

THE PHONOLOGY AND TONE SANDHI OF MOLINOS MIXTEC

GEORGIA G. HUNTER AND EUNICE V. PIKE

0. INTRODUCTION

The Molinos dialect¹ of Mixtec, like other Mixtec dialects has a two-syllable couplet as the nucleus of the phonological word (K. Pike, 1948: 79-80; Mak, 1953:87; Longacre, 1957:11). The couplet in the Molinos dialect is pertinent in the description of (1) the placement of word stress (see 1.1, Rules 2 and 4), (2) allophones of /k/, /i/, and of nasalized vowels (see 7 and 9), (3) allotones (see 5), (4) the distribution of phonemes (see 10), and (5) in the description of tone sandhi (see 11).

Because of the importance of the couplet in description, the phonological word is treated first.

1. PHONOLOGICAL WORD

1.0. The phonological word is a rhythm unit in which timing is one of the contrastive features. That is, a phonological word of several syllables tends to be said with the same length of time as one with two syllables, and a word with numerous syllables is said very fast, as in: *nda²va²* 'to jump', *ka¹nda²va²-ti³* 'the animals are jumping', *k^wi³so³* 'to boil', *si²k^wi²so¹* 'to cause to boil', *si²k^wi²so¹-sq¹* 'I'll boil (it)', *si²k^wi²so¹-sq¹de³* 'I'll boil the water', *hi³si²k^wi²so¹-sq¹de³* 'we (exclusive) will boil the water', *nda²si²k^wi²so¹-sq¹de³nsa²* 'I'll reboil the water then!'.¹

1.1. The nucleus of each phonological word is a couplet of two syllables. This couplet may or may not be preceded and/or followed by one, two,

¹ The San Pedro Molinos dialect of Mixtec has approximately 700 speakers. The town is located in the District of Tlaxiaco, Oaxaca, Mexico. The principal informant used was Felipe Ortiz Juárez. The data were first gathered in 1964 and 1965 by Georgia Hunter on field trips under the auspices of the Summer Institute of Linguistics. The final analysis and preparation for publication was done by both authors.

Y AND TONE SANDHI OF
NOS MIXTEC

TER AND EUNICE V. PIKE

TRODUCTION

ic, like other Mixtec dialects has a two-
of the phonological word (K. Pike, 1948;
e, 1957:11). The couplet in the Molinos
ption of (1) the placement of word stress
phones of /k/, /l/, and of nasalized vowels
ee 5), (4) the distribution of phonemes
ion of tone sandhi (see 11).

the couplet in description, the phonologi-

OLOGICAL WORD

a rhythm unit in which timing is one of
t is, a phonological word of several syl-
same length of time as one with two syl-
erous syllables is said very fast, as in:
-ti³ 'the animals are jumping', k^wi³so³
oil', si²k^wi²so¹-sq¹ 'I'll boil (it)', si²k^wi²so¹-
si²k^wi²so¹-sq¹de³ 'we (exclusive) will boil
e³nsa² 'I'll reboil the water then!'

ological word is a couplet of two syllables.
be preceded and/or followed by one, two,

of Mixtec has approximately 700 speakers. The
xiaco, Oaxaca, Mexico. The principal informant
ta were first gathered in 1964 and 1965 by Georgia
ices of the Summer Institute of Linguistics. The
lication was done by both authors.

or three syllables. In this paper when the couplet is not preceding word
space, we have written a hyphen separating it from the postcouplet
syllable(s). Examples² of contrasting placement of the couplet are:
ka²ta²-ži² 'the child will sing', si²ka¹a¹ 'to feed', ka¹hi²ta²-ži² 'the chil-
dren are singing', k^li¹ři³-sq¹nsa² 'I'm going then!', hi³nda²ke²te²-ña²
'the women will launder'.

1.2. The placement of word stress is dependent upon the tone sequence
and upon the position of the couplet within the word. Five rules may be
used in determining the placement of stress in the phonological word.
(Within this section, word stress has been marked by an acute accent.)

Rule 1: The syllable with the last tone 1 which is followed by a lower
tone within the word receives stress: ka²ndi¹ha²-de²ža³ 'he will obey
God', ka²ndi¹ha²-sq¹ža³ 'I will obey God', si²kú¹ři²-de²ti³ 'he will
bathe the animal', si²ku¹ři²-sq¹ti³ 'I will bathe the animal'. If no tone 1
occurs, stress occurs on the syllable with the last tone 2 which is followed
by a low tone: k^wi²ni³-de²ti³ 'he will see the animal'.

Rule 2: Stress does not occur on a precouplet syllable, even when
it is followed by a tone 3: ku¹vři³hi²-sq¹ 'I am cold'.

Rule 3: If a word is composed entirely of syllables with tone 1, or
entirely of syllables with tone 2, all syllables are equally stressed as in
kó¹ni¹-ni¹ 'your turkey hen', žó¹řl¹ni¹ 'to cover one's head', and ndá²ké²
té² 'will wash', ké²té²-de² 'he will dig'.

Rule 4: Stress occurs on the first syllable of the couplet (1) if a word
is composed entirely of syllables with tone 3, as in ti³ndó³ko³ 'avacado
seed', žú³ku³-li³ 'my herbs', (2) if it is composed of a sequence in which
each succeeding tone is higher than the preceding one, as in kři³vi²-sq¹
'I will enter', (3) if it is composed of a sequence of level tones followed by
a higher tone, as in si²ká²sq¹ 'to toast', kři²ti²-ni¹ 'your animal', ñá³řl³vi¹
'the world'.

Rule 5: If a word contains a sequence of two level tones following
a lower tone, such as 211, 322, 311, there is a unifying rhythm of the level
sequence and a slight lengthening of the vowel preceding the level
sequence, as in k^wé²le¹-ni¹ 'your comrade', ñá³ži²vi² 'people', ti³ka²-de²
'his grasshopper', sé³te¹-ni¹ 'you will shave'.

² The numbers represent tone: tone ¹ (high), tone ² (mid), and tone ³ (low).

2. PHONOLOGICAL PHRASE

A phonological phrase is made up of one or more phonological words. It is characterized (1) by a following pause, (2) by a downdrift of pitch, and (3) by phrase stress.

In precise speech, downdrift of pitch is slight or absent, but in relaxed speech in a sequence of several phrases, the downdrift is apparent. In the following example, although all syllables are tone 3, those at the end of the phrase are lower than those at the beginning: $\rho\acute{u}^3ni^3 \acute{z}\acute{u}^3ku^3 \rho\acute{u}^3va^3$ 'three bitter herbs'.

Phrase stress is independent of word stress and rarely coincides with it, since word stress does not occur on the phrase-final syllable, whereas phrase stress usually occurs there.

Phrase stress occurs on the phrase-final syllable, except when the phrase-final word has a CV?V or CVhV pattern, in which case phrase stress occurs on the next to the last syllable. (In this section word stress has been marked with an acute accent, and phrase stress with a circumflex accent.) $\acute{s}i^3ko^2-\tilde{n}a^2 n\acute{d}i^2vi^1$ 'she will sell eggs', $\acute{s}i^3ko^2-\tilde{n}a^2 \acute{z}\acute{a}^1pa^1$ 'she will sell chiles', $\acute{s}i^3ko^2-\tilde{n}a^2 \tilde{n}\acute{u}^1ha^1$ 'she will sell masa', $ka^2t\acute{a}^2-li^3$ 'I will sing'.

In addition to the phrase stress which occurs on the phrase-final syllable, a word may be emphasized by means of extra loudness. In the following examples we have marked this extra loudness with a double apostrophe. Examples: $n\acute{a}^3va^2 ku^1u^2 ha^3k\acute{q}^1pa^3 t\acute{u}^2t\acute{u}^3$ 'what does the paper(!) say?', $n\acute{u}^1\acute{u}^1 ki^2ti^2 va^1pa^2 ve^2nti^1 pe^2s\acute{u}^1$ 'if (it is) a good(!) animal (it is worth) twenty pesos'.

3. SYLLABLE

Each syllable has a nucleus which consists of one vowel and one tone. The nucleus may or may not be preceded by one, two, or three consonants, and may be followed, in restricted environments, by /ʔ/. A syllable ending in /ʔ/ occurs only couplet-medial, or at the fusion of a couplet and postcouplet, or at the fusion of two couplets (see 10.1).

Each of the following words consists of three syllables: $te^3e^2-a^1$ 'this man', $ka^2\rho vi^2-sq^1$ 'I will read', $nsti^1i^2-sq^1$ 'I glued (it)'.

Examples of various syllable patterns are: te^3e^2 (CV+V) 'man', la^1ku^1 (CV+CV) 'worm', sta^3a^3 (CCV+V) 'tortilla', $nste^3pe^3$ (CCCV+CV) 'taught', $za^2\rho vi^2$ (CV?+CV) 'expensive'.

LOGICAL PHRASE

up of one or more phonological words.
ing pause, (2) by a downdrift of pitch,

pitch is slight or absent, but in relaxed
phrases, the downdrift is apparent. In
all syllables are tone 3, those at the
those at the beginning: $\rho u^3 ni^3 \text{ } \check{z} u^3 ku^3$

word stress and rarely coincides with
ur on the phrase-final syllable, whereas

phrase-final syllable, except when the
r CVhV pattern, in which case phrase
st syllable. (In this section word stress
cent, and phrase stress with a circum-
she will sell eggs', $\check{s} i^3 ko^2 \text{-} \check{n} a^2 \text{ } \check{z} \hat{a}^1 \rho a^1$
 $\check{n} \hat{u}^1 ha^1$ 'she will sell masa', $ka^2 t \acute{a}^2 \text{-} li^3$

ess which occurs on the phrase-final
sized by means of extra loudness. In
marked this extra loudness with a double
 $\acute{u}^1 u^2 ha^3 k \acute{a}^1 \rho a^3 t \acute{u}^2 t \acute{u}^3$ 'what does the
 $\rho a^2 ve^2 nti^1 pe^2 s \acute{u}^1$ 'if (it is) a good(!)

SYLLABLE

h consists of one vowel and one tone.
preceded by one, two, or three conso-
stricted environments, by /p/. A syllable
t-medial, or at the fusion of a couplet
of two couplets (see 10.1).

sists of three syllables: $te^3 e^2 \text{-} a^1$ 'this
 $ti^1 i^2 \text{-} sq^1$ 'I glued (it)'.
terns are: $te^3 e^2$ (CV+V) 'man', $la^1 ku^1$

+V) 'tortilla', $nste^3 \rho e^3$ (CCCV+CV)
ensive'.

4. TONE CONTRASTS

There are three tones: tone 1 (high), tone 2 (mid), and tone 3 (low). In two-syllable words the nine possible sequences (11, 12, 13; 21, 22, 23; 31, 32, 33) may occur in isolation but tone sequences 13 and 31 are rare. All possible sequences also occur in three-syllable words.

Examples of the tones in contrast are: $ta^2 ta^1 \text{-} sq^1$ 'my father', $tu^2 tu^2 \text{-} sq^1$ 'my firewood', $tu^2 tu^3 \text{-} sq^1$ 'my paper', $\rho u^3 u^3 ri^1 ki^2$ 'two woodpeckers', $\rho u^3 u^3 ki^2 ti^2$ 'two animals', $\rho u^3 u^3 hi^3 ki^2$ 'two fists', $ka^3 nta^3 \text{-} sq^1$ 'I will move', $ka^3 nta^3 \text{-} \check{n} a^2$ 'she will move', $ka^3 nta^3 \text{-} ti^3$ 'the animal will move'.

Examples of tone sequences in three-syllable words: $\check{n} a^3 \check{z} i^3 vi^1$ 'the world', $ti^3 ka^3 \check{z} i^2$ 'charcoal', $\check{s} i^3 ndi^3 ki^3$ 'oxen'; $nu^3 \check{c} i^2 zo^1$ 'shoulder', $\check{n} a^3 \check{z} i^2 vi^2$ 'people', $ti^3 ka^2 su^3$ 'dry tortillas'; $tu^3 ndo^1 ko^1$ 'zapote tree', $ha^3 \check{z} a^1 \rho a^2$ 'this'; $k^w i^2 ni^3 \text{-} sq^1$ 'I will know', $\check{c} i^2 ndu^3 hi^2$ 'to bury', $k^w i^2 so^3 \text{-} de^3$ 'the water will boil'; $ndi^2 ki^2 vi^1$ 'daily', $\check{z} o^2 \check{s} i^2 ni^2$ 'hat', $ko^2 te^2 ku^3$ 'to live'; $\check{c} i^2 k^w a^1 ku^1$ 'lizard', $ka^2 ndi^1 ha^2$ 'to obey', $ki^2 \check{s} i^1 \text{-} ti^3$ 'the animal is sleeping'; $\check{z} o^1 \check{s} i^1 ni^1$ 'to cover one's head', $su^1 ku^1 \text{-} de^2$ 'he is tall', $\rho i^1 \check{z} o^1 \text{-} de^3$ 'there is water'; $ti^1 la^2 \text{-} ni^1$ 'your hen', $ti^1 la^2 \text{-} \check{n} a^2$ 'her hen', $ti^1 la^2 \text{-} li^3$ 'my hen' (familiar); $ka^1 \rho a^3 \text{-} sq^1$ 'I am talking', $ka^1 \rho a^3 \text{-} \check{n} a^2$ 'she is talking', $ka^1 \rho a^3 \text{-} li^3$ 'I am talking' (familiar).

5. TONE VARIANTS

Tone variants may be described in relations to their environment as defined (1) by contiguous tones, (2) by placement in relation to the couplet of the word, and (3) by their occurrence phrase final or nonphrase final.

There is a gradual downdrift of pitch which is perceptible in a phrase consisting of several words (see 2).

Tone 1 has a raised allotone which occurs when preceding a tone 2 or tone 3 within a word. In $ko^1 ni^1 \text{-} a^2$ 'this turkey hen', the /ni¹/ has a higher pitch than the /ko¹/. In $vi^1 lu^1 \text{-} u^2$ 'that cat', the /lu¹/ has a higher pitch than /vi¹/.

Tone 2 has a raised allotone when preceding a tone 3 within a word. In $ka^2 ta^2 \text{-} li^3$ 'I will sing' (familiar), the /ta²/ has a higher pitch than /ka²/. In $ndo^2 k^w i^2 \check{n} i^3$ 'to stand up', the /k^wi²/ has a higher pitch than /ndo²/.

When following tone 3 within a word, tone 2 has a lowered allotone. In $hi^3 to^2 hi^2 te^1$ 'wide bridge', the syllable /to²/ has a lower allotone than /hi²/.

A tone 3 glides downward when phrase final, as in *hi³ka³š³i³* 'to grind', and *žu³ku³-li³* 'my herbs' (familiar). A tone 3 has a raised allophone when following a tone 2 within a word, as in *tu²tu³-li³* 'my paper' (familiar).

6. CONSONANT CONTRASTS

There are eighteen consonant phonemes:³ stops and affricates /p (rare, loan words only), t, č, k, k^w, ʔ/; fricatives and spirants /v, d, s, š, ž, h/; nasals /m, n, ñ, ŋ/; lateral /l/; and trill /r (rare)/.

Bilabials /p, v/: *pa¹a³* 'bread', *va³a³* 'noisy'.

Dentals and alveopalatals /t, d, s, š, ž, č/: *ta²ka³* 'nest', *nda²ta²-de²* 'he is splitting (it)', *sa²ka²* 'to mix', *šq³ʔq²* 'grease', *ža²ka³* 'loft', *ča²ka²* 'fish'. (The sequence [ša] also contrasts with [sia] and with [šia] as in *vi³ša³* 'wet', *ki³si²-a¹* 'this jug', *ʔi²ši¹-a²* 'this hair'.)

Velars /k, k^w, h/: *ki²ti²* 'animal', *k^wi¹ti¹* 'short', *hi²ti³* 'intestines'. The sequence /k^wV/ contrasts with the sequence /kuV/: *su³k^wa³* 'eyebrow', *žu³ku³-a¹* 'this herb'.

The glottal stop versus the absence of glottal stop: *ko³ʔo³* 'dish', *ko³o³* 'snake'.

The nasals, lateral, and vibrant /m, n, ñ, ŋ, l, r/: *mi²ʔi²* 'exactly', *ni³ʔi²* 'fast', *ñi¹ʔi³* 'mute', *ŋi²ʔi²* 'grasped', *li²ŋki¹* 'puppy', *ri²ŋki²* 'mouse', *ri¹ki²* 'woodpecker'. (These are the only two words with /r/ which are not loan words.)

7. CONSONANT VARIANTS

The stop phonemes /p, k, k^w/ (but not /t/ or /č/) have voiced allophones when following a nasal consonant. *pa¹a³* 'bread', *mpa¹a³* [mba¹a³] 'compadre'; *ku²u²* 'to be able', *ŋku²u²* [ŋgu²u²] 'was able'; *k^we³ʔe²* 'to injure', *ŋk^we³ʔe²* [ŋg^we³ʔe²] 'was injured'.

There is a lack of symmetry in that the stop phoneme /t/ and the affricate /č/ do not have voiced allophones following a nasal consonant: *te²e²* 'to write', *n²te²e²* [nte²e²] 'wrote'; *ta²ka³* 'nest', *nta³ka¹* 'every, all', *či²i²* 'to become wet', *nči²i²* [ntši²i²] 'became wet'.

³ In addition to the phonemes which occur in native words, there is a voiced fricative /g/ which occurs in Spanish loan words. It is more fortis than the allophone of /k/: *ga²nču¹* 'hook'.

then phrase final, as in *hi³ka³ši³* 'to familiar). A tone 3 has a raised allophone within a word, as in *tu²tu³-li³* 'my pa-

CONTRASTS

phonemes:³ stops and affricates /p (rare, fricatives and spirants /v, d, s, š, ž, h/; trill /r (rare)/.

a³a³ 'noisy'.
s, š, ž, č/: *ta²ka³* 'nest', *nda²ta²-de²* 'grease', *šq³pa²* 'grease', *ža²ka³* 'loft', *ča²ka²* contrasts with [sia] and with [šia] as in *ti¹-a²* 'this hair'.
al', *k^wi¹ti¹* 'short', *hi²ti³* 'intestines'.
the sequence /kuV/: *su³k^wa³* 'eyebrow',

presence of glottal stop: *ko³po³* 'dish',

t /m, n, ñ, ŋ, l, r/: *mi²pi²* 'exactly', *ti²ki²* 'grasped', *li²ŋki¹* 'puppy', *ri²ŋki²* these are the only two words with /r/

VARIANTS

not /t/ or /č/) have voiced allophones
nt. *pa¹a³* 'bread', *mpa¹a³* [mba¹a³]
ŋku²u² [ŋgu²u²] 'was able'; *k^we³pe²*
as injured'.

that the stop phoneme /t/ and the
allophones following a nasal consonant:
ote'; *ta²ka³* 'nest', *nta³ka¹* 'every, all',
] 'became wet'.

occur in native words, there is a voiced fricative
It is more fortis than the allophone of /k/:

The fricatives /s, ž/ (but not /d/ or /š/) have affricate allophones when following a nasal consonant: *žo¹so¹* 'to be mounted', *nžo³so²* [ndžo³so²] 'was mounted'; *sa¹pa²* 'to do, make', *nsa³pa²* [ntsa³pa²] 'did, made'.

There is a lack of symmetry in that the fricative /d/ has a stop allophone (instead of an affricate), and fricative /š/ has a fricative allophone (instead of an affricate) when following a nasal consonant: *nda²pa²-de¹* [nda²pa²-de¹] 'his hand', *pu³nde³* [pu³nde³] 'until', *ši²či¹tu¹* 'to fill', *nši²či¹tu¹* [nši²tši¹tu¹] 'to have filled', *ši²či¹i²* 'to dampen', *nši²či¹i²* [nši²tši¹i²] 'to have dampened'.

Because other Mixtec dialects do not have a contrast of voicing versus voicelessness following a nasal consonant we have given examples of the contrasts here: *nda²va²* [nda²ba²] 'did fly', *nta²va²* [nta²ba²] 'did pull up'; *nži²i²* [ndži²i²] 'became old', *nči²i²* [ntči²i²] 'became wet'.

The phoneme /k/ varies from a voiceless velar stop to a voiced velar lenis fricative when in a postcouplet syllable which is not phrase final, as in *ka²a²-ni¹ ho²o³-[k/g]a³ ndu²či²* 'eat a few more beans'.

Voiceless stop /t/ has a voiceless nasal release when preceding a nasalized vowel: *tu²tu²* [tu²t^Nu²] 'firewood'.

The sibilants /š, ž/ are retroflexed when preceding /a, o, u/: *šq³a³* [šq³a³] 'very', *žo²po²* [žo²po²] 'rope'. They are not retroflexed, however, when preceding front vowels: *ši²i²* [ši²i²] 'side', *že²pe²* [že²pe²] 'outside'.

The dental nasal /n/ varies to voicelessness when phrase initial preceding a cluster of voiceless consonants, as in [n/N]ste¹pe³ 'did teach'.

The velar nasal /ŋ/ is voiceless when preceding /h/: *ŋha²a²* [I]ha²a² 'did eat'. With some speakers this alternates with the absence of the nasal consonant, as in *ŋha²a²* or *ha²a²* 'did eat'.

When preceding a consonant word medially, the glottal stop may have a voiced release with the vocoid quality of the preceding vowel, as in *ža²[p/pa]vi²* 'expensive'. This vocoid release contrasts with a sequence in which a vowel follows a glottal stop, in that the allophonic vocoid release of the /p/ is shorter than a vowel in that environment, as in *ži¹pi¹-žu¹* [ži¹pi¹žu¹] 'hollow' versus *ti²pi²* [ti²pi²] 'to suck'.

The voiced bilabial fricative /v/ fluctuates in the degree of rounding and friction. When it is word initial, and also when contiguous to a front vowel it is usually flat and fricative: *va³pa²* [ba³pa²] 'good', *ndi³vi³* [ndi³bi³] 'egg'. When preceding /u/ and also when following /p/, the rounded allophone is the more frequent: *va¹pvu³* [ba¹pvu³] 'coyote', *pu³pva³* [pu³pwa³] 'salty', *še³pva³* [še³pwa³] 'gully'.

The trill /r/ has a flap allophone which occurs word medially: *va²ra¹* [ba²ra¹] 'staff', *ka²ru¹* [ka²ru¹] 'truck'.

8. VOWEL CONTRASTS

There are five oral vowels /i, e, a, o, u/ and five nasalized vowels /ĩ, ẽ (rare), ã, õ, ũ/.

Front vowels /i, ĩ, e, ẽ/: *vi³š³i³* 'sweet', *vi³š³i³* 'warm', *ti²i²* 'tense', *ti²i²* 'to seize', *te³e²* 'man', *te³e³* 'forehead', *ki²i²* 'to arrive', *ke²e²* 'to leave'.

Central vowels /a, ã/: *ka³a²* 'bell, metal', *ka³a²* 'to adjust', *ka²a²* 'to eat'.

Back vowels /o, õ, u, ũ/: *ču²ku²* 'louse', *ču²ku²* 'fly', *ču²ko²* 'our louse', *ču²ko²* 'our fly'.

9. VOWEL VARIANTS

Allophonic nasalization of vowels is best described in relation to the couplet.

When the couplet-medial consonant is a nasal, the contiguous vowels are nasalized. (There is no contrast between oral and nasalized vowels in this environment.) For example: *ku¹nu¹* [k¹u¹n¹] 'deep', *ka¹ni¹* [k¹a¹n¹i¹] 'long'.

When the couplet-initial consonant is a nasal, both vowels of the couplet are nasalized unless a consonant other than /p/ or /h/ occurs between them. *nu³u³* [n³u³] 'face', *ña²pa²* [ñ²a²p²a²] 'woman', *ni¹hi¹* [n¹i¹h¹i¹] 'you' (polite), but *ñu³ti²* [ñ³u³t²i²] 'sand'.

Preceding a postcouplet nasal, however, and also preceding a couplet-initial nasal, there is contrast between an oral and a nasalized vowel even though the oral vowel may be slightly nasalized in that environment: *tu²tu³-ña²* 'her paper' versus *tu²tu²-ña²* 'her firewood', *ka²a³-ña²* 'she will say' versus *ka²a³-ña²* 'she will punch', *ku²nu²u²-de²* [k²u²n²u²-de²] 'he will be important' versus *ku¹nu¹-de³* [k¹u¹n¹-de³] 'the water is deep'.

There is also a contrast of an oral versus a nasalized vowel when preceding a postcouplet nasalized vowel. *ču²ku¹-u²* 'that louse' versus *ču²ku¹-u²* 'that fly'. Within the couplet, however, oral vowels and nasalized vowels do not occur contiguously (see 10.2).

Of all nasalized vowels /ũ/ is the most heavily nasalized and /ã/ is the least nasalized: *ku³u³* 'four', *ko²o³* 'we will punch', *ši²i²* 'side', *ka²a³* 'to punch'.

The vowel /ũ/ varies from a vocoid to a syllabic [m̃] when contiguous to /k/ or /p/, as in *ku³u³* [k³u³]/[k³m̃³] 'four', and *pu³pu³* [p³u³]/[p³m̃³] 'five'.

The vowels are more heavily nasalized after /ŋ/ than after other nasal

CONTRASTS

o, u/ and five nasalized vowels /ĩ, ẽ

weet', $vi^3\check{s}i^3$ 'warm', ti^2i^2 'tense', ti^2i^2

ad', ki^2i^2 'to arrive', ke^2e^2 'to leave'.

well, metal', ka^3q^2 'to adjust', ka^2a^2

louse', $\check{c}u^2ku^2$ 'fly', $\check{c}u^2ko^2$ 'our louse',

VARIANTS

is best described in relation to the

nant is a nasal, the contiguous vowels

st between oral and nasalized vowels

ple: ku^1nu^1 [$k\check{u}^1n\check{u}^1$] 'deep', ka^1ni^1

nant is a nasal, both vowels of the

sonant other than /r/ or /h/ occurs

re', $\check{n}a^2\check{p}a^2$ [$\check{n}\check{a}^2\check{p}\check{a}^2$] 'woman', ni^1hi^1

q^3ti^2] 'sand'.

however, and also preceding a couplet-

ween an oral and a nasalized vowel

lightly nasalized in that environment:

$\check{p}i^2-\check{n}a^2$ 'her firewood', $ka^2a^3-\check{n}a^2$ 'she

punch', $ku^2nu^2u^2-de^2$ [$k\check{u}^2n\check{u}^2\check{u}^2-de^2$]

de^3 [$k\check{u}^1n\check{u}^1-de^3$] 'the water is deep'.

oral versus a nasalized vowel when

vowel. $\check{c}u^2ku^1-u^2$ 'that louse' versus

couplet, however, oral vowels and

iguously (see 10.2).

ne most heavily nasalized and /a/ is

$k\check{p}^2\check{p}^3$ 'we will punch', $\check{s}i^2i^2$ 'side',

oid to a syllabic [m] when contiguous

$k\check{m}^3\check{m}^3$] 'four', and $\check{p}u^3\check{p}u^3$ [$\check{p}\check{u}^3\check{p}\check{u}^3$]

alized after /ŋ/ than after other nasal

consonants: $\eta o^2 o^3$ 'we did punch' (inclusive) versus $\check{n}o^1 o^3$ 'our town' (inclusive). Nasalized vowels are more heavily nasalized when following /k/ than when following other oral consonants, as in $ka^2 q^3$ 'to punch' versus $\check{s}a^3 q^3$ 'very'.

The vowel /i/ has various allophones. (1) It may optionally be voiceless when following a voiceless consonant phrase finally: $ka^3\check{c}[i/\check{i}]^3$ 'cotton'. (2) It varies to [i] when following /u/, as in $ha^3vu^2i^2\check{s}i^1$ 'conceited'. (3) It, or its counterpart /ĩ/, is especially short when occurring in the pre-couplet contiguous to a couplet-initial vowel: $vi^2o^2\check{p}o^2$ 'our house' (inclusive), $\check{c}i^3\check{p}^3\check{p}o^2$ 'our skunk' (inclusive). (4) When between /š/ and a couplet-initial vowel, it is actualized as nonretroflexion of the /š/: $\check{s}i^3q^3\check{p}u^3$ [$\check{s}\check{a}^3\check{p}\check{u}^3$] 'fifteen'.

The vowel /e/ has allophones ranging from [e] to [ẽ]. The [e] is the more frequent when a member of a geminate cluster, as in ke^3e^2 [ke^3e^2] 'to sink'. The [ẽ] is the more frequent when contiguous to /p/, as in $\check{z}e^2\check{p}e^2$ [$\check{z}\check{e}^2\check{p}\check{e}^2$] 'outside', and when following /h/ or /k/, as in ke^2nta^2 [$k\check{e}^2nta^2$] 'to leave', he^1te^2 [$h\check{e}^1te^2$] 'digging'. (But if a geminate cluster follows /k/, the allophone [e] occurs.) There is variation, but in other environments [ẽ] is more frequent.

The vowel /o/ varies to the open allophone [õ] following a nasal consonant or /k^w/, and when it is a member of the geminate cluster /oo/, as in $no^3\check{p}o^2$ [$n\check{o}^3\check{p}\check{o}^2$] 'our teeth', $su^3k^wo^3$ [$s\check{u}^3k^w\check{o}^3$] 'our eyebrows', $\check{z}o^2o^3$ [$\check{z}\check{o}^2\check{o}^3$] 'our song'.

10. DISTRIBUTION OF PHONEMES

10.1. The distribution of consonant clusters⁴ within a phonological word is best described in relation to the couplet and the morpheme. Couplet-medial consonant clusters begin with either /p/, /n/ or /ŋ/, whereas couplet-initial clusters, except for the cluster /st/, begin with /n/ or /ŋ/. There are no bimorphemic clusters in a couplet-medial environment, but in a couplet-initial environment the majority are bimorphemic. Only /ns/ occurs post-couplet.

Medial in a couplet the following monomorphemic clusters occur frequently: /pm, pn, pñ, pv, pž, pl/, as in $\check{n}a^2\check{p}mi^3$ 'sweet potato', $ku^2\check{p}ni^3$ 'to tie up', $\check{s}i^1\check{p}\check{n}a^1$ 'sparrowhawk', $\check{z}a^2\check{p}vi^2$ 'expensive', $ndi^2\check{s}i^1\check{p}\check{z}u^1$ 'goat',

⁴ There are various clusters in Spanish loan words which do not occur in native words, as in $ve^2rko^2ki^1$ 'apricot', $ga^2vri^2e^1e^2$ 'Gabriel', $vri^2\eta ka^1$ [$b\check{r}i^2\eta ga^1$] 'gringa', $ka^3hu^1e^2$ 'coffee'.

ko¹ɲlo¹ 'turkey'. Infrequently monomorphemic clusters /nd, nt, nč, ŋk, ɲnd/ also occur, as in *ɲu³nde³* 'until', *ka³nta³* 'to move oneself', *la²nči²* 'sheep', *mi²ŋki²* 'brains', *ko³ɲndo³* 'knee'. (No bimorphemic clusters occur couplet-medially.)

The trill /r/ never occurs couplet medially and /d/ and /ŋ/ do not occur there unless in a cluster with another consonant.

Initial in a couplet the monomorphemic clusters /nd, nt, ns, st/ may occur, as in *nda²ɲa²* 'hand', *nta³ka¹* 'all, every', *nso¹o²* 'to be carrying' (only example), *sta³a³* 'tortilla'.

Initial in a couplet the bimorphemic clusters /nt, ns, ŋk, ŋk^w, ŋh, st/ may occur. These are composed of the morpheme {n~ŋ} meaning COMPLETED ACTION, plus the initial consonant of the couplet, as in *nte²e²-sq¹* 'I wrote', *nsa³ɲa²-sq¹* 'I did', *ŋke³e²-sq¹* 'I sank', *ŋk^wa²a²-sq¹* 'I was blind', *ŋha²a²-sq¹* 'I bought'. The cluster /st/ is composed of the morpheme {s} meaning CAUSATIVE ACTION, plus the initial consonant of the couplet, as in *sti¹i²* 'to glue (something)', ('to cause to grasp, seize').

When precouplet the only monomorphemic clusters which occur are /nd, st/, as in *nda²ki³ku²-sq¹* 'I will mend', and *sti²ka³a²-sq¹* 'my blanket'.

When precouplet the bimorphemic clusters /ns, nč, nš, nž, ŋk, st/ may occur, as in *nsi³ka¹a¹-ña¹ti¹* 'she fed the animals', *nči³tu¹u¹-sq¹* 'I rolled (it) up', *nši³či¹tu¹-sq¹* 'I filled (it)', *nžo³ni²ni²-sq¹* 'I listened', *ŋka³ha²a²-sq¹* 'I ate' (plural, polite), *sta¹nda²ɲa²-de¹ži²* 'he is marrying them'.

The trimorphemic cluster /nst/ occurs infrequently initially in a couplet or precouplet environment, and is composed of {n} COMPLETED ACTION, {s} CAUSATIVE ACTION, and the initial consonant of the couplet or the precouplet, as in *nsti¹i²-sq¹* 'I did glue (it)', ('I caused it to seize or grab'), and *nsta¹nda²ɲa²-de¹ži²* 'he married them', ('he caused them to be married').

Postcouplet the only cluster which may occur is /ns/, as in *nsa²* 'then!', *kī¹ɲi³-sq¹nsa²* 'I'm going then!'.

When a couplet is followed by a post-couplet, bimorphemic clusters of /ɲ/ plus any consonant may sometimes⁵ optionally occur as the result of loss of a vowel which contiguously follows /ɲ/, as in *ši²žu¹ɲu¹-sq¹ti³/ši²žu¹ɲ-sq¹ti³* 'I will frighten the animals', *ndu²va³ɲa-ña²|ndu²va³ɲa²* 'she will be better'.

⁵ The choice of the allomorph with VɲV versus the one with Vɲ depends upon the tone sequence. If the vowel that follows the /ɲ/ is the same tone as either of the contiguous syllables, it may be lost: *si²kī¹ɲi³* 'to lose', *si²kī¹ɲ-i³* 'I will lose' (familiar). But in *si²kī¹ɲi³-sq¹* 'I will lose' (polite) the /i³/ must remain.

monomorphemic clusters /nd, nt, nč, ŋk, til/, *ka³nta³* 'to move oneself', *la²nči²* 'knee'. (No bimorphemic clusters

medially and /d/ and /ŋ/ do not occur after consonant.

monomorphemic clusters /nd, nt, ns, st/ may occur initially, as in *na¹* 'all, every', *nso¹o²* 'to be carrying'

monomorphemic clusters /nt, ns, ŋk, ŋk^w, ŋh, st/ occur initially of the morpheme {n~ŋ} meaning 'to cause to do something', as in *ni¹did¹*, *ŋke³e²-sq¹* 'I sank', *ŋk^wa²a²-sq¹* 'I will mend'. The cluster /st/ is composed of the morpheme {s} COMPLETED ACTION, plus the initial consonant of the morpheme {t} (something), ('to cause to grasp, seize').

monomorphemic clusters which occur initially, as in *ni¹ will mend¹*, and *sti²ka³a²-sq¹* 'my brother will mend'. Monomorphemic clusters /ns, nč, nš, nž, ŋk, st/ may occur initially, as in *nči³tu¹u¹-sq¹* 'I rolled', *nžo³ni²ni²-sq¹* 'I listened', *ŋka³ha²a²-sq¹* 'he is marrying them'.

occurs infrequently initially in a couplet, as in *ni¹ caused it to seize or grab¹*, composed of {n} COMPLETED ACTION, plus the initial consonant of the morpheme {t} (something), ('I caused it to seize or grab'), as in *ni¹ caused them¹*, ('he caused them to be seized').

which may occur is /ns/, as in *nsa²* 'then!'

initially in a post-couplet, bimorphemic clusters sometimes⁵ optionally occur as the result of the sandhi of /r/, as in *ši²žu¹pu¹-sq¹ti³* 'I will lose' (familiar), *ndu²va³pa³ña²|ndu²va³pa³ña²* 'animals'.

the sandhi of /r/ versus the one with VP depends upon the tone of the /r/ is the same tone as either of the consonants, as in *si²ki¹li³* 'I will lose' (familiar). The sandhi of /i³/ must remain.

Similarly, a cluster of /r/ plus any consonant may (depending upon the tone sequence) optionally occur across word boundaries. The result is a fusion of the two words into one phonological word, as in *či²žu²pu²ña²ni³-sq¹|či²žu²pa³ña²ni²-sq¹* 'my brother will deny (it)', *ndu²va³pa³ña²ni³-sq¹|ndu²va³pa³ña²ni³-sq¹* 'my brother will be better'.

10.2. The distribution of vowel clusters is also best described in relation to the couplet and the morpheme,⁶ in that vowel clusters which occur within a monomorphemic couplet are always geminate and diverse vowel clusters are always bimorphemic.

In a monomorphemic couplet, any geminate vowel cluster (with the exception of /oq/) may occur: *ži²i²* 'difficult', *ti²i²* 'to seize', or 'grasp', *te³e²* 'man', *žu²te²e³* 'tomorrow', *ka²a²* 'to eat', *ka²q³* 'to punch', *ko³o³* 'snake', *tu¹u²* 'no', *tu²u²* 'black'.

Diverse clusters of two vowels may occur when the postcouplet has no initial consonant. Such clusters are composed of (1) the final vowel of the couplet, plus a demonstrative pronoun {a} 'this/here' or {u} 'that/there', as in *pi²ta³-u²* 'that flower', *če²te²-a¹* 'this cornsilk', *ndu²či¹-a²* 'this bean', *čo²ko¹-a²* 'this ant', *ču²ku¹-a²* 'this louse', *ču²ku¹-u²* 'that fly', (2) the first person plural inclusive morpheme {o} and the demonstrative pronoun {a} or {u} (the second vowel of the stem is lost), as in *pi²ta³* 'flower' + *o* 'our' + *u* 'that' becomes *pi²to³-u¹* 'that flower of ours'; *ču²ku²* 'louse' + *o* 'our' + *a* 'this' becomes *ču²ko²-a¹* 'this louse of ours'; *ndu²či²* 'bean' + *o* 'our' + *a* 'this' becomes *ndu²čo²-a¹* 'these beans of ours'.

Clusters of three vowels may occur when a couplet with a geminate vowel cluster is followed by the first person plural inclusive morpheme {o} or a demonstrative pronoun {a} or {u}, as in *te³e²-a¹* 'this man', *k^wi²i²-a¹* 'this grass', *k^wi²i²-u¹* 'that grass'. When a cluster of diverse vowels occurs in the couplet, it is always part of a sequence of three vowels, and the first vowel is always /i/, as in *k^wi²o²-a¹* 'this grass of ours'; *te²e²* 'to write' + *o* 'we' + *a* 'here' becomes *ti²o²-a¹* 'we will write here'; *ti²i²* 'to seize, grasp' + *o* 'we' + *u* 'that' becomes *ti²o²-u¹* 'we will seize, grasp that'.

Vowel clusters occasionally occur when the precouplet is followed by

⁶ The distribution of vowels has been described in relation to bisyllabic sequences and morphemes in the San Miguel el Grande dialect (K. Pike, 1947: 166-69), in relation to the "microsegments" in the Jicaltepec dialect (Bradley, 1965), in relation to the couplet and morpheme in the Huajuapán dialect (E. Pike and Cowan, 1965), and in the Ayutla dialect (Pankratz and E. Pike, 1965). The details differ but in each dialect the couplet is an important matrix for the distribution of phonemes.

a couplet beginning with a vowel, as in $vi^2o^2\rho o^2$ 'our house', $to^2i^2ni^2$ 'good afternoon', $xi^3a^3\rho u^3$ 'fifteen'.

10.3. Concerning the distribution of vowels in relation to preceding consonants (1) nasalized vowels do not follow voiced consonants. (2) The high back rounded vowels /u, u/ do not follow /k^v/; /u/ follows /m/ only in loan words, as in mu^1li^2 'mole'; /u/ does, however, follow /v/, as in $va^1\rho vu^3$ 'coyote'.

11. TONE SANDHI

11.0. There is a system of tone sandhi in which some morphemes cause the tones of other morphemes to change. Certain changes take place when couplets occur in sequence. Other changes take place when a couplet is followed by a postcouplet.⁷ Except for the change as described in Rules 6 and 13 the changes are progressive, i.e. from 'left' to 'right'. The chart gives the tone sequences which occur when one couplet follows another (see p. 38).

11.1. In order to predict the changes which involve a sequence of couplets⁸ the following must be taken into consideration.

(1) The basic tones of the couplets involved. The basic tones are those which occur when the couplet is in isolation, or when it is following a Class A couplet with the tones 33.

(2) The class of the couplets involved. Couplets are divided into two major classes, Class A versus Class B, and one minor class, Class B'. Some couplets with the basic tones 11, 22, 32, 33 are Class A and some are Class B. Couplets with the basic tones 21, 31, 12, 13, 23 are all Class A. Only those with the basic tone sequence 32 may be B'. In this section we have indicated the various classes by adding (A), (B), or (B') after the cited basic forms.

(3) The grammatical class of the couplets with the tone sequence 22. These couplets are divided into classes, of verb versus nonverb.

(4) Couplets with the tone sequence 23 and 33 must be divided into

⁷ More study needs to be made of the tone sandhi between precouplets and also between a precouplet and a couplet.

⁸ Couplets composed of the fusion of a stem and {o} 'our, we' require a different set of rules since the resulting couplet may be a combination of a Class A couplet and a Class B enclitic, as in na^2na^1 (A) 'mother' + o (B) 'our, we' > na^2no^1 'our mother'. Such couplets have not been included in our description of the tone sandhi.

well, as in $vi^2o^2\rho o^2$ 'our house', $to^2i^2ni^2$ 'our mother', en^1 'son'.

Position of vowels in relation to preceding consonants do not follow voiced consonants. (2) /u, ʉ/ do not follow /kʷ/; /u/ follows mu^1li^2 'mole'; /u/ does, however, follow

TONE SANDHI

Tone sandhi in which some morphemes cause a change. Certain changes take place in Class B. Other changes take place when a morpheme follows a Class A couplet.⁷ Except for the change as described above, the changes are progressive, i.e. from 'left' to 'right'. The changes which occur when one couplet follows

Changes which involve a sequence of couplets are now under consideration.

Couplets involved. The basic tones are Class B in isolation, or when it is following a Class A couplet. (33).

Classes involved. Couplets are divided into Class B, and one minor class, Class B'. The basic tones 11, 22, 32, 33 are Class A and some of the basic tones 21, 31, 12, 13, 23 are all Class B. The basic tone sequence 32 may be B'. In this section, the classes are distinguished by adding (A), (B), or (B')

the couplets with the tone sequence 22. The classes, of verb versus nonverb. The tone sequence 23 and 33 must be divided into

the tone sandhi between precouplets and also the tone sandhi between a stem and {o} 'our, we' require a different description. It may be a combination of a Class A couplet and a Class B couplet. 'our, we' + o (B) 'our, we' > na^2no^1 'our mother'. This is in our description of the tone sandhi.

those with a medial consonant which is other than /r/ versus couplets having a medial /r/, or with no medial consonant.

(5) Couplets which are verb stems are divided between those of the completive aspect versus those which are not completive aspect.

The following rules describe (and predict) the tone sandhi between couplets.

Rule 1: Basic 11, 12, 13, and 21 retain⁹ their basic forms in all environments.

Rule 2: Basic 31 becomes 11 when following any couplet of Class B (except that after 32(B') it optionally remains 31): $ža^2\rho a^2$ (B) 'chiles' + $ži^3či^1$ (A) 'dry' > $ža^2\rho a^2 ži^1či^1$ 'dry chiles', so^1ko^1 (B) 'well, spring' + $ži^3či^1$ (A) > $so^1ko^1 ži^1či^1$ 'dry spring', ku^3u^3 (B) 'four' + $či^3ka^1$ (A) 'baskets' > $ku^3u^3 či^1ka^1$ 'four baskets', $ñu^3ti^2$ (B') 'sand' + $ži^3či^1$ (A) > $ñu^3ti^2 ži^1či^1$ or $ñu^3ti^2 ži^3či^1$ 'dry sand'.

But it retains its basic form after any Class A couplet: $žu^3ku^3$ (A) 'herbs' + $ži^3či^1$ (A) > $žu^3ku^3 ži^3či^1$ 'dry herbs'.

Rule 3: When a nonverb,¹⁰ basic 22(B) becomes 11, and basic 22(A) becomes 12 when following a Class B couplet: si^1vi^1 (B) 'name' + ki^2ti^2 (B) 'animal' > $si^1vi^1 ki^1ti^1$ 'name of the animal', ki^2ti^2 (B) 'animal' + $žu^2ku^2$ (B) 'mountain' > $ki^2ti^2 žu^1ku^1$ 'animal of the mountain', na^3ma^3 (B) 'soap' + nda^2va^2 (B) 'hard' > $na^3ma^3 nda^1va^1$ 'hard soap', $šu^3\rho u^2$ (B) 'money' + $ža^2\rho a^2$ (B) 'chiles' > $šu^3\rho u^2 ža^1\rho a^1$ 'chile money' (from or for chiles), si^1vi^1 (B) 'name' + $ri^2\eta ki^2$ (A) 'mouse' > $si^1vi^1 ri^1\eta ki^2$ 'the mouse's name', $ža^2k^w a^2$ (B) 'twisted' + $žu^2te^2$ (A) 'river' > $ža^2k^w a^2 žu^1te^2$ 'the river (is) twisted'.

When a verb, basic 22(B) becomes 11, and basic 22(A) becomes 12 when following any Class B but 33(B) or 32(B'): ko^1ni^1 (B) 'turkey hen' + $ko^2k\rho^2$ (B) 'to swallow' > $ko^1ni^1 ko^1k\rho^1$ 'the turkey will swallow (it)', ki^2ti^2 (B) 'animal' + ka^2a^2 (B) 'to eat' > $ki^2ti^2 ka^1a^1$ 'the animal will eat', ki^2ti^2 (B) 'animal' + ku^2nu^2 (A) 'to run' > $ki^2ti^2 ku^1nu^2$ 'the animal will run', $su^3či^2$ (B) 'child' + $k^w a^2 q^2$ (A) 'to buy' > $su^3či^2 k^w a^1 q^2$ 'the child will buy'.

⁹ One word in our data, however, vi^2ta^1 (A) 'soft' becomes vi^1ta^1 when following a Class B morpheme, as in $nda^2\rho a^2$ (B) 'hand' + vi^2ta^1 (A) 'soft' > $nda^2\rho a^2 vi^1ta^1$ 'soft hand'.

¹⁰ Certain close-knit noun phrases do not follow this rule, in that the tone sequence 33(B) + 22(B) > 33 32 (instead of 33 11); and 33(B) + 22(A) > 33 32 (instead of 33 12): $ši^3ni^3$ (B) 'head' + $žu^2tu^2$ (B) 'tree' > $ši^3ni^3 žu^3tu^2$ 'treetop', but ku^3u^3 (B) 'four' + $žu^2tu^2$ (B) 'tree' > $ku^3u^3 žu^1tu^1$ 'four trees'; $ši^3ni^3$ (B) 'head' + $ve^2\rho e^2$ (A) 'house' > $ši^3ni^3 ve^3\rho e^2$ 'roof' but ku^3u^3 (B) 'four' + $ve^2\rho e^2$ (A) 'house' > $ku^3u^3 ve^1\rho e^2$ 'four houses'. Mak (1953:93-95) reports special tone sandhi in close-knit phrases in the San Esteban dialect.

A basic 22(B) verb becomes 32, and a 22(A) may optionally become either 12 or 32, when following 33(B): $\tilde{n}u^3\tilde{n}u^3$ (B) 'bees' + ndu^2ku^2 (B) 'to seek, look for' + $-sq^1$ (A) 'I' > $\tilde{n}u^3\tilde{n}u^3 ndu^2ku^2-sq^1$ 'I'll look for bees', ko^3o^3 (B) 'snake' + ku^2nu^2 (A) 'to run' > $ko^3o^3 ku^2nu^2$ or $ko^3o^3 ku^1nu^2$ 'the snake will run'.

A basic 22(B) verb and a basic 22(A) verb optionally retain their basic forms, or 22(B) may become 11, and 22(A) may become 12, when following 32(B'): $\tilde{c}\tilde{i}^3\rho\tilde{i}^2$ (B') 'skunk' + ka^2a^2 (B) 'to eat' > $\tilde{c}\tilde{i}^3\rho\tilde{i}^2 ka^2a^2$ or $\tilde{c}\tilde{i}^3\rho\tilde{i}^2 ka^1a^1$ 'the skunk will eat (it)', $\tilde{n}u^3ti^2$ (B') 'sand' + sa^2ka^2 (B) 'to mix' + $-sq^1$ (A) 'I' > $\tilde{n}u^3ti^2 sa^2ka^2-sq^1$ or $\tilde{n}u^3ti^2 sa^1ka^1-sq^1$ 'I'll mix the sand', $\tilde{c}\tilde{i}^3\rho\tilde{i}^2$ (B') 'skunk' + ku^2nu^2 (A) 'to run' > $\tilde{c}\tilde{i}^3\rho\tilde{i}^2 ku^2nu^2$ or $\tilde{c}\tilde{i}^3\rho\tilde{i}^2 ku^1nu^2$ 'the skunk will run'.

But a basic 22(A) or 22(B), verb or nonverb, retains its basic form after a Class A couplet: $\rho u^3\tilde{s}\tilde{i}^3$ (A) 'ten' + $ri^2\eta ki^2$ (A) 'mouse' > $\rho u^3\tilde{s}\tilde{i}^3 ri^2\eta ki^2$ 'ten mice', ti^3ka^2 (A) 'grasshopper' + ka^2a^2 (B) 'to eat' > $ti^3ka^2 ka^2a^2$ 'the grasshopper will eat (it)'.

Rule 4: Basic 32(B) becomes 11, and a basic 32(B') and basic 32(A) become 12 after any Class B couplet: si^1vi^1 (B) 'name' + $su^3\tilde{c}\tilde{i}^2$ (B) 'child' + lu^2li^2 (B) 'little' > $si^1vi^1 su^1\tilde{c}\tilde{i}^1 lu^1li^1$ 'name of the little child', si^1vi^1 (B) 'name' + $\tilde{c}\tilde{i}^3\rho\tilde{i}^2$ (B') 'skunk' > $si^1vi^1 \tilde{c}\tilde{i}^1\rho\tilde{i}^2$ 'name of the skunk', si^1vi^1 (B) 'name' + te^3e^2 (A) 'man' > $si^1vi^1 te^1e^2$ 'name of the man'.

Basic 32 (B), 32(B'), and 32(A) optionally retain their basic tone after a 32(B'): hi^3ki^2 (B') 'fist' + $su^3\tilde{c}\tilde{i}^2$ (B) 'child' + lu^2li^2 (B) 'little' > $hi^3ki^2 su^1\tilde{c}\tilde{i}^1 lu^1li^1$ or $hi^3ki^2 su^3\tilde{c}\tilde{i}^2 lu^1li^1$ 'the little child's fist', hi^3ki^2 (B') 'fist (paw)' + $\tilde{c}\tilde{i}^3\rho\tilde{i}^2$ (B') 'skunk' > $hi^3ki^2 \tilde{c}\tilde{i}^1\rho\tilde{i}^2$ or $hi^3ki^2 \tilde{c}\tilde{i}^3\rho\tilde{i}^2$ 'the skunk's paw', hi^3ki^2 (B') 'fist' + te^3e^2 (A) 'man' > $hi^3ki^2 te^1e^2$ or $hi^3ki^2 te^3e^2$ 'the man's fist'.

But any basic 32 retains its basic form after any Class A couplet: $\rho\tilde{i}^2\tilde{i}^2$ (A) 'one' + $su^3\tilde{c}\tilde{i}^2$ (B) 'child' + lu^2li^2 (B) 'little' > $\rho\tilde{i}^2\tilde{i}^2 su^3\tilde{c}\tilde{i}^2 lu^1li^1$ 'one little child'.

Rule 5: Basic 23 and 33 CVCV (a couplet with a medial consonant other than /ʔ/) become 21, and basic 23 and 33 CVV or CVʔV (couplets with no medial consonant, or with a /ʔ/) become 13 after any Class B couplet: si^1vi^1 (B) 'name' + $\tilde{s}\tilde{i}^2\tilde{s}\tilde{i}^3-sq^1$ (A) 'my aunt' > $si^1vi^1 \tilde{s}\tilde{i}^2\tilde{s}\tilde{i}^1-sq^1$ 'my aunt's name', ndu^2te^2 (B) 'water' + ρu^3va^3 (A) 'bitter' > $ndu^2te^2 \rho u^2va^1$ 'bitter water', ku^3u^3 (B) 'four' + $\tilde{z}o^3o^3$ (B) 'month' > $ku^3u^3 \tilde{z}o^1o^3$ 'four months', ndu^2te^2 (B) 'water' + $\rho u^3\rho va^3$ (A) 'salty' > $ndu^2te^2 \rho u^1\rho va^3$ 'salty water', ki^2ti^2 (B) 'animal' + ku^2u^3 (A) 'to die' > $ki^2ti^2 ku^1u^3$ 'the animal will die', $\tilde{s}\tilde{u}^3\rho u^2$ (B) 'money' + $sto^2o^3-sq^1$ (A) 'my uncle' > $\tilde{s}\tilde{u}^3\rho u^2 sto^1o^3-sq^1$ 'my uncle's money'.

2, and a 22(A) may optionally become 33(B): $\tilde{n}u^3\tilde{n}u^3$ (B) 'bees' + ndu^2ku^2 (B) 'to run' > $\tilde{n}u^3\tilde{n}u^3 ndu^3ku^2-sq^1$ 'I'll look for bees', or $ko^3o^3 ku^3nu^2$ or $ko^3o^3 ku^1nu^2$

22(A) verb optionally retain their basic tone 1, and 22(A) may become 12, when ka^2a^2 (B) 'to eat' > $\check{c}i^3\check{p}i^2 ka^2a^2$ (at it)', $\tilde{n}u^3ti^2$ (B) 'sand' + sa^2ka^2 (B) 'mix' > $\tilde{n}u^3ti^2 sa^1ka^1-sq^1$ 'I'll mix sand', or ku^2nu^2 (A) 'to run' > $\check{c}i^3\check{p}i^2 ku^2nu^2$ or ku^1nu^2

verb or nonverb, retains its basic form after any Class A couplet: $ri^2\eta ki^2$ (A) 'mouse' > $ri^2\eta ki^2$ (A) 'grasshopper' + ka^2a^2 (B) 'to eat' > $ri^2\eta ki^2 ka^2a^2$ 'I'll eat (it)'

11, and a basic 32(B') and basic 32(A) couplet: si^1vi^1 (B) 'name' + $su^3\check{c}i^2$ (B) 'child' > $si^1vi^1 su^1\check{c}i^1 lu^1li^1$ 'name of the little child', or $si^1vi^1 \check{c}i^1\check{p}i^2$ 'name of the skunk', or $si^1vi^1 te^1e^2$ 'name of the man'

optionally retain their basic tone after any Class B couplet: lu^2li^2 (B) 'little' > $lu^2li^2 lu^1li^1$ 'the little child's fist', hi^3ki^2 'skunk' > $hi^3ki^2 \check{c}i^1\check{p}i^2$ or $hi^3ki^2 \check{c}i^3\check{p}i^2$ 'skunk's name', or te^3e^2 (A) 'man' > $hi^3ki^2 te^1e^2$ or te^3e^2

basic form after any Class A couplet: lu^2li^2 (B) 'little' > $\check{p}i^2\check{c}i^2 su^3\check{c}i^2$

CVV (a couplet with a medial consonant) or CVPV (couplets with a /r/) become 13 after any Class B couplet: si^1vi^1 (A) 'my aunt' > $si^1vi^1 \check{s}i^2\check{s}i^1-sq^1$ 'my aunt', or ρu^3va^3 (A) 'bitter' > ndu^2te^2 'sour' + $\check{z}o^3o^3$ (B) 'month' > $ku^3u^3 \check{z}o^1o^3$ 'sour month', or $\rho u^3\check{p}va^3$ (A) 'salty' > ndu^2te^2 'animal' + ku^2u^3 (A) 'to die' > ki^2ti^2 'money' + $sto^2o^3-sq^1$ (A) 'my uncle's money'

But any basic 23 retains its basic form after a Class A couplet: ρu^3u^3 (A) 'two' + $\check{p}i^2na^3$ (A) 'dog' > $\rho u^3u^3 \check{p}i^2na^3$ 'two dogs'

The 23 CVCV morpheme optionally retains its basic tone, and 33 CVCV may optionally become 23, after 32(B'): $\tilde{n}u^3ti^2$ (B') 'sand' + $\check{p}i^2so^3$ (A) 'rabbit' > $\tilde{n}u^3ti^2 \check{p}i^2so^1$ or $\tilde{n}u^3ti^2 \check{p}i^2so^3$ 'the rabbit's sand', or $\tilde{n}u^3ti^2$ (B) 'sand' + $\check{s}i^3ku^3$ (A) 'niece' + $-sq^1$ (A) 'my' > $\tilde{n}u^3ti^2 \check{s}i^2ku^1-sq^1$ or $\tilde{n}u^3ti^2 \check{s}i^2ku^3-sq^1$ 'my niece's sand'

All basic 33 couplets become 23 after a Class A couplet which ends in tone 2: te^3e^2 (A) 'man' + $kq^3\check{p}q^3$ (A) 'to talk' > $te^3e^2 kq^2\check{p}q^3$ 'the man will talk', ti^1la^2 (A) 'hen' + $sq^3hi^3-sq^1$ (A) 'my nephew' > $ti^1la^2 sq^2hi^3-sq^1$ 'my nephew's hen', nda^2va^2 (A) 'to fly' + $\tilde{n}u^3\tilde{n}u^3$ (B) 'bees' > $nda^2va^2 \tilde{n}u^2\tilde{n}u^3$ 'the bees will fly'. But a basic 33 couplet retains its basic form after other Class A couplets: ρu^3ni^3 (A) 'three' + $\check{z}o^3o^3$ (B) 'month' > $\rho u^3ni^3 \check{z}o^3o^3$ 'three months'

Rule 6: There is one type of regressive tone sandhi between couplets. Specifically, the last tone of a Class B couplet with tones 22, 32, or 33 becomes tone 1 when preceding a completive aspect¹¹ verb (but not when preceding a verb of another aspect): ρa^3si^3 (B) 'tasty' + ηku^2u^2 (A) 'was' > $\rho a^3si^1 \eta ku^2u^2$ 'it was tasty', $\check{p}i^2\check{z}a^2$ (B) 'sour' + ηku^2u^2 (A) 'was' > $\check{p}i^2\check{z}a^1 \eta ku^2u^2$ 'it was sour', $\check{s}q^3q^3$ (B) 'very' + ηha^3tu^3 (A) 'did hurt' > $\check{s}q^3q^1 \eta ha^3tu^3$ 'it really did hurt'

The same type of regressive tone sandhi occurs when a Class B enclitic with tones 3 or 2 precedes a completive aspect verb: se^3pe^2 (A) 'offspring' + $-lo^3$ (B) 'your' (familiar) + ηku^2u^2 (A) '(it) was' > $se^3pe^2-lo^1 \eta ku^2u^2$ 'it was your child'

11.2. There are tone sandhi changes which sometimes occur when a couplet is followed by a postcouplet — an enclitic.¹² Also enclitics sometimes cause tone changes in the following morphemes. Rules for the changes are as follows:

Rule 7: Enclitics with basic tone 1 ($-sq^1$ (A) 'I, me, my' (polite), $-ni^1$ (A) 'you, your' (polite)) retain their basic form: ko^1ni^1 (B) 'turkey hen' + $-sq^1$ (A) 'my' > $ko^1ni^1-sq^1$ 'my turkey hen', $ndu^2\check{c}i^2$ (B) 'eye' + $-ni^1$ (A) 'your' > $ndu^2\check{c}i^2-ni^1$ 'your eye'

¹¹ In the San Miguel el Grande dialect the completive aspect is indicated by a proclitic {ni³}. In the Molinos dialect the completive aspect is indicated by {n~ŋ}. It seems that although the vowel has been lost in the Molinos dialect, the effect of the tone 3 still remains. It is this tone 3 which is changed to tone 1 by the preceding Class B morpheme. That tone 1 is actualized when the Class B morpheme itself is changed from tones 3 or 2 to tone 1.

¹² Some of the less common enclitics have not been included in this description.

Basic Tones of the Second Couplet

Basic Tones of the First Couplet	11, 12 13, 21	31	22B		22A		32B	32B'	32A	23		33	
			Non-verb	Verb	Non-verb	Verb				CVCV	CVV		CVCV
Class B 11, 22, 32	b	11	11	11	12	12	11	12	12	21	13	21	13
Class B 33	b	11	11	32	12	12/32	11	12	12	21	13	21	13
Class B'	b	11/b	11	11/b	12	12/b	11/b	12/b	12/b	21/b	13	21/23	13
Class A 12, 22, 32	b	b	b	b	b	b	b	b	b	b	b	23	23
Other Class A	b	b	b	b	b	b	b	b	b	b	b	b	b

The numbers in the chart give the tones of the second couplet which actually occur in that environment. A 'b' means that the basic tones occur there.

	verb	verb	verb		CVCV CWV	CVCV CWV
Class B	11	11	12	11	12	13
Class B	11	32	12	11	12	13
Class B'	11	11/b	12	11/b	12/b	13
Class A	b	b	b	b	b	23
Other Class A	b	b	b	b	b	b

The numbers in the chart give the tones of the second couplet which actually occur in that environment. A 'b' means that the basic tones occur there.

Rule 8: All enclitics become tone 1 when following a Class B couplet with either basic or nonbasic tones 11: *ko¹ni¹* (B) 'turkey hen' + *-ña²* (B) 'her' > *ko¹ni¹-ña¹* 'her turkey hen', *si¹vi¹* (B) 'name' + *-ži²* (A) 'child' > *si¹vi¹-ži¹* 'child's name', *k^wq²q²* (A) 'to buy' + *-ña²* (B) 'she' + *ki²ti²* (B) 'animal' + *-lo³* (B) 'your' > *k^wq²q²-ña² ki¹ti¹-lo¹* 'she will buy your animal'.

Rule 9: The enclitics *-de²* (A) 'he, him, his', *-ži²* (A) 'child, children, they', and *-li³* (A) 'I, me, my' (familiar), *-ti³* (B) 'animal', *-ža³* (B) 'deity', become tone 1 when following any Class B couplet: *ča²ka²* (B) 'fish' + *-de²* (A) 'his' > *ča²ka²-de¹* 'his fish', *ndu¹ku¹* (B) 'seeking' + *-ti³* (B) 'animal' + *-ži²* (A) 'child' > *ndu¹ku¹-ti¹ži¹* 'the animal is seeking the child', but *ɸi²na³* (A) 'dog' + *-li³* (A) 'my' > *ɸi²na³-li³* 'my dog', *mi²-ŋki²* (A) 'brains' + *-ti³* (B) 'animal' > *mi²-ŋki²-ti³* 'the animal's brains'.

Rule 10: The enclitic *-ña²* (B) 'she, her, hers', however, becomes tone 1 only when added to a Class B couplet with tones 11, after other Class B couplets it remains tone 2: *li¹tu¹* (B) 'baby goat' + *-ña²* (B) 'her' > *li¹tu¹-ña¹* 'her baby goat', *ha¹a¹* (B) 'to be eating' + *-ña²* (B) 'she' + *sta³a³* (B) 'tortillas' > *ha¹a¹-ña¹ sta¹a³* 'she is eating', but *ki²ti²* (B) 'animal' + *-ña²* (B) 'her' > *ki²ti²-ña²* 'her animal'.

Rule 11: The enclitic *-lo³* (B) 'you, your' (familiar), remains tone 3 after a couplet ending with tone 3 and after a Class A couplet ending with tone 1. It becomes tone 2 after a couplet ending with tone 2, and becomes tone 1 after a Class B couplet with the tones 11. The sandhi is the same when following both basic and nonbasic tones: *su³ku³* (B) 'neck' + *-lo³* (B) 'your' > *su³ku³-lo³* 'your neck', *si²k^wi²so¹* (A) 'to boil' + *-lo³* (B) 'you' + *ndu²te²* (B) 'water' > *si²k^wi²so¹-lo³ ndu¹te¹* 'you will boil water', *nda²ke²te²* (A) 'to wash' + *-lo³* (B) 'you' + *sa²ɸma²* (B) 'clothes' > *nda²ke²te²-lo² sa¹ɸma¹* 'you will wash clothes', *si¹vi¹* (B) 'name' + *-lo³* (B) 'your' > *si¹vi¹-lo¹* 'your name'.

Rule 12: A Class B enclitic causes a following couplet or enclitic to change in the same manner that a 22 (B) couplet would cause it to change: *nda²ke²te²* (A) 'to wash' + *-lo³* (B) 'you' + *sa²ɸma²* (B) 'clothes' > *nda²ke²te²-lo² sa¹ɸma¹* 'you will wash clothes', *si²k^wi²so¹* (A) 'to boil' + *-ña²* (B) 'she' + *ndu²te²* (B) 'water' > *si²k^wi²so¹-ña² ndu¹te¹* 'she will boil water', *ndu²ku²* (B) 'to seek' + *-ti³* (B) 'animal' + *ri²ŋki²* (A) 'mouse' > *ndu²ku²-ti¹ ri¹ŋki²* 'the animal will seek the mouse', *ndu²ku²* (B) 'to seek' + *-lo³* (B) 'you' + *-ti³* (B) 'animal' > *ndu²ku²-lo²ti¹* 'you will seek the animal', *či²va³ɸa²* (A) 'to hide, store' + *-ža³* (B) 'deity' + *šy³ɸy²* (B) 'money' > *či²va³ɸa²-ža³ šy¹ɸy¹* 'the deity will store, hide the money'.

Rule 13: In our data (but further checking is needed), a nonbasic 32(A) (the basic form has tones 22) becomes 31 when preceding an enclitic with tone 2: ma^3 (B) 'won't' + ko^2po^2 (A) 'to drink' > $ma^3ko^3po^2$ 'won't drink'; then, $ma^3ko^3po^2$ (A) 'won't drink' + $-ži^2$ (A) 'child' > $ma^3ko^3po^1-ži^2$ 'the child won't drink (it)'. Another example, $ši^3ni^3$ (B) 'head' + ve^2pe^2 (A) 'house' > $ši^3ni^3 ve^3pe^2$ 'roof'; then, $ši^3ni^3 ve^3pe^2$ 'roof' + $-ña^2$ (B) 'her' > $ši^3ni^3 ve^3pe^1-ña^2$ 'her roof', but $ši^3ni^3 ve^3pe^2$ 'roof' + $-sq^1$ (A) 'my' remains $ši^3ni^3 ve^3pe^2-sq^1$ 'my roof'.

Summer Institute of Linguistics

BIBLIOGRAPHY

- Bradley, C. Henry
1965 "A linguistic sketch of Mixteco of Jicaltepec". Unpublished Ph.D. dissertation, Cornell University.
- Longacre, Robert E.
1957 *Proto-Mixtecan* (= *Publication No. 5 of Indiana University Research Center in Anthropology, Folklore, and Linguistics*).
- Mak, Cornelia
1953 "A comparison of two Mixtec tonemic systems", *International Journal of American Linguistics*, 19:85-100.
- Merrifield, William R. and Betty J. Stoudt
1965 *Molinos Mixtec clause structure* (in press).
- Overholt, Edward
1961 "The tonemic system of Guerrero Mixteco", in *A William Cameron Townsend* (Mexico, Instituto Lingüístico de Verano), 597-626.
- Pankratz, Leo and Eunice V. Pike
1965 *Phonology and morphotonemics of Ayutla Mixtec* (in press).
- Pike, Eunice V. and John H. Cowan
1965 *Huajuapán Mixtec phonology and morphophonemics* (in press).
- Pike, Kenneth L.
1947 "Grammatical prerequisites to phonemic analysis", *Word*, 3:155-172.
1948 "Tonemic perturbations in Mixteco", *Tone Languages* (Ann Arbor, University of Michigan Press), 77-94.