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QUIOTEPEC CHINANTEC SYLLABLE PATTERNING

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1. This paper is a description of the patterns by which syllables of Quiotepec Chinantec (hereafter usually referred to as Chinantec) are formed and by which they participate in the phonological word.[1]

Quiotepec Chinantec is the dialect spoken in San Juan Quiotepec, district of Ixtlán, Oaxaca, Mexico. Quiotepec is located approximately fifty air miles north of the city of Oaxaca. I estimate roughly the number of speakers of this dialect as 3,000, some of whom now reside in a lowland area near Valle Nacional, Oaxaca.

The linguistic affiliation of Chinantec has not been verified. Mason (1940),[2] followed by McQuown (1955) and Trager and Harben (1958), considers it a separate stock or division of Macro-Otomanguean. More recently it has been suggested by Fernández de Miranda et al. (1959) that Chinantec be treated as a division of the proposed Oto-Zapotecan or Oto-Huave phylum along with Mixtecan, Popolocan, and Chatino-Zapotecan on the one hand and Oto-Pamean on the other. See also Swadesh (1960).

No previous description of Quiotepec Chinantec has come to my attention. Weitlaner (1947) reported the phonemes of the Chiltepec dialect, and descriptions of the phonemes of other dialects are in progress.[3]

The Quiotepec dialect is one of a group of Highland Dialects that are all more or less mutually intelligible and thus comprise a single L-simplex (Hockett 1958, 323 f.). Other dialects on which data are available appear to be members of separate L-complexes. There is a strong likelihood that further investigation will show at least two more L-complexes within the so-called Chinantec language. This means that Chinantec

[1] Field work under the auspices of the Summer Institute of Linguistics, between 1951 and 1958, provided the data. This paper was adapted for publication from a thesis of the same title presented to the graduate faculty of Cornell University in partial fulfillment of the requirements for the degree of Master of Arts. I am indebted to Kenneth L. Pike for help in the analysis and to Charles F. Hockett, who guided the writing of the thesis.

[2] The bibliographical references for this paper are: M. T. Fernandez de Miranda, M. Swadesh, and R. W. Weitlaner. Some Findings on Oaxaca Language Classification and Cultural Terms, IJAL 25. 54–58 (1959). Joseph E. Grimes, Huichol Tone and Intonation, IJAL 25. 221–32 (1959). J. Alden Mason, Native Languages of Middle America, in The Maya and Their Neighbors, New York (1940). Charles F. Hockett, A Manual of Phonology, Indiana University Publications in Anthropology and Linguistics, Memoir 11, Baltimore (1955), A Course in Modern Linguistics, New York (1958). Norman A. McQuown, Indigenous Languages of Native America, AA 57.501–570 (1955). Kenneth L. Pike, Language in Relation to a Unified Theory of the Structure of Human Behavior, Part II, Glendale (1955). R. H. Stetson, Motor Phonetics, A Study of Speech Movements in Action, Second Edition, Amsterdam (1951). Morris Swadesh, The Oto-Manguean Hypothesis and Macro Mixtecan, IJAL 26.79–111 (1960). George L. Trager and Felicia E. Harben, North American Indian Languages: Classification and Maps, SIL Occasional Papers 5 (1958). Robert J. Weitlaner, The Phonemic System of Chinantec, Dialect of Chiltepec, Oaxaca, Memoirs XXVIo Congreso Internacional de Americanistas, Primera Sesión: 313–321, Mexico (1947).

[3] Linguistic work by members of the Summer Institute of Linguistics is in progress in the Ojitlán, Palantla, Lalana, and Usila dialects.

probably comprises at least six separate L-complexes.

2. A Chinantec utterance consists of one or more phonological WORDS. Evidence suggests the existence of a phonologically relevant PHRASE, with peak and border features, smaller than the utterance and larger than the word. The phonological word, however, is the largest unit within the scope of this paper. In our notation, words are separated by space: /ʔi̱h^{1}+na̱^{3} höh^{42} kǫh^{42}+o^{1}−ʔh^{31}/ *I want to see our (excl.) corncake dough.*

A (phonological) word consists of WORD JUNCTURE plus one or more SYLLABLES. In our notation, syllables within a word are separated by +: /höh^{42}/ *I see,* /ʔi̱h^{1}+na̱^{3}/ *I want,* /kǫh^{42}+o^{1}−ʔh^{31}/ *our (excl.) corncake dough.*

There are two types of syllables, NORMAL and EXTENDED.

A normal syllable consists of a TONE PATTERN and a REMAINDER, preceded by SYLLABLE JUNCTURE unless the syllable is first in the word: /ʔi̱h^{1}/, /na̱^{3}/, /höh^{42}/, /kǫh^{42}/.

A remainder consists of a PEAK, or of a peak preceded by an ONSET. In /ʔi̱h/, /na̱/, /höh/, /kǫh/, the onsets are, respectively, /ʔ/, /n/, /h/, /k/.

A peak consists of a vowel NUCLEUS, with or without a following PEAK SATELLITE. In /a̱/, /o/, there are no satellites; in /i̱h/, /öh/, /ǫh/, /iuih?/, the satellites are /h/ and /h?/.

A nucleus consists of a vowel pattern of one to three vowels, with or without NASALIZATION: /i̱/, /a̱/, /ö/, /ǫ/ from the illustration above; /ia/ in /dʸia^{2}/ *seven*; /iui/ in /siuih?^{14}/ *diarrhea.*

An extended syllable consists of a KERNEL and an EXTENSION. The structure of kernels is like that of a (whole) normal syllable (tone pattern plus remainder, and so on), although some specific arrangements of material in normal syllables do not occur in kernels. An extension consists of EXTENSION JUNCTURE and a tone pattern, with or without a peak satellite. Phonetically there is also a peak, but its quality is completely determined by the peak of the preceding kernel. In our notation, extended syllables appear with a dash, which represents the location of the vocalic or syllabic part of the extension: /o^{1}−ʔh^{31}/. The tone-marks before the dash indicate the location of the extension juncture.

The word /kǫh^{42}+o^{1}−ʔh^{31}/ thus consists of two syllables, normal /kǫh^{42}/ and extended /o^{1}−ʔh^{31}/. The extended syllable /o^{1}−ʔh^{31}/ consists of kernel /o^{1}/ and extension /−ʔh^{31}/. The kernel /o^{1}/ consists of tone pattern /1/ and remainder /o/ plus the preceding syllable juncture. The remainder /o/ consists of a peak with no onset; and the peak consists of a vowel nucleus with no peak satellite. The extension /−ʔh^{31}/ consists of the extension juncture, the tone pattern /31/, and peak satellite /ʔh/.

Word juncture (including stress) is a phonemic constituent of the word, syllable juncture a constituent of the syllable, and extension juncture a constituent of the extension; they are phonemic but are not phonemes (see Pike 1955, 63–6).

We assume that the structure of every word conforms to the general description given above. There are, however, doubtful cases where it has not been possible to be sure of the structure. References to impossibility in determining borders and in distinguishing extended syllables from two-syllable words (**3.11**) are allusions to the writer's uncertainty in such cases.

2.1. For the description of permitted arrangements in the word, syllables are classed as MAIN (M), with both onset and peak, and AUXILIARY (A), with no onset. Auxiliary syllables are A_1(/u̱/, /i̱/, /a/, /oi?/) and A_2(/i/; /o/, /u/, /u̱/ with or without peak satellite; /o/ may also occur with an extension). It is worthy of note in passing that A_2's occur only as or in inflectional affixes.

Every word contains at least one M syl-

lable. The first M may be preceded by an A_1. An A_2 may follow the last M. An extended syllable, whether an M or an A_2, may occur only as the final syllable in a word. The syllable constituents of the word may thus be diagrammed:

$$\pm A_1 + M\ (\pm M \ldots) \pm A_2.$$

± means optional occurrence and + obligatory occurrence.

M	/ñį³/	*salt*
A_1 M	/ų⁴+nį³/	*eye*
M A_2	/nįh⁴+oh¹²/	*yes, I'm going*
M M	/ʔi⁴+ñįʔ¹/	*bread*
A_1 $M_{extended}$	/ų⁴+nįh³¹−ʔh³¹/	*our (excl.) eyes*

Word juncture contrasts with syllable juncture within a word: /ʔi⁴+ñįʔ¹/ *bread* vs. /ʔi² nąh²/ *yellow corncake* and /kǫh³² ų¹+ʔö¹/ *one tamale* vs. /ʔįh¹+ųh³¹/ *you want.*

2.2. The differences between the normal syllable and the extended syllable require that they be treated separately. The constituents of the normal syllable are presented first. The extended syllable is then described with special attention to the extension which is the part that makes the extended syllable different from the normal syllable.

2.21. The tone pattern of the normal syllable is simultaneous with the remainder. The tone pattern goes with the remainder as a whole, including both onset and peak.

An onset is either SIMPLE or COMPLEX. A simple onset consists of any of the twenty-three consonant phonemes listed below. A complex onset is one of the following consonant combinations: /kw/; /ts/; /ʔ/ or /h/ followed by any nasal, /l/, or /g/; /ʔ/ followed by /w/ or /y/.

The phonological constituents of the consonants other than the LARYNGEALS (/h/, /ʔ/) are LABIAL, DENTAL, PALATAL, and VELAR positions of articulation; STOP, SPIRANT, NASAL, LATERAL, and TRILL manners of articulation, with voicing contrast for stops and spirants:

		Labial	Dental	Palatal	Velar
Stop	Vl.	p	t	t^y	k
	Vd.	b	d	d^y	g
Spirant	Vl.	f	s	x	
	Vd.	w^4	ð	y	ɣ
Nasal		m	n	ñ	ŋ
Lateral			l		
Trill			r		

Laryngeals—ʔ, h

The following examples show each of the 38 possible onsets to be distinctive: /poʔ⁴/ *ball*, /buʔ⁴/ *donkey*; /pa¹/ *bunch*, /bǫ³/ *chubby*; /tu²¹/ *chicken*, /du³/ *Anthony*; /tü²/ *rifle*; /tʸü³/ *thigh*; /ɣoʔ² tʸa¹/ *suddenly*, /dʸa²¹/ *ten*; /tʸiah¹/ *yesterday*, /dʸiah²/ *twenty*; /koh³/ *I burn*, /goh⁴−²/ *my town*; /kuh³/ *money*, /guʔh¹³/ *I will drink*; /kwoh³²/ *hand*, /ʔgo⁴−ʔh³/ *I'm afraid*; /kwuh³¹³/ *firewood*, /gaih³²/ *three* (*animate*); /fu³/ *powder*, /wu¹/ *black widow spider*; /fihʔ¹/ *blackberry*, /wihʔ⁴/ *fish scales*; /soh³/ *incline*, /ðo³/ *there*; /xühʔ¹³/ *armadillo*, /yühʔ¹³/ *old*; /xa²/ *cliff*, /ya⁴/ *Mary*, /ʔya³¹/ *fence*; /mį³¹/ *little girl* (address), /hmį³/ *skunk*; /mǫh¹/ *bone*, /hmǫh⁴/ *root*, /ʔmǫh³/ *a cold*; /nǔ²/ *soap*, /ʔnǔ²¹/ *thou*; /nįh⁴³/ *I go*, /hnįh¹²/ *cloud*; /nųh⁴³/ *I listen*; /hgoh¹ tǫ³/ *arrive back*; /nų²/ *meat*, /hŋǫ⁴−ʔh³/ *I kill*; /ñǔ²¹/ *nine*, /hñǔ²¹/ *hair*, /ʔñǔ²¹/ *kind of fish*; /la³¹/ *trap*, /ʔla³/ *dirty*; /loh³²/ *skin*, /hlaʔ²/ *cheap*; /roh³²/ *tobacco*; /tsüh³/ *jar*; /ʔwiʔ¹/ *black*; /hu⁴/ *mosquito*, /ʔu²/ *mirror*; /ų⁴+ñį³/ *food*, /huh³+ñįʔ¹/ *Spanish* (*lang.*), /ʔi⁴+ñįʔ¹/ bread.

A peak satellite consists of /h/, /ʔ/, or some cluster of these two (**4.2**). It is convenient in stating the distribution of tone patterns to classify normal syllables by their peak satellites. A SHORT FREE syllable has no peak satellite; a LONG FREE syllable has /h/; a SHORT CHECKED syllable, /ʔ/; a LONG CHECKED, /hʔ/; an INTERRUPTED SYLLABLE,

[4] The choice of symbols w and y reflects phonetic differences between these two vocoid spirants and the velar ones (**3.21**).

/ʔh/; and an INTERRUPTED CHECKED syllable, /ʔhʔ/: short free—/kwo^{21}/ *creek*; long free—/kwoh^{32}/ *hand*; short checked—/kwoʔ^{1}/ *church*; long checked—/kwohʔ^{13}/ *dirt*; interrupted—/kǫʔh^{1}/ *thy corncake dough*; interrupted checked—/huʔhʔ^{13}/ *our* (*incl.*) *cheeks*.

Any of the eight vowels, listed below, by itself constitutes a simple nucleus. /u/, /a/, or /e/ preceded by /i/; any vowel but /ü/ or /i/ followed by /i/; or (rarely) /u/, /o/, or /e/ preceded and followed by /i/ constitutes a complex nucleus. A sequence of vowels which in slow speech is interrupted by word or syllable juncture is sometimes spoken in fast speech as a complex vowel nucleus. The resulting nucleus, a part of the first word or syllable in the sequence, does not necessarily have /i/ as one of its vowels:

slow: /lih^{1} tsa^{4} ụ^{4}+ŋi̯h^{3}+o^{1}—ʔh^{31}/ *we* (*excl.*) *can go ask*

fast: /lih^{1} tsạụh^{4} ŋi̯h^{3}+o^{1}—ʔh^{31}/

slow: /lih^{1} tsah^{31}+o^{1}—ʔh^{31}/ *yes, we* (*excl.*) *can go*;

fast: /lih^{1} tsaoh^{31}—ʔh^{31}/.

Though /a/ and /o/ have never been observed separated by syllable juncture in /ʔyiaoh^{343} sah^{43}/ *mother-in-law* and /tsaoh^{21} fahʔ^{21}/ *deaf-mute*, they are assumed on morphological evidence, to be in one syllable as 'fast speech' forms, and thus to belong here.

Complex peaks with two vowels may be short or long. Complex peaks with three vowels are always long (i.e. always have peak satellite /h/).

Chinantec vowels form a symmetrical three dimensional system with phonological constituents FRONT and BACK, HIGH and LOW, ROUNDED and UNROUNDED:

	Front		Back	
	Rounded	Unrounded	Rounded	Unrounded
High	ü	i	u	ï
Low	ö	e	o	a

Examples of each vowel and of complex nuclei, with and without peak satellite /h/, follow: /ʔih^{343}/ *corncake* (*stative*), /tih^{32}/ *thin*; /ʔuh^{343}/ *mirror* (*stative*), /tuh^{32}/ *tube*; /ʔih^{313}/ *hammock*, /tïh^{32}/ *leg*; /ʔoh^{3}/ *mouth*, /toh^{32}/ *hole*; /ʔöh^{43}/ *my chicken*; /ʔah^{31}+mǫʔh^{31}/ *hello*, /tah^{32}/ *white*; /ʔeh^{43}/ *I teach*, /teh^{43}/ *I call* (*summon*); /tüh^{2}/ *blind*; /fu^{3}/ *powder*, /fuh^{3}/ *poor*; /to^{21}/ *bamboo*, /toh^{2}/ *brains*; /sï^{21}/ *glass*, /sïh^{3}/ *small poles*; /pa^{1}/ *bunch*, /pah^{423}/ *my bunch*; /tü^{2}/ *rifle*, /tüh^{2}/ *blind*; /he^{1}/ *spider*, /heh^{43}/ *I pant*; /tsa^{2}+lö^{2}/ *knock on*, /ʔöh^{43}/ *my chicken*; /ñi̯^{3}/ *salt*, /ñi̯h^{423}/ *my salt*; /dʸa^{21}/ *ten*; /dʸia^{2}/ *seven*, /dʸiah^{2}/ *twenty*; /gai^{12}/ *two* (*animate*), /gaih^{32}/ *three* (*animate*); /ʔya^{21}/ *fence*, /ʔyah^{423}/ *I puncture*; /ʔyia^{12}/ *day after tomorrow*, /ʔyiah^{32}/ *sunshine*; /siuihʔ^{14}/ *diarrhea*.

After a nasal consonant there is no nasal–non-nasal contrast; all peak nuclei after nasals are nasalized. /ö/, a rare vowel, has not been observed with nasalization. Nasalization is a constituent of the peak nucleus, not of the separate vowels: /huh^{4}/ *word*, /hụh^{4}/ *I burn*; /sïhʔ^{32}/ *moon*, /sï̯hʔ^{32}/ *wrinkle*; /ho^{1}/ *negative*, /hǫ^{1}/ *foam*; /tʸü^{3}/ *thigh*, /tʸü̯^{21}/ *four*; /ʔi^{2}/ *corncake*, /ʔi̯h^{4}/ *who*; /sahʔ^{32}/ *crab*, /sạʔ^{3}/ *take hold of*; /fehʔ^{1}/ *big* /sẹh^{3}+mǫh^{3}/ *there are . . .* (*animate*); /ʔöh^{43}/ *my chicken*; /taih^{313}/ *difficult*, /nǫ^{3} tại̯h^{3}/ *there he is*; /tʸiah^{313}/ *ixtle*, /nẹ^{4}+tʸi̯ạ^{423}/ *I'll go get. . . .*

A tone pattern in a normal syllable contains from one to three TONE PHONEMES (TONES). There are four tones in Chinantec. In our notation they are indicated by superscript numbers following the syllable of which they are a part, from ^{1}(low) to ^{4}(high).

The permitted tone patterns and their distributions in syllable types are shown by the following table:[5]

[5] Further work on the grammar is expected to reveal some additional two and three-tone patterns. This table does not provide for all of the tone patterns in forms sometimes spoken as normal syllables in fast speech but normally spoken as extended syllables.

short free	long free	short checked	long checked	inter-rupted	inter-rupted checked
1	1	1	1	1	
2	2	2		2	
3	3			3	
4	4	4	4	4	
12	12				
		13	13	13	13
	14				
21			21	21	
	32		32	32	
31				31	
				41	
43	43			43	
	313		313		
	343				
	423				

Various limitations on co-occurrence of tone patterns with specific types of syllables are seen from the table. The permitted co-occurrences are summarized with examples in the following paragraphs:

A short, long, or interrupted syllable occurs with any one-tone pattern: /ñį^{1}/ *thread*, /ñį^{2}/ *pig*, /ñį^{3}/ *salt*, /ñį^{4}/ *iron*, /mǫh^{1}/ *bone*, /nąh^{2}/ *yellow*, /nąh^{3}/ *Ignacio*, /mih^{4}/ *valley*, /toh^{1}/ *grinding stone*, /toh^{2}/ *brains*, /huh^{3}/ *Julius*, /huh^{4}/ *word*, /t^{y}i?h^{1}/ *your*, /hla?h^{2}/ *I loosen*, /t^{y}ü?h^{3}/ *I cut*, /hu?h^{4}/ *my cheek*.

Long checked syllables occur with one-tone patterns /1/ and /4/ only; short checked with /1/, /2/, /4/ only: /tuh?^{1}/ *vulture*, /toh?^{4}/ *a drop* (*of liquid*); /ku?^{1}/ *pain*, /hu?^{2}/ *cheek*, /hu?^{4}/ *pineapple*.

Interrupted checked syllables do not occur with a one-tone pattern.

Two-tone patterns occur in both short and long syllables. Three-tone patterns are limited to long syllables. Eight of the 12 theoretically possible two-tone patterns occur. Of the 36 theoretically possible three-tone patterns, only 3 have been observed. Long syllables occur with 7 of the 11 patterns of more than one tone; each of the remaining syllable types with less than 7. Rising two-tone patterns have initial tone /1/:

Short free syllables: /gai^{12}/ *two* (*animate*), /hñį^{21}/ *veins*, /ŋį^{31}/ *vegetable pear*, /ñį^{43}/ *his salt*.

Long free syllables: /loh^{14}/ *nopal*, /tǫh^{12}/ *thorns*, /toh^{32}/ *hole*, /toh^{43}/ *my banana*, /teh^{313}/ *frog*, /sih^{343}/ *I shave*, /tǫh^{423}/ *my bird*.

Long checked syllables: /toh?^{13}/ *sand*, /tüh?^{21}/ *breast*, /toh?^{32}/ *charcoal*, /fih?^{313}/ *image*.

Interrupted syllables: /kwo?h^{13}/ *church* (*stative*), /hla?h^{21}/ *he loosens*, /lo?h^{31}/ *you will buy*, /fi?h^{32}/ *milk* (*stative*), /lo?h^{41}/ *buy* (*imperative*), /hu?h^{43}/ *pineapple* (*stative*).

Interrupted checked syllables: /ho?h^{13}/ *our* (*incl.*) *fists*.

2.22. Every peak satellite that occurs in the extension of extended syllables, except one, occurs also in normal syllables. The exception is an extension-initial satellite /?/, as in /hï^{1}?$-^{1}$/ *thy fire*, that occurs only in slow speech.

The arrangements of peak satellites in kernels and extensions are as follows: V$-$?h /kwo$^{1}-$?h^{1}/ *thy hand*; Vh$-$ /kuh$^{2}-^{1}$/ *thy money*; Vh$-$? /kuh$^{1}-$?^{1}/ *your money*; Vh$-$?h /kuh$^{31}-$?h^{31}/ *our* (*excl.*) *money*; V?$-$ /hï^{1}?$-^{1}$/ *thy fire* (*slow speech*) (cf., in normal speech, /hï?h^{1}/); V?$-$? /ho?$^{1}-$?^{3}/ *our* (*incl.*) *fists* (*slow speech*) (cf., in normal speech, /ho?h?^{13}/); V?$-$?h /ho?$^{1}-$?h^{31}/ *our* (*excl.*) *fists*; Vh?$-$ /kwoh^{1}?$-^{1}$/ *thy hand* (*slow speech*).

Syllable juncture contrasts with extension juncture: /kwo$^{1}-$?h^{1}/ *thy hand* vs. /kwo$^{1}+$o?h^{1}/ THY *hand*, /mǫh$^{1}-$?h^{31}/ *thy bone* vs. /mǫh$^{1}+$o?h^{31}/ THY *bone*, /kuh$^{31}-$?h^{31}/ *thy money* vs. /kuh$^{31}+$o?h^{31}/ THY *money*.

A form usually spoken as a normal interrupted syllable, as /hï?h^{1}/ *thy fire*, is often spoken in slow speech as an extended syllable, as /hï^{1}?$-^{1}$/. In a form normally

spoken as an extended syllable with a short kernel and an interrupted extension, as /fi^{1}—?h^{1}/ *thy boss*, the extension juncture may shift in slow speech to lengthen the kernel and shorten the extension (i.e., satellite /h/ moves from the extension to the kernel), as /fih^{1}?—^{1}/.

A form normally spoken as a long free kernel followed by a short extension with a one-tone pattern is sometimes a normal syllable in fast speech: /kuh^{2}—^{1}/ *thy money*, /kuh^{21}/ (fast speech). Conversely, a form usually spoken as a long normal syllable, especially if it has a three-tone pattern, is sometimes, in very slow speech, pronounced as an extended syllable with a long free kernel and short extension: thus /kwoh?^{313}/ *our* (*incl.*) *hands*, but in very slow speech /kwoh^{31}—?^{3}/. Note that the whole tone sequence in such forms is the same whether spoken as an extended or as a normal syllable.

The following examples, including both normal and extended syllables, give an idea of the variety of peak satellites and tone patterns that are found for a single onset and vowel nucleus:

/to^{3}/ *work*, /to^{21}/ *bamboo*, /toh^{1}/ *grinding stone*, /toh^{2}/ *brains*, /toh^{4}/ *I roast*, /toh^{32}/ *banana* or *hole*, *hollow*, /to?^{2}/ *honey*, /toh?^{13}/ *sand*, /toh?^{21}/ *fall down*, /toh?^{4}/ *a drop*, /toh?^{32}/ *charcoal*, /to?h^{3}/ *honey* (*stative*) or *I put into*, /toh^{1}—^{1}/ *he roasts*, /toh^{1}—^{3}/ *grinding stone* (*stative*), /toh^{2}—^{1}/ *thy grinding stone*, /toh^{2}—^{13}/ *brains* (*stative*), /toh^{3}—^{43}/ *his grinding stone*, /toh^{32}—^{3}/ *banana* (*stative*), /toh^{32}—^{32}/ *his banana*, /toh^{4}—^{2}/ *my grinding stone* or *thou roastest*, /toh^{1}—?^{1}/ *your grinding stone*, /toh^{23}—?^{1}/ *you roast* or *your banana*, /toh^{31}—?^{3}/ *our* (*incl.*) *banana* or *our* (*incl.*) *grinding stone*, /toh^{42}—?^{3}/ *we* (*incl.*) *roast*, /to^{1}—?h^{3}/ *sand*, /to^{1}—?h^{32}/ *thy banana*, /to^{3}—?h^{23}/ *charcoal* (*stative*), /to^{4}—?h^{43}/ *a drop* (*stative*), /toh^{42}—?h^{31}/ *we* (*excl.*) *roast*, /toh^{31}—?h^{31}/ *our* (*excl.*) *banana* or *our* (*excl.*) *grinding stone*, /tǫ^{1}/ *shaggy* or *bird*, /tǫ^{31}/ *two*, /tǫ^{43}/ *his bird*, /tǫh^{12}/ *thorns*, /tǫh^{13}/ *bird* (*stative*), /tǫh^{313}/ *dumb*, /tǫh^{423}/ *my bird*, /tǫh^{1}/ *thy bird*, /tǫh^{13}—^{3}/ *thorns* (*stative*), /tǫh^{31}—^{3}/ *dumb* (*stative*), /tǫh^{1}—?^{1}/ *your bird*, /tǫh^{13}—?^{1}/ *you fix*, /tǫh^{31}—?^{3}/ *our* (*incl.*) *bird*, /tǫh^{13}—?^{3}/ *we* (*incl.*) *fix*, /tǫ^{1}—?h^{3}/ *I fix*, /tǫ^{1}—?h^{32}/ *thou fixest*, /tǫ^{1}—?h^{31}/ *he fixes*, /tǫh^{13}—?h^{31}/ *we* (*excl.*) *fix*, /tǫh^{31}—?h^{31}/ *our* (*excl.*) *bird*.

3. This section gives some of the articulatory-acoustic details of the phonological units that have been described (**2**). The descriptions here are largely impressionistic, not intended to be physiologically or acoustically precise.

3.1. The following sections discuss BORDER and NON-BORDER features separately. They are, however, collectively the phonetic features of the phonemic junctures (word, syllable, and extension), which characterize and delimit the units to which they belong (**2.1**).

3.11. Word juncture within a phrase is marked by a diminuendo, followed by a quick crescendo. It may be accompanied by a pause. There may also be a slight lengthening or drawing out of the end of the word before the juncture. In /?įh^{1}+ną^{3} höh^{42} kǫh^{32} ų^{1}+?ö^{1} feh?^{1}/ *I want to see a big tamale*, the vowel of /kǫh^{32}/ decreases in intensity toward the end of its articulation and is followed by a quick crescendo on the /ų/ of /ų^{1}?ö^{1}/.

Syllable juncture within a word is marked by a slight lengthening or drawing out of the end of the preceding syllable; but there is less diminuendo, when any, than at word juncture. There is never any pause between syllables within a word. The crescendo at the beginning of a non-word-initial syllable is less sharp, and perhaps more gradual, than at word initial. The vowel of /kǫh^{1}/ in /?įh^{1}+ną^{3} höh^{42} kǫh^{1}+o?h^{31} feh?^{1}/ *I want to see thy large corncake dough* (compare the example in the preceding paragraph) sounds drawn out, with perhaps some diminuendo, followed by a slight crescendo on the beginning of /o?h/.

Sometimes an onset consonant is the

only signal of syllable or word juncture. In a sequence of two syllables, or of two words, or of a kernel and extension, it is not always possible to determine whether an intervocalic /ʔ/ belongs to the first or second; impressionistically it sometimes seems to go with both.

Sometimes word juncture is distinguished from syllable juncture only by the location of stress.

Extension juncture does not involve any lengthening or diminuendo but is marked by a slight attenuation on the kernel followed by a quick increase and decrease in loudness, heard as a PULSE, at the beginning of the extension. The pulse is heard as lighter than the crescendo of syllable or word juncture.[6] Though the pulse is often very light it is audible.[7] It is less noticeable when other material follows in the same utterance than when near the end of an utterance.[8] In /ʔịh^{1}+nạ^{3} höh^{42} kǫh^{31}—ʔh^{31} feh^{ʔ1}/ *I want to see our (excl.) corncake dough*, the vowel of the kernel of /kǫh^{31}—ʔh^{31}/ is slightly attenuated toward the end, followed by a slight pulse on the peak of the extension.

Tone patterns (**3.3**) may reinforce or weaken border features:

(1) The pulse at an extension juncture sounds stronger when accompanied by a rise of more than one tone step (e.g. /1/ to /3/), as in /toh^{1}—^{3}/ *grinding stone (stative)*, as compared with a form like /ʔoh^{3}—^{3}/ *fruit (stative)*.

(2) The increase in loudness following juncture is greater on a short syllable (or extension) with a falling tone pattern, as in /ʔoh^{3}—^{32}/ *his mouth*.

An extension with tone /1/ frequently includes a slight initial dip in pitch: /si^{2}—ʔh^{1}/ *thy clothes*, /ʔih^{4}—ʔ^{1}/ *your corncakes*, /kwa^{1}—ʔh^{1}/ *thy arms*, /kwoh^{1}—ʔ^{1}/ *your hands*.

The vowel color in an extended syllable is determined by its kernel vowel pattern (**2**): /kwo^{1}—ʔh^{1}/ [kwu əʔə] *thy hand*. A phonetic diphthong (which phonemically may be a single vowel or a vowel cluster) reaches its final coloring at or immediately after extension juncture: /ʔih^{31}—ʔh^{31}/ [ʔei iʔi] *our (excl.) corncakes*, /ʔih^{4}—ʔ^{1}/ [ʔe: iʔ] *your corncakes*. In a similar two syllable sequence, however, the vowel color is determined by the onset and peak satellite environment in each of the syllables, as in /kwo^{1}+oʔh^{1}/ [kwu^{e}+əʔə] *thy hand*.

Sometimes onset consonant, change of vowel, or change of nasality is the only thing that distinguishes a syllable juncture from an extension juncture. In a taped utterance of /fih^{32}ʔ—^{3} ʔah^{3}+nạ^{3}/ *I have an image*, the feature which marks the second word as containing two syllables rather than one extended syllable is the onset /n/. Otherwise, rhythm and border characteristics of the two words sound the same. In some utterances of /kǫh^{31}+oʔh^{31}/ *you will carry*, the cessation of nasality signals the syllable juncture. The lack of nasalization in the second syllable of /kǫh^{31}+oʔh^{31}/ *you will carry* distinguishes it from /kǫh^{31}—ʔh^{31}/ *our (excl.) corncake dough*.

In some cases it is impossible to distinguish between an extended syllable and a two syllable word.

Procedurally, borders in a given utterance are frequently easier to identify when the utterance is whistled than when spoken.

3.12. There is a WORD STRESS (**2**), the placement of which, on the basis of the evidence so far observed, seems to be predictable when the borders and the phonemic content are known. Word stress seems

[6] These phonetic features of word, syllable, and extension juncture probably differ not in kind but in degree and in specific concatenations. For a discussion of syllables in physiological terms see Stetson (1951) and Pike (1955).

[7] The writer and two other investigators, working with an informant, were able to identify the extension juncture with a high degree of agreement. Probably 250 forms, most of them extended syllables, were judged. Nevertheless, it seems impressionistically that extension juncture is sometimes signalled only by extra length of the peak vowel.

[8] This may be relevant to phrase rather than to utterance boundary (see **2.**).

normally louder than the crescendos and pulses described for word, syllable, and extension borders. Not every word of an utterance is equally stressed. The differences are presumably related to the phonological phrase, not discussed here (see **3.32** for the interplay of stress and tone).

The first long syllable in a word is normally stressed: for example the second syllable in /ụ^{4}+ŋ̈ih^{3}+ðuh^{12}/ *I'll ask*. If there is no long syllable, a short syllable with a tone glide is stressed: the second syllable of /ụ^{4}+hnü^{21}/ *beans*. In the absence of either of these, stress falls on whichever of the first two syllables carries the higher tone: thus on the first syllable of /ʔi^{4}+ñị$^{?1}$/ *bread*, but on the second syllable of /hmɨ̈^{3}+ñị$^{?4}$/ *sea*. In words with no long syllable, no tone glide, and identical tones on the first two syllables, the second syllable is stressed: /tï^{1}+ʔö^{1}/ *singer*.

The relative durations of normal syllables is described in **3.22**.

An extended syllable, such as /kwo^{1}−ʔh^{1}/ *thy hand*, seems to be squeezed into a shorter time span than a two-syllable sequence with comparable onsets and peaks, such as /kwo^{1}+oʔh^{1}/ THY *hand*.

An extended syllable with a long kernel and a short checked extension, as /ʔih^{4}−ʔ^{1}/ *your corncakes*, is approximately four times as long as a normal short syllable. The kernel is about three times as long as the extension.

3.2. The articulatory-acoustic features of onsets and peaks are described here only insofar as they vary from the approximate norms implied by the tabular presentation.

3.21. Initial voiced stops are prenasalized: [mb−] in /buʔ^{4}/ *donkey*, [nd−] in /du^{1}−ʔh^{3}/ *I will drink*, [n̈dʸ−] in /dʸa^{21}/ *ten*, [ŋg−] in /go^{21}/ *bad*. /g/ is also prenasalized after /h/ (but not after /ʔ/); thus /hgoh^{1} tǫ^{3}/ *arrive again* has [N̥ŋg−].

/f/, as in /fu^{3}/ *powder*, may be bilabial or labiodental, but without contrast.

/s/ is grooved and slightly retroflex: /soh^{3}/ *incline*.

/r/ has two allophones. One, a voiced dental trill, occurs before a front unrounded vowel: /ri^{1}+xa^{1}/ *lying down*. The other, a voiced counterpart of /s/ (as described immediately above), occurs in all other positions: /roh^{32}/ *tobacco*.

The labial and palatal voiced spirants, /w, y/, also have nonfricative vocoid allophones. Though there is some fluctuation between the allophones of /w/, it is usually [w] in /kw/, as in /kwih^{2}/ *cold*; in /ʔw/ before a back vowel, as in /ʔwo^{2}/ *soft*; and initially before /o/, as in /wo^{4}/ *John*. Elsewhere /w/ is usually [β]: /wu^{1}/ *black widow spider*, /ʔwi$^{?1}$/ *black*, /wi̯h^{12}/ *far*.

/y/ is usually nonfricative in /ʔy/: /ʔyiah^{2}/ *day after tomorrow*. Elsewhere it fluctuates as to amount of friction, though there is likely to be more before /ü/, as in /yüh$^{?13}$/ *old*, or before nasalized vowels, as in /yi̯ą̈h^{2}/ *swollen*; and less elsewhere, as in /ya^{4}/ *Mary*.

Onset /h/ is the voiceless counterpart of the phone it precedes: /hmǫh^{4}/ *I do*; /hni̯h^{12}/ *fog, cloud*; /hñü^{21}/ *hair*; /hŋǫ^{4}−ʔh^{3}/ *I kill*; /hlöhʔ^{13}/ *measles*; /hi^{31}/ *book*; /hï^{21}/ *fire*; /höh^{4}/ *I see*; /hu^{4}/ *mosquito*; /hoh^{2}/ *split, break*; /ha^{2}+li̯h^{32}/ *arrive*; /he^{1}/ *spider*. Note /hgoh^{1} tǫ^{3}/ *arrive again*, [N̥ŋg−].

In /ʔy/ and /ʔw/, the articulation of the two constituents is nearly simultaneous, so that either of these is often hard to distinguish from simple onset /ʔ/: /ʔya^{4}/ *adz*, /ʔwo^{2}/ *soft*.

3.22. Of the eight vowels, six are more or less diphthongal: The arrows in the diagram (See Figure 1) show that six of the vowels, in at least some of their articulations, are pronounced with a glide toward or from a more central position. The extent of the glide is roughly indicated by the length of the arrow. The closed curve around each symbol indicates roughly the range of vowel color of allophones of the vowel in question. In the following discussion, the vowel colors described are those of monophthongal allophones and those of the most prominent points in diphthongal allophones.

A monophthongal allophone of /i/ oc-

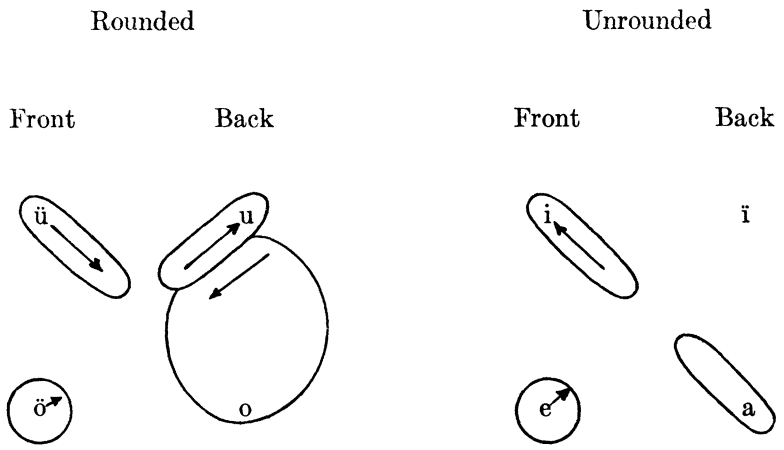

FIGURE 1

curs after a palatal or after another vowel in the same syllable: /ñi̱⁴/ *metal* /feih?¹/ *large* (*animate*). Elsewhere /i/ is diphthongal. The amount of glide is greater with length, as in /fih?¹/ *blackberry*; with nasalization, as in /ni̱⁴/ *on top of*, /nɨh?¹³/ *I'm going home*; and after a laryngeal, as in /hi³¹/ *book*, /?i̱¹/ *paint*. The glide is least in a short non-nasalized peak: /li⁴/ *flower*.

/e/ is [e] before /i/, as in /feih?¹/ *large* (*animate*); [æ] when nasalized, as in /hnɛ̨h?+ mǫ³/ *it's visible*; otherwise [ɛ]: /feh?¹/ *large* (*inanimate*). /ei/, as in /feih?¹/ *large* (*animate*), is sometimes difficult to distinguish from /i/, as in /fih?¹/ *blackberry*. Both are diphthongs which can be roughly sketched as [ei], though in /i/ the first part of the diphthong is generally less prominent than in /ei/.

/ü/ is monophthongal [ɯ̈ᵛ˃] after palatals: /xüh⁴²/ *I blow*; diphthongal [ɯ̈ɣ̈˃] elsewhere: /tü²/ *rifle*, /tüh⁴²/ *I abandon*.

/ö/ is mid, quite tense, with little rounding. It is relatively less advanced than the other front vowels: /?öh⁴³/ *my chicken*.

/u/ is diphthongal after /h/, /n/, /?/; /huh⁴/ *word* /nɥh⁴/ *I listen*, /?uh⁴²/ *I enter*; usually monophthongal elsewhere: /tu²¹/ *chicken*, /kuh³/ *money*.

A diphthongal allophone of /o/, [uᵒ], occurs after labials: /fo²¹/ *ashes*, /poh⁴²³/ *I clear the land*, /mǫh?²¹/ *mountain*, /kwoh³²/ *hand*. Elsewhere /o/ fluctuates between [o] and [ɔ]. It is more likely to be [o] after a dental or /?/: /loh³¹³/ *lime*, /?oh³/ *mouth*. It is more likely to be [ɔ] after a velar or /h/, as in /go²¹/ *ugly*, /hoh²/ *split*, *break*; in a peak with satellite /-?h/, as in /ho⁴ lo?h³¹ . . ./ *will you buy . . .* ?; and when nasalized, as in /?ǫ²/ *bridge*.

/a/ is [ə] in short unstressed peaks, as in /?ɨh³²+nɑ̨³ . . ./ *I want . . .* ; otherwise [a]: /pa¹/ *bunch*.

In syllables with onset /m/, /?m/, or /hm/, /ï/ is the syllabicity of [m̩]: /mïh³²/ [m̩:] *sandal*, /?mɨ?²/ [?m̩?] *cloth*. Otherwise /ï/ is [i˂] in unstressed position, as in /xüh⁴+ ɣï⁴/ *less*; and [i] in stressed position, as in /tïh³/ *foot*.

Peak satellite /h/ is length of syllable peak. We give below a list of five peak patterns, arranged phonetically from shortest to longest. Length is indicated phonetically in terms of a short single-vowel peak, [V]. [ᵛ] indicates slightly more than ½ the length of [V]. Colon indicates twice the length of [V]. A long checked syllable is normally slightly shorter than a long free syllable:

/V/ [V] /dʸa²¹/ *ten*; /VV/ [Vᵛ] /dʸia²/ *seven*; /Vh/ [V:] /?yah⁴²³/ *I'll puncture*; /VVh/ [V:V] /dʸiah³²/ *twenty*; /VVVh/ [VVV] /siuih?¹³/ *have dysentery*.

Peak satellite /?h/ is normally glottal catch followed by rearticulation of the peak

vowel, as in /hï?h¹/ *thy fire*. The /?/ may be very light, with laryngealization of the peak vowel; or it may be more clearly a closure, in which case the rearticulation of the vowel may be replaced by a slight retention of the glottal catch.

In slow and precise speech or at the end of a phrase, a form otherwise pronounced as a normal syllable with peak satellite /?h/ may be pronounced as an extended syllable: /hï?h¹/ *thy fire*, /hï¹?—¹/ *thy fire* (*slow speech*), /hu?h?¹³/ *our* (*incl.*) *cheeks*, /hu?¹—?³/ *our* (*incl.*) *cheeks* (*slow speech*). In such cases the /?/ before the hyphen is more deliberate than in an interrupted syllable, but still light and with laryngealization of the preceding vowel.

An interrupted syllable resembles a two-syllable word with /V+?V/, as in /tï¹+?ö¹/ *singer*, in that both include a sequence [V?V]. In /V+?V/, /?/ is longer than in an interrupted or extended syllable (as described immediately above), and there is no laryngealization of the preceding vowel.

3.3. Occurrences of the same tone in different patterns cannot be equated in absolute phonetic terms, their phonetic nature being conditioned by the surrounding tones in the pattern. The following description is limited to the tone patterns observed on normal syllables. Allophonic variation of tones in extended syllables seems to be similar.

The pitch of a form often sounds quite different when whistled than when spoken. The writer has found, however, that once he has heard a form whistled, he can identify the same pitch characteristics in at least some of the subsequent spoken utterances. This has been of considerable help in identifying subtle pitch distinctions.

A tone pattern often sounds quite different in different environments. Such differences were at first assumed to represent different tones (implying the presence of tonal morphophonemics). Careful listening in an effort to determine the differences, however, reveals a similar basic pitch pattern in each environment, contrasting with other patterns. Thus most such changes are allophonic, conditioned by the environment.

3.31. Tones /1/ and /4/ are near the bottom and top, respectively, of the normal voice range. Tones /2/ and /3/ are usually closer than /3/ is to /4/ or /2/ is to /1/. One-tone patterns are seldom heard as completely level.

In a short syllable, particularly if checked, tone /1/, /2/, or /3/ typically seems to involve a slight rise in pitch: /pa¹/ *bunch*, /?i²/ *corncake*, /fu³/ *powder*, /ku?¹/ *pain*, /hu?²/ *cheek*.

Except in a short checked syllable, /4/ often falls in pitch. The fall is sharp in a short syllable, as in /ñį⁴/ *iron*; slight and toward the end (that is, preceded by a level phase) in a long syllable; /huh⁴/ *word*, /hụh⁴/ *I burn*. In a long syllable, the drop in pitch is less likely to be noticed when the syllable is checked than when free. A syllable with tone /4/ often carries heavier stress than one with any other one-tone pattern. /4/ is sometimes difficult to distinguish from /43/. Both start high and glide to a lower pitch. The drop in /4/, however, is nearer the end of the syllable and slower than that in /43/: /mịh⁴/ *valley*, /?ih⁴³/ *my tortilla*.

/3/ in a long syllable is sometimes heard as rising in pitch, but is more likely than any other tone to be heard as level: /fuh³/ *poor*, /sïh³/ *small poles*.

/2/ in a long free syllable becomes slightly louder toward the end, often with a slight terminal rise and fall of pitch: /toh²/ *brains*, /tüh²/ *blind*.

/1/ in a long free syllable often seems to fall slightly, but sometimes rather to rise slightly: /mọh¹/ *bone*. In a long checked syllable it frequently seems to rise: /feh?¹/ *large* (*inanimate*), /tuh?¹/ *vulture*.

In general, one-tone patterns in interrupted syllables are slightly higher in pitch, and are accompanied by slightly heavier stress, than the same patterns in other types of syllables.

The pitch on a checked syllable tends to be slightly higher than that on a free syllable of the same tone: /ñį²/ *pig*, /hu?²/ *cheek*.

The line diagrams (See Figure 2) summarize the statements made above about pitch allophonics of the one-tone patterns:

A one-tone pattern will alternately sound the same in pitch as, higher than, and lower than the same pattern in a contiguous syllable. We assume that the difference relates to the portion of the pattern on which the investigator's attention is for the moment focused. The pitch glides, as shown in the line diagrams, are very subtle and the listener may hear the pitch of a portion of the pattern as that of the whole. Thus the portion of the pattern on which the listener is focusing, both in the syllable in question and in the frame, determines whether two adjacent phonetically identical patterns will sound the same or not. This explanation seems to be borne out when attempting, in successive utterings, to focus attention on the beginning, end, and middle of the pattern.

3.32. The statements which follow are general indications of the phonetic nature of tone combinations in normal syllables.

Glide characteristics of single tones tend to disappear in syllables with more than one tone.

Variations in pitch tend to be confined within a narrower and lower register in phrase-final syllables than in others. Especially, syllable-final rises in phrase-final tend to be much less pronounced than phonemically identical rises in non-final syllables: compare /. . . teh³¹³ . . ./ *frog*, in which the final pitch is approximately the same as the initial, and /. . . teh³¹³/ *frog*, in which the final rise in pitch is barely perceptible.

Falling patterns in short syllables are accompanied by relatively heavy stress: /hñį²¹/ *veins*, /ŋį³¹/ *vegetable pear*. This stress often seems to be the phonetic difference between a one-tone pattern and a falling pattern beginning with the same tone, both in short syllables, as /ñį⁴/ *iron* vs. /ñį⁴³/ *his salt*.

In patterns of two tones, rises in pitch tend to occur nearer the beginning of the syllable and falls nearer the end: /tǫh¹²/ *thorn*, /toh³²/ *hole*.

In a three-tone pattern with a fall followed by a rise, the rise is usually very close to the end: /loh³¹³/ *lime*. A rise followed by a fall in a three-tone pattern is usually near the middle: /sih³⁴³/ *I shave*.

A sharp rise in pitch (more than one tone step in a two-tone pattern) gives the impression of a pulse, almost a rearticulation of the vowel: /toh?¹³/ *sand*, /loh¹⁴/ *nopal* (a type of cactus) (**3.11**). This pulse may be louder than that at extension juncture, as in /tïh²⁴—?¹/ *your feet*. In this example the pulse in the kernel is like that accompanying any sharp rise of pitch; the second pulse is a feature of extension juncture only, unrelated to pitch.

Complex patterns in long syllables occupy a wider register than the phonemically identical patterns in short syllables.

The pitch of the first tone of a pattern tends to be higher in direct proportion to the number of successive tones in the pattern.

The tones of stressed syllables tend to be of relatively higher pitch than those of unstressed syllables; conversely, allophonically higher contours tend to be accompanied by

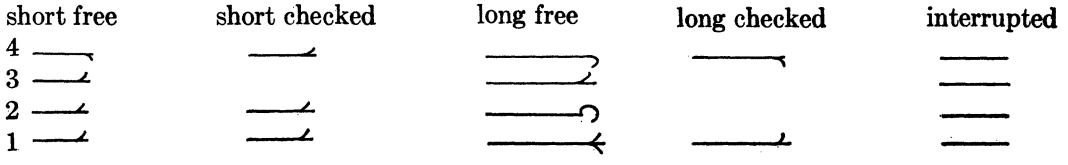

FIGURE 2

heavier stress than allophonically lower contours.

4. Alternate analyses are possible in certain onsets and peaks, for the syllabic nasal, and for tone.

4.1. Palatal onsets could be reinterpreted as dentals plus /y/. This would entail recognizing one three-consonant onset, /*ʔny/, as in /ʔña$_{\dot{q}}$^{21}/ *five*.

Voiced stops could be reinterpreted as nasal plus (otherwise voiceless) stop. Since /ʔg/ is [ʔg], without nasalization, some special treatment would be required: e.g., /ʔk/ with the /k/ voiced also in this environment, or /ʔγ/ with the /γ/ non-spirantal in this environment. Also, one onset of three consonants would result, /*hŋk/ [hŋg], as in /hgoh^{1}to$_{\dot{q}}$^{3}/ *arrive back*. Since the nasal onglide is slight, and since contrast of voicing is functional for the spirants, the proposal seems of little value.

Inasmuch as /s/ and [z$_{\dot{}}$] (one of the allophones of r) differ only by voicing, /r/ and /s/ might be interpreted as a voiced-voiceless pair. Though the evidence for our interpretation is not compelling, the voiced spirant and trill phones in the dental position are in complementation and clearly members of one phoneme. This justifies considering /r/ as different from /s/ by more than voicing. While /s/ fits the consonant system as the voiceless spirant, the presence of /ð/ interferes with our regarding /r/ (or*/z/ if the alternate interpretation were accepted) as its voiced counterpart.

/w/ and /y/ are quite different from /ð/ and /γ/, both in articulation and distribution, and could be classed separately as semivowels. The former have vocoid allophones (**3.21**); the latter are always spirantal. The distributions of /w/ and /y/ are comparable to those of the other consonant phonemes. /ð/ and /γ/ almost never occur in word initial and are limited in distribution to two or three morphemes each. /γ/ also occurs in morphophonemic alternation with /k/. Nevertheless, all four are spirantal at least some of the time, and accordingly can be regarded as a set of voiced spirant consonants.

The evidence for treating /ts/ and /kw/ as unit phonemes or as clusters is about evenly weighted. They occur as onsets with a distribution parallel to that of single consonant onsets. On the other hand, they do not fit neatly as units into the rather symmetrical consonantal system, and each of the segments involved occurs singly as an onset. Somewhat arbitrarily, we treat them as clusters, as least in notation.

4.2. Most of the diphthongal allophones of vowels could be reinterpreted as vowel sequences, each consisting of /a/ and another vowel. Thus [uə] would be */ua/; [əu], */au/: [üv̂], */üa/. As vowel sequences, however, these diphthongs would be in complementation with monophthongal vowels relative to the onsets they can follow: */ua/ with /o/; */au/ with /u/; */üa/ with /ü/. /au/, which in our interpretation does occur in fast speech, is pronounced with the lower allophone, [a], of /a/.

Since [uə] is phonetically more similar to /u/ than to /o/, it would seem reasonable to interpret it as containing /u/. It is, however, in complementation with the other allophones of /o/ and in contrast with /u/: /fo^{21}/ [fu^{ə}] *ashes*, /fu^{3}/ [fu] *powder*, /kwoh^{32}/ [kwuə] *hand*, /kwuh^{32}/ [kwu:] *cornfield*.

Vowel clusters in normal speech could be reinterpreted as /yV/, /Vy/, or /yVy/. This interpretation would result either in a sequence of two phonetically different /y/'s, the first barely perceptible and the second sometimes receiving the peak of syllabicity, or else would entail setting up /ʔy/ as a unit phoneme (see **4.1**): /ʔya^{21}/ *fence*, /ʔyah^{423}/ *I'll puncture*, /ʔyia^{12}/ *day after tomorrow*, /ʔyiah^{32}/ [ʔyi:a^{32}] *sunshine*. The vowel cluster interpretation makes neither necessary.

The use of symbols ʔ and *h* to indicate peak satellites implies a pairing and a phonemic equating of these constituents with onset consonants /ʔ/ and /h/. The onset and peak constituents are in complementation.

The laryngeal consonants have parallel distributions in onsets but do not there pattern like any of the other consonants. This makes these the logical consonants to pair with the syllable peak constituents. Phonetically, onset and peak /ʔ/ are quite similar while onset and peak /h/ are quite different. The writer is not convinced that it is valid to pair these peak constituents with any onset consonants. Therefore the use of ʔ and *h* to symbolize peak constituents is to be taken as an orthographic convenience, not necessarily implying their identification with any onset consonants.

One might consider interpreting vowel length as a feature of individual vowels rather than of whole peaks. However, most peaks pair off as long and short—the diphthongal ones as well as the monophthongal. When the informant whistles an utterance, long syllables have about the same length regardless of whether they have a single vowel, two, or three vowels.

4.3. /mɻ/ could be reinterpreted as /m/, a syllable remainder consisting of an onset with no peak. Our interpretation is based on the parallel functions of [m̩] and the usual consonant-vowel sequences. Also, while nonsyllabic /m/ precedes five of the vowels, /a, e, i, o, u/, it does not precede /ï/, /ü/, or /ö/: /mą̱h^{12}/ *liquor*, /mǫh^{1}/ *bone*, /mɻh^{4}/ *valley*, /mɥɻh^{14}/ *Raymond*, /mɐh^{14}+ną̱^{3} ʔñɻɐʔh^{43}/ *I'll hide myself*.

The choice of /ï/, rather than /ü/ or /ö/, as the vowel in /mɻ/ is perhaps partly arbitrary. It is influenced by neighboring dialects of Chinantec, which have the sequence [mɻ] in cognates of nasal words in the Quiotepec dialect, and which do not have syllabic nasals.[9] The movement of the jaw and throat, frequently observable during the pronunciation of nasal syllables with long peaks, adds articulatory evidence for the interpretation. Chinantec seems to make more extensive use of syllabic nasals (phonetically speaking) than any other language so far reported. Chinantec nasal words have all the variety of structure of words with ordinary peaks as the list below shows. Bella Coola (Pike 1955, p. 70) has words with no distinctive vowels, but they are pronounced with voiced or voiceless vocoid releases. Other languages have occasional nasal syllables: Senadi, Chiricahua, Bella Coola,[10] Huichol (Grimes 1958). Cantonese[11] has, at least in theory, entire utterances with nothing more syllabic than a nasal. Compare with these instances the variety displayed here, to which other paradigms could be added:

/mɻ̈^{2}/ *thick* (*as a tree*), /mɻh^{43}/ *I ask for*, /mɻh^{32}/ *sandal*, /mɻh^{313}/ *tick*, /mɻ̈ʔ^{3}/ *pill*, /mɻhʔ^{32}/ *snake*, /ʔmɻ̈ʔ^{2}/ *cloth*, /ʔmɻh^{3}/ *new*, /ʔmɻhʔ^{13}/ *underbrush*, /hmɻ̈ʔ^{2}/ *tomato*; /hmɻ̈^{1}/ *blood*, /hmɻh^{423}/ *my blood*, /hmɻ̈ʔh^{1}/ *thy blood*, /hmɻ̈^{43}/ *his blood*, /hmɻhʔ^{313}/ *our* (*incl.*) *blood*, /hmɻh^{31}—ʔh^{31}/ *our* (*excl.*) *blood*, /hmɻh^{1}—ʔ^{1}/ *your blood*; /hmɻh^{32}/ *water*, /hmɻh^{43}/ *my water*, /hmɻ̈^{1}—ʔh^{32}/ *thy water*, /hmɻh^{2}—^{43}/ *his water*, /hmɻhʔ^{313}/ *our* (*incl.*) *water*, /hmɻh^{31}—ʔh^{31}/ *our* (*excl.*) *water*, /hmɻh^{24}—ʔ^{1}/ *your water*; /mɻh^{43}/ *I ask for*, /mɻ̈ʔh^{43}/ *thou askest for*, /mɻ̈^{43}/ *he asks for*, /mɻhʔ^{313}/ *we* (*incl.*) *ask for*, /mɻh^{31}—ʔ^{31}/ *we* (*excl.*) *ask for*, /mɻh^{41}—ʔ^{1}/ *you ask for*; /ʔmɻ̈ʔh^{43}/ *I pinch*, /ʔmɻ̈ʔh^{31}/ *thou pinchest*, /ʔmɻ̈ʔh^{21}/ *he pinches*, /ʔmɻh^{13}—ʔ^{3}/ *we* (*incl.*) *pinch*, /ʔmɻh^{13}—ʔh^{31}/ *we* (*excl.*) *pinch*, /ʔmɻh^{2}—ʔ^{1}/ *you pinch*; /ʔï^{2}/ *corncake*, /koh^{43}/ *I play*, /loh^{32}/ *skin*, /loh^{313}/ *lime*, /poʔ^{4}/ *ball*, /tuhʔ^{1}/ *vulture*, /ʔmiʔ^{2}/ *pimple*, /ʔlïh^{313}/ *corpse*, /ʔlohʔ^{4}/ *hook*, /hlaʔ^{2}/ *cheap*; /ñɻ^{1}/ *thread*, /ñɻh^{423}/ *my thread*, /ñɻ̈ʔh^{1}/ *thy thread*, /ñɻ̈^{43}/ *his thread*, /ñɻhʔ^{313}/ *our* (*incl.*) *thread*, /ñɻh^{31}—ʔh^{31}/ *our* (*excl.*) *thread*, /ñɻh^{1}—ʔ^{1}/ *your thread*; /tsih^{32}/ *dog*, /tsih^{43}/ *my dog*, /tsi^{1}—ʔh^{32}/ *thy dog*, /tsih^{2}—^{43}/ *his dog*, /tsihʔ^{313}/ *our* (*incl.*) *dog*, /tsih^{31}—ʔh^{31}/ *our* (*excl.*) *dog*, /tsih^{24}—ʔ^{1}/ *your dog*; /koh^{43}/ *I play*, /koʔh^{43}/ *thou playest*, /ko^{43}/ *he plays*, /kohʔ^{313}/ *we* (*incl.*) *play* /koh^{31}—ʔh^{31}/ *we* (*excl.*) *play*, /koh^{41}—ʔ^{1}/ *you play*; /hïʔh^{43}/ *I*

[9] At least two other more remote dialects of Chinantec, those of Usila and Mayultianguis, do have syllabic nasals.

[10] Hockett (1955: 57, 61, 120, 128).

[11] Information from C. F. Hockett.

shake, /hï?h^{31}/ *thou shakest*, /hï?h^{21}/ *he shakes*, /hïh^{13}—?^{3}/ *we* (*incl.*) *shake*, /hïh^{13}—?h^{31}/ *we* (*excl.*) *shake*, /hïh^{2}—?^{1}/ *you shake*.

4.4. A tone pattern might be interpreted as a constituent of the syllable peak rather than of the entire remainder. When the onset is voiceless, this is of course phonetically the case. But a voiced sonorant onset carries contrastive pitch. The initial tone of a pattern may occur entirely on a sonorant onset, sometimes with the result that the first tone of a pattern was at first missed by the investigator: /wɥh^{12}/ [βɥ:] *dish*.

The non-level character of one-tone patterns and the difficulty of equating the same tone in different patterns or twice in the same pattern in an absolute phonetic sense, suggests the possibility of a reinterpretation of Chinantec tone as a contour system. Each of the patterns listed in the table of permitted tone patterns would then be a separate tone phoneme. Thus each normal syllable, kernel, and extension would have one tone phoneme.

This alternative would obviate certain difficulties. One difficulty, under the treatment chosen, is that of identifying each of the parts of a pattern as one of four tone levels, which is especially difficult in view of the interplay of the phonetic properties of word, syllable, and extension juncture with features of tone. Another difficulty, related to the first, is that of predicting the precise phonetic shape a given tone sequence will have in a given environment.

The alternative interpretation, however, would result in fifteen tone phonemes in normal syllables (and some additional ones in kernels and extensions). This large a number of tone 'phonemes' seems unusual, if not improper, and urges finer-grained analysis. The hierarchical or immediate-constituent approach allows us to recognize the more than fifteen contrasting tone patterns as units within whole syllables, without forcing us to accept these units as indivisible. In spite of the difficulties mentioned above, each pattern can be interpreted as a sequence of one or more of just four tone phonemes, the relative pitches of which are conditioned by their environment.