PHONOLOGY AND MORPHOTONEMICS OF AYUTLA MIXTEC

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0. A very pertinent feature in the analysis of Ayutla Mixtec[1] phonology is the two-syllable couplet[2] which is the nucleus of most phonological words. (For an exception, see **9.2**.) It is phonologically marked by consonantal allophones and rhythm (**2** and **9.1**). Word-stress is predictable by tone provided that the couplet occurs word-initially, but it is not predictable if the couplet occurs elsewhere. Phrase-stress, however, is independent both of tone and of the couplet (**10**).

The phonological word and phrase are domains of two separate morphotonemic systems. These systems involve the lexical, phonological, and, to a lesser degree, the grammatical hierarchies, since in describing the morphotonemics it is necessary to classify the lexical items both according to their basic phonological shape, and (when describing the morphotonemics within a word) according to their grammatical status (i.e. according to stem versus proclitic versus enclitic).

Ayutla Mixtec is unique among the thirty or so Mixtec dialects and subdialects yet studied, in that it has a phonemic morpheme-final and word-final glottal stop.[3] Although the morpheme-final glottal stop disappears word-medially, and the word-final glottal stop disappears phrase-medially, morphemes and words characterized by this feature are morphotonemically distinct from those not having it in their basic forms. In fact, the role of morpheme-final and word-final glottal stop in morphotonemics is so important that Ayutla Mixtec may be considered to preserve here an archaic feature of considerable importance to the understanding of the development of Mixtec morphotonemics in its manifold dialectal

[1] There are about 5,000 speakers of the Ayutla, Guerrero dialect of Mixtec. A number of residents of the community of Tepango were used as informants, but Artemio Alvarez was the principal one for the analysis of the segmental phonemes. Leo Pankratz did the analysis of the segmental phonemes and the lexical and grammatical materials were furnished by him. Eunice V. Pike did the analysis of tone, the phonological word, and the phonological phrase, using the informants José Maximino García and Sabino Morales Ángel. She also is responsible for the presentation of the material.

[2] K. Pike speaks of 'tonemic couplets' and morphemes which are 'basically dissyllabic' in the San Miguel el Grande dialect of Mixtec. See Kenneth L. Pike, Tone Languages, University of Michigan Press, (Ann Arbor, 1948), 79–80. Mak uses a 'tone couplet' in describing the morphotonemics of the San Esteban dialect. See Cornelia Mak, A comparison of two Mixtec tonemic systems, IJAL 19.87 (1953). Longacre calls the couplet 'the primary distributional matrix' in Mixtec. See Robert E. Longacre, Proto-Mixtecan, Publication No. 5 of Indiana University Research Center in Anthropology, Folklore, and Linguistics (1957), 11.

[3] Longacre (Proto-Mixtecan, p. 82) said confidently in 1957, "Mixtec loses final [Proto-Mixtecan] *-ʔ everywhere and without trace, except for the situation described under (4) [development of *CVʔ to Mixtec CVʔV]."

variations. In this paper special attention has been paid to morphotonemics.

1. There is contrast between the following consonant phonemes: voiceless stops and alveopalatal affricate /p (rare), t, t^y, č, k, k^w, ?/; prenasalized stops /b (rare), d, d^y, g (rare), g^w (rare)/; spirants /s, š, h (rare), h^w (rare)/; nasals /m, n, ñ/; lateral, vibrant, and semiconsonants /l, r, v, y/.

Bilabials /p, b, v/: $pa^3lá^1$ *brown sugar*, $bé^3e^3$ *sheep*, $vá^3{}^?a^3$ *good*.

Alveolar and palatalized alveolar stops, and alveopalatal affricate /t, t^y, č, d, d^y/: $tó^3o^3$ *a span*, $t^yó^3{}^?o^3$ *a root*, $čó^2{}^?o^3$ *a nest*, $dó^3{}^?o^3$ *adobe*, $d^yó^3{}^?o^3$ *a humming bird*.

Velars and labialized velars /k, k^w, g, g^w, h, h^w/: $ką^1{}^?ą^1ra^3$ *he talks*, $k^wą^2{}^?ą^3ra^3$ *he goes*, $tí^3ka^3$ *grasshopper*, $í^3ga^3$ *another*, $sí^3k^wi^3$ *tree sap*, i^3-$g^wí^3i^3$ *fox*, ho^3-$lį^1į^1$ *seseme seed*, $ka^3h^wé^1$ *coffee*.

The glottal stop versus the absence of glottal stop, and versus /t/ and /k/: $ná^2ma^3$ *wall*, $ná^2ma^{?3}$ *soap*, $tó^2to^3$ *clothing*, $t^yo^3kó^{?1}$ *ant*, $t^yo^3{}^?ó^{?1}$ *flea*, $yó^2ko^{?3}$ *steam*.

The nasals, lateral, and vibrant /m, n, ñ, l, r/: $tú^3mi^3$ *feather*, $nú^2ni^{?3}$ *corn*, $ñú^2ñu^{?3}$ *honey*, $lú^1lu^1$ *small*, $a^3ró^1$ *rice*.

The semiconsonants /v, y/: $yá^1{}^?a^1$ *brown*, $vá^3{}^?a^3$ *good*, $ná^2ya^{?3}$ *a dog*, $dá^3va^3$ *rafter*.

The sibilants /s, š/ versus the affricate /č/: $kí^3si^3$ *a pitcher*, $dí^3ši^3$ *corn liquor*, $dí^3či^3$ *stringbean*.

2. The environment most pertinent to the description of the consonant variants is the nucleus of phonological word type one (**9.1**). This nucleus is a couplet which coincides with the grammatical stem. It has been indicated by a preceding hyphen. If a word contains no hyphen, the couplet follows word space. te^3-$sá^3va^3$ *boy*, $ká^3ka^3$ *lime*. Since the couplet is marked by hyphen or word space, a stress mark is redundant; I have written it, however, since the rules are a bit complicated (**9.1**), and since the various phonemic tones are sometimes most easily identified in relation to stress.

Voiceless stops /t, t^y, k, k^w/ and the affricate /č/ are preaspirated when occurring as the second consonant in a couplet.[4] $sí[h]tį^3$ *cheek*, $tú^2[h]t^ya^3$ *atole*, $šá^3[h]ku^{?3}$ *a few*, $ká^2[h]či^{?3}$ *cotton*, $yá^2[h]k^wa^{?3}$ *syrup foam*. (The following example has a word-medial, couplet-initial /k/ which is not preaspirated. ti^3-$ká^3[h]t^ya^3$ *cornsilk*.)

A nasal, the nasal of a prenasalized stop, and the voiced continuants /l, v, y/ are lengthened when occurring as the second consonant in a couplet. $tí^1m[\cdot]a^{?1}$ *candle*, $šá^3n[\cdot]u^3$ *daughter-in-law*, $ñú^2ñ[\cdot]u^{?3}$ *honey*, $kó^2[n\cdot]do^3$ *knee*, ti^3-$ná^3n[\cdot]a^{?3}$ *tomato*, $čé^1l[\cdot]e^1$ *scissors*, $vá^3v[\cdot]i^3$ *a joint*, $ná^2y[\cdot]a^{?3}$ *dog*.

The voiceless continuants when occurring as the second consonant of a couplet are either lengthened, or are preceded by a slight hiatus. $tó^3s[\cdot]o^3$ or $tó^3[\#]so^3$ *a floral arch*, ti^3-$sú^3[h]t^ya^3$ *a crane*, $ká^3š[\cdot]į^3$ or $ká^3[\#]šį^3$ *dew*.

When postcouplet[5] the stop /k/ varies from a voiceless stop to a lenis voiced fricative, the affricate /č/ varies from a voiceless to a voiced affricate, and the bilabial continuant /v/ varies from slight friction to frictionless. $ká^1ni^3va^1$ [$ká^1n\cdot i^3va^3$] or [$ká^1n\cdot i^3wa^3$] *it is very long*, $ká^2ką^3ka^3ra^3$ [$ká^2hką^3ka^3ra^3$] or [$ká^2hką^3ga^3ra^3$] *he will ask again*, $ká^2či^3či^3$ [$ká^2hči^3či^3$] or [$ká^2hči^3ji^3$] *her cotton*.

If only native words were considered, the lateral /l/ could be described as a vibrant [ř] when in postcouplet position, and a lateral [l] in other environments. For example, $lu^1lú^1ra^3$ *he is small*. However, due to Spanish

[4] Longacre (Proto-Mixtecan p. 11) says of Metlatonoc Mixtec, 'The M couplet, thus defined, is phonologically marked by optional lengthening of its medial consonant (with voiceless element before medial t or k in M-M).' Longacre gleaned this information from unpublished data written by Edward Overholt.

[5] The postcouplet environment is pertinent in the description of the phoneme of the Mixtec or San Miguel el Grande also. K. Pike describes an allophone of /r/ as occurring enclitic initial (i.e. postcouplet) in that dialect. See Kenneth L. Pike, Analysis of a Mixteco text, IJAL 10.115 (1944).

loan words, the lateral and vibrant are in contrast. /lú¹lu¹/ *small*, /tó¹ro¹/ *bull*.

3. There is contrast between five oral /i, e, a, o, u/ and four nasalized vowels /į, ę (rare), ą, ų/.

Front vowels /i, į, e, ę/ contrast: i³kį́ʔ¹ *squash*, i³kí ʔ¹ *bone*, dí³ʔi³ *pimple*, dé²ʔi³ *mud*, té²i³ *chair*, tę́¹į́ʔ¹ *narrow*, šá³tu³i³ *my trousers*, šá³tu³eʔ³ *our trousers*. The vowel /a/ contrasts with the above. í³ta³i³ *my flower*, tú³tu³aʔ³ *her paper*.

Back vowels /o, u, ų/ contrast: tó²to³ *clothing*, tú³tu³ *paper*, tu³tų́ʔ¹ *firewood*, šá²tų́ʔ³ *box*, yá¹tuʔ³ *tumpline*.

Central oral and nasal vowels contrast: tʸá³ʔa³ *gourd*, tʸą³ʔą³ *spleen*.

4. The environments most pertinent to the description of vowel variants are contiguous nasal consonants, contiguous palatalized consonants, and contiguous vowels.

A vowel preceding /m, n, ñ/ becomes slightly nasalized, but there is still contrast between slightly nasalized oral vowel and phonemic nasal vowel in that environment: tú³tu³ña³ *their paper*, tu³tų́¹ña¹ *their firewood*, i³i³ñá¹ *their husbands*, į³į³ñá¹ *their hides*, yú²ku³ña³ *their leaf*, yú²kų³ña³ *their furrow*.

When following a nasal consonant, a vowel, a vowel cluster, and vowels separated by /ʔ/ become nasalized, but since there is no contrast between a nasal and an oral vowel in that environment, we have considered them to be phonemically oral. nú³ni³aʔ³ [nų́³n·į³ąʔ³] *her corn*, ñáʔ³a³ [ñąʔ³ą³] *morning*.

In a cluster of diverse vowels the first of the cluster is very short, especially if it is not stressed. čí²tʸa³i³ *my banana*. šá³nu³aʔ³ *her sister-in-law*, tú³tʸa³uʔ³ *your atole*, sóʔ²o³i³ *my ear*, sé³i³ *cold*. In spite of the shortness of the first vowel, there is contrast between the sequence /kuV/ and /kʷV/. yá²kʷaʔ³ *syrup foam*, yú²ku³aʔ³ *her leaf*. Vowels of the syllable pattern CV which occur postcouplet are shorter than vowels which occur in the couplet. For example, the last three syllables of the following example are very short. sá¹ta³ka¹ra³riʔ³ *he is buying animals again*.

There are portmanteau phones [æ] and [ǽ] which phonemically are the clusters /ae/ and /ąę/. They occur especially after palatalized consonants and in fluctuation with the vowel cluster after other consonants. dí²šą³ęʔ³ [dí²šǽʔ³] *our sandal*, má²ta³eʔ³ [mą́²tæʔ³] or [mą́²ta³eʔ³] *our pocket*, čí²tʸa³eʔ³ [čí²tʸæʔ³] *our banana*.

There is a portmanteau phone [ǫ] which is phonemically the sequence /oų/. It contrasts with [ų] /ų/. tó²to³ųʔ³ [tó²htǫʔ³] *your clothing*, tu³tų́ʔ¹ [tu³htų́ʔ¹] *your firewood*, só²ko³ųʔ³ [só²hkǫʔ³] *your shoulder*, sú²kųʔ³ [sú²hkųʔ³] *your neck*.

The phoneme /a/ has an allophone [aⁱ] which occurs when preceding /ʔi/. dáʔ²i³ [dáⁱʔ²i³] *to shout*.

The first couplet vowel of the canonical pattern VCV or VCVʔ may become voiceless when preceding a voiceless stop, especially when nonstressed phrase medially. For example: ya³táʔ¹ *old* + íʔka³ *basket* > ya³ta¹ i¹ká¹aʔ³ [Ikáʔ¹aʔ³] *the basket is old*.

5. There are certain systemic co-occurrence restrictions in the distribution of phonemes. Nasalized vowels do not occur following voiced consonants; rounded vowels do not occur following labial consonants; /i/ and /į/ do not occur following /tʸ, dʸ, ñ/.

Some vowel clusters which occur at the juncture of couplet and postcouplet do not occur within a couplet. Some consonant clusters which occur in the second syllable of a couplet do not occur in a couplet-initial environment.

5.1. Nasal vowels do not follow voiced consonants, but they follow any of the voiceless consonants: pę́¹į́¹ *handkerchief*, tų́³ʔų³ *word*, tʸą́²ą³ *tomorrow*, čų́³ų³ *work*, kį́¹ʔį́ʔ¹ *much*, kʷą́¹ą¹ *yellow*, sá²šį³ *nephew*, sú²kųʔ³ *throat*, sį́²ʔį³ *leg*.

The vowels /o, u, ų/ do not follow labial consonants /p, kʷ, b, gʷ, m, v/, but they fol-

low other consonants. tú^{3}t^{y}a^{3} *atole*, t^{y}ó^{3}ʔo^{3} *root*, čó^{2}ʔo^{3} *nest*, kú^{2}ši^{3} *bow*, dó^{3}ko^{3} *shrimp*, d^{y}ó^{3}ʔo^{3} *humming-bird*, te^{3}-gó^{1}oʔ^{3} *Mexican*, só^{2}ko^{3} *shoulder*, šų^{3}ʔú^{ʔ1} *money*, lú^{3}ši^{3} *nectar*, yo^{1}ʔó^{1}o^{3} *you* (sg).

The vowels /i, į/ do not follow /t^{y}, d^{y}, ñ, b, h/, but they do follow /č, š/ and other phonemes. čí^{2}t^{y}a^{3} *banana*, ší^{2}niʔ^{3} *head*, sá^{3}šį^{3} *nephew*, sí^{3}tį^{3} *cheek*, kí^{3}si^{3} *a pitcher*, dí^{3}ka^{3} *brush*, čí^{ʔ2}giʔ^{3} *acorn*, i^{3}-g^{w}í^{3}i^{3} *fox*, lí^{1}maʔ^{1} *a type of fish*, ví^{3}ʔe^{3} *house*, kí^{1}ʔiʔ^{1} *hook*, ne^{3}-yi^{1}viʔ^{3} *people*.

The vowels /a, ą/ follow any consonant but /g^{w}/. pá^{2}či^{3} *a spongy fruit*, tá^{2}ʔma^{3} *gorge*. tú^{3}t^{y}a^{3} *atole*, ča^{3}ʔví^{1}ra^{1} *he will pay*, k^{w}á^{1}ʔa^{1} *red*, ká^{3}šį^{3} *dew*, kó^{2}ʔba^{3} *oak gall*, dá^{3}va^{3} *rafter*, sá^{3}a^{3} *bird*, šá^{3}a^{3} *jaw*, má^{2}ta^{3} *pocket*, ná^{2}ma^{3} *wall*, ñá^{3}ʔa^{3} *morning*, la^{3}tú^{ʔ1} *youngest child*, yá^{3}ʔvi^{3} *market*, vá^{3}vi^{3} *joint*.

5.2. Within a stem, vowel clusters are either the geminates /ii, ee, aa, oo, uu; įį, ąą, ųų/ or they are diverse clusters /ei, ie, ęį/. í^{3}iʔ^{3} *husband*, bé^{3}e^{3} *sheep*, ká^{3}a^{3} *metal*, kó^{2}oʔ^{3} *snake*, yú^{2}uʔ^{3} *stone*; į^{3}įʔ^{3} *hide*, t^{y}á^{2}ą^{3} *tomorrow*, t^{y}ú^{3}ųʔ^{3} *turkey*; sé^{3}i^{3} *cold*, ví^{3}e^{3}ʔi^{3} *my house*, tę́^{1}į^{ʔ1} *narrow*.

Clusters of vowels also occur at the juncture of a couplet and postcouplet. If the couplet vowel is nasalized, the postcouplet vowel is also nasalized, but if the couplet vowel is oral, the postcouplet may be nasal. tú^{3}ʔų^{3} *word* + a^{ʔ3} *her* > tų^{3}ʔų^{3}ą^{ʔ3} *her word*; čí^{2}t^{y}a^{3} *banana* + ų^{ʔ3} *your* (*sg*) > čí^{2}t^{y}a^{3}ų^{ʔ3} *your banana*.

If the postcouplet vowel is the same quality and tone as the couplet vowel, it fuses with it, and the two forms become homophonous. tú^{3}či^{3} *vein* + i^{3} *my* > tú^{3}či^{3} *my vein*; sá^{2}šį^{3} *nephew* + i^{3} *my* > sá^{2}šį^{3} *my nephew*; ší^{2}daʔ^{3} *tongs* + a^{ʔ3} *her* > ší^{2}daʔ^{3} *her tongs*.

In our data vowel clusters which occur at the juncture of a couplet and postcouplet are as follows: ka^{2}či^{3}í^{1} *my cotton*, ti^{2}ʔe^{3}í^{1} *my forehead*, ká^{3}ka^{3}i^{3} *my lime*, tó^{2}to^{3}i^{3} *my clothing*, tú^{3}tu^{3}e^{ʔ3} *our paper*, tú^{3}či^{3}e^{ʔ3} *our vein*, če^{1}lé^{1}e^{ʔ3} *our scissors*, ká^{3}ka^{3}e^{ʔ3} *our lime*, tó^{2}to^{3}e^{ʔ3} *our clothing*, tú^{3}tu^{3}e^{ʔ3} *our paper*, tú^{3}či^{3}a^{ʔ3} *her veins*, če^{1}lé^{1}a^{ʔ3} *her scissors*, la^{1}šá^{1}a^{ʔ3} *her orange*, tó^{2}to^{3}a^{ʔ3} *her clothing*, tú^{3}tu^{3}a^{ʔ3} *her paper*, tú^{3}či^{3}ų^{ʔ3} *your veins*, če^{1}lé^{1}ų^{ʔ3} *your scissors*, ká^{3}ka^{3}ų^{ʔ3} *your lime*, tó^{2}to^{3}ų^{ʔ3} *your clothing*, ti^{1}kú^{1}ų^{ʔ3} *your needle*.

Vowel clusters of three vowels may also occur at a juncture of couplet and postcouplet. i^{3}i^{3}í^{1} *my husband*, šá^{3}a^{3}i^{3} *my jaw*, yó^{3}o^{3}i^{3} *my jar*, yu^{2}u^{3}í^{1} *my stone*, į^{2}į^{3}í^{1} *my salt*, di^{3}-są́^{3}ą^{3}į^{3} *my meat tamale*, tų^{3}ú^{1}į^{1} *I am black*, čí^{1}e^{3}i^{3} *I am big*; sę^{3}į^{3}í^{1} *my corncob*, í^{3}i^{3}e^{ʔ3} *our husbands*, šá^{3}a^{3}e^{ʔ3} *our jaws*, yó^{3}o^{3}e^{ʔ3} *our jars*, yú^{2}u^{3}e^{ʔ3} *our stones*, į^{2}į^{3}ę^{ʔ3} *our salt*, di^{3}-są́^{3}ą^{3}ę^{ʔ3} *our meat tamale*, tų^{3}ú^{1}ę^{ʔ1} *we are black*, sę́^{3}į^{3}ę^{ʔ3} *our corncob*; í^{3}i^{3}a^{ʔ3} *her husband*, yó^{3}o^{3}a^{ʔ3} *her jar*, yú^{2}u^{3}a^{ʔ3} *her stone*, į^{2}į^{3}ą^{ʔ3} *her salt*, tų^{3}ú^{1}ą^{1} *it is black*, sę́^{3}į^{3}ą^{ʔ3} *her corncob*; ka^{3}da^{2}á^{1}aʔ^{3} *she is not going to move*; i^{3}i^{3}ú^{ʔ1} *your husband*, šá^{3}a^{3}ų^{ʔ3} *your jaw*, yó^{3}o^{3}ų^{ʔ3} *your jug*, yu^{2}u^{3}ú^{ʔ1} *your stone*, į^{2}į^{3}ų^{ʔ3} *your salt*, di^{3}-są́^{3}ą^{3}ų^{ʔ3} *your meat tamale*, sę́^{3}į^{3}ų^{ʔ3} *your corncob*, té^{2}i^{3}ų^{ʔ3} *your chair*.

There are occasional vowel clusters of four vowels as in ki^{3}í^{1}i^{3}i^{1} *I am not smart* ká^{3}t^{y}a^{3}i^{3}a^{3}ų^{3} *I am going to really throw it*.

5.3. Consonants that occur as the first in a cluster of two are restricted to /ʔ, s, š m, n/.

In our data glottal stop may precede any of the voiced consonants but /r, g^{w}/. The resulting consonant clusters occur only in a couplet-medial environment. tá^{2}ʔma^{3} *gorge*, t^{y}á^{3}ʔni^{3} *chest*, di^{3}-ná^{3}ʔña^{3} *a scaly lizard*, yá^{3}ʔvi^{3} *market*, dó^{3}ʔyo^{3} *marsh*, kó^{2}ʔba^{3} *oak gall*, či^{3}ʔdú^{ʔ1} *button*, či^{3}ʔlú^{ʔ1} *button* (baby talk), ká^{3}ʔd^{y}a^{3}ra^{3} *he will cut*, čí^{2}ʔgi^{ʔ3} *acorn*.

In addition there are a few examples with the clusters /sk, šk, št/. These occur only couplet-initial. sku^{3}ʔní^{ʔ1} *entered*, ská^{3}ʔd^{y}a^{3}ra^{3} *he will pass*, štà^{ʔ3} *tortilla*.

Clusters /mp/ and /nt/ occur in Spanish loan words. si^{3}-é^{1}nto^{1} *hundred*, ko^{3}-mpá^{1}ri^{1} *compadre*.

5.4. All of the consonants but /g^{w}/ may occur both in couplet-initial and in couplet-medial environment. When couplet-medial,

however, /b/ occurs only following /ʔ/. Examples are found randomly in other sections of the paper.

6. There is contrast between tone ¹ (high), tone ² (mid), and tone ³ (low). The five contrastive tone sequences which occur most frequently on couplets in isolation are ¹ ³, ² ³, ³ ³, ¹ ¹, and ³ ¹. ší¹ni?³ *hat*, ší²ni?³ *head*, tí³ku?³ *louse*, ší¹ñu?¹ *pineapple*, yu³čí?¹ *pinole*. Tone couplets ¹ ² and ³ ² do not occur in any environment. When in isolation, the tone couplet ² ¹ occurs only in some idiolects and only in a question. For example in José's idiolect, ya²kʷá?¹ *is it crooked?*

The tone couplet ² ² occurs following ¹ ¹ in contrast with ¹ ¹ and ³ ³. kʷá¹či¹ tí¹ku¹ *the needles are small*, lú¹lu¹ tí²ku² *the needle is small*, lú¹lu¹ tí³ku?³ *the louse is small*.

The tone couplet ² ¹ occurs in some environments in contrast with ¹ ¹ and ³ ¹. ya³kʷá¹ tí¹ku¹ *the needle is crooked*, ya³kʷá¹ tu²tú?¹ *the firewood is crooked*, ya³kʷá¹ ti³?vá¹ *the shell is crooked*.

Contrast of three tones can also be demonstrated in three syllable words: su³tʸá¹i¹ *I will swim*, su³tʸa²í¹ *I will not swim*, sa³ta³í¹ *I will buy*; nu³ñá¹ra¹ *he will open*, nu³ña²rá¹ *he will not open*, ñu³nu³rá¹ *his hammock*.

Examples of the various three syllable sequences follow: ší¹ñu¹ra¹ *his pineapple*, la¹šá¹ra³ *his orange*, ší¹ni³ra¹ *his hat*, ší¹ni³a?³ *her hat*, ku²nu³rá¹ *his tobacco*, sá²šį³ra³ *his nephew*, vi³?e³á?¹ *her house*, kí³si³a?³ *her pitcher*, ka³sá¹ų?¹ *your brother-in-law*, ma³?ná¹i³ *my drowsiness*, te³-kʷá²či?³ *boys*, da³va²rá¹ *he will not run*, ya²tá¹ra¹ *is he old?* ku¹-ya²ta?¹ *she is becoming old*.

There are two additional sequences which occur only when following a tone ¹. These are ² ² ², ² ² ³. lú¹lu¹ ší²ñu²ra² *his pineapple is small*, lú¹lu¹ la²šá²ra³ *his orange is small*.

7. The most obvious variants of the tonemes can be described in relation to their environment as defined by contiguous tones, by their position in the phonological word—the couplet versus the non-couplet, by their occurrence in a stressed versus nonstressed syllable, and by their occurrence prepause versus non-prepause.

7.1. When otherwise analogous, syllables which precede a couplet-medial glottal stop frequently have higher allotones than those which do not. That is, in the following examples the first syllable of *ear* is frequently higher than the first syllable of *shoulder*, and the first syllable of *adobe* is frequently higher than that of *shrimp*. só²?o³ *ear*, só²ko³ *shoulder*; dó³?o³ *adobe*, dó³ko³ *shrimp*.

When in analogous environments, syllables with /i/ or /u/ frequently have higher allotones than syllables with /a/ or /o/. That is, in the following examples the syllables /ši?¹/ and /ki?¹/ have higher allotones than /sa?¹/ and /ko?¹/. di³ší?¹ *green corn*, ka³sá?¹ *son-in-law*; i³kí?¹ *bone*, vi³kó?¹ *feast*.

There is a general downdrift of pitch within a phonological phrase, such that tone ¹ at the end of a phrase is not as high as at the beginning, etc. (**10**).

7.2. Tone ¹: The highest allotone occurs when in a stressed syllable and followed in the same word by tone ³. kʷá¹či¹ ší¹ni?³ *the hats are small*, la¹šá¹ra³ *his orange*. (The highest syllables are /ši¹/ and /ša¹/.)

When postpause and not stressed, tone¹ does not have as high an allotone as a stressed tone ¹ in that environment. šá¹tʸa¹ra¹ *he is digging*, ku¹-tá¹tą¹ra¹ *he is taking medicine*. (The syllable /ku¹/ is lower than /ša¹/.)

Between tone ³ and pause, there is no contrast between tone ¹ and tone ². We have chosen to interpret such an allotone as tone ¹ because to do so helps regularize the morphotonemics, and because a higher allotone is used when a following word is added. For example, i³čí¹ tu³tú?¹ *the firewood is dry*. In the preceding example, the syllable /tų?¹/ has a mid-like allotone. In the following example that syllable has a higher allotone. i³čí¹ tu³tú¹ ñá²ni³ *my brother's firewood is dry*.

7.3. Tone ²: A tone ² followed in the same

word by a tone ³ is higher than one without a following tone ³. lú¹lu¹ la²šá²ra³ *his oranges are small.* (The syllable /ša²/ is higher than /la²/.)

7.4. Tone ³ may have a downglide when preceding pause. tí³ka³ *grasshopper*, ñá³ni³ra³ *his brother*, ma³ʔná¹ra³ *his drowsiness.*

When following tone ¹, a tone ³ has a raised allotone. lú¹lu¹ kí³si³ *the pitcher is small*, ku³mí¹ yo³só?¹ *four grinding stones.* (The syllables /ki³/ and /yo³/ have raised allotones.)

When prepause, syllables with nasalized vowels frequently have lower allotones than syllables with oral vowels. That is, in the following examples /tųʔ³/ and /kų³/ have lower allotones than the syllables /tuʔ³ and /ku³/. yá¹tuʔ³ *carrying rope*, yá¹tųʔ³ *your (sg) carrying rope*; yú²ku³ *leaf*, yú²kų³ *furrow.*

Between tone ¹ and pause, there is no contrast between tone ³ and tone ². We have chosen to interpret such an allotone as tone ³ because to do so helps regularize the morphotonemics, and because a lower allotone is used when a following word is added. For example, yá¹tuʔ³ *carrying rope*, te³-ší¹ni³ *drunkard.* In the preceding examples the syllables /tuʔ³/ and /ni³/ have mid-like allotones. In the following examples, those syllables have lower allotones. yá¹tu³ ká¹ni?³ *a long carrying rope*, te³-ší¹ni³ ká²ką³ra³ *the drunkard will ask.*

Tone ³ (as part of a ³ ¹ couplet) has a downgliding allotone when followed in the same word by a V³ or Vʔ³. tú³mi³ da³tų́¹ųʔ³ *the feather is not pretty*, ví³ši³ du³-čí¹e² *the rooster is cold.* (The syllable /da³/ has a downglide, but /du³/ does not.)

8. Each vowel is the nucleus of a syllable, even in a word with contiguous vowels. For example, the word yá¹a³i¹ *my tongue* has three syllables.

There are six syllable patterns: V, Vʔ, CV, CVʔ, CCV, CCVʔ. All occur with all the vowels and with all the tones; however, their distribution in the phonological word (i.e. into couplet versus postcouplet), and phonological phrase is restricted.

In our data, syllables with CCV or CCVʔ occur only in a couplet, never postcouplet. Those with ʔCV or ʔCVʔ occur only as the second syllable of a couplet. yá³ʔvi³ *market*, ñú²ʔma³ *smoke*, ka³ʔví?¹ *younger brother.* Syllables sCV and šCV occur only in couplet-initial position. sku³ʔní¹ *entered*, štò³ *bed.*

Syllables with final glottal stop may occur as the second syllable of a couplet, and in a word-final environment if at the same time they are phrase-final but they do not occur word-finally when in a phrase-medial environment. sa³ʔmá?¹ *napkin*, but sa³ʔmá¹ lú¹lu¹ *a small napkin.*

9. There are two types of phonological words. Type one (described below) is an open class, containing most of the words of the language. Type two words have (probably the result of fusion) a one-syllable nucleus, and most of them begin with /s/ or /š/.

9.1. A phonological word may be composed of the nucleus only, or the nucleus may be preceded by a prenucleus syllable or syllables, or the nucleus may be followed by a postnucleus syllable or syllables.

The nucleus of a type one phonological word is composed of two syllables, a couplet which coincides with the grammatical stem. It is phonologically marked by a unit of time on the first syllable. This timing is sometimes actualized as voicelessness between the first vowel and the second consonant, and sometimes by a lengthening of the second consonant (**2**). In words in which all the syllables are tone ³ (or all tone ¹) and the couplet is not word-initial, the first syllable of the couplet is usually marked by a slight raise in pitch.

Examples of the phonological word composed of (1) the couplet only, ñú²ma?³ *wax*, (2) precouplet plus couplet, ši³-dú²ʔva³ *spider web*, te³še³ni³-sá³ta?³ *a man who bought*, (3) couplet plus postcouplet, sa³ta³rá¹ *he bought*, sa³ta³ká¹ra³ *he will buy more*, (4)

precouplet plus couplet plus postcouplet, ša^{3}ni^{3}-sa^{3}ta^{3}rá^{1} *he already bought*, ko^{3}-dá$^{2?}$vi^{3}ra^{3} *his shadow*.

A phonological word, in our data, may consist of from two to six syllables. ká^{3}ni^{3} *hit (imperative)*, ká^{3}ni^{3}ra^{3} *he will hit*, ni^{3}-ká^{3}ni^{3}ra^{3} *he hit (past)*, ni^{3}-ká^{3}ni^{3}ka^{3}ra^{3} *he hit (past) again*, ni^{3}-ká^{3}ni^{3}ka^{3}ra^{3}ri$^{?3}$ *he hit (past) him (the animal) again*.

Each phonological word has a word-stress which occurs on the couplet or on a postcouplet syllable. Word-stress occurs on the first couplet or postcouplet syllable with a tone ^{1} which is contiguously followed by tone ^{3}. ší^{1}ni$^{?3}$ *hat*, la^{1}šá^{1}ra^{3} *his orange*, sa^{3}ta^{3}ká^{1}ra^{3} *he is going to buy more*. (A precouplet syllable never has word-stress even if tone ^{1}. kó^{3}o^{3} ti^{1}-ka^{3}čí$^{?1}$ *there are no blankets*.)

If there is no $^{1\ 3}$ sequence, word-stress occurs on a syllable with tone ^{2} of a $^{2\ 3}$ sequence. lú^{1}lu^{1} la^{2}šá^{2}ra^{3} *his orange is small*, čí^{2}t^{y}a^{3} *banana*.

If there is neither the sequence $^{1\ 3}$, nor $^{2\ 3}$, word-stress occurs on the first tone ^{1} of the couplet. or postcouplet; if there is no tone ^{1}, then it occurs on the first syllable of the couplet. ší^{1}ñu^{1}ra^{1} *his pineapple*, ku^{1}-tá^{1}tą^{1}ra^{1} *he is taking medicine*, ku^{2}nu^{3}rá^{1} *his tobacco*, tó^{2}to^{3}ra^{3} *his clothing*, kí^{3}si^{3}a$^{?3}$ *her pitcher*, te^{3}-sá^{3}va^{3} *boy*.

A sequence of two precouplet syllables plus a couplet contrasts with a sequence of two couplets in that there is both a stress and a rhythm difference. That is, the precouplet syllables have no stress, and their vowels have shorter allophones than couplet vowels. į^{3}į^{3} te^{3}ni^{3}-dá^{3}va^{3} *one who ran*, į^{3}į^{3} ñá^{3}ni^{3} dá^{3}va^{3} *one brother will run*.

A sequence of couplet plus two postcouplet syllables contrasts with a sequence of two couplets. There is a difference (1) in stress placement, (2) occasionally in allotones (a tone ^{1} preceding a postcouplet syllable with tone^{3} is higher than when preceding a separate word with tone ^{3}, see **7.2**), (3) in rhythm (nonstressed postcouplet syllables have shorter vowel allophones, see **4**), and (4) occasionally, as in the following example, there is a difference of the consonant allophones. That is, the /v/ of the postcouplet syllable is [w], but the couplet initial /v/ is a fricative, see **2**. lu^{1}lú^{1}va^{3}ra^{3} *he is very small*, lú^{1}lu^{1} vá^{3}vi^{3} *the joint is small*.

The following samples are the same number of syllables, and have the same phonemic tones, but they differ in word division and couplet placement. These contrasts are phonologically marked by word-stress and rhythm. šá^{3}ku^{3} ti^{1}-ka^{3}čí$^{?1}$ *a few blankets*, šá^{3}ku^{3} ší^{1}ni^{3}ra^{1} *a few hats*, t^{y}a^{3}nu^{3}rá^{1} t^{y}a^{3}ká$^{?1}$ *he is going to send fish*.

Part of the morphotonemic system marks word borders. Specifically (**11.1** rule 8), when a morpheme with a final glottal stop in its basic allomorph precedes a word with the tone sequence $^{2\ 3\ 3}$, the tones of that word change to $^{1\ 1\ 3}$. That is, in the following example the word čí^{2}t^{y}a^{3}ra^{3} *his banana*, becomes či^{1}t^{y}á^{1}ra^{3}. ku^{3}mí$^{?1}$ *four* + čí^{2}t^{y}a^{3}ra^{3} *his banana* + ya^{3}tá$^{?1}$ *old* > ku^{3}mí^{1} či^{1}t^{y}á^{1}ra^{3} ya^{3}tá$^{?1}$ *four of his old bananas*. If, however, the sequence $^{2\ 3\ 3}$ is interrupted by a word border, an extra syllable with tone ^{3} is added. Notice that in the following example an extra syllable is added to the interrupted sequence $^{2\ 3\ 3}$. ku^{3}mí$^{?1}$ *four* + čí^{2}t^{y}a^{3} *banana* + ya^{3}tá$^{?1}$ *old* > ku^{3}mí^{1} či^{1}t^{y}á^{1}a^{3} ya^{3}tá$^{?1}$ *four old bananas*.

9.2. There is a second phonological word type in which the nucleus has one syllable only. All the words of this type (except those containing the morpheme "to be") have an initial consonant cluster of /s, š/, followed by /t, k, n/. Four of the words sometimes occur as one-syllable utterances. They are: štą̀$^{?2\ 3}$ *grandmother*, štį$^{?2\ 3}$ *nose*, štà$^{?2\ 3}$ *tortilla*, and štò^{3} *bed*. They contrast with phonological word type one in so^{2}o^{3}rá^{1} *his shell*, versus šti$^{2\ 3}$rà^{1} *his nose*; yó^{3}o^{3}a$^{?3}$ *her water jar*, versus štò^{3}a$^{?3}$ *her bed*. (We have marked the phonological word type two with a grave accent; type one has an acute accent.)

Those with the tone cluster $^{2\ 3}$ act morphotonemically like a phonological word type with the tone sequence $^{2\ 3}$ (**11.1**, rule 8). ku^{3}mí^{1} štá^{1}a$^{?3}$ *four tortillas*.

The word štò^{3} *bed* has a variant which acts morphotonemically like a type one word with the tone sequence $^{3\,3}$ (**11.1**, rule 9). šá^{3}ku^{3} ší^{1}to^{3} *a few beds.*

Type one words with /s, š/ as the first consonant of the couplet and with /t, k, n/ as the second consonant may drop the first couplet vowel especially when that vowel is in an environment that does not receive word-stress. The alternant form is type two. k^{w}é^{1}i^{1} snà^{1}ra^{3} (or sa^{1}ná^{1}ra^{3}) *his horse.* ni^{3}-škà$^{2\,3}$ra^{3} ñú^{3}u^{3} or ni^{3}-ší^{2}ka^{3}ra^{3} ñú^{3}u^{3} *he walked to town.*

In most environments the morpheme *to be* is a couplet dú^{1}u^{1} and therefore is part of a phonological word type one. For example, ña^{3}-dú^{1}u^{1} vé^{1}la^{1} *a woman who is old,* te^{3}-dú^{1}u^{1} te^{3}-tá^{1}tą$^{?1}$ *a man who is a doctor,* t^{v}a^{3}ká^{1} ni^{1}-dú^{1}u^{3} ri$^{?3}$ *it was a fish.*

In one environment, namely when in the durative aspect preceding a pronoun, this morpheme *to be* has only one syllable and thus becomes the nucleus of a phonological word type two. te^{3}-tá^{1}tą^{1} dù^{1}ra^{1} *he is a doctor,* ne^{3}-yí^{1}vi^{3} dù^{1}e$^{?1}$ *we are people,* ña^{3}-sá^{3}va^{3} dù^{1}či^{1} *she is a young woman.*

There is a contrast of length between a type one word with a couplet as nucleus, and a type two word with one syllable as nucleus as in the following examples. di^{3}-sí^{1}tį^{3} na^{3}-du^{3}u^{3}rí$^{?1}$ *the tadpole will undergo a change,* di^{3}-sí^{1}tį^{3} dù^{1}ri$^{?1}$ *the tadpole is an animal.*

A type two word made up of its one syllable nucleus plus a postnucleus syllable contrasts with a type one word made up of its couplet as nucleus in that the medial consonant of the type two word does not have couplet-medial allophones (**2**). For example, the [č] of ña^{3}-sá^{3}va^{3} dù^{1}či^{1} *she is a young woman* contrasts with the [hč] of sa^{3}ta^{3}rá^{1} dú^{3}či$^{?1}$ *he will buy beans,* and the /ñ/ in ne^{3}-yí^{1}vi^{3} dù^{1}ña^{1} *they are people* is shorter than the /ñ/ in ší^{1}ñu$^{?1}$ *pineapple.*

In the potential aspect /ku^{3}/ precedes the allomorph /du^{3}/ *to be.* In this environment the /du^{3}/ is the second syllable of a couplet—the only couplet which in our data is made up of two morphemes. We consider ku^{3}du^{3} to be a couplet, and the word kú^{3}du^{3}ra^{3} to be a type one phonological word since the /ku^{3}/ is stressed (**9.1**), and since the /d/ has a couplet-medial allophone (**2**). Notice that in the following pair of examples, the /ku^{3}/ is stressed in the first example, but not stressed in the second. te^{3}-tá^{1}tą^{1} kú^{3}du^{3}ra^{3} *he will be a doctor.* te^{3}-tá^{1}tą^{1} ku^{3}-dá^{3}ni^{3}ra^{3} *the doctor will know.*

10. A phonological phrase is characterized by (1) downdrift of pitch, (2) the fact that morphotonemic changes do not occur across a border between two phonological phrases, (3) by a phrase stress which occurs on the last word in the phrase, and (4) by pause.

The downdrift of pitch can be illustrated in the sentence tu^{3}tú^{1} ta^{3}?ví^{1} ka^{3}sá$^{?1}$ *her son-in-law will split kindling.* Each successive tone ^{1} is lower in pitch than the preceding tone ^{1}.

A syllable with phrase-stress may be louder than other syllables, but the most consistent contrastive feature is added length with a bit of crescendo before decay. (The final syllable of a word, however, which is not prepause may have length, but with decrescendo.) Phrase-stress occurs on the final syllable if it has the canonical pattern CV or CV?, but if the final syllable has the canonical pattern ?V, V, V?, or ?V? there is variation. That is, if it has a higher tone than the preceding syllable, it is stressed; if it is the same tone, or a lower tone than the preceding syllable, phrase-stress frequently occurs on the preceding syllable. (In this section phrase-stress has been indicated as ˆ, as in /lû^{1}/; in other sections it has not been marked.) tó^{2}to^{3} lú^{1}lû^{1} *the small clothes,* tó^{2}to^{3} ká^{1}nî$^{?3}$ *the long clothes,* tó^{2}to^{3} ka^{3}sá^{1}râ^{1} *his brother-in-law's clothes,* tó^{2}to^{3} k^{w}â^{1}?a^{1} (or, rarely, k^{w}á^{1}?â^{1}) *the red clothes,* tó^{2}to^{3} t^{v}á^{2}â^{3} (or, rarely, t^{v}â^{2}a^{3}) *the man's clothes.*

Words which are not prepause have a word-stress which is characterized by loudness or a raised allotone (**7** and **9**). If a word-stressed syllable has a tone ^{1}, it may be louder and more prominent than the phrase-

stress. This is especially so if the phrase-stress is on a syllable with tone ³. ya³kú¹ra³ ví³tį³ *he will shred today*, la¹šá¹ra³ ví³šį³ *his cold oranges.*

A word with the tone sequence ¹ ¹ ¹, or ³ ³ ³ has word-stress on the first syllable, and when prepause it has phrase-stress on the last syllable. Therefore when postpause the first syllable is the more prominent, but when prepause the last syllable is the more prominent. Therefore in the following examples the syllables /ši³/ and /ši¹/ are the more prominent: ší³to³ra³ ná³tʸâ³ *his uncle will wash*, ší¹ñu¹ra¹ ná³tʸâ?³ *she will wash his pineapple.* But when those words are prepause the syllables /ra³/ and /ra¹/ are the more prominent. ná³tʸa³ ší³to³râ³ *his uncle will wash*, ná³tʸa³ ší¹ñu¹râ¹ *she will wash his pineapple.*

The tones of one word do not cause the tones of a following word to change if a border of a phonological phrase occurs between them. In the first example, with no medial phonological-phrase border, there is interaction of tone between the tones of all three words (**11.1**, rules 3 and 9). ka³ši³rá¹ dí¹vi³ vâ¹?a³, *he will eat the good egg.* In the second example, due to an intervening phrase border, there is no interaction between the tones of the second and third word. ka³ši³rá¹ dí¹vî?³, vâ³?a³. *He will eat the egg. It is good.* In the third example, due to an intervening phrase border, there is no interaction between the tones of the first and second words. ka³ši³râ¹, dí²vi³ vâ¹?a³. *He will eat. The egg is good.*

11. One morphotonemic system has to do with the interaction of tones between words within a phonological phrase. This system cannot be described wholly in terms of phonological words since one of the factors causing the change is the presence versus the absence of a final glottal stop in the basic lexical form (allolog) involved. Since the glottal stop is lost phrase-medially, homophonous forms may cause different tone changes. For example, vá³?a³ *good* when following the word *wall* has the tone sequence ³ ³, but when following the word *soap*, it has the sequence ¹ ³. ná²ma³ vá³?a³ *the good wall*, versus ná²ma³ vá¹?a³ *the good soap.* These changes are predictable, however, in terms of the basic allologs ná²ma³ *wall* versus ná²ma?³ *soap.*

Another factor in the interaction of tones between words is the presence versus the absence of one of an arbitrary class of words (**11.1**, rule 10).

The second morphotonemic system has to do with interaction of tones between morphemes of varying grammatical status within a phonological word. There is interaction of tone between stem and enclitic, between two enclitics, and between proclitic and stem. Again, one of the factors causing tone changes is the presence versus the absence of a morpheme-final glottal stop in the basic allomorph involved. (In the above morphotonemic system it was the word-final glottal stop.) For example the tone difference in the following pair of examples is due to the glottal stop in the basic allomorph ná²ma?³ *soap.* na²ma³rá¹ *his soap* versus ná²ma³ra³ *his wall.*

11.1. Rules for morphotonemic changes between words within the phonological phrase follow.

In this section, # indicates the absence of a word-final glottal stop in the basic allolog, and ³#, etc., means a word which ends in tone ³ with no final glottal stop in its basic allolog. In the listed rules, ¹?, etc., means a word which ends with tone ¹ and which has a glottal stop in its basic allolog. (See Chart 1 for a summary of morphotonemic changes between phonological words.)

Rule 1: ³# + any tone sequence > same. Words which in the basic allolog have no final glottal stop, and which end in tone ³ never cause a change of tone in a following word. ú²ša³ čí¹lo¹ *seven pairs of scissors*, ú²ša³ kí²ni³ *seven pigs*, ú²ša³ tú³tu³ *seven pieces of paper*, ú²ša³ sa³?má?¹ *seven napkins*, ú²ša³ ší¹ni?³ *seven hats.*

Rule 2: ¹# + ¹ ³ or ¹ ¹ > ¹ ² ³ or ¹ ² ². Words which in their basic allologs have no final

glottal stop, and which end in tone ¹, cause a following tone ¹, or a sequence of tone ¹'s to become tone ². kʷá¹ʔa¹ *red* + tí¹ma¹u²ʔ¹ *your candle* > kʷá¹ʔa¹ tí²ma²u²ʔ² *your candle is red*; lá¹ša¹ *orange* + kʷí¹i²ʔ³ *green* > lá¹ša¹ kʷí²i²ʔ³ *a green orange*; ša²tų³rá¹ *his box* + lú¹lu¹ *small* > ša²tų³rá¹ lú²lu² *his box is small.*

Rule 3: ¹# + ²³ > ¹¹³. Words which in their basic allologs have no final glottal stop and which end in a tone ¹ cause a following tone ² to become tone ¹. yá¹ʔa¹ *brown* + ná²ma²ʔ³ *soap* > yá¹ʔa¹ ná¹ma²ʔ³ *the soap is brown*; ka³ʔni³rá¹ *he will kill* + ná²ya²ʔ³ *dog* > ka³ʔni³rá¹ ná¹ya²ʔ³ *he will kill the dog.*

Rule 4: ¹# + ³³ or ³¹ > same. Words which in their basic allologs have no final glottal stop and which end in a tone ¹ do not cause a following word with tone ³³ or ³¹ to change. lú¹lu¹ tú³mi³ *the feather is small*, lú¹lu¹ sa³ʔmá¹ *the napkin is small.*

Rule 5: ¹ʔ or ³ʔ + ¹³ or ¹¹ > same. Words which in their basic allologs have a final glottal stop and which end in tone ¹ or tone ³ do not cause a following word with tone ¹ to change. kʷá¹či²ʔ¹ *small (pl)* + tí¹ma¹u²ʔ¹ *your candle* > kʷá¹či¹ tí¹ma¹u²ʔ¹ *your candles are small*; vi³e³ʔá²ʔ¹ *her house* + lú¹lu¹ *small* > vi³e³ʔá¹ lú¹lu¹ *her small house*; šá³ku²ʔ³ *a few* + ší¹ni²ʔ³ *hat* > šá³ku³ ší¹ni²ʔ³ *a few hats.*

Rule 6: ¹ʔ or ¹³ʔ + ³³ > ¹²³ or ¹³²³. Words which in their basic allologs have a final glottal stop and which end in tone ¹, or the tone sequence ¹³, cause a following word with the tone sequence ³³ to become ²³ (unless it is part of the tone sequence ³³¹ Class B, see rule 10). či¹ló¹a²ʔ³ *her knife* + ví³šį³ *cold* > či¹ló¹a³ ví²šį³ *her cold knife*; kʷí¹i²ʔ³ *green* + ti³-ná³na²ʔ³ *tomato* > kʷí¹i³ ti²-ná³na²ʔ³ *the tomato is green*, ku³mí²ʔ¹ *four* + dí³ka³ *brush* > ku³mí¹ dí²ka³ *four brushes.* kʷá¹či²ʔ¹ *small* (pl) + tú³mi³ *feather* > kʷá¹či¹ tú²mi³ *the feathers are small.*

Rule 7: ¹ʔ + ³¹A (but not ³¹B) > ¹²¹. Words whose basic allologs end in tone ¹ and glottal stop cause the sequence ³¹ (Class A) to change to the sequence ²¹, but do not cause ³¹ (Class B) to change. ya³kʷá²ʔ¹ *crooked* + tu³tú²ʔ¹ (Class A) *firewood* > ya³kʷá¹ tu²tú²ʔ¹ *the firewood is crooked*; kʷá¹či²ʔ¹ *small* (pl) + i³kí²ʔ¹ (Class A) *bone* > kʷá¹či¹ i²kí²ʔ¹ *the bones are small.* But ³¹ (Class B) does not change. kį¹ʔį²ʔ¹ *much* + šų³ʔú²ʔ¹ (Class B) *money* > kį¹ʔį¹ šų³ʔú²ʔ¹ *much money*; ku³mí²ʔ¹ *four* + ti³ʔvá¹ (Class B) *shell* > ku³mí¹ ti³ʔvá¹ *four shells.*

Rule 8: ¹ʔ or ³ʔ + ²³ or ²³³A > ¹¹¹³ or ³¹¹³, ¹ʔ or ³ʔ + ²³¹ > ¹¹³¹ or ³¹¹³¹; ¹ʔ or ³ʔ + ³²³A or ³²³³A > ¹¹¹¹³ or ³¹¹¹³. Any word with a final glottal stop in the basic allolog causes a following word with the tone sequence ²³ or ²³³A to become ¹¹³, causes ²³¹ to become ¹¹³¹, and causes ³²³A and ³²³³A to become ¹¹¹³. ná¹tʸa²ʔ¹ *she is washing* + tó²to³ *clothing* > ná¹tʸa¹ to¹tó¹o³ *she is washing clothing*; ká²ką³ų²ʔ³ *you will ask* + ná²ma²ʔ³ *soap* > ká²ką³ų³ na¹má¹a²ʔ³ *you will ask for soap*; ku³mí²ʔ¹ *four* + sá²šį³ > ku³mí¹ sa¹šį́¹į³ *four nephews*; sá²šį³ra³ *his nephew*, ku³mí¹ sa¹šį́¹ra³ *four of his nephews*; ti³ká²či²ʔ³ *whirlwind*, ku³mí¹ ti¹ka¹čí¹i²ʔ³ *four whirlwinds*; ka³sá²ʔ¹ *son-in-law* + ká²ką³ka³ra³ *he will ask more*, ka³sá¹ ka¹ką́¹ka³ra³ *the son-in-law will ask more*, kó³o²ʔ³ *there is none* + ká²či²ʔ³ *cotton* > kó³o³ ka¹čí¹i²ʔ³ *there is no cotton*; kó³o²ʔ³ *there is none* + ka²či³rá¹ *his cotton* > kó³o³ ka¹čí¹ra³a¹ *there is none of his cotton.*

In José's speech, unless the tone sequence ²³ occurs on a word with a canonical pattern CVCV or CVCV? it sometimes changes to ¹³ instead of to ¹¹³. té²i³ *chair* > té¹i³ or te¹í¹i³, kó²o²ʔ³ *snake* > kó¹o²ʔ³ or ko¹ó¹o²ʔ³, kú²ʔu³ *bush* > kú¹ʔu³ or ku¹ʔú¹u³, ší²ʔi²ʔ³ *mushroom* > ší¹ʔi²ʔ³ or ši¹ʔí¹i²ʔ³, sí²ʔva³ *cocoa bean* > sí¹ʔva³ or si¹ʔvá¹a³.

Rule 9: ²³ʔ or ³³ʔ + ³³ > ²³¹³ or ³³¹³. A word whose basic allolog has tone ²³ or ³³ and which ends with a glottal stop causes a following word[6] with the sequence ³³ (unless a part of the sequence ³³¹ Class B, see rule

[6] There is one exception to this rule. Sequences tú³ku³ra³ *another* and tú³ku³ra³ *again* are homophonous except when following a morpheme whose basic allomorph ends in /ʔ/. In that environment tú³ku³ra³ *another* follows the regular rules, whereas tú³ku³ra³ *again* is an exception. It becomes tú¹ku¹ra¹. For example, dá³tų³ tú¹ku³ra³ *another pretty one*; dá³tų³ tú¹ku¹ra¹ *he is pretty again.*

10) to change to $^{1\,3}$. ší²da?³ *tongs* + ví³šį³ *cold* > ší²da³ ví¹šį³ *the cold tongs*; kó³o?³ *there is none* + ñá³?mi³ *sweet potatoes* > kó³o³ ñá¹?mi³ *there are no sweet potatoes*; ti³-ná³na?³ *tomato*, kó³o³ ti¹-ná³na?³ *there are no tomatoes*. (Notice that a $^{1\,3}$? differs from a $^{2\,3}$? or $^{3\,3}$? in that after a $^{1\,3}$? a $^{3\,3}$ becomes $^{2\,3}$. See Rule 6.)

Rule 10: ^{3}? + $^{3\,1}$, $^{3\,3\,1}$, $^{3\,1\,3}$, $^{3\,2\,1}$ (all Class B) > $^{3\,1}$ or ^{3} followed by $^{3\,1}/_{1\,3\,1}$, $^{3\,3\,1}/_{1\,3\,3\,1}$, $^{3\,1\,3}/_{1\,3\,1\,3}$, $^{3\,2\,1}$. Also ^{3}? + $^{2\,3\,3}$ (Class B) > $^{3\,1}$ or ^{3} followed by $^{1\,3\,3}/_{1\,1\,3}$. Also ^{3}? + $^{3\,2\,3}$ (Class B) > $^{3\,1}$ or ^{3} followed by $^{3\,2\,3}$.

Tone sequences $^{3\,1}$, $^{3\,3\,1}$, $^{3\,1\,3}$, and $^{3\,2\,1}$ which are Class B act morphotonemically as though preceded by a proclitic with tone but no segmental phonemes. (In our data a few nouns and all verbs in negative and completive aspect are Class B.) When preceded by a basic allolog has a final ^{3}?, the proclitic with zero segmental phonemes is actualized as tone ^{1}. The place of its occurrence alternates between the end of the first word and the beginning of the second, or it may even occur on both. All of the following phonemic shapes are frequent. šá³ku?³ *a few* + ka³sá?¹ (Class B) *son-in-law* > ša³ku³ú¹ ka³sá?¹, or šá³ku³ ká¹a³sa?¹, or ša³ku³ú¹ ká¹a³sa?¹ *a few sons-in-law*; ná²ma?³ *soap* + ka³?vi²rá¹ (Class B) *he is not counting* > na²ma³á¹ ka³?vi²rá¹ *he is not counting soap*; ná²ya?³ *dog* + ša³ší¹i?³ *is not eating* > na²ya³á¹ ša³ší¹i?³, or na²ya³á¹ šá¹a³ši¹i?³, or ná²ya³ šá¹a³ši¹i?³ *the dog is not eating*.

When the tone sequence $^{2\,3\,3}$ (Class B) occurs following ^{3}?, the preceding word changes from a final tone ^{3} to a final $^{3\,1}$, and the word with $^{2\,3\,3}$ (Class B) changes either to $^{1\,1\,3}$ or to $^{1\,3\,3}$. ná²ma?³ *soap* + ši²ką³ra³ (Class B) *he asked for* > na²ma³á¹ ši¹ką¹ra³ or na²ma³á¹ ší¹ką³ra³ *he asked for soap*.

When the tone sequence $^{3\,2\,3}$ (Class B) occurs following ^{3}?, the preceding word changes from a final tone ^{3} to a final $^{3\,1}$. ná²ya?³ *dog* + ni³-kí²ši³ *slept* > na²ya³á¹ ni³-kí²ši³ *the dog slept*.

Rule 11: The change that one word causes in a following word is based on the tone of its basic allolog, not on the tone which occurs in that specific environment.

For example, in the second of the following pair of examples, vá³?a³ *good* is still changed to $^{1\,3}$ even though a $^{1\,3}$? is preceding it. šá²tų?³ *box* + vá³?a?³ *good* > šá²tų³ vá¹?a³ *a good box*; ší¹to¹ra¹ šá¹tų³ vá¹?a³ *he is guarding a good box*.

In the second of the following pair of examples, vá³?a³ *good* is changed to $^{2\,3}$ even though a $^{2\,3}$? is preceding it. Compare rules 6 and 9. ší¹ni?³ *hat*, ší¹ni³ vá²?a³ *a good hat*; ší¹to¹ra¹ ší²ni³ vá²?a³ *he is guarding a good hat*.

11.2. Rules for morphotonemic changes within the phonological word and between a stem and an enclitic are dependent upon the presence versus the absence of stem-final glottal stop in the basic allomorph, and also the enclitic-final glottal stop in the basic allomorph. Therefore in the following rules # means an enclitic without glottal stop. A ? means an enclitic with a glottal stop. A ^{1}?, etc., means a stem which ends with tone ^{1} and has a glottal stop in the basic allomorph.

CHART 1. The numbers in the chart give the tones of the second word which actually occur in that environment. An s means that the tone in that environment is the same as that of the basic allolog.

Final tone of the first word, with or without ?	Basic tones of the second word				
	11	13	23	33	31A
3#	s	s	s	s	s
1#	22	23	13	s	s
23?/33?	s	s	113*	13	s
13?	s	s	113*	23	s
1?	s	s	113*	23	21

* See Rule 8.

CHART 2.

STEM	ENCLITIC	
Final tone, with and without ?	Without ?	With ?
3# or 1#	3	3 or 1*
3?	1	3 or 1**
1?	1	1

* See enclitic rules 3 and 4.

** See enclitic rule 6.

(See Chart 2 for a summary of the morphotonemic changes within a phonological word.)

Rule 1: $^{1}? + \# \text{ or } ? > {}^{1}{}^{1}$. Both enclitics with glottal stop and those without glottal stop have tone ^{1} when added to a stem with final tone ^{1} and final glottal stop in its basic allomorph. yo^{3}só$^{?1}$ *grinding stone* + i^{3} *my* > yo^{3}só^{1}i^{1} *my grinding stone*; tu^{3}tú$^{?1}$ *firewood* + ra^{3} *his* > tu^{3}tú^{1}ra^{1} *his firewood*; ší^{1}ñu$^{?1}$ *pineapple* + a$^{?3}$ *her* > ší^{1}ñu^{1}a$^{?1}$ *her pineapple*.

Rule 2: $^{1}\# + \#$ or $? > {}^{1}{}^{3}$. When added to a stem with final tone ^{1} and without final glottal stop in the basic allomorph, enclitics both with and without glottal stop have tone ^{3}. lú^{1}lu^{1} *small* + a^{3} *it* > lu^{1}lú^{1}a^{3} *it is small*, čí^{1}lo^{1} *knife* + e$^{?3}$ *our* > či^{1}ló^{1}e$^{?3}$ *our knife*.

Rule 3: $\#^{3}\# + \#$ or $? > {}^{3}{}^{3}$. When added to a stem with final tone ^{3} and with neither medial nor final glottal stop in the basic allomorph, all enclitics remain tone ^{3}. tú^{3}tu^{3} *paper* + e$^{?3}$ *our* > tú^{3}tu^{3}e$^{?3}$ *our paper*, ná^{2}ma^{3} *wall* + ra^{3} *his* > ná^{2}ma^{3}ra^{3} *his wall*; ká^{3}da^{3} *to move* + ų$^{?3}$ *you* (sg) > ká^{3}da^{3}ų$^{?3}$ *you will move*.

Rule 4: $?^{3}\# + \# > {}^{3}{}^{3}$; $?^{3}\# + ? > {}^{3}{}^{3}$ (Sabino), or $^{3}{}^{1}$ (José).

When added to a stem with final tone ^{3} and stem-medial glottal stop, enclitics without glottal stop in the basic allomorph remain tone ^{3}. Enclitics with glottal stop may be either tone ^{3} or tone ^{1}. (José usually has tone ^{1}; Sabino prefers tone ^{3}.) ví^{3}?e$^{?3}$ *house* + ra^{3} *his* > ví^{3}?e^{3}ra^{3} *his house*; vi^{3}?e^{3} *house* + a$^{?3}$ *her* > vi^{3}e^{3}?á$^{?1}$ *her house*; tų́^{3}?ų^{3} *word* + e$^{?3}$ *our* > tų^{3}?ų^{3}ę́$^{?1}$ or tų́^{3}?ų^{3}ę$^{?3}$ *our word*; tų́^{3}?ų^{3} *word* + i^{3} *my* > tų́^{3}?ų^{3}į^{3} *my word*; t^{y}á^{3}?ni^{3} *chest* + a$^{?3}$ *her* > t^{y}a^{3}?ni^{3}á$^{?1}$ or t^{y}á^{3}?ni^{3}a$^{?3}$ *her chest*.

Rule 5: $^{3}? + \# > {}^{3}{}^{1}$. When added to a stem with final tone ^{3} and with final glottal stop in the basic allomorph, an enclitic whose basic allomorph does not end in glottal stop becomes tone ^{1}. ná^{2}ma$^{?3}$ *soap* + ra^{3} *his* > na^{2}ma^{3}rá^{1} *his soap*; šá^{2}tų$^{?3}$ *box* + i^{3} *my* > ša^{2}tų^{3}į^{1} *my box*.

Rule 6: $^{3}? + ? > {}^{3}{}^{3}$ or, occasionally, $^{3}{}^{1}$. When added to a stem with final tone ^{3} and with final glottal stop in the basic allomorph, an enclitic whose basic allomorph ends in glottal stop usually remains tone ^{3}, but with José it varies to tone ^{1}. ná^{2}ma$^{?3}$ *soap* + e$^{?3}$ *our (inclusive)* > ná^{2}ma^{3}e$^{?3}$ or na^{2}ma^{3}é$^{?1}$ (rare); šá^{2}tų$^{?3}$ *box* + a$^{?3}$ *her* > šá^{2}tų^{3}ą$^{?3}$ or ša^{2}tų^{3}ą́$^{?1}$ (rare) *her box*.

Rule 7: The rules for enclitic plus enclitic are the same as the above rules for stem plus enclitic. ší^{1}to$^{?1}$ *watching*, ri$^{?3}$ *he (animal)*, ra^{3} *he (man)*, ší^{1}to^{1}ri$^{?1}$ *he (the animal) is watching*, ší^{1}to^{1}ri^{1}ra^{1} *he (the animal) is watching him (the man)*, ši^{1}to^{1}rá^{1}ri$^{?3}$ *he (the man) is watching him (the animal)*; ká^{3}ši$^{?3}$ *to eat*, ka^{3}ši^{3}ri^{3}rá^{1} *he (the animal) will eat him (the man)*; ka^{3}ši^{3}rá^{1}ri$^{?3}$ *he (the man) will eat him (the animal)*.

11.3. The morphotonemic rules between proclitic and stem need further study. In our present data, however, a proclitic with tone ^{1} causes a following stem with tones $^{3}{}^{3}$ to become $^{1}{}^{3}$, a stem with tones $^{2}{}^{3}$ to become $^{1}{}^{1}{}^{3}$, and a stem with $^{3}{}^{1}$A to become $^{2}{}^{1}$. Stems with $^{1}{}^{3}$, $^{1}{}^{1}$, and $^{3}{}^{1}$B remain unchanged. vá^{3}?a^{3} *good*, ku^{1}-vá^{1}?a^{3}ra^{3} *he is becoming good*; ší^{2}ñu^{3} *bright*, ku^{1}-ší^{1}ñú^{1}a^{3} *it is becoming bright*; ya^{3}tá$^{?1}$ (Class A) *old*, ku^{1}-ya^{2}tá^{1}ra^{1} *he is becoming old*; si^{3}ní^{1} (Class B) *industrious*, ku^{1}-si^{3}ní^{1} *he is becoming industrious*. (Except that a proclitic with tone ^{1} plus a $^{3}{}^{3}$ stem becomes $^{1}{}^{1}{}^{3}$ (instead of $^{1}{}^{2}{}^{3}$), the above changes are the same as those of a word with /^{1}?/ followed by another word.)

For the most part a proclitic with tone ^{3} causes no change in the tone of the stem. ku^{3}-vá^{3}?a^{3}ra^{3} *he will become good*, ku^{3}-ší^{2}ñu^{3}a^{3} *it will become bright*, ku^{3}-ya^{3}tá^{1} *it will become old*. There are, however, certain frozen forms which do not coincide with the above rules. Notice the contrast between the following words. k^{w}á^{1}či$^{?1}$ *small* (pl), te^{3}-k^{w}á^{1}či$^{?1}$ *those (men) who are small*, te^{3}-k^{w}-á^{2}či$^{?3}$ *boys*.

12. Tone has a heavy functional load in Ayutla Mixtec. It is one of the contrastive features used to distinguish lexical items. A

few examples of minimal pairs are: kʷá¹ʔa¹ *red*, kʷá³ʔa³ *right-hand side*; na²ma³rá¹ *his soap*, ná²ma³ra³ *his wall*; ká²vaʔ³ *gall bladder*, ká³vaʔ³ *cliff*.

With some verbs, tone is the contrastive feature which distinguishes aspects: ká³da³ra³ *he will move*, ka¹dá¹ra³ *he is moving*; ná³tʸa³ra³ *he will wash*, ná¹tʸa¹ra¹ *he is washing*; su³tʸá¹ra¹ *he will swim*, sú¹tʸa³ra¹ *he is swimming*; nu³ñá¹ra¹ *he will open*, nú¹ña¹ra¹ *he is opening*; ku³-tá¹tą¹ra¹ *he will take medicine*, ku¹-tá¹tą¹ra¹ *he is taking medicine*.

Tone, in combination with a contrast between a single vowel and a cluster of geminate vowels, distinguishes most affirmative descriptive clauses from negative descriptive clauses; lu¹lú¹ra³ *he is small*, lu³lu²ú¹ra³ or lu³lu²u¹rá¹a³ *he is not small*; ví³šį³ra³ *he is cold*, vi³ši²į¹ra³ or vi³ši²į¹rá¹a³ *he is not cold*; ká¹ni³a¹ *it is long*, ka³ní¹a³a¹ *it is not long*.

Affirmative verbs are distinguished from negative verbs by tone, or by tone in combination with a contrast between a single vowel and a cluster of geminate vowels: ká²ką³ra³ *he will ask*, ka³ką²ą¹ra³ *he will not ask*; ší¹ta¹ra¹ *he is singing*, ši³ta²rá¹ *he is not singing*.

In Jose's idiolect many interrogative descriptive clauses are distinguished from affirmative descriptive clauses by tone. (Sabino introduced the interrogative descriptive clause with /a³a¹/.) ší²ñu³a³ *it is shiny*, ši³ñu²ú¹a³ *it is not shiny*, ši¹ñu¹a³ *is it shiny*?

Following are a few examples of words which are distinguished from each other by tone, or by tone in combination with a contrast between a single vowel and a cluster of geminate vowels. ší¹ni³ra¹ *his hat*, ši²ni³rá¹ *his head*, ší¹ni¹ra¹ *he understands*, ši³ni²rá¹ (Sabino prefers ši³ni³i²rá¹) *he doesn't understand*, ši¹ní¹ra³ *he knows*, ší³ni³ra³ *he knew*, ši³ni²í¹ra³ or ši³ni²rá¹a³ (Sabino prefers ši³ni³i²rá¹a³) *he doesn't know*, ší¹ni³ra³ *he is drunk*; ša¹kú¹ra³ *he is laughing*, šá²ku³ra³ *he laughed*, ša³ku²ú¹ra³ or ša³ku²rá¹a³ (Sabino prefers ša³ku³u²rá¹a³) *he isn't laughing*, šá¹ku¹ra¹ *he is crying*, šá³ku³ra³ *he cried*, ša³ku²rá¹ (Sabino prefers ša³ku³u²rá¹) *he isn't crying*.