HUAJUAPAN MIXTEC PHONOLOGY AND MORPHOPHONEMICS

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0. This dialect of Mixtec[1] is like other Mixtec dialects[2] in that: (1) The couplet*— the nucleus of the phonological word and usually the stem of the grammatical word — is vital as a matrix for the distribution of phonemes. In Huajuapan Mixtec consonant clusters /ʔm, ʔn, ʔñ/ occur couplet-medial but do not occur couplet-initial. Vowel clusters of diverse vowels are rare within a monomorphemic couplet, but are frequent elsewhere. (2) The couplet is an environment needed for the description of allophones. In Huajuapan /ž/ has one allophone whose occurrence is restricted to postcouplet, and /k/ has an allophone whose occurrence is restricted to pre- or postcouplet. (3) Tone sandhi is dependent upon arbitrary classes of morphemes. (4) Morphemes with tone sequences 11, 12, or 13 as basic forms are the more stable. (5) In most dialects some, but not all, alveopalatal consonants may occur preceding /i/, and there are distributional restrictions in relation to the couplet.

Huajuapan Mixtec is different from other Mixtec dialects thus far reported in that: (1) There is a contrast of /o/ versus /ǫ/ following /m, n, ñ/. (2) The 'fifth' vowel instead of being back-rounded or back-unrounded (or a system of six vowels with both), is front-rounded [ü] (for convenience written /u/). (3) One-syllable 'dependent' morphemes may combine to form a separate phonological word.

1. There are the following consonant phonemes in native words: voiceless stops / t, k, k^w/ ; voiceless affricate / č/; prenasalized voiced stops / ^{n}d, ^{n}g (rare)/; nasals / m, n, ñ/; voiceless fricatives / s, š/ ; voiced fricatives / ƀ, đ, ž/; lateral / l/; semiconsonant / w (rare)/.

The following additional phonemes occur in Spanish loan words: / p, ^{m}b, ᵽ, h, ǥ, r, rr/.

The bilabials / m, ƀ, w/ contrast as follows: đą^{3}mą^2 will change, ka^{2}ƀa^2 will lie down, ka^{1}wa^1 is twisting.

The dentals / t, ^{n}d, n, s, đ (interdental), l/ contrast as follows: ta^{3}ta^3 medicine, ^{n}da^{2}ʔa^3 hand, ną^{3}mą^3 soap, sa^{1}đi^1 is closing, đa^{3}ši^3 nephew, la^{1}sa^3 bone.

The alveopalatals / č, š, ž, ñ/ contrast as follows: čǫ^{2}ǫ^2 work, šo^{3}o^3 comal, žo^{2}o^3 cantaro, ñǫ^{2}ǫ^3 town.

Contrasting / s/ and / š/ : ka^{3}či^{3}so^3 our (inclusive) cotton, ti^{3}šo^2 our (inclusive) stomachs, la^{1}sa^3 bone, ka^{1}ša^1 a hard thing, sǫ^{1}ną^1 is opening.

Contrasting / đ/ and / ž/: ži^{2}tǫ^3 tree, đi^{3}či^3 nose, že^{1}ʔe^1 door, đe^{3}ʔe^2 son.

Contrasting / t/ and / č/: či^{2}ka^3 banana, ti^{3}či^3 avocado, če^{1}lo^3 calf, te^3-ʔi^{2}i^2 man. Contrasting / tiV/ and / čV/: đi^{3}čǫ^3 your (singular, child) nose, nį^3-tį^{2}ǫ^2 you (singular, child) grasped.

Contrasting / n/ and / ñ/ : kǫ^{3}ñǫ^2 meat, nį^{3}nǫ^2 above, di^{2}to^{3}ñą^2 her/ their (stranger) uncle, đi^{2}to^{3}ną^3 his/ her/ their (known) uncle.

The velar consonants / k, k^w, ^{n}g/ contrast as follows: či^{2}ka^3 banana, le^{3}k^{w}ą^3 eyebrow, ʔi^2^{n}ga^{3}ñą^3 another one, ʔo^2^{n}ga^3 again (the only examples with / ^{n}g/). Contrasting / k^{w}V/ with / kuV/ k^{w}a^{1}i^3 horse, ku^{3}a^3 year.

The glottal stop contrasts with the absence of glottal stop, and also with / t/ and / k/ : ko^{3}o^3 snake, ko^{3}ʔo^3 plate, ^{n}de^{1}e^1 is caring for, ^{n}de^{1}ʔe^1 is watching, ko^{2}ko^2 will swallow, tu^{2}tu^3 paper, tu^{1}ʔu^{2}nį^1 you (singular, adult) are sucking.

Examples of the phonemes / p, ^{m}b, ᵽ, h, ǥ, r, rr/ in Spanish loan words are: sa^2-pa^{1}a^3 bread, ^{m}ba^{1}a^3 compadre, ka^2-ᵽe^{1}e^3 coffee, to^{1}ro^1 bull, ti^3-ƀu^{1}rro^3 donkey, ga^{1}sto^1 expense, (The [g] in Spanish loan words is more fortis than the [g] which is an allophone of / k/ and which alternates with lenis [k].) ka^{1}ha^1 box. There is also an / h/ in one Mixtec word: hą^{2}ą^3 yes.

Words which have 'j' in Spanish sometimes have / č/ or / k/ in the Mixtec words derived from Spanish: ko^{2}ko^2-lį^{1}į^3 sesame seed (Sp. ajonjolí), či^2-ką^{1}mą^1 Sp. jícama.

2. The most obvious consonant allophones are described below.

The phoneme / k/ has a palatal allophone which occurs when preceding the front vowels / i, e, u/ : ki^{2}ti^3 [k^{y}i^{2}ti^3] animal, ke^{2}te^2

[k^{y}é^{2}te^{2}] will dig, ku^{3}ka^{3} [k^{y}ǘ^{3}ka^{3}] comb. There is a voiced lenis velar fricative allophone [g] which alternates with lenis voiceless stop [k] when it occurs either precouplet or postcouplet within a word: kǫ^{2}ʔnį^{3}ka^{3}nį^{1} [kǫ́^{2}ʔnį^{3}ga^{3}nį^{1} / kǫ́^{2}ʔnį^{3}ka^{3}nį^{1}] you (singular, adult) will tie again, ka^{2}-sto^{3}ʔo^{3}^{n}do^{3} [ga^{2}stó^{3}ʔo^{3}^{n}do^{3}/ ka^{2}stó^{3}ʔo^{3}^{n}do^{3}] you (plural) will notify.

The alveopalatal fricative / ž/ has a lenis frictionless allophone [y] which occurs postcouplet: da^{3}-te^{2}i^{3}žo^{3} [da^{3}-té^{2}i^{3}yo^{3}] we (inclusive) will loosen (it).

The prenasalized dental stop / ^{n}d/ has a retroflexed allophone which occurs when preceding / o, ǫ/ : ^{n}do^{2}ko^{3} [^{n}dó^{2}ko^{3}] zapote, ^{n}dǫ^{1}ǫ^{2} [^{n}dǫ́^{1}ǫ^{2}] you (singular, child) are washing.

The nasals / m/ and / n/ have allophones which end in a very lenis stop which optionally occur when preceding the oral vowel / o/ . (This is the only oral vowel which occurs in that environment.) ką^{2}no^{2} [ką́^{2}n^{d}o^{2} / ką́^{2}no^{2}] we (inclusive) will call, ką^{2}ʔmo^{2} [ką́^{2}ʔm^{b}o^{2} / ką́^{2}ʔmo^{2}] we (inclusive) will burn (it).

When preceding a nasal or prenasalized consonant, / ʔ/ has allophones which fluctuate between a lenis glottal closure and a glottal closure followed by rearticulation of the preceding vowel. The pitch of the rearticulated vowel is the same as that of the following syllable. Therefore when the second syllable is lower than the first there is an etic downglide: dą^{2}ʔmą^{3} [dą́^{2}ʔa^{3}mą^{3} / dą́^{2}ʔmą^{3}] clothing, te^{1}ʔ^{n}de^{3} [te^{1}ʔe^{3}^{n}de^{3} / te^{1}ʔ^{n}de^{3}] is cutting. There is no etic downglide when the two syllables have the same emic tones: sǫ^{1}ʔnį^{1} is tieing. The sequence / VʔC/ contrasts with both / VʔV/ and / VC/ : ^{n}da^{2}ʔa^{3}ñą^{3} her/ their (stranger) hand, ža^{1}a^{3}ñą^{3} her/ their (stranger) tongue.

3. There are five oral vowel phonemes / i, u (front rounded), e, a, o/ and four nasalized vowel phonemes / į, ę̇, ą, ǫ/ : ʔi^{1}ʔi^{1} raw, ʔį^{3}į^{3} salt, ^{n}de^{1}ʔe^{1} is watching, dę^{3}ʔę^{3} lard, k^{w}a^{3}ʔa^{1} red, k^{w}ą^{3}ą^{1} yellow, ko^{3}o^{3} snake, čǫ^{2}ǫ^{2} work, žo^{2}ʔo^{3} rope, žu^{2}ʔu^{3} mouth, k^{w}a^{1}-ką^{1}ną^{2}^{n}do^{2} you (plural) are not calling, k^{w}ą^{1}-ką^{2}ną^{2}^{n}do^{2} you (plural) are going to go call.

4. A precouplet vowel optionally has length and decrescendo: ʔa^{3}-ku^{1}ʔu^{3}nį^{1} Are you (singular, adult) sick?, ʔǫ^{3}-ku^{1}ša^{1}a^{3} It is not white, ti^{3}-ža^{2}ka^{2} fish.

The vowel / e/ has a slight glide when preceding / ʔi/ : ^{n}de^{3}ʔi^{3} [^{n}de^{i3}ʔi^{3}] mud.

There is a slight allophonic nasalization of vowels when they precede nasal consonants. There is still contrast, however, between a couplet-final oral vowel and a couplet-final nasal vowel preceding an enclitic with / n, ñ/ : ši^{3}i^{3}-ną^{1} his/ her/ their (known) grandfather, ʔį^{3}į^{3}ną^{1} his/ her/ their (known) salt, ši^{3}to^{2}ną^{3} his/ her/ their (known) bed, ši^{3}tǫ^{3}ną^{3} his/ her/ their (known) oven.

5. The distribution of phonemes in relation to each other and in relation to the word has two features of special interest: (1) The alveopalatal consonants / š, č, ž, ñ/ and / s/ have sharply different distributions both in relation to the vowels which they precede and in relation to their distribution into the couplet. (2) The oral vowels / o/ and / ǫ/ occur in very different environments from that of other vowels.

Only one oral vowel, / o/ , follows / m, n, ñ/ and it is always the same morpheme, {o^{2}} we (inclusive): đį^{3}ño^{3} our (inclusive) heads, đą^{2}mo^{2} we (inclusive) will change. These examples contrast with đį^{3}ñǫ^{3} your (singular, child) head, and đą^{2}mǫ^{2} you (singular, child) will change.

Nasalized vowels do not follow voiced consonants other than / m, n, ñ, đ/ in monomorphemic words.

The nasalized vowel / ǫ/ (always the same morpheme {ǫ^{2}} second person singular child) and vowels in cluster with / ǫ/ or preceding / ʔǫ/ may follow voiced consonants in bimorphemic words: ka^{2}ƀa^{2} will lie down, ka^{2}ƀǫ^{2} you (singular, child) will lie down, ža^{1}a^{3} tongue, žą^{1}ǫ^{3} your (singular, child) tongue, ^{n}da^{2}ʔa^{3} hand, ^{n}dą^{2}ʔǫ^{3} your (singular, child) hand. These contrast with ka^{2}ƀo^{2} we (inclusive) will lie down, ža^{1}o^{3} our (inclusive) tongues, ^{n}da^{2}ʔo^{3} our (inclusive) hands.

The phoneme / s/ precedes only the oral vowels / o, a/ and the nasal vowel /ǫ/ or clusters with / ǫ/: ʔu^{3}sa^{3} seven, ku^{3}ka^{3}so^{3} our (inclusive) comb, ^{n}di^{3}sa^{3} sandal, sǫ^{1}ną^{1} is opening, ku^{3}ka^{3}sǫ^{2} your (singular, child) comb.

When the consonants / š, č/ occur in the middle of a monomorphemic couplet, they precede only / i/: ti^{3}ši^{2} stomach, ʔi^{3}či^{1} dry. They do, however, precede other vowels in the middle of bimorphemic couplets: ti^{3}šo^{2} our (inclusive) stomachs, ti^{3}šǫ^{2} your (singular, child) stomach, ʔi^{3}ča^{1}a^{3} a dry thing. There are a few examples in which they precede other vowels when couplet-initial: ša^{3}a^{3} spoiled, čǫ^{3}ǫ^{3} hen, čį^{1}į^{3} fingernail, ti^{3}-ču^{1}tu^{3} cat, če^{1}lo^{3} calf, šį^{3}ʔį^{3} mushroom, šę^{1}ę^{2} is buying.

The phoneme / ñ/ does not precede the vowel / į/. It is rare in the middle of a monomorphemic couplet (kǫ^{3}ñǫ^{2} meat, ʔį^{3}ñǫ^{3} six), but occurs frequently in the middle of couplets composed of two morphemes: đį^{3}nį^{3} head, đį^{3}ño^{3} our (inclusive) heads, ką^{1}nį^{3} long, ką^{1}ą^{3}ñą^{1} a long thing. Examples of / ñ/ occurring couplet-initial: ñą^{3}mą^{3} corn husk, ñǫ^{2}ʔǫ^{3} fire, ñę^{1}ʔę^{2} is scratching.

In our data, / ž/ does not occur couplet-medial. When couplet-initial / ž/ may precede any oral vowel, but in monomorphemic words it does not precede nasal vowels: ža^{1}a^{3} tongue, že^{1}ʔe^{1} door, ži^{2}kǫ^{3} furrow, žo^{3}ko^{3} steam, ti^{3}-žu^{2}tu^{3} a braid of hair.

In our data, / ^{n}d, k^{w}/ occur couplet-medial in only the following morphemes: le^{2n}de^{3} navel, le^{3}k^{w}ą^{3} eyebrow, ža^{2}k^{w}a^{2} crooked.

The only consonant clusters which occur in native words are: / ʔm, ʔn, ʔ^{n}d, st/. The clusters / ʔm, ʔn, ʔnd/ occur only in a couplet-medial environment: dą^{2}ʔmą^{3} clothing, kǫ^{2}ʔnį^{3} will tie up, te^{3}ʔ^{n}de^{3} will cut. In our data, the cluster / st/ occurs in only two examples: ʔi^{2}-sto^{2}ʔa^{3} owner, ka^{2}-sto^{3}ʔo^{3} will notify.

Consonant clusters occur in Spanish loan words as in: kru^{1}ši^3 cross, ka^{1}rta^1 letter, mą^2-rte^{1}ši^3 Tuesday, mą^2-drį^{1}ną^1 godmother, mu^{1}lta^1 a fine.

Geminate clusters of any of the vowels may occur in a couplet composed of one morpheme: ši^{3}i^3 grandfather, te^{1}e^2 is writing, sa^{3}a^3 new, ^{n}do^{1}o^2 is washing, žu^{3}u^3 rock, čį^{1}į^3 fingernail, šę^{1}ę^2 is buying, k^{w}ą^{3}ą^1 yellow, čǫ^{3}ǫ^3 hen. The following diverse clusters occur in couplets composed of one morpheme: te^{2}i^3 chair, ku^{3}a^3 year, ʔį^{2}ǫ^3 thorn, ʔi^{2}a^2 sour, ʔo^{3}a^3 bitter.

If the first of two vowels is nasal in a monomorphemic couplet, the second vowel is usually nasal. If the first vowel is oral (but for one word le^{3}k^{w}ą^3 eyebrow), the second is either oral or /ǫ/: kǫ^{3}mį^3 four, kį^{2}nį^2 poor quality, ką^{3}ʔą^3 will talk, ši^{3}tǫ^3 oven, đi^{3}kǫ^3 neck, ke^{2}đǫ^2 will sneeze.

Numerous vowel clusters (all ending in either /i, į, a, ą, o, ǫ/) occur in words composed of two or more morphemes: ti^{3}ši^{2}i^3 my stomach, ki^{1}đi^{3}o^3 we (inclusive) are sleeping, ƀi^{3}đi^{3}a^3 a sweet thing, te^{1}i^3 I am writing, te^{1}o^2 we (inclusive) are writing te^{1}a^3 it is writing, ƀi^{2}ta^{1}a^3 a soft thing, či^{3}ka^{2}i^3 my chest, či^{3}ka^{2}o^2 our (inclusive) chests, ^{n}do^{1}a^3 it is washing, ^{n}do^{1}i^3 I am washing, ^{n}do^{1}o^2 we (inclusive) wash, tu^{1}i^3 I am poking, tu^{1}o^2 we (inclusive) are poking; čį^{1}į^3 fingernail, čį^{1}ǫ^3 your (singular, child) fingernail, šę^{1}į^3 I am buying, šę^{1}ǫ^2 you (singular, child) are buying, kǫ^{1}ną^{1}ą^3 a deep thing, le^{3}k^{w}ą^{1}į^1 my eyebrow, le^{3}k^{w}ą^{3}ǫ^3 your (singular, child) eyebrow, čǫ^{3}ǫ^3 your (singular, child) arm, đi^{3}kǫ^{1}į^1 my neck, tu^{1}ǫ^2 you (singular, child) poke.

Vowel clusters of three vowels: čį^{1}į^{3}į^1 my fingernail, k^{w}i^{1}i^{3}a^1 k^{w}i^{1}a^{3}a^1 a green thing, k^{w}į^{1}į^{3}ą^1 / k^{w}į^{1}ą^{3}ą^1 a narrow thing, ža^{1}a^{3}i^1/ ža^{1}i^{3}i^1 my tongue, ža^{1}a^{3}a^1 its tongue, ñǫ^{2}į^3/ ñǫ^{2}į^{2}į^3 my land, ñǫ^{2}ǫ^{3}ǫ^2 your (singular, child) land, ñǫ^{2}ą^3 / ñǫ^{2}ą^{2}ą^3 its land, k^{w}e^{1}a^{1}a^3 a slow thing, ^{n}do^{3}i^{2}i^3 / ^{n}do^{3}o^{2}i^3 I will stay, ^{n}de^{1}i^{1}i^3 I am caring for, ^{n}de^{1}o^{1}o^3 we (inclusive) are caring for, ^{n}dę^{1}ǫ^{1}ǫ^2 you (singular, child) are caring for, ^{n}do^{3}a^{2}a^3 it stays, tu^{1}i^{1}i^3 I am blowing, tu^{1}o^{1}o^3 we (inclusive) are blowing, tu^{1}ǫ^{1}ǫ^2 you (singular, child) are blowing, tu^{1}a^{1}a^3 it is blowing.

There is a restriction in the vowel sequences which occur in a monomorphemic couplet with a medial /ʔ/. Except for the sequences /eʔi/, /uʔa/, and /įʔą/, the sequences consist of like vowels: či^{3}ʔi^3 smooth, ƀe^{2}ʔe^2 house, sa^{3}ʔa^3 foot, ko^{3}ʔo^3 plate, žu^{2}ʔu^3 mouth, ^{n}de^{3}ʔi^3 mud, žu^{3}ʔa^3 thread; đį^{3}ʔį^2 leg, ñę^{1}ʔį^2 is scratching, ką^{1}ʔą^1 wants, nǫ^{3}ʔǫ^2 tooth, đį^{1}ʔą^1 buzzard.

If the couplet is composed of two morphemes, there are various sequences of diverse vowels. For example: są^{3}ʔǫ^3 your (singular, child) foot, sa^{3}ʔo^3 our (inclusive) feet, sa^{3}ʔi^1 my foot, dę^{3}ʔǫ^2 your (singular, child) son, de^{3}ʔo^2 our (inclusive) son, žu^{2}ʔo^3 our (inclusive) mouths, žu^{2}ʔǫ^3 your (singular, child) mouth, ^{n}de^{1}ʔi^1 I am watching, ^{n}de^{1}ʔa^1

it watches, ką^{1}ʔį^1 I want, ka^{1}ʔo^1 we (inclusive) want, ką^{1}ʔǫ^1 you (singular, child) want, ^{n}do^{1}ʔi^3 I am suffering, ku^{1}ʔi^3 I am sick.

6. The syllable types V, CV, CCV occur, but, except for two examples with /st/, only CV occurs couplet- or word-initial. Examples: ku^{3}ka^3 comb, čo^{3}i^1 my arm, ʔį^{2}nį^2 warm, đǫ^{3}ʔnǫ^3 shirt.

A syllable contains one, and only one, emic tone. There are three syllables in each of the following examples: čį^{1}į^{3}į^1 my fingernail, ką^{1}ą^{3}ñą^1 a long thing, ƀi^{3}đi^{3}a^3 a sweet thing, đi^{2}to^{3n}do^2 your (plural) uncle.

7. There is a contrast of three tones: 1 (high), 2 (mid), and 3 (low). All the possible sequences occur in two syllable words, but the sequences 21 and 31 are rare.

Examples of the tones in contrast are: la^{1}sa^3 ką^{1}nį^3 a long bone, ži^{2}kǫ^3 ką^{1}nį^3 a long furrow, ƀi^{3}ko^3 ką^{1}nį^3 a long cloud; ʔu^{3}sa^3 te^3-tu^{1}u^1 seven bandplayers, ʔu^{3}sa^3 ši^{3}to^2 seven beds, ʔu^{3}sa^3 ši^{3}ta^3 seven grandmothers; đi^{2}to^{3}ną^3 his/her/their (known) uncle, đi^{2}to^{3n}do^2 your (plural) uncle, đi^{2}to^{3}nį^1 your (singular, adult) uncle; ʔu^{3}sa^3 ža^{1}a^3 seven tongues, ʔu^{3}sa^3 žu^{2}u^3 seven mats, ʔu^{3}sa^3 žu^{3}u^3 seven stones; žu^{1}ʔu^{1n}di^3 we (exclusive) are afraid, tu^{1}ʔu^{2n}di^3 we (exclusive) are sucking, ku^{1}ʔu^{3n}di^3 we (exclusive) are sick.

8. The highest allotone of tone 1 occurs when preceding a tone 2 or tone 3 within a word. That is, the second syllable in the following example is higher than the first: sa^{1}đi^{1}ną^3 he/she/they (known) are closing (it). A lower allotone occurs when preceding a couplet within a word. That is, the first syllable in the following example is lower than the succeeding syllables: k^{w}a^1-sa^{1}đi^{1}nį^1 you (singular, adult) are not closing (it).

The highest allotone of tone 2 occurs when preceding a tone 3 within a word. In the following example the second syllable is higher than the first: ^{n}di^{2}đi^{2}ną^3 his/her/their (known) pulque. A lower allotone occurs when following a tone 3 prepause. In the following example, the last syllable is lower than the other syllables with tone 2: ką^{1}ną^{2n}do^2 tį^{3}ną^2 you (plural) are calling the dog. Tone 2 is sometimes a bit lower in a final syllable if the word has the pattern CVV: ʔį^{2}į^2 ka^{3}a^2 one bell.

There is a downgliding allotone of tone 3 which occurs prepause: đu^{3}ku^3 niece, đi^{3}kǫ^3 neck. A tone 3 in a stressed syllable may be slightly higher than a contiguously preceding tone 3 in a nonstressed syllable. In the following example the second syllable is higher than the first: nį^3-ši^{3}ʔi^{3}ną^3 he/she/they (known) died.

9. Each phonological word has a two-syllable couplet as a nucleus. This couplet may or may not be preceded and/or followed by other syllables.

Word-stress usually occurs on the first syllable of the couplet. If, however, some syllable in the couplet or postcouplet is followed in the same word by a syllable with a lower tone, then the word-stress occurs on the syllable preceding the lower tone. In this section word-stress has been written with an acute accent: ñą́^{2}nį^{3}nį^1 your (singular, adult) brother, đú^{3}ku^{3}nį^1 your (singular, adult) niece, sá^{1}đi^{1}nį^1 you (singular, adult) are closing (it), sa^{1}đí^{1}ną^3 he/ she/ they (known) are closing (it), ki^{3}đí^{2}ši^3 my jug.

Stress never occurs on a syllable preceding the couplet. Throughout this paper, if the couplet does not occur word-initial, a hyphen has been written separating it from the precouplet syllable: k^{w}a^1-sá^{1}đi^{1}nį^1 you (singular, adult) are not closing (it), ʔį́^{2}į^2 đí^{3}ta^{3}ši^3 his/ her/ their (child) one tortilla, ʔį́^{2}į^2 te^3-đú^{3}sa^3 one lazy man, ší^{3}to^{2}so^2 our (inclusive) bed, ti^3-kó^{2}lo^2 turkey.

When two pronouns of the CV pattern follow a couplet, either one of which — if alone — would be a part of the preceding phonological word, the combination becomes a separate phonological word. It has its own rhythm wave and stress, even although it cannot occur as a separate word in isolation: nį^3-sǫ^{2}ʔní^{2}ną^3 he/ she/ they (known) tied (it), nį^3-sǫ́^{2}ʔnį^2 ną́^{3}ñą^2 he/ she/they (known) tied her/ them (stranger), nį^3-są́^{2}ʔnį^{3}ną^1 he/ she/ they (known) hit (it), nį^3-są́^{2}ʔnį^3 ną́^{1}ši^2 he/ she/ they (known) hit him/ them (child).

If the first one-syllable morpheme is not a pronoun, or if the first pronoun has the syllable pattern V, the two syllables do not combine into a separate phonological word: kǫ́^{2}ʔnį^{3}ka^{3}nį^1 you (singular, adult) will tie (it) again, nį^3-sǫ^{2}ʔní^{2}į^{3}ną^3 I tied him/ her/ them (known).

Usually only one syllable occurs precouplet within a phonological word. When two syllables precede the couplet, either one of which, if alone, would be a part of the following phonological word, they usually combine into a separate phonological word: nį^3-ké^{2}ʔe^2^{n}do^2 you (plural) teased (someone), ní^{3}są^3 ké^{2}ʔe^2^{n}do^2 you (plural) went to tease (someone), nį^3-^{n}dá^{2}ta^2^{n}do^2 you (plural) split (it), ʔǫ^3-^{n}dá^{1}ta^1^{n}do^1 you (plural) will not split (it), nį^3-^{n}dá^{2}ta^2 ^{n}dó^{2}tǫ^2 you (plural) split it (wood), ʔǫ́^{3}nį^3 ^{n}dá^{1}ta^1 ^{n}dó^{1}tǫ^1 you (plural) didn't split it (wood). This last example has the same rhythm (with length and decrescendo of a word-final vowel) as a sentence composed of three stems: đú^{3}ku^3 kí^{2}ši^2 ƀí^{2}či^2 the niece will come now.

But the following examples consist of single phonological words: ki^{1}a^1-čǫ́^{1}ǫ^{2}nį^1 you (singular, adult) are working, nį^{3}ki^2-^{n}do^{3}ó^{2}ną^3 he/ she/they (known) stayed.

There is a phrase-stress which occurs on the last syllable prepause. This syllable is about the same loudness as a syllable with word-stress, therefore when a two-syllable word with a CVCV pattern occurs prepause, the two syllables may (or may not) have equal stress.

In the following examples word-stress is written ´ and phrase-stress ^: sá^{1}đî^1 is closing, ƀí^{2}čî^2 now, tí^{3}čî^3 avocado, žé^{1}ʔê^1

door, žé^{1}ʔe^1 sá^{1}đi^{1}nį̂^{1} you (singular, adult) are closing the door, ƀɨ́^{2}či^2 ká^{2}ta^{2}ndô^2 now you (plural) will sing, ʔį́^{2}į^2 tɨ́^{3}či^{3}šî^{3} his/ her/ their (child) one avocado.

Within a phonological phrase there is usually a slight length on the word-final vowel. In a sequence of several words with tone 1 or with tone 2, the contour is approximately level. In a sentence with a sequence of words with tone 3, the last syllable has a down glide: te^3-tú^{1}u^1 sá^{1}đi^1 žé^{1}ʔe^1 ƀɨ́^{1}čɨ̂^{2} the bandplayer is closing the door now, ná^{2}čo^2 ká^{2}ta^{2}ndo^2 ƀɨ́^{2}čɨ̂^{2} why will you (plural) sing now? ʔú^{3}sa^3 đú^{3}ku^{3}ną^3 nį^3-šɨ́^{3}ʔɨ̂^{3} seven of his/ her/ their (known) nieces died.

10.0. The replacement of one allomorph for another can be divided into two types: (1) The basic allomorph is replaced by one which differs from it by tone only — tone sandhi. (2) The basic allomorph is replaced by one which may differ from it by tone, by a change or loss of vowel, and by a change from /ni/ to /ñ/, or /ko/ to /k^w/, or by a combination of tone change plus one of these segmental changes.

10.1. Tone sandhi between words can be predicted only if the morphemes are divided into classes in accordance with the changes which they cause, and again in accordance with the way they themselves are changed.

Class A morphemes are followed by basic allomorphs. Class B morphemes are followed by nonbasic allomorphs, or by basic allomorphs with the tone sequence 13, 12, or 11. The basic allomorph is that form which occurs in isolation.

A few morphemes have alternant forms of their basic allomorphs. That is, either form may occur in isolation: ti^{3}la^2 / ti^3-la^{2}a^3 (A) bird, ʔi^{3}ʔi^3 / ʔi^{1}ʔi^1 (B) raw.

Two different morphemes may be homophonous and yet in different classes: sa^{1}đi^1 (A) is closing, sa^{1}đi^1 (B) is nursing, ʔį^{3}į^3 (A) nine, ʔį^{3}į^3 (B) salt.

Class A two-syllable morphemes occur with all of the possible tone sequences. There are, however, certain restrictions. The tone sequence 12 occurs in verbs only; sequences 21 and 31 are rare; sequences 32 and 33 are frequent in nouns but rare in verbs.

In our data, Class B two-syllable morphemes do not occur with the tone sequences 12, 21, or 32, only once with 31. The tone sequence 11 occurs most frequently in verbs; tone sequence 22 occurs most frequently in modifiers.

Morphemes of two syllables with a tone sequence 22, 23, and 33 (and perhaps 32), are divided into Classes R 'regular' and L 'level', in accordance with their nonbasic forms. Both syllables are raised in the nonbasic allomorphs of Class L morphemes; that is, all have the tone sequence 11. Class R nonbasic allomorphs have only the first syllable raised; that is, the nonbasic forms are 12 or 13. In our data Class R morphemes are frequent. Class L morphemes occur as follows: 22 (AL), 22 (BL), 23 (AL), 23 (BL), 33 (BL). Lacking, but perhaps due to insufficient data are: 33 (AL), 32 (AL), 32 (BL).

Following are the specific rules for tone sandhi with different classes of morphemes.

Rule 1: Morphemes whose basic forms have the tone sequence 13, 12, 11 are unchanging.[4] They have only one allomorph: la^{1}sa^{3} (A) *bone*, žo^{1}ʔo^{2} (A) *here*, sa^{1}đi^{1} (A) *is closing*.

Rule 2: When following a Class B morpheme, the first syllable of a non-Class L morpheme is raised. That is, 21 > 11, 31 > 11, 22 > 12, 32 > 12, 23 > 13, 33 > 13. Thus, the tone sequences of the nonbasic allomorphs are either 11, 12, or 13. The basic allomorph is retained whenever the morpheme follows a Class A morpheme.

The following examples show morphemes with the basic allomorphs following Class A morphemes, and then the same morphemes with their nonbasic allomorphs following Class B morphemes: ʔi^{2}đa^{1} (A) *day after tomorrow*, ka^{2}ka^{2n}do^{2} (AR) *you (plural) will walk*, ka^{2}ka^{2n}do^{2} ʔi^{2}đa^{1} *you (plural) will walk day after tomorrow*; sǫ^{1}ną^{1n}do^{1} (B) *you (plural) will open (it)*, sǫ^{1}ną^{1n}do^{1} ʔi^{1}đa^{1} *you (plural) will open (it) day after tomorrow*; ʔi^{3}či^{1} (A) *dry*, ku^{3}ka^{3} (AR) *comb*, ku^{3}ka^{3} ʔi^{3}či^{1} *a dry comb*, đo^{3}o^{3} (BR) *blanket*, đo^{3}o^{3} ʔi^{1}či^{1} *a dry blanket*; ka^{2}ta^{2} (AR) *will sing*, đu^{3}ki^{3} (AR) *my niece*, đu^{3}ki^{3} ka^{2}ta^{2} *my niece will sing*, ši^{3}ta^{3}o^{3} (BR) *our (inclusive) grandmother*, ši^{3}ta^{3}o^{3} ka^{1}ta^{2} *our (inclusive) grandmother will sing*; tį^{3}ną^{2} (AR) *dog*, ʔu^{3}sa^{3} (AR) *seven*, ʔu^{3}sa^{3} tį^{3}ną^{2} *seven dogs*: kǫ^{3}mį^{3} (BR) *four*, kǫ^{3}mį^{3} tį^{1}ną^{2} *four dogs*; či^{2}ka^{3} (BR) *banana*, ʔu^{3}sa^{3} či^{2}ka^{3} *seven bananas*, kǫ^{3}mį^{3} či^{1}ka^{3} *four bananas*; čǫ^{3}ǫ^{3} (BR) *hen*, ta^{2}-ʔi^{2}i^{2} (BR) *boy*, ^{n}de^{1}e^{1} (A) *is caring for*, ta^{2}-ʔi^{2}i^{2} ^{n}de^{1}e^{1} čǫ^{3}ǫ^{3} *the boy is caring for the hens*; ^{n}de^{1}ʔe^{1} (B) *is watching*, ta^{2}-ʔi^{2}i^{2} ^{n}de^{1}ʔe^{1} čǫ^{1}ǫ^{3} *the boy is watching the hens*.

Rule 3: Class L morphemes[5] become 11 when following a Class B morpheme: kǫ^{3}mį^{3} (BR) *four*, ta^{2}ka^{3} (AL) *nest*, kǫ^{3}mį^{3} ta^{1}ka^{1} *four nests*; ^{n}de^{1}ʔo^{1} *we (inclusive) are looking*, ^{n}di^{2}di^{2} (AL) *pulque*, ^{n}de^{1}ʔo^{1} ^{n}di^{1}di^{1} *we (inclusive) are looking at pulque*; đo^{3}o^{3} (BR) *blanket*, sa^{3}a^{3} (BL) *new*, đo^{3}o^{3} sa^{1}a^{1} *new blanket*.

Some morphemes, especially those of the tone sequence 33, have both Class L and Class R alternants: ti^{3}či^{3} (BL/R) *avocado*, kǫ^{3}mį^{3} ti^{1}či^{3} / kǫ^{3}mį^{3} ti^{1}či^{1} *four avocados*; žo^{3}đo^{3} (BL/R) *grinding stone*, kǫ^{3}mį^{3} žo^{1}đo^{3} / kǫ^{3}mį^{3} žo^{1}đo^{1} *four grinding stones*.

Rule 4: A Class AL morpheme with the tone sequence 23 optionally varies to 22 when contiguously preceding a tone 3: ta^{2}ka^{3} (AL) *nest*, ʔi^{3}či^{1} (A) *dry*, ta^{2}ka^{2} ʔi^{3}či^{1} / ta^{2}ka^{3} ʔi^{3}či^{1} *a dry nest*; kǫ^{2}ʔnį^{3} (AL) *will tie*, ta^{3} *third person masculine stranger*, kǫ^{2}ʔnį^{2}ta^{3} / kǫ^{2}ʔnį^{3}ta^{3} *he/they (stranger) will tie*.

The Class AL morpheme does not change when preceding a tone 2 or 1: ta^{2}ka^{3}li^{2}-lu^{2}u^{2} *a small nest*, kǫ^{2}ʔnį^{3}nį^{1} *you (singular, adult) will tie*. Nor does it change if the morpheme is Class AR: ži^{2}kǫ^{3} (AR) *a furrow*, ži^{2}kǫ^{3} ʔi^{3}či^{1} *a dry furrow*.

Rule 5: A Class BR morpheme with the tone sequence 23 optionally varies to 22 when preceding any morpheme, that is, when nonprepause: či^{2}ka^{3} (BR) banana, ƀi^{3}đi^{3} (AR) sweet, či^{2}ka^{2} ƀi^{1}đi^{3} / či^{2}ka^{3} ƀi^{1}đi^{3} a sweet banana; ^{n}do^{2}ko^{3} (BR) zapote, ^{n}do^{2}ko^{2} ƀi^{1}đi^{3} / ^{n}do^{2}ko^{3} ƀi^{1}đi^{3} a sweet zapote. But a Class BL morpheme with the tone sequence 23 does not change: ka^{2}a^{3} (BL) will eat, đu^{3}ku^{3} (AR) niece, či^{2}ka^{3} (BR) banana, đu^{3}ku^{3} ka^{2}a^{3} či^{1}ka^{3} the niece will eat bananas.

Rule 6: A bimorphemic word with the tone sequence 31 (composed of 33 + 1) becomes 131 when following a Class B morpheme: đi^{3}či^{3} (BR) nose, i^{3} first person singular, đi^{3}či^{1} my nose, te^{3}-ʔi^{2}i^{2} ^{n}de^{1}ʔe^{1} đi^{1}i^{3}či^{1} the man is looking at my nose. (For an example of the change of a monomorphemic word with the tone sequence 31, see the following: đo^{3}o^{3} (BR) blanket, ʔi^{3}či^{1} dry, đo^{3}o^{3} ʔi^{1}či^{1} a dry blanket.)

10.2.0. Tone sandhi and segmental changes within words can be predicted only if the enclitics which follow[6] a couplet within a phonological word — one-syllable morphemes — are divided into Classes A, B, and C, and if they are divided again according to the canonical pattern CV versus V.

10.2.1. Class A enclitics act like Class A two-syllable morphemes in that they are followed by basic allomorphs. All Class A enclitics but one (nį^{1} second person singular adult) are basically tone 3; they become tone 1 when following any Class B morpheme: sa^{1}đi^{1} (A) is closing, sa^{1}đi^{1}ną^{3} he/ she/ they (known) is closing (it); ^{n}de^{1}ʔe^{1} (B) is watching, ^{n}de^{1}ʔe^{1}ną^{1} he/ she/ they (known) is watching (it).

In our data Class A enclitics consist of: ši^{3} ~ ši^{1} ~ i^{3} ~ i^{1} ~ į^{3} ~ į^{1} first person singular, ^{n}di^{3} ~ ^{n}di^{1} first person plural exclusive, ną^{3} ~ ną^{1} third person known, ta^{3} ~ ta^{1} third person masculine stranger, a^{3} ~ a^{1} ~ ą^{3} ~ ą^{1} third person inanimate, ža^{3} ~ ža^{1} divine, wa^{3} ~ wa^{1} augmentative, ka^{3} ~ ka^{1} repetitive, nį^{1} second person singular adult.

The only Class B enclitic in our data is so^{3} ~ so^{2} ~ so^{1} ~ o^{3} ~ o^{2} ~ o^{1} first person plural inclusive. It functions like a two-syllable Class B morpheme in that it may be followed by nonbasic allomorphs: ki^{2}ši^{2} (AR) will come, tį^{3}ną^{2}so^{2} ki^{3}ši^{2} our (inclusive) dog will come. The Class B enclitic has the same tone as any Class B allomorph which precedes it: že^{1}ʔe^{1} (B) door, že^{1}ʔe^{1}so^{1} our (inclusive) door; ną^{3}mą^{3} (B) soap, ną^{3}mą^{3}so^{3} our (inclusive) soap, ^{n}da^{2}ta^{2} (B) will split (it), ^{n}da^{2}to^{2} we (inclusive) will split (it).

A Class B enclitic is tone 3 when following a Class A morpheme with tones 3 or 1, and is optionally tone 2 or 3 when following a Class A morpheme with tone 2: ną^{2}mą^{3} (AR) wall, ną^{2}mą^{3}so^{3} our (inclusive) wall; te^{3}-tu^{1}u^{1} (A) bandplayer, te^{3}-tu^{1}u^{1}so^{3} our (inclusive) bandplayer; tǫ^{3}mį^{2} (AR) feather, tǫ^{3}mį^{2}so^{2} / tǫ^{3}mį^{2}so^{3} our (inclusive) feather.

Class C enclitics differ from other enclitics in that when they follow a Class A stem they function like Class A morphemes; when they follow a Class B stem, they usually function like Class B enclitics.

When Class C enclitics follow a Class A stem, they are tone 2 and are followed by basic allomorphs: sa^{1}đi^{1n}do^{2} you (plural) are closing (it), ši^{3}tǫ^{3n}đo^{2} your (plural) oven, šę^{1}ę^{2n}do^{2} you (plural) are buying.

When Class C enclitics follow a Class B stem (and are functioning as a Class B morpheme), they take the same tone as the final tone of the stem and cause a following morpheme to change from the basic to the non-basic form: sǫ^{1}ną^{1n}do^{1} you (plural) are opening (it), ^{n}da^{2}ta^{2n}do^{2} you (plural) will split (it), ta^{3}ta^{3n}do^{3} your (plural) medicine; ^{n}de^{1}ʔe^{1n}do^{1} (B) you (plural) are watching + tį^{3}ną^{2} (AR) dog > ^{n}de^{1}ʔe^{1n}do^{1} tį^{1}ną^{2} you (plural) are watching the dog.

Optionally, however, even when following a Class B stem, Class C enclitics may function like Class A morphemes, in which case they are tone 1 and are followed by basic allomorphs: ka^{2}-đa^{3}ʔa^{3} (BR) will make, ka^{2}-đa^{3}ʔa^{3n}do^{3} (BR) / ka^{2}-đa^{3}ʔa^{3n}do^{1} (AR) you (plural) will make; ^{n}do^{3}ʔo^{3} basket, ka^{2}-đa^{3}ʔa^{3n}do^{3} ^{n}do^{1}ʔo^{3} / ka^{2}-đa^{3}ʔa^{3n}do^{1} ^{n}do^{3}ʔo^{3} you (plural) will make a basket.

In our data Class C enclitics consist of: ^{n}do^{2} ~ ^{n}do^{3} ~ ^{n}do^{1} second person plural, sǫ^{2} ~ sǫ^{3} ~ sǫ^{1} ~ ǫ^{2} ~ ǫ^{3} ~ ǫ^{1} second person singular child, ši^{2} ~ ši^{3} ~ ši^{1} third person child, ñą^{2} ~ ñą^{3} ~ ñą^{1} third person feminine stranger, ti^{2} ~ ti^{3} ~ ti^{1} third person animal, ta^{2} ~ ta^{3} ~ ta^{1} third person liquid, tǫ^{2} ~ tǫ^{3} ~ tǫ^{1} third person wood.

10.2.2. Four of the pronouns have allomorphs consisting of a vowel without a preceding consonant: i^{3} ~ i^{1} ~ į^{3} ~ į^{1} first person singular, ǫ^{3} ~ ǫ^{2} ~ ǫ^{1} second person singular child, o^{3} ~ o^{2} ~ o^{1} first person plural inclusive, a^{3} ~ a^{1} ~ ą^{3} ~ ą^{1} third person inanimate. These allomorphs are used when the pronoun is added to a verb stem, or to an innately possessed noun. At such times the second stem vowel may be lost (see 10.2.3). The stem tone, however, is usually retained.

Following are the specific rules for combination with pronoun allomorphs.

Rule 1: When the allomorph with the canonical pattern V has the same tone as the stem, the tone contour remains the same. A syllable may be lost, however, if a vowel is replaced (see 10.2.3): đi^{3}či^{3} (BR) nose + o^{3} ours (inclusive) > đi^{3}čo^{3} our noses; ti^{3}ši^{2} (AR) stomach + o^{2} ours (inclusive) > ti^{3}šo^{2} our (inclusive) stomachs; sǫ^{1}ną^{1} (B) is opening + į^{1} first person singular > sǫ^{1}ną^{1}į^{1} I am opening.

Rule 2: When an allomorph is added which has a lower tone than the stem, the stem final tone is lost when the canonical pattern is CV^{1}V^{2} and the pronoun is tone 3: te^{1}e^{2} (A) is writing + i^{3} first person singular > te^{1}i^{3} I am writing; šę^{1}ę^{2} (A) is buying + į^{3} first person singular > šę^{1}į^{3} I am buying. But there is no loss of tone with other canonical patterns: ke^{2}te^{2} (AR) will dig + i^{3} first person singular > ke^{2}ti^{2}i^{3} I will dig; k^{w}e^{1}e^{1} (A) slow + a^{3} third person inanimate > k^{w}e^{1}a^{1}a^{3} a slow thing; kǫ^{1}nǫ^{2} (A) wide + ą^{3} third person inanimate > kǫ^{1}ną^{2}ą^{3} a wide thing; sǫ^{1}ʔnį^{1} (A) is tieing + ǫ^{2} second person singular child > sǫ^{1}ʔñǫ^{1}ǫ^{2} you (singular, child) are tieing.

Rule 3: When an allomorph is added which is higher than the last vowel of the stem, the stem final tone is lost if the canonical pattern is CV^{3}CV^3 or CV^{3}V^3: đo^{3}ko^3 (AR) shoulder + ǫ^2 you (singular, child) > đo^{3}kǫ^2 your (singular, child) shoulder; le^{3}kw^{w}ą^3 eyebrow + į^1 first person singular > le^{3}k^{w}ą^{1}į^1 my eyebrow, čo^{3}o^3 (BR) arm + i^1 first person singular > čo^{3}i^1 my arm.

Rule 4: If the canonical pattern is CV^{2}CV^2 or CV^{2}V^2 and the allomorph is tone 1, the stem final tone is lost: ko^{2}ko^2 (BL) will swallow + i^1 first person singular > ko^{2}ki^1 I will swallow; đi^{2}i^2 (BL) will singe + i^1 first person singular > đi^{2}i^1 I will singe (it).

Rule 5: If the canonical pattern is CV^{1}CV^3, or CV^{2}CV^3, and the allomorph is tone 2 or tone 1, the contour remains the same, but there is optional variation of the canonical pattern. The vowel with tone 3 may occur on either side of the medial consonant: CV^{1}V^{3}CV^2 (preferred) or CV^{1}CV^{3}V^2, etc: kǫ^{1}nį^3 (A) want + ǫ^2 second person singular child > kǫ^{1}ǫ^{3}ñǫ^2/ kǫ^{1}ñǫ^{3}ǫ^2 you (singular, child) want; ką^{1}nį^3 (B) long + ą^1 third person inanimate > ką^{1}ą^{3}ñą^1 / ką^{1}ñą^{3}ą^1 a long thing; ka^{2}đi^3 (BL) will nurse + i^1 first person singular > ka^{2}a^{3}đi^1 / ka^{2}đi^{3}i^1 I will nurse; žo^{2}đo^3 (BR) level + a^1 third person inanimate > žo^{2}o^{3}đa^1 / žo^{2}đa^{3}a^1 a level thing.

There is similar variation if the canonical pattern is CV^{1}V^3 or CV^{2}V^3 and the allomorph added is tone 2 or 1: ža^{1}a^3 (B) tongue + i^1 first person singular > ža^{1}a^{3}i^1 / ža^{1}i^{3}i^1 my tongue.

10.2.3. There may be certain changes in the segmental phonemes when a pronoun of the canonical pattern V is added to a stem. These are stated in the following rules.

Rule 1: Except for the clusters /uǫ/ and /uʔǫ/, vowel clusters and sequences of vowels separated by /ʔ/ have either all oral vowels, or all nasalized vowels. Therefore (1) when the pronoun vowel is /o/ first person inclusive, nasalized stem vowels are replaced by oral vowels: đį^{3ʔ}į^2 (AR) leg, đi^{3ʔ}i^{2}o^2 our legs. (2) When the pronoun vowel is /ǫ/ second person singular child, oral stem vowels are replaced by nasalized vowels: đo^{3ʔ}o^2 (AR) ear, đǫ^{3ʔ}ǫ^2 your (singular, child) ears. (3) When, however, the pronoun {i} first person singular, or {a} third person inanimate follow a stem, the choice of their allomorph is determined by the quality of the stem vowel. That is, an oral allomorph follows an oral stem vowel, and nasalized allomorphs follow a nasalized stem vowel: đį^{3ʔ}į^2 (AR) leg, đį^{3ʔ}į^{2}į^3 my leg, đo^{3ʔ}o^2 (AR) ear, đo^{3ʔ}i^{2}i^3 my ear.

Rule 2: When a pronoun of the syllable pattern V is added to a stem with the canonical pattern CVV, the second vowel of the stem is lost (unless the resulting tone contour is falling-rising, see 10.2, Rule 5): ža^{1}a^3 (B) tongue, ža^{1}o^3 our tongues; čį^{1}į^3 fingernail, či^{1}o^3 our fingernails, čo^{3}o^3 (BR) arm, čo^{3}i^1 my arm.

Rule 3: When a pronoun of the canonical pattern V is added to a stem which ends in /ši/ or /či/, the /i/ is lost; when added to a stem which ends in /nį/, the /nį/ is replaced by /ñ/; in other environments the /i/

is retained: đi^{3}či^3 (BR) *nose*, đi^{3}čo^3 *our (inclusive) noses*; ti^{3}ši^2 (AR) *stomach*, ti^{3}šo^2 *our (inclusive) stomachs*, đɨ^{3}nɨ^3 (BR) *head*, đɨ^{3}ño^3 *our (inclusive) heads*; sa^{1}đi^1 (A) *is closing*, sa^{1}đi^{1}o^3 *we (inclusive) are closing*.

Rule 4: When a pronoun of the canonical pattern V is added to a stem which ends in /e/, the /e/ is lost: te^{3}ʔ^{n}de^3 (AR) *will cut*, te^{3}ʔ^{n}di^3 *I will cut*; ke^{2}te^2 (AR) *will dig*, ke^{2}to^2 *we (inclusive) will dig*.

Rule 5: When a pronoun of the canonical pattern V is added to a stem which ends in the sequence /ei/ or /eʔi/, /ž/ occurs between the stem and the pronoun: ^{n}de^{1}ʔi^3 (A) *is crying*, ^{n}de^{1}ʔi^{3}žo^3 *we (inclusive) are crying*; đa^3-te^{2}i^3 (AR) *will loosen*, đa^3-te^{2}i^{3}žo^3 *we (inclusive) will loosen*.

Rule 6: When a pronoun of the canonical pattern V is added to a stem which ends in /a/ or /ą/, that stem vowel is retained after /s, k, k^w/: đi^{3}ta^{3}sa^1 (AR) *liver*, đi^{3}ta^{3}sa^{1}i^3 *my liver*, le^{3}k^{w}ą^3 (BR) *eyebrow*, le^{3}k^{w}ą^{1}ɨ^1 *my eyebrow*, ši^{1}ka^3 (A) *is asking*, ši^{1}ka^{3}i^3 *I am asking*. After /m, n, t/ the /a, ą/ are arbitrarily retained or lost: ʔa^2-nɨ^{1}mą^3 (A) *heart*, ʔa^2-nɨ^{1}mą^{3}ɨ^3 *my heart*, ką^{2}ʔmą^2 (AR) *will burn*, ką^{2}ʔmɨ^{2}ɨ *I will burn (it)*, sǫ^{1}ną^1 (B) *is opening*, sǫ^{1}ną^{1}ɨ^1 *I am opening*, ką^{2}ną^2 (AR) *will call*, ką^{2}nɨ^{2}ɨ^3 *I will call*; ka^{2}ta^2 (AR) *will sing*, ka^{2}ti^{2}i^3 *I will sing*, ši^{3}ta^3 (BR) *grandmother*, ši^{3}ta^{1}i^1 *my grandmother*. After /w/ there are alternants: nɨ^3-ka^{2}wa^2 (AR) *twisted*, nɨ^3-ka^{2}wi^{2}i^3 / nɨ^3-ka^{2}wa^{2}i^3 *I twisted*. In other environments the stem vowel is lost: ka^{2}ƀa^2 (AR) *will lie down*, ka^{2}ƀi^{2}i^3 *I will lie down*.

Rule 7: A stem which ends in /ku/ or /đu/ becomes /ki/ or /đi/ when a pronoun of the canonical pattern V is added: đu^{3}ku^3 (AR) *niece*, đu^{3}ki^{3}o^3 *our nieces*; ku^{3}đu^3 (AR) *will sleep*, ku^{3}đi^{3}o^3 *we (inclusive) will sleep*. Examples which end in /u/ are rare, but it is lost after /ʔ/: ku^{3}ʔu^3 (AR) *a girl's sister*, ku^{3}ʔi^3 *my sister*.

Rule 8: Examples of stem final /o, ǫ/ are lacking for a thorough check, but /ǫ/ is retained in: đi^{3}kǫ^3 (BR) *throat*, đi^{3}kǫ^{1}ɨ^1 *my throat*, ke^{2}đǫ^2 (BL) *will sneeze*, ke^{2}đǫ^{1}ɨ^1 *I will sneeze*. The /o/ is lost after /đ/ in: ną^1-^{n}do^{1}đo^1 (B) *forget*, ną^1-^{n}do^{1}đi^1 *I forget*. The /o/ is retained after /k/ in đi^{3}ko^3 (BL) *will sell*, đi^{3}ko^{1}i^1 *I will sell*. In at least one example, ko + i optionally varies from /k^{w}ɨ/ to /ki/: nɨ^3-ko^{2}ko^2 (BL) *swallowed*, nɨ^3-ko^{2}ki^1 / nɨ^3-ko^{2}k^{w}i^1 *I swallowed*.

NOTES

1. This dialect of Mixtec is spoken by approximately 5,000 people living in the vicinity of Huajuapan de León, Oax., Mexico. The principal informant used for the study was Antonio Hernández, about thirty-five years old. He lives in the town of Cacaloztepec, eight miles south of Huajuapan de León. John H. Cowan is responsible for the analysis of

the segmental phonemes, and for the lexical and grammatical materials. Eunice V. Pike did the analysis of tone, the morphophonemics, and is responsible for the presentation of the materials.

2. San Miguel: Kenneth L. Pike, Grammatical Prerequisites to Phonemic Analysis, Word 3.155-72 (1947) and Tonemic Perturbations in Mixteco, with Special Emphasis on Tonomechanical Subclasses, Tone Languages, 77-94, University of Michigan Publications in Linguistics, Vol. IV, Ann Arbor, 1948. San Esteban: Cornelia Mak, A Comparison of Two Mixtec Tonemic Systems, IJAL 19.85-100 (1953). Santa Tomás: Cornelia Mak, The Tonal System of a Third Mixtec Dialect, IJAL 24.61-70 (1958). Metlatonac: Edward Overholt, The Tonemic System of Guerrero Mixteco, A William C. Townsend, México, D.F. 1961, 597-626, and Robert E. Longacre, Proto-Mixtecan, RCPAFL 5 (1957), esp. 11-15, 21-23. Jicaltepec: Charles H. Bradley, A Linguistic Sketch of Mixteco of Jicaltepec, A thesis presented to the Graduate School of Cornell University, June, 1965. Ayutla: Leo Pankratz and Eunice V. Pike, Phonology and Morphotonemics of Ayutla Mixtec, in manuscript.

* [In this presentation the term 'couplet' is used as the kind of standard linguistic term which needs no special identification. The term was apparently introduced in Kenneth L. Pike's Tone Languages, pp. 79-81. Under the heading 'Mixteco Dissyllabic Toneme Forms: Tonemic Couplets', Pike discusses the dissyllabic nature of 'every Mixteco morpheme found in isolation' and the fact that 'in the tonemic sandhi the morpheme as a whole, not the isolated syllable, is the basic unit', with the conclusion that "Mixteco dissyllabic morphemes might be called TONEMIC COUPLETS because of this unified action." Ed.]

3. Throughout this paper tone is written as follows: ^{1} (high), ^{2} (mid), ^{3} (low).

4. The morpheme ku^{1}ši^1 (A) white is an exception; it becomes ku^{3}ši^1 when following a Class A morpheme. The morpheme ši^{1}ka^1 (B) far is also an exception; it becomes ši^{3}ka^3 when following a Class A morpheme.

5. Since it is necessary to know the class to which a morpheme belongs before generating a sentence, and since comparativists might find it of interest to compare members of the classes, a short list has been added here: ʔu^{3}sa^3 (AR) seven, ku^{3}ka^3 (AR) comb, đa^{3}ši^3 (AR) nephew, ƀi^{3}đi^3 (AR) sweet, ku^{3}đu^3 (AR) will sleep, te^{3}ʔ^{n}de^3 (AR) will cut, te^{1}ʔ^{n}de^3 (A) is cutting; ^{n}do^{3}o^3 (BR) sugarcane, ^{n}da^{3}ku^3 (BL/R) pozole, đi^{3}ta^3 (BR) tortilla, ƀi^{3}ko^3 (BR) cloud, sa^{3}a^3 (BL) new, či^{3}ki^3 (BL/R) prickly pear, žǫ^{3}đo^3 (BR/L) grinding stone, đi^{3}ko^3 (BL) will sell, đi^{1}ko^1 (B) is selling; ^{n}da^{3}ku^2 (AR) broom, ƀa^{3}ʔa^2 (AR) good, đe^{3}ʔe^2 (AR) son, ƀi^{3}ši^2 (AR) cool, ši^{3}to^2 (AR) bed, ku^{3}ku^2 (AR) will sew, ku^{1}ku^2 (A) is sewing; ʔi^{3}či^1 (A) dry, k^{w}ą^{3}ą^1 / k^{w}ą^{1}ą^1 (A) yellow; ži^{2}kǫ (AR) furrow, ną^{2}ma^3 (AR) wall, ta^{2}ka^3 (AL) nest, tu^{2}tu^3 (AR) paper, đi^{2}đi^3 (AL) aunt, sa^{2}ti^3 (AL) trousers, ka^{2}či^3

(AL) will say, ka^{1}či^{1} (A) is saying, kǫ^{2}ʔnį^{3} (AL) will tie, sǫ^{1}ʔnį^{1} (A) is tieing đi^{2}to^{3} (AL) uncle, ka^{2}đi^{3} (AL) will nurse, či^{2}ka^{3} (BR) banana, ki^{2}ti^{3} (BR) animal, ^{n}du^{2}či^{3} (BR) bean, ƀi^{2}i^{3} (BL) pretty; ƀe^{2}ʔe^{2} (AR) house, kǫ^{2}nį^{2} (AR) yesterday, li^{2}-lu^{2}u^{2} (AR) small, đą^{2}mą^{2} (AR) will change, đą^{1}mą^{2} (A) is changing, ką^{2}ną^{2} (AR) will call, ką^{1}ną^{2} (A) is calling, ƀi^{2}či^{2} (AR) now, ^{n}di^{2}đi^{2} (AL) pulque, ža^{2}k^{w}a^{2} (BL) crooked, ʔį^{2}nį^{2} (BL) warm, ke^{2}đǫ^{2} (BL) will sneeze, ke^{1}đǫ^{1} is sneezing, đi^{2}i^{2} (BL) will singe, đi^{1}i^{1} (B) is singeing; la^{1}sa^{3} (A) bone, ką^{1}nį^{3} (B) long, ža^{1}a^{3} (B) tongue, k^{w}i^{1}i^{3} (B) green, čį^{1}į^{3} (B) fingernail, žo^{1}ʔo^{2} (A) here; ʔį^{1}į^{1} (B) hail, že^{1}ʔe^{1} (B) door, đį^{1}ʔą^{1} (B) hawk, k^{w}e^{1}e^{1} (A) slow.

6. Tone sandhi involving one-syllable morphemes which precede a couplet needs further study. A few examples follow: ką^{2}ną^{2n}do^{2} you (plural) will call, nį^{3}-ką^{2}ną^{2n}do^{2} you (plural) called, ʔǫ^{3}-ką^{1}ną^{2n}do^{2} you (plural) will not call, ʔǫ^{3}nį^{3} ką^{1}ną^{2n}do^{2} you (plural) didn't call, ʔa^{3}-ką^{1}ną^{2n}do^{2} will you (plural) call?, ʔą^{3}nį^{1} ką^{2}ną^{2n}do^{2} did you (plural) call?