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THE SYLLABLE STRUCTURE AND ASPECT MORPHOLOGY OF ISTHMUS ZAPOTEC¹

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1. Introduction. This article presents novel analyses of the phonology of Isthmus Zapotec (IZ), for both the syllable structure and the aspect morphophonemics.

In 2 we discuss the basic features of Isthmus Zapotec syllable structure. Although previous work (Pickett 1967) has done this in some detail already, the present analysis differs radically from the previous one. First, we follow current work on the syllable in making explicit reference to the constituent "rhyme." Second, glides are analyzed as forming part of the rhyme in some instances, whether they precede or follow the vowel. Third, glottal stop is analyzed here as a laryngeal feature of the syllable rather than as a consonant restricted to syllable-final position. Fourth, in the present analysis only glides occur after a vowel in a given syllable (except in loanwords).²

In 3 we turn to the morphophonemics of aspect prefixes with this syllable structure in mind and present a motivated alternative to the previous nongenerative analysis (Pickett 1953; 1955). We appeal explicitly to the syllable structure (including the skeletal tier) to account

¹ We thank our colleague María Villalobos for confirming the Zapotec data which were not drawn from previous publications. The contribution made by the first author was facilitated by a research position at the Universidad Nacional Autónoma de México during 1984–85. We also thank Bruce Benson, Jan Benson, Donna Kreutz, David Payne, Judy Payne, Chuck Speck, Tom Smith-Stark, Joseph Stemberger, and especially Diana Archangeli for their helpful comments. They are not responsible for the inadequacies that remain.

² In Pickett (1967) phonetically long consonants were analyzed as geminates. In the present analysis, which reflects that followed in Pickett et al. (1965), long obstruents are phonetic variants of short obstruents. Any segment occurring in a nonbranching onset which follows a stressed vowel in the same word is lengthened phonetically EXCEPT A LENIS RESONANT. This is the only place in IZ where the contrast between lenis and fortis resonants is perceived. Three examples of fortis resonants are *čonna* 'three', *belle* 'flame', and *beññe* 'and'. The result of this different analysis is to eliminate syllables closed by (true) consonants.

for certain facts. The analysis of certain irregular verb classes appeals to the notion of stratum in Lexical Phonology (Kiparsky 1982, Mohanan 1982; 1986, and Kaisse and Shaw 1985). The present work supplies more data than have appeared in earlier discussions of IZ and does so in a format which makes it easier to use. We believe this analysis makes an important contribution not only to the data base for phonological theory but also to comparative Zapotecan studies. Our analysis can be compared with that of Speck (1984), which is a (linear) generative treatment of similar facts from another Zapotec language with a very different syllable structure.

2. Syllable structure. IZ has the following phonemes in native words.³ As we show below, the high vowels may occur at the edge of the syllable, yielding what are perceived as the glides *y* and *w*; we write them as vowels or as glides in data below depending on whether they are or are not the nucleus of the syllable.

(1) Consonants				Vowels							
Obstruents				Resonants							
<i>p</i>	<i>t</i>	<i>č</i>	<i>k</i>	fortis	<i>m</i>	<i>nn</i>	<i>ññ</i>	<i>i</i>	(<i>y</i>)	<i>u</i>	(<i>w</i>)
<i>b</i>	<i>d</i>	<i>ǰ</i>	<i>g</i>	lenis		<i>n</i>	<i>ñ</i>	<i>e</i>		<i>o</i>	
	<i>s</i>	<i>š</i>		fortis		<i>ll</i>		<i>a</i>			
	<i>z</i>	<i>ž</i>		lenis		<i>l</i>					
				lenis		<i>r</i>					

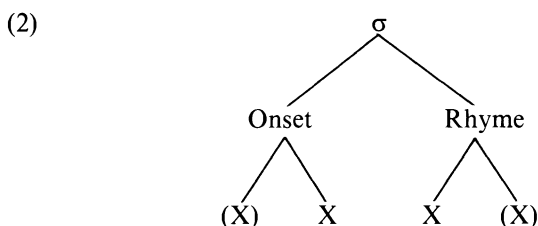
Vowels occur either simple, as in *gi* 'fire', or checked (written as V[?]), as in *gye*? 'flower', or laryngealized (written as VV), as in *zee* 'fresh corn'. We do not discuss the prosodic representation of these vowels below. The evidence we have suggests that they must be treated as single vowels, despite the fact that the modified vowels occur in very restricted positions. In fact, we take the syllable (rather than the vowel) as either unmodified (i.e., simple) or modified (i.e., laryngealized or checked).

³ We basically ignore here certain rare exceptions and also loanwords. The examples given in Pickett (1967) are: velar nasal, as in the Spanish loan *paŋ* 'bread' (which also violates the IZ syllable structure condition given below); trilled *r*, as in *řu'zaa* 'semiripe'; *f*, as in the Spanish loanword *few* 'ugly' and *řlřu'čř* 'loud whistle'. A phone [h] occurs in three interjections: [hanna] and [hora], which both mean 'Go ahead!' and [hã?] 'Isn't that true?'. This phone [h] does not contrast with the voiceless nasals and lateral, which occur in allomorphs of the possessive prefix /š-/. (See (a) in n. 6.) While these voiceless sonorants were previously taken to be allophones of a phoneme /h/, in this paper we analyze them as allophones of /š/. The marginal phoneme /h/, under this analysis, occurs only in interjections and loanwords.

Only stressed syllables can be laryngealized. Checked syllables must be either (1) stressed or (2) in utterance-final position with a certain tone pattern.⁴ Vowels in unmodified syllables are lengthened slightly before lenis consonants within the same word.

The fortis obstruents are typically voiceless, and the lenis obstruents typically voiced; we use the feature [voice] to distinguish them below. Fortis resonants are phonetically longer than lenis resonants (see n. 2).

These sounds are grouped into syllables in very limited ways. We propose that the following syllable template is adequate for the basic syllable types of IZ.



The X's refer to positions in the skeletal tier and ambiguously represent the C and V positions (see Mohanan 1985 for discussion). In many of the representations below, however, we suppress the skeletal tier. The parenthesized elements are optional. Restrictions on what may occur at each terminal point of this syllable template are stated below. Before presenting these, we give examples of the various syllable types which this schema allows. As this template indicates, only two segments may occur in the onset constituent and only two segments in the rhyme constituent. The basic IZ syllable contains at most four segments.

⁴ We represent unstressed syllables below in their utterance-medial form. Pickett et al. (1965) gives the prepause form. An unstressed syllable is checked utterance-finally when it either has a rising tone or follows a syllable (in the same word) which is checked or laryngealized. A checked syllable with rising tone loses its checking utterance-medially (if it is not a pronoun). (For a discussion of the interaction of tone and glottal features, see also Mock 1982; to appear.) We indicate the superficially contrasting tones in this article in the following way: high tone [á], low rising tone [ǎ], and low tone (unmarked). (When a low rising tone occurs on a laryngealized vowel, we transcribe it as [ǎ̃].)

The forms translated as adjectives or with the verb 'be' (to avoid ambiguity, as in 'be cut') are intransitive predicates. In the stative aspect a verb such as /-ne'/ 'stained' would be translated 'is stained'. In other aspects it would be translated with the auxiliary 'become' or 'get'.

The cliticization of the first-person singular pronoun /-á'/ onto a laryngealized syllable results in what is clearly perceived as a checked AND laryngealized syllable utterance-finally: *šňáa* 'mother', *šňáa'* 'my mother'.

(3)	Onset	Rhyme	Example	
	<i>s</i>	<i>aa</i>	<i>saa</i>	'music, fiesta'
	<i>w</i>	<i>a</i>	<i>waga</i>	'rat'
	<i>n</i>	<i>aa</i>	<i>naa</i>	'I'
	<i>ññ</i>	<i>e</i>	<i>beññe</i>	'mud'
	<i>k</i>	<i>oʔ</i>	<i>koʔ</i>	'no'
	<i>g</i>	<i>i</i>	<i>gi</i>	'fire'
	<i>š</i>	<i>n</i>	<i>šneza</i>	'correct'
	<i>s</i>	<i>t</i>	<i>sti</i>	'other'
	<i>n</i>	<i>g</i>	<i>ngola</i>	'big'
	<i>m</i>	<i>b oo</i>	<i>mboota</i>	'very big'
		<i>g y eʔ</i>	<i>gyeʔ</i>	'flower'
		<i>ř y a</i>	<i>řya</i>	'griddle'
		<i>b w iʔ</i>	<i>bwiʔ</i>	'guayava'
		<i>n w i</i>	<i>na'nwĩ</i>	'fine (quality)'
		<i>b ii w</i>	<i>biiw</i>	'flea'
		<i>t oʔ w</i>	<i>toʔw</i>	'turkey' ⁵
	<i>s</i>	<i>t w i</i>	<i>stwi</i>	'sickness from embarrassment'
	<i>š</i>	<i>p y aʔ</i>	<i>špyaʔ</i>	'custom/manner of'
	<i>m</i>	<i>b y oʔšo</i>	<i>mbyoʔšo</i>	'old man clown'
	<i>n</i>	<i>g ii w</i>	<i>ngiiw</i>	'man'

We shall assume in this paper that segmental sequences are scanned by this template and syllabified or resyllabified in accordance with it and the restrictions stated below.

2.1. Onsets. As the template above indicates, virtually every syllable has an onset. There are some word-initial exceptions. Many, but not all, of these exceptions are due to the loss (historically or synchronically) of initial *g*.⁶ Therefore, we add the following stipulation:

⁵ Phonetically a rhyme such as /oʔw/ is pronounced as [owʔ].

⁶ Many words in the speech of a large number of people occur phonetically without an initial consonant. Dialectically these typically alternate with *g* initial forms.

u'naa ~ *gu'naa* 'woman'

Nevertheless, it can be shown that the velar has not been lost in all forms of the small paradigm. The possessed form of most such vowel-initial words reveals the underlying *g*.

š-ku'naa < /š + gu'naa/

The *g*-Deletion rule may be stated as follows (although it is not completely predictable as to the forms to which it will apply): a *g* is optionally deleted if it occurs word-initially in an unstressed syllable.

The word *iza* 'year' never has an initial *g*, and in fact can be shown to have an underlying initial vowel by examining its possessed form.

- (4) The Onset may be absent in some word-initial syllables.

Any segment except nonhigh vowels may appear in the Onset. The restriction is given as (5).

- (5) If x is [-consonantal, -high], then x is linked to the Rhyme.

Syllables with branching onsets are much less common than non-branching onsets. There are severe restrictions on what may occur at the syllable edge in branching onsets. The following onset clusters exist:

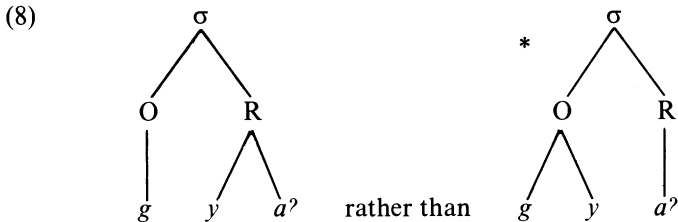
- (6) Word-initial: st sk
 $\check{s}p$ $\check{s}t$ $\check{s}k$ $\check{s}m$ $\check{s}n$ $\check{s}\check{n}$ $\check{s}l$
 mb nd $\check{n}\check{j}$ ng
 Word-medial: mp nt $\check{n}\check{c}$ nk
 mb nd $\check{n}\check{j}$ ng

(The nasal before [g] is actually velar before velars, although we write it as n .)

These onsets violate the Sonority Sequencing Generalization which, as given in Selkirk (1984:116), claims the following:

- (7) In any syllable, there is a segment constituting a sonority peak that is preceded and/or followed by a sequence of segments with progressively decreasing sonority values.

In our analysis, glides may not occur in branching onsets. Rather, a sequence of consonant-glide-vowel is to be analyzed as a simple onset and a complex rhyme, as shown in (8).



The restriction which prohibits the unwanted structure can be stated as follows:

\check{s} -iza < / \check{s} + iza/

Other words with no initial g include i' ntiikă 'any', i' ntiisi 'any', and I' zii 'Tehuantepec'.

As a side note, we point out that some speakers insert a g before unstressed word-initial vowels of loanwords which begin with vowels in Spanish, as shown below:

Spanish		Speech of Some IZ Speakers
[a'niyo]	(<i>anillo</i>) 'ring'	$ga'niw$
[a'byon]	(<i>avión</i>) 'airplane'	$ga'byon$

(9) Branching onsets can only be linked with [+consonantal] segments.

We return to this claim below in 2.3.

The first segment of a branching onset may be *s*, *š*, or a nasal. Monomorphemic words with the obstruents in this position are rare; obstruents are commonly found, however, on possessed forms of nouns.⁷

The restrictions on the first element of branching onsets are given as (10)–(13).

(10) If *x* is the first segment of a branching onset, then *x* is either [+nasal] or [+continuant, –voice].

(11) If an oral consonant is the first segment of a branching onset, then it is in a word-initial syllable.

(12) If a nasal consonant is the first segment of a branching onset, then it is followed by a homorganic noncontinuant.⁸

(13) If a nasal consonant is the first segment of a word-initial branching onset, then it is followed by a voiced segment.

The addition of the possessive prefix /š-/ often creates (intermediate-level) sequences that do not occur superficially. Two rules apply. First, if the root begins with a lenis obstruent, Devoicing (14) applies.

(14) Devoicing: [–sonorant] → [–voiced] / [–voiced] —

(15) Example: /š-biʔku/ (POSS-dog) → [špiʔku].

If the root begins with a sibilant (affricate or fricative), a Cluster Simplification applies. The facts are given in (16) and the rule in (17).

(16) *š* + *š*, *ž*, *č* *ʃ* → *š*

š + *z* → *s*

š + *s* (none found)

(17) Cluster Simplification: [+strid] $\left[\begin{array}{c} +\text{strid} \\ \alpha\text{high} \end{array} \right]$ [αhigh]

1 2 \implies 1 ∅

⁷ The *š* reduces to a voiceless nasal or lateral by the following rule: /š/ becomes the voiceless counterpart of the following nasal or lateral.

There is a small degree of optionality in the application of this rule in the speech of some speakers; the rule is more likely to apply if the /š/ is not a separate morpheme. Thus *šneza* ‘correct’ is usually pronounced [Nneza]; *š-neza* (POSS-road) is usually pronounced [Nneza] but [šneza] by some people.

⁸ There is one word which (phonologically) may exemplify a nasal followed by a resonant rather than a stop, but an epenthetic *d* intervenes: *beren[d]ru* ‘ant lion’. If the *d* is not analyzed as epenthetic, then this example has three onset positions. The cluster *str* occurs word-initially in two words referring to a certain fruit: *stro'mpiʔpi* and *stro'mpoʔpo*. It also occurs word-internally in the word *na-strooco* ‘very thick (liquid) (stat.)’.

2.2. Rhymes. The restriction on the rhyme positions of the syllable template is very severe.⁹

(18) Only vowels can appear in the rhyme.

We claim that IZ roots are subject to the Obligatory Contour Principle (McCarthy 1986). As we shall see later, this principle is also operative in the derivation of words, with one major exception (see 60).

(19) Obligatory Contour Principle: At the melodic level, adjacent identical elements are prohibited.

(“Melodic level” here refers to the segmental tier.) This principle rules out structures such as (20), both within a syllable and across syllable boundaries.

(20) * X X
 | |
 α α

e.g., *aa*, *ee*, *ii* (*iy*, *yi*), *oo*, *uu* (*uw*, *wu*)

Another restriction is also necessary since the sequences /ao/, /oa/, /ae/, and /ea/ are also not attested:

(21) One of the segments of a branching rhyme must be [+high].

The remaining sequences are permitted. Unexpectedly, rhymes of a mid vowel followed by a glide in an unmodified syllable do not appear, nor do rhymes of a low vowel followed by a glide (except in the words in n. 9).

(22) high-high	e.g., <i>w i</i>	<i>na'nwĩ</i>	‘fine’
high-mid	e.g., <i>w eʔ</i>	<i>kweʔ</i>	‘next to’
high-low	e.g., <i>y aa</i>	<i>na'žyǎa</i>	‘spongy’
high-high	e.g., <i>ii w</i>	<i>biiw</i>	‘flea’
mid-high	e.g., <i>oʔ w</i>	<i>toʔw</i>	‘turkey’

Branching rhymes in which the glide occurs in syllable-final position occur only word-finally in IZ. There are no words such as **biiwza*. The restriction is given as (23).

(23) A modified syllable whose terminal element is not the nucleus of the syllable occurs only word-finally.

⁹ Three native IZ verbs have rhymes which cannot be described by the syllable template shown above. They involve two glides and a vowel in a single rhyme: *r-ywiʔ* ‘extinguished (hab.)’, *r-ywi* ‘chewed (hab.)’, and *r-ywa* ‘less (hab.)’. See also 3.6.

And as we discuss in the next section, branching rhymes (of any type) occur only in stressed syllables.

If a branching rhyme has two high vowels, the first is usually non-syllabic. The second high vowel can be nonsyllabic rather than the first only if the syllable is laryngealized. These statements still allow the following possible rhymes: [yuu] or [iiw]. The latter is attested in word-final syllables like *biiw* 'flea' (see restriction 23). The former appears to be restricted to the first syllable of a stem, as in *byuuza* 'visitor', *r-yuu* (Hab.-enter). There are no verb roots such as /-iiw/ or /-uuy/. The relevant restriction is given as (24).

- (24) If *x* is a morpheme-initial high vowel and is the first segment of a branching rhyme, then *x* is linked to a C.

2.3. Arguments for glides in the rhyme. Harris (1983) has argued that glides in Spanish must be analyzed as occurring in the rhyme rather than in the onset. We have claimed here that glides in IZ may not occur in branching onsets.

The first argument for this claim is that while severe restrictions obtain between segments which occur in a branching onset, there are no major restrictions between segments of which one occurs in the onset and one in the rhyme. One restriction we do observe is that if onset is a glide, the rhyme cannot begin with a glide. This follows (we presume) from the Sonority Sequencing Generalization (but see n. 8). Another restriction is that a branching rhyme beginning with *y* or *w* cannot be preceded by *m*. There are no syllables [mwi] or [mya], although there is [nwi] (see 21).

The second argument for placing glides where we do is that a significant generalization can be stated regarding branching rhymes in IZ.¹⁰

- (25) Branching Rhyme Constraint: Branching rhymes occur only in stressed syllables.

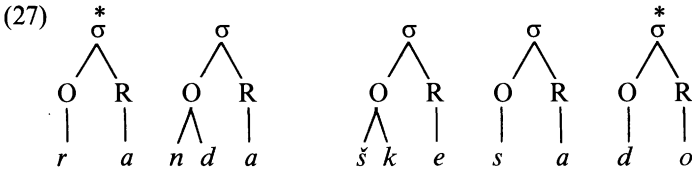
The IZ primary stress rule is given in (26); numerous exceptions to this generalization can be found in nouns but are rare in verbs. We indicate

¹⁰ This restriction on branching rhymes must refer to word-level stress at a somewhat abstract level. When words occur in phrases or compounds, the stress of each word except the peak of the phrase is reduced significantly without affecting the syllable structure of the words. (Laryngeal modification is lost when stress is reduced, however, although the conditions are not entirely clear.) A few words which are not obvious compounds also appear to be exceptions to this constraint. These include *gay'waa* 'one hundred', *byu'lu* 'hummingbird', and *mew'zúbi* 'scorpion'. The first-person singular stem for 'eat' is /-(d)aw/ (see n. 11), after which the enclitic pronoun /á?/ always appears. In phonetic form, therefore, neither syllable has a branching rhyme.

stress on exceptions (or otherwise where desired) by means of a raised bar preceding the stressed syllable.

(26) Stress Rule: Stress the first rhyme of the root.

In the word *wa'ra* 'sick' the *w* is in the onset; the rhyme is not branching and the syllable *wa* may occur unstressed. In the word *kwe'* 'next to' the *w* is in the rhyme; such a syllable can occur only when stressed. Branching onsets, on the other hand, may occur in unstressed syllables, e.g., '*randa* 'able' (hab.), *škesa'do* 'fontanel', as shown in (27) (where the asterisk indicates stress).



The generalization stated above cannot be made if the syllable structure of IZ is analyzed more traditionally.

Finally, we take \tilde{n} (when it is not the result of nasal assimilation) to be the association of a single C position in the skeletal tier with an *n* and an *i* (*y*) on the melody tier. Together with the Obligatory Contour Principle, this correctly predicts the nonoccurrence of syllables such as [ñi]. A syllable such as [ñe] therefore does not have a branching rhyme and may occur in unstressed syllables, as in '*diiñe* 'debt'.

3. Aspect morphology. The minimal verb form in Zapotec languages is typically a verb root plus an aspect prefix (Pickett, to appear). The verb structure of IZ is given in (28).

(28) ASPECT (THEME) (CAUSATIVE) ROOT
VOWEL

Causative morphology is brought into the discussion at various points; extensive data are presented in Appendix A. Passive morphology is not at all productive and is discussed in n. 12. The theme vowel is discussed in 3.4 below.

Unlike Texmelucan Zapotec (TZ) (Speck 1984), which has only four aspects, IZ verbs regularly have seven—eight if the stative aspect /na-/ is counted.¹¹ In certain ways the aspect morphologies of IZ and TZ are similar both to each other and also to other Zapotec languages, and

¹¹ There is another verb form which should be discussed briefly. We use the name "participle" for this form since it is only used in conjunction with an auxiliary verb.

these similarities can be seen in the rules which are developed below for IZ. In other ways IZ is very different. For example, under certain conditions in TZ (Speck 1984:142) two aspect markers may occur on a single verb. A verb in TZ may also carry a negative prefix without an aspect prefix. IZ (along with most other Zapotec languages, to the best of our knowledge) does not share these properties with TZ. More important, however, is the fact that the syllable structures of the two languages are quite different.

We discuss the allomorphy of aspect prefixes by groups of verbs. Verbs are usually cited in the forms they would have with a singular noun phrase subject.¹² Some of the rules we write make reference to unincorporated segments; the output of these rules includes explicit reference to syllable structure.

We use the model of Lexical Phonology to account for various facts. In this theory, morphological rules and phonological rules take place at different modules of the lexicon called "strata." Phonological rules may apply at one stratum, at a series of strata, or postlexically. Since we are not discussing compounding or cliticization in this paper, we do not label the strata by numbers but refer to them as strata y and z, as in (29). Certain morphemes are added at each stratum. Stratum y does not

The participle occurs following the auxiliary forms of the verbs 'come' and 'go' (see Pickett, to appear). A phrase like *z-e gite* means 'will go along playing' and *z-eda gite* means 'will come along playing'.

It is also used after the auxiliary verb /-na/. This auxiliary verb occurs only in the progressive aspect. A phrase like *ka-na gite* means 'goes around playing'.

For most verbs the participle appears to be simply the verb without an aspect prefix. For verb stems beginning with stressed vowels (i.e., before root vowels, or a stressed theme vowel, as for the verb /-uuti/ 'kill' (</u-θ-ati/)), a y appears: *ka-na yuuti* 'goes around killing'. This y might be viewed as the last remnant of a participial prefix, perhaps as the last remnant of the Potential prefix (as comparison with other Zapotec languages might suggest), or as the epenthetic y discussed in 3.1.

There is also a motion-cum-purpose construction in which a verb, typically in the Potential aspect, follows the auxiliary verb 'go' or 'come': *č-i g-uuya* 'will go to see'. There is some irregularity here, however, for the radical stem-changing verbs of the set PC verbs (see 3.3) take a special form in the motion-cum-purpose construction. This form has an affinity with the stem used in the Completive aspect. In this construction these verbs choose the alternate root allomorph (that which is used in the Completive) and inflect it for Potential aspect as usual (at stratum y—see 3.3 below): *č-i tapă* 'will go to hit' (</k-yi k-dapă/). A stem beginning with /l/, which would normally stay /l/, changes to /nd/ in this form, however.

¹² In a couple of instances where suppletion (or partial suppletion) is involved, another stem (such as the first-person singular stem) is cited. The latter citation involves a bit of abstraction since we cite the stem without the obligatory enclitic pronoun which fuses to the stem, producing regular vowel and tone changes.

necessarily produce free-standing words in IZ but may feed into stratum z. Both strata are cyclic strata as the rules which apply in them all obey Strict Cyclicity; that is, the rules apply only in derived environments.

(29) Stratum y: stem formation and irregular aspect

Stratum z: regular aspect

Specifically, we propose that causative stems are formed at stratum y, as well as irregular completives and potentials. All other aspects are added at stratum z. In 3.5 we include a summary of the phonological rules, their ordering, and their relevant domains.

3.1. Vowel-initial roots. Of the five vowels of IZ, only two are commonly found root-initially: *a* and *u*. Roots beginning with the other vowels are virtually nonexistent; in the following paradigms we have included the only possible examples of *e*- and *o*-initial roots. The only *o*-initial root has a partially suppletive allomorph with an initial *d* in the completive aspect and sometimes elsewhere.¹³ The three possible *e*-initial roots also have stem allomorphs and in fact two of these roots are suppletive allomorphs of each other (see n. 11). Underlying syllabic *i* does not occur root-initially in verbs at all (but see 3.6).

We indicate the underlying forms which we posit for the aspect prefixes. Some choices of underlying forms are justified when consonant-initial roots are discussed.

(30)

HABITUAL	POTENTIAL	FUTURE	PROGRESS.	REPETITIVE	UNREAL	COMPLETIVE	
<i>r-</i>	<i>k-</i>	<i>z-</i>	<i>ka-</i>	<i>wa-</i>	<i>ni-</i>	<i>gb-</i>	
<i>r-aku</i>	<i>g-aku</i>	<i>z-aku</i>	<i>kay-aku</i>	<i>way-aku</i>	<i>ñ-aku</i>	<i>gu-ku</i>	'dress oneself'
<i>r-aana</i>	<i>g-aana</i>	<i>z-aana</i>	<i>kay-aana</i>	<i>way-aana</i>	<i>ñ-aana</i>	<i>guu-na</i>	'clean (field)'
<i>r-a'de</i>	<i>g-a'de</i>	<i>z-a'de</i>	<i>kay-a'de</i>	<i>way-a'de</i>	<i>ñ-a'de</i>	<i>gu?-de</i>	'receive gift'
<i>r-e?</i>	<i>g-e?</i>	<i>z-e?</i>	<i>kay-e?</i>	<i>way-e?</i>	<i>ñ-e?</i>	<i>gw-e?</i>	'drink'
<i>r-eedä</i>	<i>g-eedä</i>	<i>z-eedä</i>	<i>kay-eedä</i>	<i>way-eedä</i>	<i>ñ-eedä</i>	<i>b-eedä</i>	'come'

¹³ A few verbs have a different stem when the subject is first-person plural (exclusive or inclusive). For example, the verb 'sleep' is /-dusi/ with such a subject but is /-asi/ generally (and for some speakers even with a first-person plural subject). A couple of verbs have different stems when the subject is first-person singular. The verb 'eat' is /-do?/ when the subject is first-person plural (in all aspects), /-daw/ when the subject is first-person singular in the completive aspect, /-aw/ when first-person singular in other aspects, /-do/ for other subjects in the completive aspect, and /-o/ elsewhere. (We discuss the special completive aspect stems below.) Both of the *e*-initial verbs listed here have other stems: 'drink' is /-de?/ with first-person plural subject and /-e?/ otherwise; 'come' is /-yupa/ with first-person plural subject, /-endä/ with first-person singular subject, and /-eedä/ otherwise.

<i>r-endă</i>	<i>g-endă</i>	<i>z-endă</i>	—	<i>way-endă</i>	<i>ñ-endă</i>	<i>b-endă</i>	'come' (1s stem)
<i>r-o</i>	<i>g-o</i>	<i>z-o</i>	<i>kay-o</i>	<i>may-o</i>	<i>ñ-o</i>	<i>gu-do</i>	'eat'
<i>r-una</i>	<i>g-una</i>	<i>z-una</i>	<i>kay-una</i>	<i>way-una</i>	<i>ñuna</i>	<i>b-ina</i>	'obey'
<i>r-uuna</i>	<i>g-uuna</i>	<i>z-uuna</i>	<i>kay-uuna</i>	<i>way-uuna</i>	<i>ñ-uuna</i>	<i>b-iina</i>	'cry'

We give the rules here which are needed to account for the allomorphs which occur with vowel-initial stems, except that we do not give a rule to account for the apparent allomorph [ñ-] of the unreal prefix. As stated in 2.3, the segmental sequence *ni* is taken up into the syllable structure as occupying a single C position when it precedes a vowel.

Voicing. Although it is not apparent at this point that /k-/ is the underlying form for the potential prefix, as it is in TZ, the voiceless feature of this prefix is crucial with certain consonant-initial roots discussed below. We derive the voiced (lenis) variant by the following rule:

(31) Voicing (domain: strata y-z)

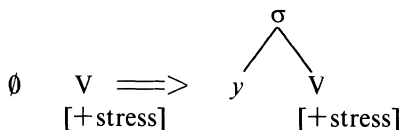
$k \rightarrow [+voice] / _ [+sonorant]$

The causative prefix /k-/ undergoes the same rule.

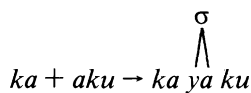
(32) $r + u + k + a\check{y}\acute{e} \rightarrow ruga\check{y}\acute{e}$ (Hab.-Theme-Cause-wet)

y-Insertion. A *y* is inserted before stressed rhymes which have not been incorporated into a syllable.

(33) *y*-Insertion (domain: stratum z)



(34) Example:



(This rule also applies to one causative stem: *ka'yuuŋi* 'is killing' < /ka + u + \emptyset + ati/ (Prog.-Theme-Cause-die) via *a*-Deletion (38).)

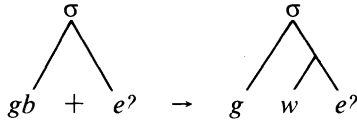
Vocalization. An important rule in our account of IZ morphophonemics is given in (35). This rule changes *b* to *u* (which may show up superficially as either *u* or *w*, depending on whether it is followed by a vowel or a consonant). As with the other rules, it applies only in derived environments. It also applies only in stratum *y*. We claim that all *a*-initial roots are inflected for completive aspect in stratum *y*, as well as

the verb 'eat' and the verb 'drink'. This rule applies in the derivation of the completive aspect of these verbs (and other verbs discussed below) but not in the derivation of the completive aspect of *u*-initial verbs.

(35) Vocalization (domain: stratum *y*)

$$b \rightarrow u / C _$$

(36) Example:



This rule is also used for allomorphy following the potential prefix; see 3.3. It applies in the derivation of the following causative form:

(37) $r + u + k + bez\check{a} \rightarrow rukwez\check{a}$ (Hab.-Theme-Cause-wait)

a-Deletion. The sequence *gba*, which occurs when the completive morpheme precedes an *a*-initial root, surfaces as *gu*. If the first syllable of the root carried a laryngeal feature, that feature is retained in the *u*. We account for these facts by a rule deleting *a* (except for the laryngeal features associated with it) when it occurs at the beginning of a root which is preceded by a labial consonant (or the completive aspect, if one prefers to use a morphological environment) and Vocalization (35).

(38) *a-Deletion* (domain: stratum *y*)

$$a \rightarrow \emptyset / [+labial] _$$

(39) Examples: UR $gb + aana$ $gb + aku$

(38) $gb na$ $gb ku$

(35) $guu na$ $gu ku$

SR $guuna$ $guku$

We assume that this rule also applies in the derivation of one causative stem.

(40) $ruut\check{i}$ 'kills' < /r-u- \emptyset -ati/ (Hab.-Theme-Cause-die)

The same rule applies in the derivation of *gudo* (Compl.-eat); we discuss similar facts in 3.3.

Dissimilation. A *u* changes to *i* following a *b*. Then other changes occur which are discussed immediately below.

(41) Dissimilation (domain: stratum *z*)

$$u \rightarrow i / b _$$

(42) Examples: $gb + una \rightarrow gb + ina$ ($\rightarrow b + ina$)

$gb + uuna \rightarrow gb + iina$ ($\rightarrow b + iina$)

The Erasure Convention. Harris (1983) motivates the following convention in Spanish:

- (43) Erasure Convention: Segments not incorporated into syllable structure at the end of a derivation are erased.

We use this convention to account for the loss of the *g* of the prefix /gb-/ in those cases where it cannot be syllabified (either through the lenition or vocalization of *b*). (We also use it to describe other allomorphy below.)

- (44) Examples:

$$\begin{array}{l} \sigma \quad \sigma \\ \uparrow \quad \uparrow \\ gb + una \rightarrow gbina \rightarrow bina \\ gb + eed\check{a} \rightarrow beed\check{a} \end{array}$$

3.2. Regular consonant-initial roots. A wide variety of consonants are found at the beginning of roots. In this section we discuss what is in our analysis the regular set of consonant-initial verbs. All of these verbs inflect for all aspects at stratum *z*.

(45) <i>r-</i>	<i>k-</i>	<i>z-</i>	<i>ka-</i>	<i>wa-</i>	<i>ni-</i>	<i>gb-</i>	
<i>r-yaka</i>	<i>g-yaka</i>	<i>z-yaka</i>	<i>ka-yaka</i>	<i>wa-yaka</i>	<i>ñaka</i>	<i>b-yaka</i>	'enjoy'
<i>r-yuu</i>	<i>g-yuu</i>	<i>z-yuu</i>	<i>ka-yuu</i>	<i>wa-yuu</i>	<i>ñuu</i>	<i>b-yuu</i>	'enter'
<i>ri-wiini</i>	<i>gi-wiini</i>	<i>za-wiini</i>	<i>ka-wiini</i>	<i>wa-wiini</i>	<i>ni-wiini</i>	<i>bi-wiini</i>	'little'
<i>ri-kabī</i>	<i>gi-kabī</i>	<i>za-kabī</i>	<i>ka-kabī</i>	<i>wa-kabī</i>	<i>ni-kabī</i>	<i>bi-kabī</i>	'answer'
<i>ri-dubi</i>	<i>gi-dubi</i>	<i>za-dubi</i>	<i>ka-dubi</i>	<i>wa-dubi</i>	<i>ni-dubi</i>	<i>bi-dubi</i>	'worn out'
<i>ri-lā</i>	<i>gi-lā</i>	<i>za-lā</i>	<i>ka-lā</i>	<i>wa-lā</i>	<i>ni-lā</i>	<i>bi-lā</i>	'push'
<i>ri-niti</i>	<i>gi-niti</i>	<i>za-niti</i>	<i>ka-niti</i>	<i>wa-niti</i>	<i>ni-niti</i>	<i>bi-niti</i>	'lost'
<i>ri-ree</i>	<i>gi-ree</i>	<i>za-ree</i>	<i>ka-ree</i>	<i>wa-ree</i>	<i>ni-ree</i>	<i>bi-ree</i>	'leave'

The Obligatory Contour Principle prohibits the *i* of /ni-/ and the *y* of the *y*-initial roots from remaining contiguous. The Erasure Convention and our assumption about the representation of [ñ] (see 2.3) yield the correct result (by having the *i* delete and the sequence *ny* yield *ñ*).¹⁴

We propose two insertion rules to account for the *a* after /z-/ and the *i* after the prefixes /r-/, /k-/, and /gb-/.

a-Insertion. An *a* is inserted between *z* and a root-initial consonant other than *y*. The fact that the *a* is inserted before a *w*-initial root shows that the insertion rule is not completely phonetically motivated.

¹⁴ The *i* of the causative prefix /si-/ will be lost in similar fashion in forms such as the following:

r + u + si + ya → *rusya* 'make dissolve' (hab.)

(46) *a*-Insertion (domain: stratum *z*) $\emptyset \rightarrow a / z _ C$ Condition: the following consonant is not *y*(47) Example: $z + l\check{a} \rightarrow zal\check{a}$ $z + yuu \nrightarrow *zayuu$

i-Insertion. An *i* is inserted between consonant-final aspect prefixes and consonant-initial roots, except before *y*. This rule feeds Voicing. The rule does not apply in causative formation.¹⁵ The Obligatory Contour Principle can be invoked to account for the fact that no *i* is inserted before *y*.

(48) *i*-Insertion (domain: stratum *z*) $\emptyset \rightarrow i / C _ C$ (49) Examples: $r + l\check{a} \rightarrow ril\check{a}$ $k + kab\check{i} \rightarrow kikab\check{i} \rightarrow gikab\check{i}$ $gb + l\check{a} \rightarrow gbil\check{a} \rightarrow bil\check{a}$

In n. 6 we mentioned a process which optionally deletes word-initial *g* in unstressed syllables. This process applies commonly to the *g* of the potential and completive morphemes. Therefore, the potential form *gikab\check{i}* commonly alternates with *ikab\check{i}*.

3.3. Two exceptional sets of verbs. Besides the regular set of consonant-initial verbs, there are in IZ, as in some other Zapotec languages, the following two sets which are exceptional in specific ways. We label them as set PC (irregularity in potential and completive) and set C (irregularity only in completive).

(50) Set PC:

<i>r-</i>	<i>k-</i>	<i>z-</i>	<i>ka-</i>	<i>wa-</i>	<i>ni-</i>	<i>gb-</i>	
<i>r-yaʔki</i>	<i>čaʔki</i>	<i>z-yaʔki</i>	<i>ka-yaʔki</i>	<i>wa-yaʔki</i>	<i>ñaʔki</i>	<i>gu-yaʔki</i>	'burn'
<i>ri-na</i>	<i>na</i>	<i>za-na</i>	<i>ka-na</i>	<i>wa-na</i>	<i>ni-na</i>	<i>gu-na</i>	'agree to'
<i>ri-žiji</i>	<i>šiji</i>	<i>za-žiji</i>	<i>ka-žiji</i>	<i>wa-žiji</i>	<i>ni-žiji</i>	<i>gu-žiji</i>	'sound'
<i>ri-žana</i>	<i>šana</i>	<i>za-žana</i>	<i>ka-žana</i>	<i>wa-žana</i>	<i>ni-žana</i>	<i>gu-žana</i>	'give birth'
<i>ri-dindě</i>	<i>tindě</i>	<i>za-dindě</i>	<i>ka-dindě</i>	<i>wa-dindě</i>	<i>ni-dindě</i>	<i>gu-dindě</i>	'fight'
<i>ri-gaabi</i>	<i>kaabi</i>	<i>za-gaabi</i>	<i>ka-gaabi</i>	<i>wa-gaabi</i>	<i>ni-gaabi</i>	<i>gu-daabi</i>	'rub'
<i>ri-guza</i>	<i>kuza</i>	<i>za-guza</i>	<i>ka-guza</i>	<i>wa-guza</i>	<i>ni-guza</i>	<i>gu-luza</i>	'break'
<i>ri-gibi</i>	<i>kibi</i>	<i>za-gibi</i>	<i>ka-gibi</i>	<i>wa-gibi</i>	<i>ni-gibi</i>	<i>gu-žibi</i>	'shake'
<i>ri-biji</i>	<i>k-wiji</i>	<i>za-biji</i>	<i>ka-biji</i>	<i>wa-biji</i>	<i>ni-biji</i>	<i>gu-liji</i>	'call'
<i>ri-bi</i>	<i>k-wi</i>	<i>za-bi</i>	<i>ka-bi</i>	<i>wa-bi</i>	<i>ni-bi</i>	<i>gu-ri</i>	'sit'
<i>ri-bee</i>	<i>k-wee</i>	<i>za-bee</i>	<i>ka-bee</i>	<i>wa-bee</i>	<i>ni-bee</i>	<i>gu-lee</i>	'take out'

¹⁵ The *i* is NOT inserted after the causative prefix /*k-*/. Thus *i*-Insertion does not apply to the underlying form /*r-u-k-dindě*/ 'make fight' (Hab.-Theme-Cause-fight). The *k* cannot be incorporated and deletes by the Erasure Convention after causing the following consonant to devoice: *rutindě*.

(51) Set C:

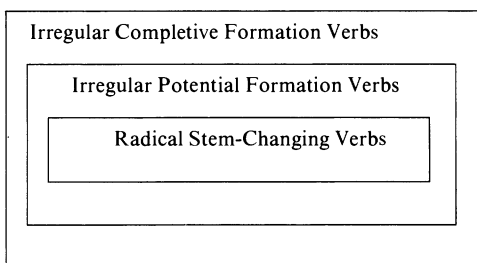
<i>ri-česa</i>	<i>gi-česa</i>	<i>za-česa</i>	<i>ka-česa</i>	<i>wa-česa</i>	<i>ni-česa</i>	<i>gu-česa</i>	'jump'
<i>ri-nă</i>	<i>gi-nă</i>	<i>za-nă</i>	<i>ka-nă</i>	<i>wa-nă</i>	<i>ni-nă</i>	<i>gu-nă</i>	'have sight'
<i>ri-lăa</i>	<i>gi-lăa</i>	<i>za-lăa</i>	<i>ka-lăa</i>	<i>wa-lăa</i>	<i>ni-lăa</i>	<i>gu-lăa</i>	'broken'

Both of the sets of verbs illustrated above differ in only one or two ways from the verbs discussed in 3.2. Both set PC and set C are different in that they have the allomorph [gu-] in the Completive instead of the allomorph [bi-] previously seen. Set PC also displays different allomorphy in the Potential than that of other verbs seen so far.

Many of the verbs in set PC have radical stem alternations. (We would also include the verb 'eat' from 3.1 in this group.) These alternations are a widely attested feature of Zapotecan languages. Speck (1984) derives the initial *g* and *b* by special rules from underlying forms beginning with the consonants which appear in the completive forms. We suggest that similar rules are needed here, although we do not formulate them.

The following Venn diagram summarizes some basic observations regarding the above-mentioned facts:

(52)



The implications are as follows. If a verb is a radical stem-changing verb, then it also is a verb which is irregular in its potential formation. If a verb is irregular in its potential formation, then it also is a verb which is irregular in its completive formation.

To account for these data, we claim that the potential forms of the verbs of set PC and the completive forms of the verbs of sets PC and C are formed at stratum *y*.¹⁶ Therefore, *i*-Insertion (48) cannot apply in the

¹⁶ The theory of lexical phonology makes a claim to which these facts are relevant. As Kiparsky (1982:27) notes, idiosyncratic marking for lexical phonological rules should be concentrated in basic lexical entries. Since the verbs in (50) and (51) are irregular in one or more of three ways (irregular stem changes, stratum for Potential inflection, stratum for Completive inflection), these verbs should be basic verbs. However, this is not entirely clear. Consider the following transitive/intransitive verb pairs:

derivation of these words since *i*-Insertion has only stratum *z* as its domain. The derivations of certain crucial forms are given below (suppressing irrelevant rules):

(53) Stratum *y* (formation of irregular Completive & Potential)

	C-have=sight	P-fight
Input	<i>gb</i> [nə]	<i>k</i> [dindě]
Vocalization (35)	<i>gu</i> [nə]	—

	Transitive		Intransitive	
	(Hab.)	(Compl.)	(Hab.)	
(a) 'sing'	<i>r-uunda</i>	<i>b-iinda</i>	<i>r-yuunda</i>	('sung')
'grab'	<i>r-aša</i>	<i>gu-ša</i>	<i>r-yaaša</i>	('grabbed')
(b) 'rub'	<i>ri-gaabi</i>	<i>gu-daabi</i>	<i>ri-daabi</i>	('rubbed')
'break'	<i>ri-guza</i>	<i>gu-luza</i>	<i>ri-luuzā</i>	('broken')
'shake'	<i>ri-gibi</i>	<i>gu-jiibi</i>	<i>ri-biibi</i>	('shaken')
'take out'	<i>ri-beě</i>	<i>gu-lee</i>	<i>ri-ree</i>	('leave', 'taken out')
'break'	<i>ri-ndaa</i>	<i>gu-ndaa</i>	<i>ri-lāa</i>	('broken')

The transitive verbs in the (b) group are among those which inflect irregularly (for the Completive) and which must be marked for irregular Completive stems or for stratum *y* Completive inflection. The intransitive verbs are regular (except 'broken', which also happens to be a stratum *y* Completive—this is a problem for claiming that only the transitive or the intransitive form is basic). It has been assumed in the past that the transitive verbs of these pairs are the causative forms of the intransitive verbs. Such an analysis would be at variance with the claim of lexical phonology mentioned above. Another point in disfavor of this analysis is that these putative causatives would be irregular in the sense that, unlike most causative verbs, they do not take the theme vowel (see 3.4).

An alternative analysis is to claim that the intransitive verbs above are passive forms. Passive morphology is attested in Zapotec languages (Speck 1984 and Butler 1980). The initial *y* in the first two intransitive verbs could be viewed as the passive morpheme. This analysis fits well with the claims of the theory and also with the generalization that causative verbs generally take the theme vowel, since it would remove a large set of putative counterexamples. This analysis also fits with another observation which can be made regarding derived verbs: laryngealization is generally added in derivation, not lost. (Compare the transitive and intransitive forms of 'shake' above and the causative/non-causative pairs forms in Appendix A.) The following fact is apparently in its disfavor: the irregular stem changes which would be posited between basic verb and passive form, such as *nd* → *l* 'break/broken' above, are also attested in THE OPPOSITE DIRECTION for causative verb formation (*ri-luuba* 'swept' (intro.), *r-u-nduuba* 'sweep' (tr.)). Another fact which should be noted is that the intransitive verb *ri-ree* may be used with the passive sense 'taken out', but it may also mean simply 'leave' in the sense of a volitional action.

Therefore, it is not entirely clear which analysis should be taken regarding the direction of the derivation. Perhaps it will be necessary simply to list both stems in the lexicon, thus treating them both as basic.

Devoicing (14)	—	<i>k</i> [<i>tindě</i>]
(Erasure)	—	<i>tindě</i>
Output		<i>gună</i> <i>tindě</i>

Stratum z (formation of all regular aspect forms)

	P-have=sight
Input	<i>k</i> [<i>nă</i>]
i-Insertion (49)	<i>ki</i> [<i>nă</i>]
Voicing (31)	<i>gină</i>
Output	<i>gină</i>

With *b*-initial stems of these classes, Vocalization (35) applies after Voicing (31) attempts to apply (and does not because these are obstruent-initial roots). The application of Vocalization allows the velar stop of the potential morpheme to be incorporated into the syllable and not to be lost by the Erasure Convention.

$$(54) \quad k + bi \rightarrow k \begin{array}{c} \sigma \\ \wedge \\ w i \end{array}$$

Causative verbs which use the /k-/ allomorph of the causative prefix also show the effect of devoicing as set PC verbs do.

$$(55) \quad r + u + k + \textit{dindě} \rightarrow \textit{rutindě} \text{ (Hab.-Theme-Cause-fight)}$$

Set PC roots beginning with *y* undergo Palatalization, also a stratum *y* rule. The rule is given informally in (56).

(56) Palatalization (domain: stratum *y*)

$$k + y \implies \check{c}$$

(57) Example: $k + ya^?ki \rightarrow \check{c}a^?ki$

3.4. Verbs with the theme vowel /u-/. The majority of IZ causative verbs (and a few others) are conjugated with the vowel *u* intervening between the aspect prefix and the root. We suggest that this vowel should be considered a theme vowel and that it is inserted as part of the regular causative formation rule.¹⁷

¹⁷ The idea of a theme vowel is suggested for Zapotec in unpublished work by W. Kreikebaum and D. Tuggy (Kreikebaum 1983).

- (58) *r-u-k-weezǎ g-u-k-weezǎ z-u-k-weezǎ k-u-k-weezǎ wa-k-weezǎ*
r-u-si-dubi g-u-si-dubi z-u-si-dubi k-u-si-dubi wa-si-dubi
n-u-k-weezǎ b-i-k-weezǎ 'make wait'
n-u-si-dubi b-i-si-dubi 'wear out'

The few verbs which are not causative verbs (with known non-causative counterparts) but which take this theme vowel must be idiosyncratically marked to be ill-formed if they are inflected without the theme vowel. Some examples:

- (59)
- | | | | | | | | |
|------------------|------------------|------------------|------------------|-----------------|------------------|------------------|---------|
| <i>r-u-dii</i> | <i>g-u-dii</i> | <i>z-u-dii</i> | <i>k-u-dii</i> | <i>wa-dii</i> | <i>n-u-dii</i> | <i>b-i-dii</i> | 'give' |
| <i>r-u-yǎa</i> | <i>g-u-yǎa</i> | <i>z-u-yǎa</i> | <i>k-u-yǎa</i> | <i>wa-yǎa</i> | <i>n-u-yǎa</i> | <i>b-i-yǎa</i> | 'dance' |
| <i>r-u-zellé</i> | <i>g-u-zellé</i> | <i>z-u-zellé</i> | <i>k-u-zellé</i> | <i>wa-zellé</i> | <i>n-u-zellé</i> | <i>b-i-zellé</i> | 'belch' |

This *u* changes to *i* by the same dissimilation rule (41) that affects root-initial *u*.

- (60) Examples: $gb + u + dii \rightarrow gbidii \rightarrow bidii$
 $gb + u + yǎa \rightarrow gbiyǎa \rightarrow biyǎa$

Notice that Dissimilation applies even though it produces a violation of the Obligatory Contour Principle.

This pretonic vowel *u* creates problems for the three aspect prefixes which have vowels, since they cannot be syllabified straightforwardly. Recall that branching rhymes are allowed only in stressed syllables in IZ, and that every word-internal syllable must have an onset. Syllabification gives the following intermediate representations:

- (61a)
- | | | | |
|----------|-------|----------|-------------------------|
| σ | | σ | |
| \wedge | | \wedge | |
| ka | + u + | dii | ($\rightarrow kudii$) |

- (61b)
- | | | | |
|----------|-------|----------|-------------------------|
| σ | | σ | |
| \wedge | | \wedge | |
| wa | + u + | dii | ($\rightarrow wadii$) |

- (61c)
- | | | | |
|----------|-------|----------|-------------------------|
| σ | | σ | |
| \wedge | | \wedge | |
| C | | V | |
| \wedge | | | |
| ni | + u + | dii | ($\rightarrow nudii$) |

Given the constraints mentioned in 2, (61a) and (61b) cannot surface as such. (61c) does not violate any constraint, but it is not the desired output.

Example (61c) suggests that the following rule is necessary in stratum z.

(62) Vowel Deletion (domain: stratum z)

$$\begin{bmatrix} +\text{son} \\ -\text{cns} \end{bmatrix} \rightarrow \emptyset / _ \begin{bmatrix} +\text{son} \\ -\text{cns} \end{bmatrix}$$

This rule correctly deletes the *i* of *ni* in (61*c*) and also the *a* of *ka* in (61*a*). The Obligatory Contour Principle can be invoked for its non-application to (61*b*) since the illicit sequence *wu* would result. Then since the *u* is not syllabified, it is deleted by the Erasure Convention.

3.5. Rule summary. The rules in (63) have been discussed above. They apply in the order shown. Crucial orderings are indicated.

We have claimed that stratum *y* is the level at which causative stems are formed (see Appendix A) as well as where irregular inflection is performed. Stratum *z* is the level at which regular inflection is done. Both are cyclic strata.

(63)	Stratum <i>y</i>	Stratum <i>z</i>
<i>a</i> -Insertion (46)		X
<i>i</i> -Insertion (48)		X
<i>a</i> -Deletion (38)	X	
Vocalization (35)	X	
Dissimilation (41)		X
Palatalization (56)	X	
Voicing (31)	X	X
<i>y</i> -Insertion (33)		X
Vowel Deletion (62)		X
Devoicing (14)	X	X

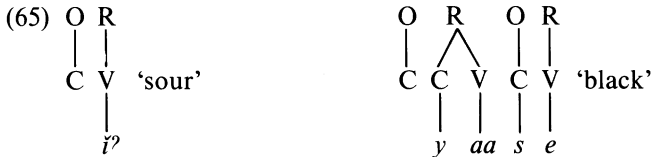
3.6. Three special verbs. The following verbs appear to be exceptional in several ways.

(64)	<i>ri-ĩʔ</i>	<i>gi-ĩʔ</i>	<i>za-ĩʔ</i>	<i>ka-ĩʔ</i>	<i>wa-ĩʔ</i>	<i>ni-ĩʔ</i>	<i>bi-ĩʔ</i>	'sour'
	<i>ri-yaase</i>	<i>gi-yaase</i>	<i>za-yaase</i>	<i>ka-yaase</i>	<i>wa-yaase</i>	<i>ni-yaase</i>	<i>bi-yaase</i>	'black'

The allomorphy which occurs with the verb 'sour' is exactly that which occurs with regular consonant-initial roots, although it does not begin with a consonant. The epenthetic vowels *i* and *a* occur after the appropriate prefixes. There is no gliding of the *i* of /ni-/. There is no epenthetic *y* after /ka-/ and /wa-/. These forms also appear to be exceptional in that they have word-internal syllables without onsets. If this were an *i*-initial root, it would be the only one attested in the language. Finally, the causative form is (cited in the habitual aspect) *rusiĩʔ*. The allomorph /si-/ of the causative commonly occurs with consonant-initial roots but not with vowel-initial roots.

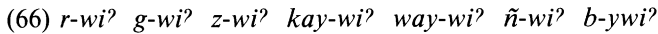
The allomorphy which occurs with the verb 'black' is exactly that which occurs with regular obstruent-initial roots, although it begins with *y*. Epenthetic *i* and *a* do not occur with other *y*-initial verbs (see 3.2). The forms with epenthetic *i* are unusual since IZ enforces the Obligatory Contour Principle (20). The causative form is *r-u-si-yaase*; the causative allomorph *si-* is expected before obstruent-initial roots but not before *y*-initial roots.

We propose an analysis here in which these exceptional characteristics are accounted for by one device: the verbs 'sour' and 'black' have an empty root-initial consonant position. (A similar analysis has been proposed for larger classes of verbs in other languages, such as Seri [Marlett and Stemberger 1983].) The proposed underlying forms of these verbs are as follows:



Given these representations, the various superficial properties are accounted for without resort to other devices.

Another verb which is superficially irregular is the verb which occurs in the expression */-wi[?] dii[?]ja* ('word')/ 'chat'.



The allomorphy which occurs with this verb is exactly that which occurs with vowel-initial roots, not that with *w*-initial roots. But if it had an underlying form */-ui[?]/*, it would be unique in that it has a vowel cluster. And phonetically the stem begins with a glide (and in the completive stem with two glides—the completive form is monosyllabic). We propose that the underlying forms of this verb are as shown in (67).



Therefore, *i*-Insertion (48) and *a*-Insertion (46) will not apply in the derivation of any aspect of this verb, since it does not begin with *w*, and *y*-Insertion (33) will apply since it does begin with a vowel, and the prefix */ni-/* will surface as [ñ-] as it does before vowel-initial roots. (But this verb stands as an exception to our generalization in (52) since it does not

inflect for completive at stratum *y*, although it does have an irregular completive stem.)

Such examples provide additional evidence for the claim that the CV skeleton and syllable structure are both necessary (see Mohanan 1985).

4. Conclusion. In this paper we have presented a new analysis of IZ syllable structure, one that makes several improvements over previous analyses and that reflects our most current knowledge of IZ. Among other things, we argued that what are perceived as prevocalic glides in IZ are sometimes in an onset position and sometimes in a rhyme position. We also presented a new analysis of the verb aspect morphology. The rules posited were seen to be motivated in large part by the constraints imposed by the syllable structure of IZ. Some rules applied only at certain levels of the phonology. We claimed that for some verbs the completive and potential aspect prefixes are added at an earlier stratum than for most verbs. Various facts were cited in support of the operation of the Obligatory Contour Principle in IZ.

The facts in this paper may be compared with those of Speck (1984). We make note here of certain important points of comparison. First, the Zapotec languages differ in their syllable structures. Some are highly restrictive, whereas others allow a much broader inventory of syllable types. The rule of *i*-Insertion discussed above has an analogue in languages of the first type but not in those of the second. Second, some Zapotec languages have the theme vowel discussed above, whereas others (including Texmelucan Zapotec) do not. Third, most (if not all) Zapotec languages preserve to some degree the radical stem changes in the completive aspect of certain verbs. Fourth, most (if not all) Zapotec languages preserve some form of the Dissimilation rule. Fifth, most (if not all) Zapotec languages preserve some form of the *a*-Deletion and Vocalization rules. Detailed analyses of other languages of the large Zapotec family will enable us to make reasonably good hypotheses about the phonology of Proto-Zapotec.

APPENDIX A

CAUSATIVE MORPHOLOGY IN ISTHMUS ZAPOTEC

At least four causative prefixes (or suppletive allomorphs of the causative prefix) must be recognized: /k-/, /si-/, /z-/, and / \emptyset -/. Some verbs have doubly marked causative forms without having singly marked

causative forms. Doubly marked causatives usually involve the sequence /si-k-/, but one involves the sequence /si-si-/. Many verbs are also changed with respect to laryngeal features of the stressed vowel when causativized. Some verbs use a special stem allomorph in causative forms; this stem is sometimes akin to the special allomorph used in the completive form of the noncausative verb.

Verb roots which begin with *y* sometimes drop the *y* in the causative stem. We do not know of any way to predict which stems do this and which do not, although a minor observation is that following the /z-/ allomorph, the *y* is always lost.

A few causative verbs irregularly do not use the theme vowel /u-/. All of these verbs take the zero allomorph of the causative prefix.

For some of the causative forms below we give the underlying form between diagonal bars.

Forms with /k-/:

With voicing of *k* (common pattern)

-aze	'bathe oneself'	-u-g-aze	'bathe (tr.)' /-u-k-aze/
-waʔ	'carry'	-u-g-waʔ	'make carry' /-u-k-waʔ/

With lenition of *b*

-bezǎ	'wait'	-u-k-weezǎ	'make wait' /-u-k-bezǎ/
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With palatalization of *k*

-yača	'spattered'	-u-č-yača	'spatter' /-u-k-yača/
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With loss of *y* (and voicing or palatalization)

-yuuda	'braided'	-u-g-uuda	'braid' /-u-k-yuuda/
-yaazi	'submerged'	-u-č-aazi	'submerge' /-u-k-yaazi/

With fortition of following obstruent and loss of *k* (very common pattern)

-dallě	'increase'	-u-tallě	'make increase' /-u-k-dalle/
-giiči	'pressed'	-u-kiiči	'press' /-u-k-giiči/
-za	'walk'	-u-sa	'make walk' /-u-k-za/

With irregular stem change

-ačě	'snap'	-g-ičě	'make snap'
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Forms with /si-/:

Simple (most common pattern)

-ati nisa	'thirsty'	-u-sy-ati nisa	'make thirsty'
-bě	'narrow'	-u-si-běʔ	'make narrow'
-dubi	'worn out'	-u-si-dubi	'wear out'
-ganí	'quiet'	-u-si-ganí	'make quiet'
-u-zellé	'belch'	-u-si-zellé	'make belch'
-lase	'thin'	-u-si-lase	'make thin'
-ndáʔ	'hot'	-u-si-ndáʔ	'heat'
-winní	'appear'	-u-si-winní	'show'
-yanda	'cold'	-u-s-yanda	'make cold'

With loss of *y*

-yaba	'fall'	-u-s-aba	'let fall, make fall'
-yeegu	'close (mid.)'	-u-s-eegu	'close'

Forms with / \emptyset -/:

Simple (fairly common pattern)

-ati	'die'	-uu-tí	'kill' /-u- \emptyset -ati/
-dye-	'pressed'	-u-dye	'press'
-ga	'be cut'	-u-ga	'cut'
-za	'strung'	-u-zaa	'string'
-laǰí	'inserted'	-u-laǰi	'insert'
-neʔ	'stained'	-u-neʔ	'stain'
-jela	'found'	-u-jela	'find'

With irregular stem change (some fairly common patterns)

-bya	'come apart'	-u-čya	'take apart'
-byáa	'extended'	-u-čyáa	'extend'
-liuba	'swept'	-u-nduuba	'sweep'
-ruugu	'be cut'	-u-čuugu	'cut'
-yaʔ	'constructed'	-u-zaʔ	'construct'
-ruužě	'cut up'	-u-žuuzě	'cut up'

Forms with /si-k-/:

-uunda	'sing'	-u-si-g-uunda	'make sing' /-u-si-k-uunda/
-aʔde	'receive gift'	-u-si-g-aʔde	'give gift' /-u-si-k-aʔde/
-žuuna	'defecate'	-u-si-žuuna	'make defecate' /-u-si-k-žuuna/

Form with /si-si-/:

-asi	'sleep'	-u-si-sy-aasi	'make sleep, let sleep'
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Forms with /z-/: (always with loss of *y*)

-yaande	'cooked (corn)'	-u-z-aande	'cook (corn)'
-yeeču	'folded'	-u-z-eeču	'fold'
-yeeke	'move'	-u-z-eeke	'move'

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