produce-corn-flower *will-begin-(3p)* *will-produce-small-ear*

corn flower; it begins to produce small ears;

kue^{4}cɩ$^{?42*424}$ ku^{2*4} ma^{3}nču^{34}tɩ^{34} ʔɩ^{3}ska^{3}
will-begin-(3p) *will-produce-tender-ear* *even*

it begins to produce tender ears; even before we notice it,

ku^{4}ma^{3}ča^{2}yąɩ^{214}nah^{42} nɩ^{24*4}štɩ^{34} ne^{34*4}
will-become-not-noticeable-to-us-(in) day ,

the mature ears will begin to turn yellow.

kue^{4}cɩ$^{?42*424}$ ku^{2*4}ma^{3}sɩ^{3}ne^{1} nɨh^{14*4} 26. ʔya^{3} šɩ^{3}
will-begin-(3p) *will-become-yellow* *mature-ear* *when ....*

When the

kue^{4}cɩ$^{?424}$ ʔñu^{2} ku^{24*4}ma^{3}sɩ^{3}ne^{1} nɨh^{14*4} ne^{14*4}
will-begin-(3p) *strong will-become-yellow mature-ear ,*

mature ears would really begin to turn yellow,

sa^{3}kua?^{34} šku^{4}sɥ^{14} šɨ^{3} ta^{2}kɥ^{2} ne^{24*4} (pp) khue^{4}
like custom which is , will-go-(3p)

the custom was to go pick a few to make corn gruel.

čha?^{414}rä^{14} nku^{2} štɻ^{2} ku^{24*4}ma^{3}nčah^{2} (pp)
will-be-taken-away-(3p) one little-bit will-be-made-corn-gruel

27. ?ya^{3} šɨ^{3} škuɥ^{2}nɨ^{2}bä^{24} šɨ^{3} ntah^{31} ?yu^{1}
when.... unripe-just-that when good drinkable

When those are sill just unripe, (that's when) the corn gruel

nčah^{2}rä^{24} (pp) 28. tu^{4}ñɨ?^{3} ta^{3} (pp) khue^{4}sa^{3}
corn-gruel-its as-soon-as.... will-go-(3p)-more

tastes real good. Later on, (the mature ears) would

nɨ^{4}štɻ^{34} ne^{34*4} khuä^{3} šɨ^{34*4}
day will-be-finished-(3p) will-dry-(3p)

all become dry.

29. tu^{4}ñɨ?^{3} ta^{3} ka^{3}hbä^{3} ka^{3}šɨ^{1} ne^{14*4} (pp)
as-soon-as.... was-finished-(3p) dried-(3p) ,

As soon as it would all dry up,

kue^{4}cɻ?^{424} kuɨ^{24*4}nčɨ^{2}rä^{24} mu^{3}su^{34} šɨ^{3} khue^{34*4}
will-begin-(3p) will-be-looked-for hired-worker who will-go-(3p)

one would begin to look for hired workers to go harvest.

khua^{4}nka^{1} (pp) 30. kuɨ^{4}nčɨ^{2}rä^{24} na^{24*4}šɻ^{2} šɨ^{2*3}
will-harvest-(3p) will-be-looked-for horse/mule which

One would look for mules

kua^{24*4}nɨh^{41} ču^{14*4} 31. ?ɨ^{3}skɥ^{14} šɨ^{3} tɨ^{2}ña^{2} ne^{24*4} (pp)
will-carry-(3p) animal where .... near ,

to transport it. Where it was close,

sa^{4}?mɨ^{1} ču^{14*4} ho^{1} ntɨ^{14*4}ya^{2} (pp) 32. ?ɨ^{3}skɥ^{14} šɨ^{3} khɻ^{2}
makes-(3p) animal two time where .... far

the animals would make two trips. Where it was far,

ne^{24*4} nku^{2} nɨ^{2}ya^{2}nɨ^{2} (pp) 33. ʔɨ^{3}ska^{3} šɨ^{3} ku^{4}ma^{3}nki^{3}šų^{1}
, *one time-just* *until .... will-become-night*

just one trip. *They would barely be on their*

ne^{14*4} se$^{?34}$ bɨ^{3}ntu^{3}ba^{2}rä^{24} (pp) 34. tu^{4}ñi$^{?3}$ ta^{3} ka^{3}hbä^{3}
, *barely is-coming-(3p)* *as-soon-as.... was-finished-(3p)*

way back at nightfall. *As soon as one*

ka^{3}cɨ^{3}ñah^{3}rä^{34} ne^{34*4} (pp) ʔa^{4}kua$^{?4}$ ka^{2}ma^{2}nku^{2}ta^{2}kų^{214*21}
was-carried-(3p) , *also* *became-relieved-we-(in)*

finished transporting it, one would be relieved,

ta^{3} thɨ^{2} ka^{24*4}ʔntä^{3*34} ne^{3*4} he^{1}mu^{1} thɨ^{2} ču^{24*4} šta^{3}ña^{34}
for there-is place , *very* *there-is animal pest*

because there are some places where there are a lot of pests.

35. maih^{31} bɨ^{1*3}yuh^{2}ta$^{?21}$ hnu^{14*4} šɨ^{3} ba^{3}thu^{3} nɨ^{4}štɨ^{34}
cannot stay-(3p) *corn-plant when passes-(3p)* *day*

The cornfield cannot just stay out there day after day.

36. tu^{4}ñi$^{?3}$ ta^{3} ka^{3}hbä^{3} ka^{3}thu^{3}nka^{14}rä^{14} ne^{14*4} (pp)
as-soon-as.... was-finished-(3p) *was-harvested* ,

As soon as one finished harvesting,

ʔa^{4}kua$^{?4}$ ka^{2}ma^{2}nku^{2}ta^{2}kų^{21} (pp) 37. ʔa^{4}ne^{4} se$^{?3*34}$
also *became-relieved-we-(in)* *and* *then*

one was relieved. *And then*

kue^{14}cę^{42} nɨ^{24*4}ʔña^{42} nku^{2} nʈa^{2*3}ʔnka^{24*34} šɨ^{3}
will-begin-we-in *will-make-we-in* *one* *corncrib* *which*

one would begin to make a corncrib to store it in,

šɨ^{4}nča^{1} (pp) sa^{3} šɨ^{3} cęh^{2} ta^{3} khɨ^{1} ma^{1} (pp)
will-be-put-in-(3p) *if .... is-seen-(3p)* *that much is*

if it looks like there is a lot.

38. sa^{3} šɨ^{3} ʔa^{4}kųɨ^{41} khɨ^{1} ne^{14*4} (pp) ʔa^{4} nta^{2}sa^{1}
if .... not *much* , *although*

If it is not a lot, then even though it is

ka^{14*4}ʔncua^{14*4} ntɨ^{3}ʔya^{34}nɨ^{2} ku^{24*4}ma^{3}ntah^{31} ka^{14*4}ʔntä^{34}rä^{34}
inside *house-just* *can-be-fixed-up* *place-its*

just inside the house, one can fix up a place for it,

ne^{34*4} (pp) nkąh^{2}ni^{2} šį^{2*3}nčа^{2}ntah^{21} (pp) 39. ?ya^{3} šį^{3}
, *there-just is-put-away-(3p)* *when....*

and store it right there. *When one*

ka^{3}hbä^{3} ka^{3}šį^{3}nčа^{2}ntah^{21} ne^{14*4} ka^{2}ma^{2}nku^{2}ta^{2}kų^{21} (pp)
was-finished was-put-away-(3p) , *became-relieved-we-(in)*

finishes storing it away, one would be relieved.

40. sa^{3} šį^{3} čhą?^{31}nka^{1} nku^{2} ša^{2} ni^{24*4}?ña^{42} ne^{24*4}
if .... take-we-(in)-again one work will-do-we-(in) ,

If one takes up another job, one does it some other day.

(pp) pe^{4}ru^{4} ?a^{4}nku^{2} ni^{2}štį^{2} bä?^{24*34} 41. nta^{3}stu^{14} šį^{3}
but another day that *at-least which*

At least the

meh^{31} ša^{1}tį^{2} ne^{24*4} ka^{2}hne^{2}ta?^{2} (pp) 42. kua^{4}thį^{2}
is-needed fast , *ended-(3p)* *like-that*

important thing is done. *That is*

ka^{2*3}ntu^{2*3}ba^{2} ni^{24*4}štį^{34} bä?^{34}
came-(3p) *day* *that*

what those days were like.

REFERENCES

Jamieson, Allan R
1976 Chiquihuitlan Mazatec phonology. (In this volume.)

Jamieson, Carole A.
1974 Chiquihuitlan Mazatec phrases structure. SIL Mexico Workpapers 1:1-7.

——— 1974a Chiquihuitlan Mazatec verbs. Unpublished manuscript.

Kirk, Paul L.
1966 Proto-Mazatec phonology. Unpublished doctoral thesis. University of Washington.

Pike, Eunice V.
1956 Tonally differentiated allomorphs in Soyaltepec Mazatec. IJAL 26:1.57-71.

Pike, Kenneth L.
1948 Tone Languages. Ann Arbor: University of Michigan Press.

NOTES

1

The data presented in this paper were gathered during the years 1969 through 1973, under the auspices of the Summer Institute of Linguistics, from speakers of the Mazatec language as spoken in Chiquihuitlan de Juárez, District of Cuicatlan, in the extreme northern part of the State of Oaxaca in Mexico. The analysis is based mainly on the pronunciation of Mr. Ernesto Tejeda Salvador, in his mid-forties, a native-born Chiquihuitecan of native-born parents. There are now about 6000 inhabitants of Chiquihuitlan, about 90% of whom speak the Mazatec language.

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2

Numbers preceded by 'A' refer to cognate sets in Kirk (1966).

3

Cluster /^{114}/ is not included in this discussion because it occurs only rarely and in a complicated environment.

4

Numbers precede by 'S' refer to sentences in the text appended to this paper.

5

According to Tone Sandhi Rule 5, this word should have tone pattern ^{34}:^{34}:^{34}.

CHOAPAN ZAPOTEC PHONOLOGY

Larry Lyman
Rosemary Lyman

1. Phoneme
2. Syllable
3. Word
4. Phrase
5. Sentence
6. Tone sandhi

This paper presents the phonological structure of Choapan Zapotec[1] (hereafter CZ) within a hierarchically oriented framework consisting of five levels. Each level has an inventory of contrastive units distributed into the units of the next higher level. Theoretically at least, the model[2] is open-ended. However, this description goes no further than sentence level. In ascending order, these levels are: phoneme, syllable, phonological word, phonological phrase, and phonological sentence. The adjective 'phonological' is used together with 'word', 'phrase', and 'sentence' to refer to units of the phonological hierarchy[3] in contrast to units of the grammatical hierarchy--units defined in phonological terms quite apart from grammatical considerations.

The first part of this paper, then, is a taxonomy presenting the various units of the various levels and the criteria for distinguishing them. Following this, there is a section which utilizes certain morpheme groupings to handle tone sandhi. This section represents morphophonemic phenomena, in that both phonological and grammatical considerations must be taken into account in order to handle the material in any reasonable way. Furthermore, a set of ordered rules is employed as the most satisfactory method of describing this extensive system of tone sandhi.[4]

1. The contrastive units of CZ on the phoneme level consist of 18 consonants, 6 vowels, and 3 pitches.

1.1 Consonants may be characterized as either obstruent or sonorant and will be discussed in that order. Obstruents are either stopped or spirantal. Stops are either labial, alveolar, or velar, and each has a counterpart distinguished by voicing. All voiceless stops are unaspirated.

The stops of CZ are:

p	t	k
b	d	g

Examples:

/p/	rčǐ^{1}pa?^{2}	*I pick*	/b/	rčǐ^{1}ba?^{2}	*I pluck*
/t/	tu^{2}	*one*	/d/	du^{3}	*rope*
/k/	kǔ^{2}ba^{2}	*corn dough*	/g/	gú^{3}ba^{3}	*broom*

The phoneme /g/ has an optionally spirantal allophone in one word only:

[nío^{3}ge^{3}] ~ [nío^{3}ge^{3}] nío^{3}ge^{3} *yesterday*

In no other place has this fluctuation been observed.

The phoneme /k/ also has a spirantal allophone, which can be characterized as a voiceless velar spirant (here written as h). Certain CZ speakers employ the plural marking morpheme ia^{1}ka^{1}, while others use a shortened form ka^{1}. Still others spirantize the stop to ha^{1}.

ráo^{2}ia^{2}ka^{2}bi?^{2} ~ ráo^{2}ka^{2}bi?^{2} ~ [ráo^{2}ha^{2}bi?^{2}] *he/she (informal) eats*

In no other place has this fluctuation been observed.

Spirants are either simple or complex (stop plus spirant) and are produced at the alveolar and alveopalatal points of articulation. They exhibit the same voiceless-voiced pairing as seen in the stops.

The spirants of CZ are:

s	š
z	ž
c [ts]	č [tš]
j [dz]	ǰ [dž]

Examples:

/s/	rá^{1}sa?^{2}	*I get up*	/z/	zen?^{3}	*chalky*
/z/	rá^{1}za?^{2}	*I plant*	/ž/	žen?^{2}	*saliva*
/š/	šú^{2}za?^{2}	*my father*	/c/	cen^{2}	*weak*
/ž/	žú^{2}ba?^{1}	*corn*	/j/	jen^{2}	*smoke*
/s/	sia?^{3}	*bitter*	/č/	gá^{2}či^{2}	*yellow*
/š/	šia^{1}	*hot*	/ǰ/	gá^{1}ǰi^{1}	*seven*

The alveopalatal spirants are retroflexed except when occurring before /ɪ/. The degree of retroflexion is greater before back vowels than before non-high front vowels.

ǰʃ²tu¹ [ǰʃ²tu¹] *cat*

šʃ²ja?² [šʃ²dza?²] *zapotec*

ǰe² [ʐe²] *big*

re²šé³da?³ [re²ʂé³da?³] *I like*

ǰú²ba?¹ [ʐú²ba?¹] *corn*

šú²za?² [ʂú²za?²] *my father*

bɛ́²šte² [bɛ́²ʂte²] *dust*

čɪ¹ [tšɪ¹] *ten*

ču³nʃ?³ [tʂu³nʃ?³] *spider*

ǰʃ²la² [dǰʃ²la²] *griddle*

ǰa [dǰa?ə] *good*

Alveopalatal spirants remain unretroflexed before the vowel /ɪ/, even when another consonant intervenes between the spirant and the vowel.

škɪ̲¹na? [škʃ?ɪ¹na?¹] *my nose*

žbɪa?² [ʑbya?²] *my finger*

Sonorant consonants are either nasal, lateral, or vibrant. All nasals are voiced and are either labial or alveolar. The nonnasal sonorants include a voiced alveolar lateral /ɪ/ as in la²nʃ² *fiesta* and sla?² *bitter*, and an apico-alveolar vibrant /r/. Phonetically, the latter ranges between one and several flaps, with a single flap being the most predominant. Furthermore, /r/ always has the same quality of voicing as the segment it precedes, except when that segment is a nasal, in which case it fluctuates as to voicing. In the following examples, the voiceless allophone is written [R].

rga?m³bɪ? [ɾga?əm³bɪ?¹] *he/she (informal) remains*

ršʃ¹tɪ¹bɪ?¹ [Ršʃ¹tɪ¹bɪ?¹] *he/she (informal) jumps*

rná¹ba?² [Rná¹ba?²] ~ [ɾná¹ba?²] *I ask*

The alveolar nasal has a velar allophone when occurring utterance finally or preceding velar stops, /ɪ/, /r/, or /y/.

ren^{2} [reŋ^{2}] *blood*

ré?n^{3}ka^{1}bi?^{2} [ré?eŋ^{3}ka^{1}bi?^{2}] *they (informal) want*

ré?n^{3}gɛ?^{1} [ré?eŋ^{3}gɛ?^{1}] *he/she (respectful) wants*

ré?n^{3}lɛ̲^{2}bi?^{1} [ré?eŋ^{3}lɛ?ɛ^{2}bi^{1}] *he/she (informal) wants too much*

ré?n^{3}ro^{1} [ré?eŋ^{3}ro^{1}] *we (inclusive) want*

ré?n^{3}ya^{1}kɛ?^{2} [ré?eŋ^{3}ya^{1}kɛ?^{2}] *they (respectful) want*

ré?n^{3}ka^{1}bi?^{2} [ré?eŋ^{3}ha^{1}bi?^{2}] *they (informal) want*

The sonorant consonants of CZ are:

m	n
	l
	r

Examples:

/m/ šman^{2} *week*

/n/ nío^{3}ge^{3} *yesterday*

/l/ lá̋o^{2}a?^{2} *my face*

/r/ rá̋o^{1}a?^{2} *I eat*

1.2 CZ vowels are either front or back; and high, mid, or low. All front segments are unrounded. All segments are voiced. CZ vowels are as follows:

i	u
e	o
ɛ	a

Examples:

/i/	i^{1}tú^{2} *again*	/u/	gíú^{2} *dirt*
/e/	be^{2} *air*	/o/	gió^{3} *flower*
/ɛ/	bɛ^{3} *butterfly*	/a/	gía?^{3} *soap*

The phoneme /i/ has a slightly lower allophone [ɪ] when preceded by alveopalatal stops and followed by a word-final glottal stop.

čí?^{2} [tšɪ?^{2}] *well!*

co^{3}lą̲^{3}ǰi?^{3} [tso^{3}lą́?a^{3}džɪ?^{3}] *slowly*

1.3 There are three contrastive pitch levels in CZ, ranging from high (1) to mid (2) to low (3).

gín?^{1} *black wax*

gí?^{2} *fire*

gìn?^{3} *chili*

Tone one actualizes as a slightly rising glide which is most prominent in an utterance-initial syllable preceding another high tone. Tone two is perceptually level. Tone three is perceptually longer in duration than the other two tones and actualizes as a slight down glide which is more prominent in an utterance-final syllable or over a sequence of two vowels. All three tones have a slightly lower allotone utterance final.

Every nasal that does not initiate a syllable carries one and only one of the three possible tones. Every vowel carries at least one of the three possible tones. Syllables with a single vowel nucleus may carry a tone sequence of either mid-high or mid-low. A vowel with such a sequence is perceptually longer than one without. The tone sequence that any given syllable has is indicated by the raised numbers at the end of that syllable. A single number following any syllable indicates that all the tone carrying elements in that syllable have that tone.

béo^{1} *comb*

béo^{2} *cloud*

béo^{3} *earthmole*

ré?n^{3}da?n^{31} *I want it*

rá^{2}pan^{21}do?^{2} *we (exclusive) take care of*

zú^{21}bi?^{2} *he/she (informal) exists*

uɛ́^{21}za?^{2} *opossum*

škiɛ́^{23}ba?^{1} *nape of his (animal) neck*

2. The syllable level is that level into which phonemes are distributed in certain patterned ways. A syllable is characterized by a vowel nucleus and consonantal margins.

2.1 There are three basic kinds of CZ syllable nuclei: laryngeal, checked, or unchecked. A laryngeal nucleus is realized phonetically as [v́?v], with the two vocalic segments being of same or different quality (limitations are discussed below). A checked nucleus always ends in a glottal stop; an unchecked nucleus exhibits no glottal closure whatsoever. Furthermore, CZ syllable nuclei may consist of one, two, or three vowel segments. Nuclei with one and only one vowel in their underlying form are here called simple, while those with more than one vowel are here termed complex. These and other parameters result in 14 subclasses of syllable nuclei.

A typical complex vowel nucleus consists of a mid or low vowel with a high vowel preceding or following, or both. Preceding or following high vowels are realized phonetically as glides, for which a rule will be presented later. Only two main rules are necessary to get from the underlying form to the phonetic form in CZ syllable nuclei. The first rule deals only with laryngeal vowels and specifies the placement of stress and glottal stop. The rule has the form:

(1)

$$\underline{V}_1 \rightarrow \begin{cases} \acute{V}?_1 \; / \_\_\_ V_2 \\ \acute{V}_1?V_1 \end{cases}$$

This rule states that a laryngeal vowel (symbolized V) will be realized phonetically as V́? if followed by another vowel; otherwise the laryngeal vowels becomes V́?v. Subscript numbers indicate where the vowels in the phonetic form must have the same or different quality. Examples of the application of the first part of the above rule are as follows, where the forms to the left and right of the arrow represent the underlying form and first line of the derivation respectively:

lo → lé?o *wall of a house*

rue-bi? → rú?e-bi? *he/she gives*

rua → rú?a *my mouth*

rao → rá?o *we (inclusive)*

guao-bi? → guá?o-bi? *he/she will buy*

giua → giú?a *I may carry*

Examples of the application of the second part of the rule are as follows:

ugia → ugiá?a *I will go*

giu → giú?u *house*

gio-bi? → gió?o-bi? *he/she will drink*

rdue-bi? → rdué?e-bi? *he/she is ashamed*

lɛ → lɛ́?ɛ *side, stomach*

didza? → dí?idza? *word, language*

The second rule simply takes any high unstressed vowel and reduces it to y or w if either preceded or followed by another

vowel, or by y or w. The rule is as follows:

(2)

$$[+high] \rightarrow [+cons] \; / \underline{\quad\quad} v,w,y$$

$$v,w,y \underline{\quad\quad}$$

Taking the first line of the derivation from each example above where the environmental restrictions are met, we get:

guá?o-bi? → [gwá?o-bi?] gíú?u → [gýu?u]

gíú?a → [gyú?a] gió?o-bi? → [gyó?o-bi?]

ugiá?a → [ugyá?a] rdué?e-bi? → [rdwé?e-bi?]

Rule (2) also applies equally well to both unchecked and checked syllable nuclei.

gáigiuá → [gáygywá] *one hundred*

céina → [céyna] *it will burn*

giuá? → [gywá?] *load, cargo, baggage*

giá? → [gyá?] *soap*

These two rules, then, applied in the order given, will give the proper phonetic output.

Taking into consideration the horizontal parameter of simple vs. complex, and the vertical parameter of laryngeal vs. checked vs. unchecked, the possible syllable nuclei of CZ may be conveniently displayed in the following manner:

	Simple		Complex	
	Oral	Nasal	Bivocalic	Trivocalic
Laryngeal	v̲		v̲v	vv̲v
			vv̲	
Checked	v?	vn?	v́v?	vvv́?
			vv́?	
			vv	vvv
Unchecked	v		v́v	vv́v
			vv́	vvv́

The following are examples of all syllable nuclei observed to date:

Simple laryngeal:

didzaʔ [díʔidzaʔ] *word*

le [léʔe] *you (plural)*

lɛ [lɛ́ʔɛ] *side, stomach*

rum-biʔ [rúʔum-biʔ] *he/she is throwing*

rpombom [rpóʔombom] *bread dough*

ba [báʔa] *flat*

Complex laryngeal bivocalic:

giu [gyúʔu] *house*

ugia [ugyáʔa] *I went*

rio-biʔ [ríʔo-biʔ] *he/she is drinking*

leo [leʔo] *wall of a house*

rue-biʔ [rúʔe-biʔ] *he/she gives*

rdue-biʔ [rdwéʔe-biʔ] *he/she is ashamed*

rua [rúʔa] *my mouth*

rao-biʔ [ráʔo-biʔ] *he/she is buying*

In the case of vʔv anywhere in the word, the medial glottal closure may be alternately actualized as a laryngealization of the two contiguous vowels. This happens most frequently in rapid speech forms. Examples are as follows, where underlining indicates that the vowels have a laryngeal quality:

[bɛ́ʔɛlaʔ] ~ [bɛ́ɛlaʔ] *meat*

[tsolaʔadžɩʔ] ~ [tsolaadžɩʔ] *slowly*

[rúʔebiʔ] ~ [rúebiʔ] *he/she is giving*

Complex laryngeal trivocalic:

guao-biʔ [gwáʔo-biʔ] *he/she may buy*

giua-biʔ [gyúʔa-biʔ] *he/she may carry*

Simple checked oral:

-biʔ[1] [-biʔ[1]] *3rd person human familiar*

beʔ [beʔ] *ice, snow*

-nɛʔ[1] [-nɛʔ[1]] *3rd person human respectful*

stuʔ [stuʔ] *shame, embarrassment*

-lo? [-lo?] *2nd person (singular)*

-ba?[1] [-ba?˥] *3rd person animal*

A syllable nucleus of this type has a variant which occurs other than word final in rapid speech. In such an environment, the vowel tends to be rearticulated as an 'echo vowel'. bɛ?gɪdɪ? *bat* in rapid speech becomes [bɛ?ɛgɪ̈dɪ?].

Simple checked nasal:

gun? [g̬ũ?] *mud*

bzɪn? [bzɪ̃?] *rat*

dan? [d̬ã?] *because*

den? [d̬ẽ?] *but*

bɪ̈škɪɛn˥ [bɪ̈škyɛ̃?] *why*

This type of syllable nucleus has here been interpreted as a vowel plus following nasal in order to avoid the necessity of including nasalized vowels in the phoneme inventory, since [gũ?] *mud* contrasts with [gu?] *you (singular) will do*, [gɪ̃?] *chili* contrasts with [gɪ?] *fire*, and [-dã?] *3rd person evil spirit* contrasts with [-da?] *1st person singular.*

Complex checked bivocalic:

báo? [b̬áo?] *you (sing.) did/made*

bɪá? [b̬yá?] *I did/made*

luɛ́? [lwɛ́?] *2nd person (sing.)*

gɪɛ́? [g̬yɛ́?] *excrement*

gɪé? [g̬yé?] *cooked*

Complex checked trivocalic:

pkulá? [pkwyá?] *I caused to arise*

gluá? [gywá?] *load, cargo, baggage*

Simple unchecked:

bɪ [bɪ] *negative*

be [be] *air, wind*

bɛ [bɛ] *butterfly*

nu [nu] *some*

-ro [-ro] *1st person plural (inclusive)*

ra [ra] *more*

Complex unchecked bivocalic:

ráo-bɪ? [ráo-bɪ?] *he/she is eating*

béo [bẹ́o] *cloud*

gáigiua [gáygywá] *one hundred*

céina [tsḛ́yna] *it will burn*

ruế-bi? [rwḗ-bi?] *he/she is doing*

biú [byú] *chicken*

ciố-bi? [tsyṓ-bi?] *he/she may go*

uí [wí] *orange*

žuá [žwá] *John*

rudié-bi? [rudyḗ-bi?] *he/she hates*

biá [byá] *cactus*

Complex unchecked trivocalic:

giáo [gyáo] *river*

škuiá [škwyá] *level, floor*

guáo [gwáo] *food*

regiué-bi? [regywḗ-bi?] *he/she is repairing*

gáigiuá [gáygywá] *one hundred*

2.2 The structure of syllable margins in CZ is quite simple and straightforward. Apart from certain exceptions to be given later, all syllable nuclei share nearly identical sets of margins. The typical syllable margin in CZ consists of an optional labial stop, spirant, or r as its initial member. A second member is obligatory and may consist of most any consonant. An optional nasal may close the syllable. This structure may be summarized as: (C) C Nucleus (N), where N = any nasal consonant.

A glance at the summary above will show that there are four possible syllable types, namely: C Nucleus, CC Nucleus, C Nucleus N, and CC Nucleus N. The fourteen different syllable nuclei raise the possibilities to 56. Actual phoneme substitution in the places indicated quickly raises the possibilities to a number in the thousands. Various restrictions, of course, limit the actually occurring syllable possibilities to something less than the mathematical potential. Examples of syllable margins are here given. No attempt has been made to exemplify every possible margin with every possible nucleus. Syllables contained within words are enclosed in square brackets.

Cvv kia[2] *my chin*

Cvvv? giuá?[3] *cargo, baggage, load*

Cvv bɘo^{1} *comb*

Cv? gi?^{2} *fire*

CV tu^{2} *one*

CCvv snlá^{2} *fierce*

CCv? šcé? *evening*

CCv [rši^{1}] tia?^{1} *I jump*

CCV̲ žŋa̲^{1} *my mother*

CCvv? bdao?^{21} *baby*

Cv?N [re?m^{3}] [ba?n^{12}] *he (animal) wants it*

Cvn? jun?^{2} *mud*

CvN ren^{2} *blood*

Cvv?N pši [tiá?n^{1}] *I made it jump*

CvvN rión^{1} *it goes*

CCvv?N bguá?n^{12} *I loaded it*

CCvn? bǰin?^{1} *deer*

CCvN šman^{2} *week*

CCvv̲N [rgui̲n^{2}] da?^{1} *I am quick tempered*

CCvvv?N pkuiá?n^{12} *I made it rise*

CCvvvN škuián^{31} *tier, floor, level*

Certain exceptions to the general pattern given above need to be mentioned. First, syllable nuclei containing a nasalized vowel rarely have a nasal post margin. To date only one example can be cited:

ré?n^{3} [dan?n^{31}] *he (the evil spirit) wants it*

This, then, has the structure Cvn?N.

Secondly, an unchecked nucleus, when in word-initial position, may occur without any margin whatsoever.

[i^{1}] tú^{2} *again*

[u^{3}] bán^{3} *thief*

[o^{2}] bǰ^{2}ja^{2} *sun*

[ao^{21}] dáo^{1}a?^{2} *I already ate*

Thirdly, the vowels of utterance-final syllables may be affected in three ways: 1) slight fade, 2) loss of voice, 3) dropped completely. In the case of 3), any voiced consonant preceding the dropped vowel will unvoice.

[ré?m^{3}b ?^{2} gǰ^{1}čI^{2}] ~ [ré?m^{3}bI?^{2} gǰ^{1}čI^{2}] ~ [ré?m^{3}bI?^{2} gǰč^{1}] *he/she (informal) wants paper*

An example of complete vowel loss with consequent consonant devoicing is seen in [pa^{1}diú^{1}že^{2}] ~ [pa^{1}diúš] *greetings*. It is this kind of vowel loss that results in a syllable which is closed by a consonant other than a nasal. In each case, only spirants are involved.

The following restrictions of occurrence apply to consonant clusters within syllables: 1) /b/ occurs only before voiced consonants other than /m/; 2) /p/ occurs only before voiceless consonants; 3) /r/ never occurs before /m/; 4) /s/ occurs only before /l/, /n/, /r/ and /k/; 5) /š/ occurs only before /m/, /n/, /l/, and voiceless stops; 6) /ž/ occurs only before /m/, /n/, /l/, and voiced stops.

3. The phonological word[5] level is that level into which syllables are directly distributed. These units are characterized as stress units consisting of from one to several syllables. The nucleus is distinguished by lack of any internal tone sandhi and is the unit of actual stress placement. Because phonological word (P word) boundaries are unclear when margins are present, they have been determined on the basis of words in isolation, in which case they coincide with the boundaries of the grammatical word.

3.1 There are four main types of P words in CZ, distinguished on the basis of differing nuclear structures. P word nuclei are distinguished on the basis of the number of syllables they contain. Furthermore, P word nuclei coincide with the grammatical stem. To say that a P word has a monosyllabic, bisyllabic, trisyllabic, or quadrisyllabic nucleus is to say that it must consist of that many syllables. The number of syllables a nucleus has is therefore diagnostic of its type.

Subtypes are determined by the placement of stress, e.g., penultimate or ultimate in bisyllabic nuclei, and antepenultimate, penultimate, or ultimate in trisyllabic and quadrisyllabic nuclei. P words may have a premargin of from one to three syllables and a postmargin of from one to five syllables, but all do not occur simultaneously.

The following chart summarizes P word nuclei:

S	monosyllabic	bɛ^{3}	*butterfly*
ŚS	bisyllabic	có^{1}na^{1}	*three*
SŚ		du^{3}brʃ?^{2}	*basket*
ŚSS	trisyllabic	gɨó^{2}cu^{2}go^{2}	*weevil*
SŚS		be^{2}lá^{2}ga^{2}	*bed*
SSŚ		ua^{3}ce^{3}sám^{3}-bɨ?^{1}	*he/she (informal) is going to leave (it)*
ŚSSS	quadrisyllabic	re^{2}zʃ^{2}la̲^{3}ʲɟɨ^{3}-bɨ?^{1}	*he/she (informal) rests*
SSŚS		rɛ^{3}pɨ^{3}gɨé^{3}sa^{3}	*lightning*
SSSŚ		ce^{2}tɨ^{3}šo^{3}ge̲^{3}-nɛ?^{1}	*he/she (respectful) is going to advise*

Stress most often occurs on a syllable having a complex nucleus unless the syllables are all of equal length, in which case stress usually falls on the penultimate syllable. There are, however, a number of exceptions. It is these exceptions that make it impossible to predict stress even if long vowels are posited. For example, in rɔla^{3}láo^{3}-bi?^{1} *he/she (informal) is going ahead* and rio^{3}nig̱^{3}-da?^{3} *I understand*, the stress occurs on the ultimate rather than penultimate syllable, even though both syllables have complex nuclei. In cases such as bé^{2}lo^{2} *star* and be^{2}ló^{2} *cave*, the stressed syllable is longer in each case because all stressed syllables are longer than unstressed syllables. Also, there is no perceptual difference in length between syllables having complex nuclei and syllables having simple nuclei.

cu^{3}táo?^{3} *spider* and bɛ^{3}ré?^{3} *ant*

ao^{21}dáo^{2}-bi?^{2} *he/she (informal) already ate* and ao^{21}d̲á^{2}-bi?^{2} *he/she (informal) already walks*

3.2 Only unchecked syllables may occur as premargins in a P word. In the postmarginal position, only syllables with simple nuclei may occur. A nasal nucleus may only occur word finally or as the nucleus of the word. No attempt has been made to exemplify every possible syllable combination in P words.

Examples of words with monosyllabic nuclei are:

za^{1} *oil*

tá^{1}-bi?^{2} *he/she (informal) will walk*

be?^{2} *crab*

ré?n^{3}-ka^{1}zi^{3}da?^{1} *I surely want*

gin?^{1} *black wax*

biũ^{21} *chicken*

ráo^{1}-ce^{1}ge^{2}ra^{1}bi?^{2} *he/she (informal) eats too much more*

báo?^{3} *charcoal*

guáo-n^{1} *it will eat*

gl̲u^{1} *line*

l̲e^{2}-na?^{1} *my belly*

bi^{2}ra^{2}-r̲i^{1}-bi?^{2} *he/she (informal) does not get any more*

z̲la^{2} *chocolate*

ga^{1}bi^{2}ra^{2}-r̲ao^{2}-a?^{2} *I do not buy any more*

Examples of words with bisyllabic nuclei are:

ʃ²za² *year*

bi²-gu²ni¹-bi?² *he/she (informal) did not grow*

bɛ̃?m²¹gi.u² *man*

bi²ra²-rú¹ti?²-ce²ge²ia²ka²bi?² *they (informal) don't sell too much more*

be²ió² *cave*

ni³sɛ́i?³ *atole*

bžʃ³jo?³ *badger*

bi²ra¹-ru²ca²-bi?² *he/she (informal) doesn't heat more*

Examples of words with trisyllabic nuclei are:

nʃ¹gu¹ia¹ *woman*

rdɛ́³iɛ³bɛ¹-bi?¹ *he/she (informal) wakes up*

u¹dá¹pa¹-bi?¹ ce²tɛ¹ʒi²-bi?² *he/she (informal) is going to go embrace*

ži?³gf³ba³ *key*

be?²gf²di?¹ *bat*

re²giu?²iáo²-ka¹zi¹ia²ka²bi?² *they (informal) are surely accustomed*

u¹zio¹niɛ²-bi?¹ *he/she (informal) understood*

Examples of words with quadrisyllabic nuclei are:

gua²de²iɛ³bɛ¹-bi¹ *he/she (informal) will wake up*

ua²ce²ga³ia-n³do?³ *we (exclusive) are going to go light*

gua²ce²sá¹ke²-nɛ?² *he/she (respectful) is going to go plan*

u²di²žo³giɛ³-io?³ *you (singular) advised*

4. A P phrase is a rhythm unit composed of from one to five P words. The peak or nucleus is marked by features of stress and length more prominent than that of the P word itself. A typical P phrase begins with rapid pronunciation and build-up of intensity until a peak is reached. Following the peak there is a corresponding lessening of these features.

Two types of P phrases have been observed in the data: non-amazement and amazement. These types are distinguished on the basis of the degree of length and stress exhibited by their peaks.

Of these two phrase types, length and stress are present to a lesser degree in the non-amazement than in the amazement. Since length is analyzed as concomitant with stress, only the former is marked by a double accent (˝) in the examples to follow.

já²gá̋² gí²do?³ *day nine you come*

rű̃en¹ ní²sa²gló² *it is raining*

pues² ná² u²glűa?¹ ká²ra² *well now the car arrived*

The peak of an amazement phrase, in addition to having stress, has prolonged prominence or a certain intensity signalling that certain elements of the narration are considered quite remarkable by the speaker. In addition, it has a pitch level slightly higher than that of a normal high, which replaces the usual pitch on that syllable. Examples are as follows, where a triple accent (‴) marks the peak:

bén?² ží¹ ní²ta¹la²kε?² *there were ma...ny people!*

bía² zέ¹ gű²la² glú² ga²zi²gán?² *house where ve..ry many animals graze!*

be²gía² klá¹se² bía² bí²ši?² *a nu...mber of kinds of animals!*

Regarding the placement of phrase stress, there appear to be certain limitations. These limitations are, however, not clearly understood at present. In this respect, observe the following examples, where non-amazement phrases are stressed on the first, second, third, and fourth P words:

nal²gí² do?³ čóa²pan³ *that you come to Choapan*

já² be¹zá?a²ya²kε?² *the day they (respectful) left*

ga²zú¹ lí¹dia² zá²na?¹ *where my sister Lydia is*

dé¹ wén¹ súer¹te² bdű?u²lda?¹ *by good fortune, what I wanted came to pass*

5. A phonological sentence is composed of from one to several phrases. The tones of a sentence-final syllable are all slightly lower, and there is a slight fade in voicing. This slight fade may also be actualized by the complete unvoicing of a final segment or final syllable, or by the loss of a final vowel and unvoicing of the preceding voiced consonant. Examples are as follows (where slight fade is symbolized by a vertical arrow (↓) and voiceless vowels by upper case letters):

[fé?n³da?³ gí³či³↓] ~ [fé?n³da?³ gí³čI] *I want paper*

[pa^{1}dyú^{1}ǰe^{2}↓] ~ [pa^{1}dʃúš^{1}] *hello*

There are three types of P sentences in CZ, distinguished on the basis of particular concomitant phonological features: (1) declarative, (2) repetitive, and (3) interrogative.

A declarative sentence has no features other than those common to all sentences:

rɛ̃$^{?}$n^{3}lo^{3} *you want*

ra^{2}šɛ̃^{3}bi$^{?1}$ ca^{1}tʃ^{1}bi$^{?2}$ la^{2}ri$^{?2}$ *he/she (informal) likes to go wash clothes*

gua^{2}ce^{2}šʃa^{21} nʃ^{3}sa^{3} *I am going to carry water*

A repetitive sentence has, in addition to final fade and tone lowering, a downstep of key (↘) in the repetition of a phrase:

re^{1}gʃɛ^{2}bi^{2}bi$^{?2}$ zʃ^{1}la^{1} zʃ^{1}la^{1}↘ zʃ^{1}la^{1}↘ *he/she (informal) vomits morning after morning*

ru^{2}bi$^{?2}$ ta^{1}lɑ̃^{2} rɛ̃^{1}la^{1} rɛ̃^{1}la^{1}↘ *he/she (informal) has fever night after night*

An interrogative sentence, like a repetitive sentence, also exhibits final fade and tone lowering. However, its distinguishing characteristic is an extra high tone (h), usually occurring on the first syllable. This extra high tone signals the interrogative character of the sentence:

rɛ̃$^{?}$n^{h}lo$^{?3}$ *do you want?*

ra^{2}šɛ̃^{h}bi$^{?1}$ ca^{1}tʃ^{1}bi$^{?2}$ la^{2}ri$^{?2}$ *does he/she (informal) like to go wash clothes?*

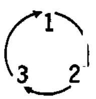
quɑ̃^{h}zao$^{?2}$ qula^{2} nʃ^{2}sa^{2} *will you go with me to carry water?*

6. The three register tone system of CZ exhibits an extensive system of tone sandhi.[6] Tones may be either lowered or raised as certain morphemes are juxtaposed. Furthermore, this lowering or raising occurs either preceding or following a morpheme juncture, or both. Tone shifts preceding a morpheme boundary are here called Prejunctural Tone Sandhi, while tone shifts following a morpheme boundary are called Postjunctural Tone Sandhi.

The terms "lower" or "higher", however, do not accurately describe all the tone shifts that take place at morpheme boundaries in CZ. Namely, tone 1 may be lowered to 2, and tone 2 may be lowered to tone 3, but then tone 3, since it cannot go any lower, is raised to tone 1. The analogy of a clock seems appropriate here; hence this type of tone shift (i.e., 1→2, 2→3, 3→1) is here

called Clockwise Tone Sandhi. Tone shifts which involve the substitution of a "lower" tone for a "higher" tone are here called Counterclockwise Tone Sandhi. Such tone replacements shift tone 3 up to tone 2 and tone 2 up to tone 1. This may be summarized in the following diagram. Note that tone 1 is not replaced by tone 3 in the system.

The intersection of these two parameters, direction of linear replacement and clockwise versus counterclockwise replacement, results in four types of tone sandhi, namely, 1) Postjunctural Clockwise, 2) Prejunctural Clockwise, 3) Postjunctural Counterclockwise, and 4) Prejunctural Counterclockwise. This is summarized in the following chart, where the upper case letters A through H represent classes of certain morphemes in CZ. The membership of these eight classes will be given later in this article. The arrows indicate the linear order of replacement involved. Solid lines in the arrows indicate clockwise substitution, while broken lines indicate counterclockwise substitution.

	Postjunctural	Prejunctural
	A → B	C ← D
	E --→ F	G ←-- H

6.1 In rule form, postjunctural clockwise tone sandhi may be represented as:[7]

(1) Bt → Bt + 1 / A__

Examples are as follows, where the first form is the basic form,[8] and the second form is the form derived from the application of the appropriate rule:

rší^{1}tí^{1} + ro^{1}

(1) rší^{1}tí^{1} + ro^{2} *we (inclusive) jump*

rja̲^{21} beʼ^{2}

(1) rja̲^{21} beʼ^{3} *the crab is angry*

ɪú^{1}ɲɪ^{1} béo^{3}

(1) ɪú^{1}ɲɪ^{1} béo^{1} *the earthmole's tongue*

In the case of a morpheme of more than one syllable in postjunctural position having a sequence of high or of mid tones, all tones in the sequence will be affected in accordance with rule (1).

bɪɛ̲^{21}bɪʔ^{2} ga^{1}bán^{1}

(1) bɪɛ̲^{21}bɪʔ^{2} ga^{2}bán^{2} *he/she (informal) saw the blanket*

ɪú^{1}ɲɪ^{1} bé^{2}coʔ^{2}

(1) ɪú^{1}ɲɪ^{1} bé^{3}coʔ^{3} *the dog's tongue*

In the case of a morpheme with a low sequence, the first one will be replaced by a high tone in accordance with postjunctural clockwise sandhi, but any immediately following low tone will be replaced by a mid tone.

réʔm^{3}bɪʔ^{1} gɪ̌^{3}čɪ̌^{3}

(1) réʔm^{3}bɪʔ^{1} gɪ̌^{1}čɪ̌^{2} *he/she (informal) wants paper*

6.2 Prejunctural clockwise tone sandhi may be summarized in rule form as:

(2) Ct → Ct + 1 / ___D

Examples include:

réʔn^{3}ka^{3}zɪ^{3} + aʔ^{2}

(2) réʔn^{3}ka^{1}zɪ^{1} + aʔ^{2} *I really want*

guạo^{1} + ra^{1}bɪʔ^{2}

(2) guạo^{2} + ra^{1}bɪʔ^{2} *he/she (informal) will buy more*

When the conditions for prejunctural clockwise tone sandhi are fulfilled, and the prejunctural morpheme carries a series of high tones, the final high tone and all contiguous high tones in that word are replaced by mid tones.

rá^{1}pa^{1}bɪʔ^{1} béo^{1}

(2) rá^{2}pa^{2}bɪʔ^{2} béo^{1} *he/she (informal) takes care of*

Clockwise tone sandhi may occur both prejuncturally and postjuncturally at the same time. Since it is necessary to posit both types of sandhi on independent grounds, such reciprocal or simultaneous tone sandhi is here interpreted as the application of ordered rules, namely rules (1) and (2).

bɪɛ̲^{21} + dɨ?^{3}

(1) bɪɛ̲^{21} + dɨ?^{1}

(2) bɪɛ̲^{2} + dɨ?^{1} *I saw*

ré?m^{3}bɪ?^{1} béo^{3}

(1) ré?m^{3}bɪ?^{1} béo^{1}

(2) ré?m^{3}bɪ?^{2} béo^{1} *he/she (informal) wants an earthmole*

rá^{1}pa^{1} + ɲ^{3}do?^{3}

(1) rá^{1}pa^{1} + ɲ^{1}do?^{2}

(2) rá^{2}pa^{2} + ɲ^{1}do?^{2} *we (exclusive) take care of*

6.3 Postjunctural counterclockwise tone sandhi may be represented as:[8]

(3) Ft → Ft - 1 / E____

Examples include:

rɪ̲?o^{2} + gɛ?^{2}

(3) rɪ̲?o^{2} + gɛ?^{1} *I drink*

6.4 Prejunctural counterclockwise sandhi may be summarized as:

(4) Ht → Ht - 1 / ___G

Examples include:

rgɪ^{3}tu^{3} + ga?^{2}

(3) rgɪ^{2}tu^{2} + ga?^{2} *I play*

rčú^{2}gu^{2} + a?^{2}

(3) rčú^{1}gu^{1} + a?^{2} *I cut*

Notice that in this type of sandhi, a tone substitution takes place affecting all syllables of the prejunctural morpheme.

6.5 The membership of tone sandhi classes A through H is arbitrary and only weakly cross classifies with semantic or grammatical classes in CZ. Little can be said about them apart from listing representative examples for each class. In addition, some lexical items are simultaneously members of more than one class. For example, the adverbial element -ra^{1} *more* is simultaneously a member of classes A, B, C, D, and E. This is one of those elements which is included within a verb and may both perturb

and be perturbed in accordance with sandhi rules (1), (2), or (3). Hence, -ra^{1} may precede certain elements and perturb them in a clockwise fashion. It may follow certain elements and itself be perturbed. Or, conversely, it may follow certain other elements and perturb them or precede certain other elements and be perturbed. However, when -ra^{1} perturbs in a counterclockwise fashion, it always precedes the element it perturbs. Likewise, the adverbial element -ka^{3}zi^{3} *surely, always*[9] is simultaneously a member of classes B,C, and D for much the same reasons.

The pronominal elements (which mark person of verb and possessor of noun) also belong to several tone sandhi classes simultaneously. Namely, tone 1 person and plural markers are simultaneously members of classes A, B, and C; tone 2 person markers are simultaneously members of classes F and H; and tone 3 person markers are simultaneously members of classes B and D.

Tone 1 person and plural markers are:

-ro^{1} *we (inclusive)*

-le^{1} *you (plural)*

-bi?^{1} *he/she (human, informal)*

-nɛ?^{1} *he/she (human, respectful)*

-ba?^{1} *he/she (animal)*

ya^{1}ka^{1} *plural*

Tone 2 person markers comprise only first person singular markers -a?^{2} and -ga?^{2}. These person markers constitute the entire membership of tone sandhi classes F and H.

Tone 3 person markers consist of one other first person singular alternate and the remaining persons possible in CZ:

-da?^{3} *I*

-ndo?^{3} *we (exclusive)*

-dan?^{3} *he/she (spirit being)*

In addition to -ra^{1} *more*, -ka^{3}zi^{3} *surely, always*, and the various person markers, certain (but not all) nouns and verbs also have the ability to cause tone substitutions in preceding or following elements. Such nouns and verbs make up by far the bulk of each class. Representative members of each class will now be given.

Examples of nouns and verbs (Class A) having the ability to perturb the tones of certain following elements in a clockwise fashion are as follows:

ǰɾ¹la¹	*sister*	la?¹	*arrive*
šú²zɪ²	*father*	giué	*repair*

Examples of nouns and verbs (Class E) having the ability to perturb the tones of certain following elements in a counterclockwise fashion are as follows:

šú¹ku¹	*fingernail*	ɾo²	*drink*
lú¹ǰɪ¹	*tongue*	sɾ²	*get*

Examples of nouns (Class D) having the ability to perturb the tones of certain preceding elements in a clockwise fashion are as follows:

giu³láo?³ *city hall*

bé³no³ *owl*

Examples of nouns which are perturbed in a clockwise fashion (Class B) when preceded by some member of Class A are as follows:

bé²ko?²	*dog*	čɾ²ta²	*bone*
ǰɾ²tu¹	*cat*	gláo³	*river*

Examples of nouns and verbs which are perturbed in a clockwise fashion (Class C) when followed by some member of Class D are as follows:

škɪ?n¹	*nose*	á¹pa¹	*take care of*

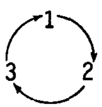
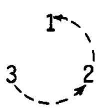
Examples of nouns and verbs (Class G) which are perturbed in a counterclockwise fashion when followed by some member of Class H are as follows:

laš²tā̲o²	*heart*	áo²	*eat*
ǰɾ²čo²	*arm*	gɾ³bi³	*wash*

The above is summarized in the following chart where, as above, the direction of the arrows indicates the linear direction of the tone sandhi, and a solid arrow represents clockwise sandhi, while counterclockwise sandhi is shown by arrows with broken lines for shafts.

Actually, the letters A, B, C, etc. represent morphophonemes and would have to be included in the spelling of any given morpheme listed in the lexicon. This would be necessary in order to identify which rule would be applicable in any given morpheme combination. Only in this way could the proper environment be supplied to trigger the application of rules (1) through (4). For

example, while any alienable noun stem is a member of Class B, only certain noun stems are members of Class C, etc. Without prior knowledge of tone sandhi class membership, there is no way of predicting if a tone substitution will take place, or in what manner.

Morphophonemic Tone Sandhi Classes				
	A	B	C	D
	ra^1 PM^1 ží^{1}la^1 šú^{2}zi^2 laʔ^1 giué^2 . . etc.	ra^1 ka^{3}zi^3 PM^1 PM^3 bé^{2}koʔ^2 ží^{2}tu^1 čí^{2}ta^2 gláo^3 . etc.	ra^1 ka^{3}zi^3 PM^1 ží^{1}la^1 škíʔn^1 á^{1}pa^1 á̲o^1 . . etc.	ra^1 ka^{3}zi^3 aʔ^2 PM^3 glu^{3}láoʔ^3 bé^{3}no^3 . . etc.
	E	F	G	H
	ra^1 šú^{1}ku^1 lú^{1}ǰi^1 í̲o^2 sí̲^{2} . . etc.	PM^2	laš^{2}tá̲o^2 ží^{2}čo^2 áo^2 gí^{3}bi^3 . . . etc.	PM^2

points to describe tone substitutions in other environments. Note the following examples:

ré?m^{3} + b ?^{1} *he/she (informal) wants*

rgf^{3}b + a^{2} *I sew*

ré?n^{3} + da?^{3} *I want*

Similarly, since no tone sandhi has ever been observed between adjectives and alienable nouns, the basic tone of these elements may be determined by simple juxtaposition.

Examples:

béo^{1} žé^{2}	*big comb*	béo^{1} dáo?^{3}	*small comb*
béo^{2} žé^{2}	*big cloud*	béo^{2} dáo?^{3}	*small cloud*
béo^{3} žé^{2}	*big earthmole*	béo^{3} dáo?^{3}	*small earthmole*

Any inalienable noun or verb stem followed by a noun beginning with a basic tone one or two will likewise exhibit its basic tone. The basic tone of this following noun may undergo sandhi, but the preceding noun or verb is never perturbed. In the following examples, the noun bé^{2}ko?^{2} *dog* will be used to determine the basic tones of three verbs and three nouns:

rf^{1}da^{1} bé^{3}ko?^{3} *the dog comes*

rzf?^{2} bé^{2}ko?^{2} *the dog gets*

rgf^{3}b^{3} bé^{2}ko?^{2} *the dog washes*

lũ^{1}ȳ^{1} bé^{3}ko?^{3} *the dog's tongue*

nã^{2}ga^{2} bé^{2}ko?^{2} *the dog's ear*

čf?^{3} bé^{2}ko?^{2} *the dog's voice*

Notice that in Examples 1 and 4, the basic ^{22} sequence of the noun was perturbed to ^{33} as a result of rule (2). This does not, it should be noted, hinder the determination of the basic tone of the preceding form. On the contrary, when such perturbation occurs, the analyst knows for sure that the perturbing form has a basic tone 1 if that no such perturbation occurs when the preposed form ends in tone 2 or 3. Of course, the basic tone of the frame morpheme must be determined in some other environment prior to its use here.

For further details see Pike, Kenneth L., Tone Languages: A Technique for Determining the Number and Type of Pitch Contrasts in a Language, with Studies in Tonemic Substitution and Fusion. (University of Michigan Publications, Linguistics, 4) pp. 75-6.

Footnotes

1

The Choapan dialect of Zapotec is spoken in the district of Choapan in the State of Oaxaca, Mexico. The dialect area forms a small peninsula from Comaltepec in the south to Arenal Grande in the north and is flanked on the east by Mixe and on the west by Chinantec.

The data for this study were collected during several field trips to the village of Comaltepec under the auspices of the Summer Institute of Linguistics, Inc. An initial draft of this paper was prepared at the Centro de Estudios "Manuel Gamio", Ixmiquilpan, Hidalgo, Mexico. Informants were Concepción Gonzales, female, 33 years of age, and Máximo Jiménez, male, 28 years of age, both of Comaltepec.

2

See Pike, Kenneth L., Language in Relation to a Unified Theory of the Structure of Human Behaviour, (The Hague: 1967), Mouton and Co.

3

Also, these terms will be occasionally abbreviated as P words, P phrases, etc., or, where that unit has been clearly identified as phonological, simply as word, phrase, etc.

4

The problem of tone analysis in Zapotec and its influence on the grammar has received considerable attention since 1926, when Jaime de Angulo wrote "The Development of Affixes in a Group of Monosyllabic Languages of Oaxaca," Lg. 2.46-61 (1926). See also Leal, Mary, "Patterns of Tone Substitution in Zapotec Morphology," IJAL 16.132-36 (July 1950) and Pike, Eunice V., "Problems in Zapotec Tone Analysis," IJAL 14.161-70 (July 1948).

5

In the P word examples in this section, the nucleus is set off by dashes.

6

A basic form has only basic tones represented. A basic tone is that tone a form has when in an environment where it will be unaffected by tone sandhi. For example, the basic tone of any person marker may be determined by observing what tone it has when preceded by a verb stem ending in tone three. Since such verbs have never been observed perturbing other elements, it is then assumed that the following person marker will have its basic or unperturbed tone. Basic tones, then, serve as convenient reference

7

This rule is intended to be read as follows: A morpheme of tone sandhi class B will have the next possible tone in accordance with clockwise tone sandhi when preceded by some morpheme of tone sandhi class A (i.e., 1 + 1 = 2, 2 + 1 = 3, but 3 + 1 = 1.)

8

This rule is intended to be read the same as tone sandhi rules (1) and (2) except that t^{-1} represents counterclockwise tone sandhi (i.e., 3 - 2 = 2, 2 - 1 = 1; recall that 1 - 1 = 3 does not occur).

9

For a description of the grammatical function of such morphemes as ra^1 *more*, ka^3zi^3 *surely*, and others, see Lyman, Larry G., "The Verb Syntagmemes of Choapan Zapotec," Linguistics 7:16-41 (July 1964).

[blank]

GUELAVIA ZAPOTEC PHONEMES

Ted E. Jones
Lyle M. Knudson

1. Consonants
2. Semivowels
3. Vowels
4. Distribution
5. Tone

This paper describes the basic phonemic structure of Guelavía Zapotec (GZ),[1] leaving certain interesting morphophonemic matters for a later study. The presentation begins with a brief introduction to the structure of the (phonological) word and then focuses on the elements which combine to form syllables.

A word consists of one or more syllables, only one of which is stressed. Stress affects a syllable in a variety of ways, tending to raise the pitch of the syllable, to lengthen fortis consonants, and to lengthen or cause rearticulation of vowels. In the majority of words, stress tends to be in the penultimate syllable and is left unmarked in illustrations when so occurring.

A syllable has an optional onset of from one to three consonants, an optional semivowel, a nuclear vowel which may be oral or laryngeal and open or checked by glottal, and an optional coda of one or two consonants and/or optional semivowel. The optional character of onset and coda permits two vowels to occur contiguously across a syllable boundary. Such a sequence of vowels may occur anywhere within the word, except that none is attested word-initially.

1. A consonant is fortis or lenis. Every fortis consonant has a corresponding lenis consonant, with the exception of fortis retroflex /ṣ/. Conversely, only lenis /r/ has no fortis counterpart. A fortis consonant is more tense and generally longer than a lenis consonant. All fortis obstruents are voiceless. A lenis consonant is more lax, with stops tending towards fricative articulation. A lenis consonant also has a voiceless release before pause (with the exception of the nasals /m n/). Lenis consonants also cause preceding stressed oral vowels to be lengthened.

The consonants of GZ are:

Obstruents:				
Stops:	Fortis:	p	t	k
	Lenis:	b	d	g

Affricates:	Fortis:	c	č	ç̌
	Lenis:	ʒ	j	
Fricatives:	Fortis:	s	š	ṣ̌
	Lenis:	z	ž	ẓ̌
Sonorants:				
Nasals:	Fortis:	m̲	n̲	
	Lenis:	m	n	
Lat. & Flap:	Fortis:	l̲		
	Lenis:	l	r	

/p b m̲ m/ are labial.

pap	*potato*	l̲am̲	*boss*
špala?	*my bullet*	m̲am̲	*grandmother*
bɛ̊l	*meat*	lam	*animal (pronoun)*
nislób	*teardrop*	mam̲	*mother*

/t d c ʒ s z n̲ n l̲ l r/ are alveolar.

wetípy	*wasp*	ináz	*to grab*
tu	*who*	n̲an̲a?	*I know*
dů	*rope*	čon̲	*three*
bed	*(he) came*	rson	*message*
cɨ?	*ten*	šn̲ana?	*my mother*
decpéngw	*hunchback*	pkwel̲	*cornhusk*
ʒɨt	*bone*	šl̲i?a	*type of scrambled eggs*
biaʒ	*plum*	gel	*cornfield*
sap	*toad*	škela?	*my cornfield*
tas	*a glass*	rapa?	*I have*
za	*lard*	besér	*bee*

/č j š ž/ are palatal.

ča?a *I will go* jåp *young girl*
gɨč *thorn* gɨj *town*
šaga? *my tree* žaga? *my grandchild*
yaš *avocado* gɨž *field grass*

/ç ʂ ʐ/ are retroflexed palatal.

gɨçú *cough* gaʂ *near*
pçuʐ *disguised* ʐajím̲y *bottom of the basket*
ʂaga? *my jaw* gɨčguʐ *needle*

/k g/ are velar.

kald *broth*
guk *when?*
gald *twenty*
gůg *turtledove*

1.1 The consonants of GZ contrast as follows:

STOPS

/p/	pap	[pap:ʰ]	*potato*	sop	[sop:ʰ]	*soup*
/b/	bal	[ɓa:lL]	*bullet*	nɪs̲lob	[nɪs̲lo:ɓp]	*teardrop*
/t/	tu	[tu|	*who*	aret	[aɾ̌ɛt:ʰ]	*earring*
/d/	dů	[dů']	*rope*	ared	[aɾ̌ɛ:dt]	*ox cart*
/k/	kald	[ka:ldt]	*broth*	guk	[gʊk:ʰ]	*when?*
/g/	gald	[ga:ldt]	*twenty*	gůg	[gůgx]	*turtledove*

AFFRICATES

/c/	cɨ?	[tsɨ?]	*ten*	rac	[ř̌at:s]	*ripe*
/ʒ/	ʒɨt	[dzɨt:ʰ]	*bone*	biaʒ	[ɓi:adzs]	*plum*
/č/	gɨçú	[gɨʈ:ʂú:]	*cough*			
/č/	kaličú?	[ka:litšú?]	*where are you (fam.) going?*			
	ča?	[tša?a]	*I will go*	gɨč	[gɨt:š]	*thorn*
/j/	jåp	[dža?ap:ʰ]	*young girl*	gɨj	[gɨ:dž̌š]	*town*

FRICATIVES

/s/	sa?	[sa?a]	*wedding*	tas	[tas:]	*a glass*
/š/	šaga?	[ša:ga?]	*my tree*	yaš	[yaš:]	*avocado*
/ṣ/	ṣaga?	[ṣa:ga?]	*my jaw*	gaṣ	[gaṣ:]	*near*
/z/	za	[za:]	*lard*	ináz	[i:názs]	*I will grab*
/ž/	žaga?	[ža:ga?]	*my grandchild*	yuž	[yu:žš]	*sand*
/ẓ/	ẓajíṃy	[ẓajíṃi]	*seat of the basket*			
	gɨčgúẓ	[gɨtšgú:ẓš]	*needle*			

SONORANTS

/ṃ/	laṃ	[laṃ:]	*boss*	maṃ	[maṃ:]	*grandmother*
/m/	lam	[la:m]	*it (animal)*	mam	[ma:m:]	*mother*
/n̲/	čon̲	[tšon̲:]	*three*	nan̲a?	[n̲an̲:a?]	*I know*
/n/	rson	[řso:n]	*message*	šnana?	[šna:na?]	*my mother*
/l̲/	pkwel̲	[pkwɛl̲:]	*cornhusk*	bel̲ak	[bel̲:ak:ʰ]	*how much?*
/l/	gel	[gɛlL]	*cornfield*	škela?	[ške:la?]	*my cornfield*

1.2 All fortis consonants are long when occurring intervocalically following a stressed vowel, or before pause. Fortis stops and nasals are also long following a stressed vowel when preceding a semivowel or voiced consonant.[2] In addition to length, the fortis stops /p t k/ are aspirated before pause.

[p:] rapa? [řap:a?] *I have*
rapyu? [řap:yu?] *you (form.) have*
rjapnɨ [řyap:ən̲ɨ] *we have*

[p:ʰ] tap [tap:ʰ] *four*
sop [sop:ʰ] *soup*

[t:] žyite?e [žyít:e?e] *kitten*
šitya? [šɪt:ya?] *my onion*
båtɨn [bå?åt:ɨŋ] *it is a skunk*

[t:ʰ] nit [nɪt:ʰ] *sugar cane*

[k:] špaka? [špak:a?] *my tadpole*
šåkya? [šå?ålk:ya?] *my cage*

špakn̈ [špak:ən̈] *our tadpole*

[k:ʰ] bak [ɓak:ʰ] *tadpole*
guk [guk:ʰ] *when*

[t:s][3] deca? [dɛt:sa?] *my back*
rac [řat:s] *ripe*

[t:š] gič [gɨt:š] ~ [xɨt:š] *hair*
škɨča? [škɨt:ša?] *my thorn*

[s:] rsesa? [ř̥sɛ̊?ɛ̊s:a?] *I shake*
nas [nas:] *day before yesterday*

[š:] našɨn [naš:ɨŋ] *it is sweet*
vaš [yaš:] *avocado*

[ʂ:] kuʂaʂ [kúʂ:aʂ:] *magpie*
boʂ [ɓoʂ:] *cocoon*

[m:] šlama? [šl̥am:a?] *my boss*
šlamnɨ [šl̥ám:ənɨ] *our boss*
ščlmya? [štšlm:ya?] *my basket*
nam [mam:] *grandmother*

[n:] šaplna? [šapln:a?] *my pine tree*
gɨnyu [gɨn:yu?] ~ [xɨn:yu?] *your throat*
gɨnbɨ [gɨn:əbɨ] ~ [xɨn:əbɨ] *his throat*
čon [tšon:] *three*

[l:] yulåy [yul:åy] *town hall*
šllya? [šfl:ya?] *my sheep*
pkwel [ɸkwɛl:] *cornhusk*

Voiceless bilabial /p/ is fricative before a voiceless consonant.

pkuz [ɸkuzs] *spark*
bapslo [ɓapslo:] *pupil (of the eye)*
ptåza? [ɸtåza?] *I hit (with an instrument)*

1.3 All lenis stops tend to occur predominantly fricative. Each has a full stop allophone, however, occurring after a homorganic consonant.

[b] rsånbyu? [ř̆såmbyu?] *you leave (it)*
runbɨ [ř̆umbɨ] *he does/makes (it)*

[d] ldu?a [ldu?a] *Oaxaca City*
nde [nde:] *that*
rdeda? [ř̆de:ɗa?] *I give*

[g] ngul [ŋgu:lL] *male*
decpéngw [dɛtspɛuŋgW] *hunchback*

Word initially, [d] fluctuates with [ɗ]. [ɗ] is more frequent initially when prevoicing occurs.

dub [du:bp̚] ~ [əɗu:bp̚] *maguey cactus*
deca? [dɛt:sa?] ~ [əɗɛt:sa?] *my back*

[g] fluctuates word initially with [h] and Ø before [u], and with [x] before [y], [ɪ], and [ɨ].

gůg [g̊ůgx] ~ [h̊ůgx] ~ [ů̊gx] *turtledove*
gyit [gyɪt:ʰ] ~ [xyɪt:ʰ] *squash*
giny [ginI] ~ [xinI] *steamer trunk*
gɨč [gɨt:š] ~ [xɨt:š] *thorn*

All lenis consonants except nasals have a voiceless release before pause.

[bp̚] ž̥ub [ž̥u:bp̚] *corn*
tě̊b [tě̊bp̚] *crooked*

[dt̚] zed [zɛ:dt̚] *salt*
gald [ga:ldt̚] *twenty*

[gx̚] yag [y̥a:gx̚] *tree*
žig [ži:gx̚] *gourd cup*

[dzs̚] bʒɨʒ [bdzɨ:dzs̚] *squirrel*
biaʒ [bi:adzs̚] *plum*

[dž̌š̌] dlčgíj [ditšgí:dž̌š̌] *argument*

bɨj [ɓɨ:dž̌š̌] *wide reed*

[zs] iz [i:zs] *year*

mɔndůz [mandůzs] *spider*

[ž̌š̌] yuž [yu:ž̌š̌] *sand*

glž [gi:ž̌š̌] ~ [xi:ž̌š̌] *field grass*

[ž̌š̌] nɔ̊ž [nɔ̊ž̌š̌] *do you see?*

[lL] gůl [gůlL] ~ [hůlL] ~ [ůlL] *egg yolk*

bɔl [ɓalL] *flame*

[řŘ] bɔsér [ɓesɛ́:řŘ] *bee*

pkalór [pkaló:řŘ] *type of bird*

Lenis flap /r/ is voiceless preceding a voiceless consonant.

rkô [Řkô?] *you (fam.) throw out*

rson [Řsɔn] *message*

rto?o [Řto?o] *you (fam.) sell*

When /r/ combines with itself in a cluster, it becomes a trill [r̃]. Phonetic [r̃] in any Spanish loanword is also treated as a phonemic cluster /rr/.

rragela? [r̃agela?] *I awaken*

rrů [r̃ů?] *you (fam.) cough*

arréd [ar̃ɛ́:dt] *ox cart (Spanish: carrete)*

Lenis nasal /n/ is [m] preceding a bilabial non-nasal consonant, and [ŋ] preceding a velar consonant and following [ɨ] before pause.

[m] bånbɨ [ɓåmbɨ] *he made/did*

rsanbɨ [Řsamɓi] *he leaves (it)*

[ŋ] ngul [ŋgu:lL] *male*

wenkɨ [wɛŋkɨ] *it's good*

cɨn [tsɨ:ŋ] *there are ten (inanimate objects)*

našɨn [naš:ɨŋ] *it's sweet*

2. The semivowels of GZ are palatal /y/ and labial /w/. Both are fricative word initially and before pause. In word-initial position, [w̬] fluctuates with [gw], and [y̬] fluctuates with [gy] and [xy].

[w̬] wetúb [w̬etú:bp] ~ [gwetú:bp] *ox beetle*
wetípy [w̬etíp:I] ~ [gwetíp:I] *wasp*
becpaw [bɛtspaw] *woodpecker*

[y̬] yu? [y̬u?u] ~ [xyu?u] ~ [gyu?u] *house*
yaš [y̬aš:] ~ [xyaš:] ~ [gyaš:] *avocado*
bliey [bliey] *type of tree*

Both semivowels are voiceless when following a consonant and preceding pause, or when interconsonantal. In these same environments, prelabialization in the case of /w/ and prepalatalization in the case of /y/ occur before the preceding consonant or consonant cluster.

[U] bɛ̊kw [bɛ̊?ɛ̊ukU] *dog*
dešpɛkwtɨ [dɛšpɛ̊?ɛ̊ukUtɨ] *your (pl.) dogs*

[I] ʒɨny [dzɨ:InI] *honey*
kwåkytɨ [kwå?åikItɨ] *you (pl.) will plant*

In the above cases, we have interpreted /w/ and /y/ as semivowels rather than the vowels /u/ and /i/ because of their fricative quality (/i/ and /u/ and other vowels are not fricative), and because of the prelabialization and prepalatalization occurring before preceding consonants, which does not occur before /i/ or /u/.

3. There are six vowels /i e ɨ a u o/, each of which may occur plain, laryngealized, or checked by glottal closure. Plain and checked vowels contrast phonemically, while laryngeal open and checked vowels occur in complementary distribution with one another.

The vowels of GZ in chart form are:

	Plain	Laryngeal	Checked
High:	i ɨ u	i̊ ɨ̊ ů	i? ɨ? u?
Low:	e a o	e̊ å o̊	e? a? o?

/i i̊ i?/ are high front.

gíny *steamer trunk*
gi̊ny *chili pepper*
pkí?n *we roasted (it)*

/e e̊ e?/ are mid front.

gel *cornfield*
be̊l *meat*
be?ld *snake*

/ɨ ɨ̊ ɨ?/ are high central.

zɨt *bone*
zɨ̊ny *work*
tɨ?šy *body*

/a å a?/ are low central.

yan *to sting*
yån *cornсob*
ya?n *to remain*

/u ů u?/ are high back.

gun *to do*
gůn *to cry*
gu?n *bull*

/o o̊ o?/ are mid back.

do *corn tassel*
rido̊ *you (fam.) loosen*
rido? *you (fam.) break*

3.1 The six oral vowels /i e a ɨ u o/ contrast as follows:

/i/ bidy [bi:di] *plant shoot*
/e/ bed [be:dt] *Peter*
/a/ bad [ba:dt] *duck*
/ɨ/ bɨdy [bɨ:di] *chicken*
/u/ kudy [ku:di] *thigh*

/o/ mod [mo:dt] *way*

Each of the six oral vowels contrasts with its corresponding checked and laryngeal vowels as follows:

/i/	giny	[ɡi:nI] ~ [xi:nI]	*ear wax*
/i̥/	gi̥ny	[ɡi̥nI] ~ [xi̥nI]	*chili pepper*
/iʔ/	pkiʔn	[pkiʔin]	*we roasted (it)*
/e/	gei	[ɡe:iL]	*cornfield*
/e̥/	be̥i	[bɛ̥iL]	*meat*
/eʔ/	beʔid	[bɛʔɛidt]	*snake*
/a/	yan	[ya:n]	*to sting*
/å/	yån	[yån]	*corncob*
/aʔ/	yaʔn	[yaʔan]	*to remain*
/ɨ/	ʒɨny	[dzɨ:inI]	*honey*
/ɨ̥/	ʒɨ̥ny	[dzɨ̥inI]	*work*
/ɨʔ/	tɨʔšy	[tɨʔɨišI]	*body*
/u/	gun	[gun:] ~ [hun:]	*to do*
/u̥/	gu̥n	[gu̥n] ~ [hu̥n]	*to cry*
/uʔ/	guʔn	[guʔun:] ~ [huʔun:]	*bull*
/o/	do	[do:]	*corn tassel*
/o̥/	rido̥	[řido̥ʔ]	*you (fam.) loosen*
/oʔ/	ridoʔ	[řidoʔo]	*you (fam.) break*

3.2 The oral open vowels /i e ɨ a u o/ are long when stressed preceding a lenis consonant or pause. In the case of /i/, its long variant also occurs when stressed preceding another vowel. Long [e:] is restricted to open syllables in the above environments, while long open [ɛ:] occurs in closed syllables.

[i:]	bidy	[bi:dI]	*plant shoot*
	bi	[bi:]	*air/wind*
	biaʒ	[bi:adzs]	*plum*
[e:]	webyuʔ	[we:byuʔ]	*you (form.) went*
	nde	[nde:]	*that*

[ɛ:] bɐsér [bɐsɛ́:ɾ̌Ř] *bee*
bɾed [bɾ̌ɛ:dt] *board*

[ɨ:] bɨj [bɨ:dž̌š̌] *wide reed*
yɐbʒf [yabədzf:] *organ cactus*

[a:] gɐʒ [ga:dzs] *seven*
zɐ [za:] *lard*

[u:] yʊž [yu:ž̌š̌] *sand*
bǫu [bəgu:] *knot*

[o:] gɔzmɨ [go:zmɨ] *sickle*
dɔ [do:] *corn tassel*

The above six oral open vowels are short when unstressed preceding a lenis consonant or pause, and preceding a fortis consonant either stressed or unstressed. Unchecked, unstressed /a o/ do not occur before pause in our limited corpus. Here again, as with the long variant of /e/, short [ə] occurs only in open syllables, and short open [ɛ] occurs in these environments only in closed syllables.

[ɪ] nɪs [nɪs:] *water*
bɨdɪngúl [bɨdɪŋgú:lL] *male turkey*

[ə] bəgɪ́dy [bəgɪ́:dI] *butterfly*
rkwabede [ɾ̌kwabə:də] *it is spicy*

[ɛ] gɛlgɪ́j [gɛlgɪ́:dž̌š̌] *illness*
gɛt [gɛt:ʰ] *tortilla*
bɐcgɪ́dy [bɐtsxɪ́:dI] *field rodent*

[ɨ] bɨdɪngúl [bɨdɪŋgú:lL] *male turkey*
gɔzmɨ [go:zmɨ] *sickle*
ʒɨt [dzɨt:ʰ] *bone*
gɨčgúž̌ [gɨtš̌gú:ž̌š̌] *needle*

[a] fluctuates with [ə] before fortis consonants, predominantly fortis nasals.

dəgɪz [dagɪ́:ž̌š̌] *straw raincape*

tap [tap:ʰ] *four*

datm̲ám̲ [datm̲ám̲] ~ [datm̲óm̲] *grandfather*

[u][4] gubá [gubá:] *vapor*

bɬyu [bɬyu] *moon*

ptyúš [ptyúš] *tomato*

škuliza? [škuli:za?] *my daughter-in-law*

[o] todad [toda:dt] *deceased grandfather*

m̲os [m̲os:] *a kiss*

bošẹ?n [boṣ̌ɛ?ɛn] *little cocoon*

In addition to its short variant [ɪ], /ɪ/ has a short open variant [ɹ] which occurs following /y/ preceding a fortis consonant.

žyɪt [žyɹt:ʰ] *cat*

gyɪt [gyɹt:ʰ] *squash*

3.3 The six oral checked vowels are rearticulated when stressed. In the case of /e?/, open [ɛ?] occurs in stressed closed syllables, while [e?e] is restricted to stressed open syllables.

[ɪ?ɪ] rɪ? [řɪ?ɪ] *water jug*

pkɪ?n [pkɪ?ɪn] *we roasted it*

[e?e] rkište?byu? [řkište?ebyu?] *you advise*

ze? [ze?e] *green bean*

[ɛ?ɛ] be?ɪd [bɛ?ɛɪdt] *meat*

bwe?n [bwɛ?ɛn] *moon*

[ɨ?ɨ] tɨ?šy [tɨ?ɨšɪ] *body*

rɨ?nɪ [řɨ?ɨnɪ] *tender*

[a?a] ya?n [y̲a?an] *to remain*

ča? [tša?a] *I will go*

[u?u] gu?n [gu?un] *bull*

yu? [y̲u?u] *house*

[o?o] ƚyo?n [ɓyo?on] *we went*
ƚo? [ɓo?o] *charcoal*

A short checked variant occurs when unstressed before pause for /ɨ? a? o? u?/. It is possible that these variants exist for /i? e?/; however, these have not been attested in the data.

[ɨ?] cɨ? [tsɨ?] *ten*

[a?] šn̲ana? [šn̲a:na?] *my mother*
rkaza? [ř̆ka:za?] *I want*

[u?] bɛcu? [bɛt:su?] *your brother*
rsanu? [ř̆sa:nu?] *you leave (it)*

[o?] l̲cko? [l̲ok:o?] *your forehead*
rɑgo? [ř̆a:go?] *you bite*

3.4 All six laryngeal vowels /i̥ e̥ ɨ̥ ḁ u̥ o̥/ occur unchecked preceding lenis consonants or semivowels. /e̥/ occurs as [ɛ̥] in a closed syllable and as [e̥] in an open syllable in the above environment.

[i̥] ži̥z [ži̥zs] *branch*
gi̥ny [gi̥nI] *chili pepper*

[e̥] ke̥za? [ke̥za?] *I will embrace*
rte̥ba? [ř̆te̥ba?] *I will make it crooked*

[ɛ̥] te̥b [tɛ̥ɓp] *crooked*
bɛz [bɛ̥zs] *puma*

[ɨ̥] gɨ̥j [gɨ̥:dž̆š] ~ [xɨ̥:dž̆š] *pimple*

[ḁ] yułḁy [yułḁy] *town hall*
ptḁza? [ptḁza?] *I hit*

[u̥] mandú̥z [mandú̥zs] *spider*
gu̥l [gu̥lL] *egg yolk*

[o̥] no̥ž̥ [no̥ž̥š̥] *do you see?*

/e̥ ḁ u̥ o̥/ are checked before pause. No checked /i̥ ɨ̥/ have been attested before pause.

[e̊ʔ] ndê [ndêʔ] *this one*

bê [ɓêʔ] *ant*

[å̊ʔ] lábå [lá:ɓå̊ʔ] *root*

[ů̊ʔ] dů [dů̊ʔ] *rope*

[o̊ʔ] rldô [řldô̊ʔ] *you (fam.) loosen*

All six laryngeal vowels are rearticulated when stressed preceding a fortis consonant. In the case of /i/, rearticulated variant [i̊ʔi̊] occurs in the above environment following /y/.

[i̊ʔi̊] gi̊š [gi̊ʔi̊š:] ~ [xi̊ʔi̊š:] *field*

[i̊ʔi̊] yi̊c [yi̊ʔi̊t:s] *paper*

[e̊ʔe̊] rsêsa? [řsê̊ʔe̊s:aʔ] *I shake*

[ɨ̊ʔɨ̊] gɨ̊ty [gɨ̊ʔɨ̊t:I] ~ [xɨ̊ʔɨ̊t:I] *a clay pot*

[å̊ʔå̊] båp [ɓå̊ʔå̊p:ʰ] *reed*

[ů̊ʔů̊] gů̊š [gů̊ʔů̊š:] ~ [hů̊ʔů̊š:] *smoke*

[o̊ʔo̊] ṣ̌o̊p [ṣ̌o̊ʔo̊p:ʰ] *six*

4. Eleven different syllable patterns occur in GZ: V, VC, CV, CVC, CVCC, CVCCC, CCV, CCVC, CCVCC, CCCV, and CCCVC.

4.1 The syllable nucleus contains one of any of the six vowels /i e ɨ a u o/, plain, checked, or laryngeal. Any vowel cluster of two vowels is ambisyllabic, and either [i] or [u] is one of the members. (In cases where stem-final vowels /e/ or /o/ occur before an /a/-initial suffix, a morphophonemic rule raises the two vowels to /i/ and /u/ respectively to maintain the /i/ or /u/ obligatory occurrence in a vowel cluster.

4.2 A syllable-initial margin may be filled by any consonant or semivowel in a single C position. In consonant clusters involving a two-consonant onset, the majority involve /p b š r/ as first members, with a few rare instances of ld, nd, ng, and mn.

In the case of /p/-initial two-cluster onsets, /l/, /r/, and fortis obstruents, except /p/ itself, occur as second members. /b/-initial clusters have /l r w y/ and all lenis obstruents, with the exception of /b/ itself and /ẓ/, occurring as second members. /š/-initial clusters have /r/ and all fortis consonants, except /š/ itself and /ç s ṣ/, occurring as second members. /r/-initial

clusters have /y/ and all fortis and lenis consonants, except retroflexed palatals /c̬ s̬ z̬/ and /m/ and /w/, occurring as second members. Examples of the most frequently occurring two-consonant onset clusters are:

pt	ptåz	*to hit*
pk	pkalor	*a type of bird*
ps	psía	*eagle*
bd	bdun	*whirlwind*
bz	bzå	*bean*
bl	blǒ	*crow*
šp	špala?	*my bullet*
št	štleš	*garlic*
šk	šketa?	*my tortilla*
rt	rtåza?	*I hit*
rd	rded	*to give*
rs	rseb	*voice*

Examples of rare consonant clusters:

ld	lday	*a piece*
nd	nde	*that*
ng	ngul	*male*
mn	mnin̊n	*little boy*

A syllable onset filled by a three-consonant cluster occurs with only /p b š r/ as initial members. /p/ and /š/-initial clusters are most frequent, with /r/ next, and /b/ occurring only in a /bld/ cluster. /s/ is most frequent as the second member. Examples of attested three-consonant onsets are:

pst	pstubyu?	*you (form.) consumed*
psk	psko?	*you (fam.) lengthened*
psl	pslo	*eye*
pkw	pkwel	*cornhusk*
pty	ptyu	*egg shell*
štr	štrages	*centipede*
šty	štyu	*shame*

škw	škwåna?	*my alfalfa*
šky	škyɨta?	*my squash*
šmn	šmn̥ɨmbyu?	*your (form.) little boy*
rst	rstubya?	*I consume*
rsl	rslasa?	*I thin out*
rld	rldonɨsa?	*I rinse*
bld	blda	*shade*

4.3 In a syllable-final margin, any consonant or semivowel except retroflexed /č/ may occur in a single C position. Reference may be made to Section 1.1 for examples of consonants in final position.

In a two-consonant cluster in syllable-final position, with the exception of -ld and -nd, all clusters end with semivowels /y/ or /w/. /w/-final clusters occur only with velars /k/ or /g/ as first members. /y/ occurs as the final member of a cluster preceded by any stop except /g/, or any nasal or lateral. Only one three-consonant cluster in syllable-final position has been attested: -ngw, found in bengw *bent*.

4.4 A few restrictions occur in regard to the relationship between a syllable margin and its nucleus. The rare phoneme /č/ occurs only before /u/. The phonemes /c/ and /ʒ/, when occurring in word-initial position, precede /ɨ/ only.

The problem of differentiating between semivowels /w/ and /y/ and vowels /u/ and /i/ has been simplified in word-initial and final positions due to the fricative nature of /w/ and /y/ when preceding or following vowels and the feature of voicelessness and accompanying prelabialization and prepalatalization respectively when occurring finally after consonants, all of which are lacking with the vowels /ɨ/ and /u/. When a high front vocoid occurs as a final member of a syllable onset, however, the only criterion available is stress placement. In words such as /štyu/ [štyú:] *shame*, for example, where stress is on the /u/ (causing it to be phonetically long), we consider the high front vocoid to be a semivowel, part of the margin. In words like /štieš/ [štɨ:eš:] *garlic*, however, where the /ɨ/ is stressed, it is analyzed as part of a vowel cluster.

5. GZ has a register tone system. Three level phonemic tones occur: low /ˋ/, mid /¯/, and high /ˊ/. Each of these three tones has a slightly lower allotone before pause and a slightly higher allotone which occurs with laryngealized vowels, checked vowels, or when stressed. Each vowel carries one of these three tones,

and a phonetic long vowel may carry either two identical level tones or a mid followed by a high tone, which resembles a contour mid-to-high glide.

The following data show the phonemic contrast among these three tones:

LOW-MID CONTRASTS

gə̀l	[gə̀ːlL]	*cornfield*
gə̄l	[gə̄ːlL]	*midnight*
bzà	[ɓzàʔ]	*bean*
bzā	[ɓzāʔ]	*I will cooperate*
zyìt	[zyìtːʰ]	*far*
žyīt	[žyītːʰ]	*cat*

LOW-HIGH CONTRASTS

tàp	[tàpːʰ]	*four*
táp	[tápːʰ]	*lid*
làdy	[làːɪdI]	*clothes*
l̲át	[l̲átːʰ]	*tin can*
gə̀l	[gə̀ːlL]	*cornfield*
bál	[ɓáːlL]	*bullet*

MID-HIGH CONTRASTS

m̲ām	[ɪm̲āːm]	*mother*
m̲ám̲	[ɪm̲ám̲]	*grandmother*
mɨ̄žˊ	[ɪmɨ̄ːžš]	*table*
mɨžˊ	[ɪmɨːžš]	*blond*
bēd	[ɓɛ̄dt]	*he came*
bɛ́d	[ɓɛ́ːdt]	*Peter*

Examples of long vowels carrying two different tones:

bzɪ̄ˊz	[ɓzɪ̄ˊːzs]	*smile*
gɪ̄ˊny	[gɪ̄ˊːnI] ~ [xɪ̄ˊːnI]	*ear wax*
za	[zāˊː]	*cloud*

NOTES

1

Guelavía Zapotec is a Zapotecan language spoken by approximately 30,000 people centering in the area of the village of San Juan Guelavía located in the district of Tlacolula in the state of Oaxaca in southern Mexico. The present study is based upon data gathered by TEJ while living in San Juan Guelavía for nine months and during a four month linguistic workshop sponsored by the Summer Institute of Linguistics at Mitla, Oaxaca, Mexico in the Spring of 1974. The principal informant was Edmundo Vásquez García, age 40, of Guelavía, for whose patience and cooperation we are indebted.

2

An open transition occurs between fortis stops or nasals and a voiced heterorganic consonant.

3

Since there is no release between identical consonants, a long /c/ is actualized phonetically as [t:s], and likewise long /č/ and /ǰ/ as [t:š] and [ṭ:ṣ], respectively.

4

A nasalized [ụ] occurs extra systemically in rare instances in the environments of /n/:

[nyụ] *smooth*

[yanǧ:n] *a small fruit*

[nʃʔụ] *your foot*

ERRATA to Studies in Otomanguean Phonology

p. 37, line 15: *it (inanimate)* > *it (animal)*
line 8 from bottom: *it (animal)* > *it (inanimate)*, and add ža?^{3} *it (animal)*
p. 38, line 10: kã^{3}mba? > kã^{3} mba?
p. 39, line 7 from bottom: zyendo^{32} > zyando^{32}
p. 41, line 3 from bottom and p. 54, line 14: dipthongs > diphthongs
p. 43, line 8: *annoint* > *anoint*
p. 47, line 3: /u. > /u/.
p. 53, line 11 from bottom: onset on > onset of
line 5 from bottom: nz~n > zn~n
p. 58, line 13: yana^{3} > yana^{34}
line 18: gači^{3} > gači?^{3}
line 9 from bottom: dots under vowels should be small circles, indicating voicelessness or breath
line 6 from bottom: somewhat > sometimes
p. 59, line 19: SJC /e/ > SJC /ẹ/
line 20: SJC /o/ > SJC /ọ/
p. 61, line 2: niža^{3} > niža^{53}
line 17: *(anticipatory,* > *(potential,*
p. 62, line 18 from bottom: yana^{3} > yana^{34}
p. 65, note 1, line 7: question, > questions,
p. 66, line 7: consistently > usually
p. 67, note 9: rule should read V(+high) → V(-high) / __#
p. 93, last example in (1) should be: nča^{3}ku^{34}
p. 94, first example in (6) should be: ču^{4}ra^{4}
p. 95, line 2: following > preceding
section (8): ?ai > ?ai^{2} (two occurrences)
line 13: /si/ > /ai/
line 6 of the paragraph following (10) should read: all such vowels are heavily nasalized.
third example in (11) should be: suąi^{21}
last example in (11) should be: [?ɨnda]
p. 97, line 9: /a/ > /ai/
p. 100, first example in (31) should be: bi^{2}ʒhɨ^{24}
third example in (31) should be: tɨ?^{314}nʒɨ^{14}
line 13 from bottom: [k^{Y}] > [k̠^{Y}]
p. 102, line 4: [y] > [?]
line 19 from bottom should read: . . . phonemes such as /Y ɸ/ (or maybe /Y f/), which . . .
p. 103, (34) and (35): Talapa > Jalapa
second example in (35) should be: c?é^{2}
p. 104, first example in (37) should be: nʒoh^{4}
last example in (37) should be: khä^{31}
line 4 from bottom: CV^{T}?V > CV^{T}?V^{T}
p. 105, note 1: Tejada > Tejeda
note 1: 6000 > 3000
note 2: -ua > -uą
note 3: GS-932 > GS-934
p. 107, second example in (4) should be: kɨ^{4}šu^{2}
p. 109, lines 4 and 5 from bottom: delete "on the same syllable"
p. 110, second example in (20) should be: rka^{14} ča^{2}
p. 115, first word in list should be: ta^{3} *(relator)* S2
p. 116, (28) and (32): *(cause)* > *(relator)*
line 9: *uh* > *(,)*
lines 5 and 6 from the bottom: ". . . pronounced with tone . . ." > ". . . pronounced with the cluster /^{31}/ when preceded by a syllable with tone . ."

(over)

p. 118, second paragraph: delete phrase in parentheses, lines 5 and 6, and add the following at the end of the sentence: "In the latter environment, the /^{24}/ may be preceded within the syllable by /^{4}/."
The context of Rule 7 in (36) should then be adjusted accordingly by moving (^{4}) from the middle of the first context to the first position of the second context.
last form of second example in (36) should be: ku^{2}ma^{3}si^{3}ne^{1}
p. 123, line 6 should read: ". . . in isolation, and they include all the words in the language."
p. 124, line 21: -nah^{41} > -nuh^{41}
p. 125, line 2: exclusive > inclusive
line 17: -ą; > -į;
p. 131, in second word of (23): -thąi^{4}- > -thąi^{3}-
p. 135 Jamieson 1974a has appeared in SIL Mexico Workpapers 2:85-107 (1976).
p. 136, note 1, line 8: 6000 > 3000