

## Ixpantepec Nieves Mixtec Word Prosody\*

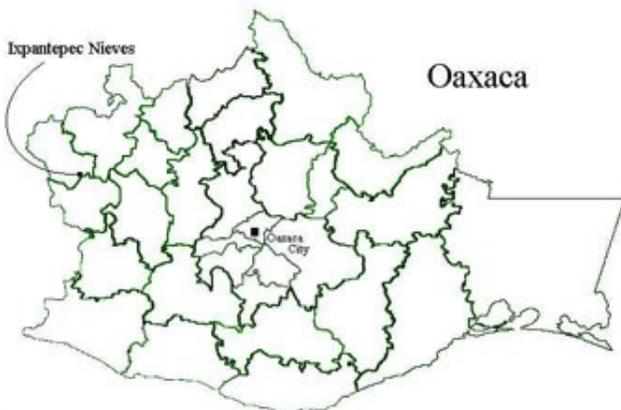
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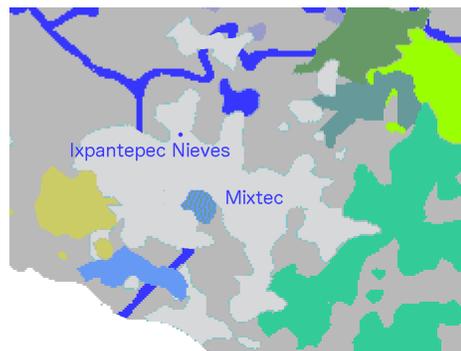
### I. Introduction

This paper presents ongoing investigation into the word prosodic phonology and acoustic correlates of Ixpantepec Nieves Mixtec (Tu'un Savi).

- Ixpantepec Nieves is in the northwest corner of Oaxaca state, on the northern edge of Josserand's (1983) Southern Mixteca Baja dialect group.
- Data collected with two native speakers currently living in San Diego, California.<sup>1</sup>
- Other work on Ixpantepec Nieves Mixtec:
  - Some aspects of the discourse (Villas-Boas 2010) and syntax (Caponigro et al 2012) have been described
  - Documentation and description also underway in UCSD field methods classes
  - But no systematic phonological description is yet available.



*Ixpantepec Nieves within Oaxaca State (map by Carlos Cisneros)*



*Ixpantepec Nieves within Mixtec language area (adapted from wikimedia image)*

\* This version differs from the original handout, fixing an error in the stress acoustics section.

1 I gratefully acknowledge the assistance and insights of my Mixtec teachers, Matilde Castillo and Otilio Osorio. In the example data shown here, their initials indicate the source of particular examples. There is significant between-speaker variation that is only briefly noted here. Also, through no fault of theirs, and despite my efforts to avoid it, I have undoubtedly made some errors in transcription or translation here.

Thanks are also due to Gabriela Caballero and other discussants in the Linguistic Field-Work Group, and funding from UC MEXUS.

## Stress and tone systems:

- Mixtec languages are usually described (e.g. Pankratz and Pike 1967; Pike and Oram 1976) as having both:
  - complex lexical tone systems
  - word-level stress accent
- The cross-linguistic variation and acoustic properties of such ‘hybrid’ systems are only beginning to be explored (Remijsen and van Heuven 2005; Pearce 2006).
  - Acoustic correlates like segment duration, voice quality, and pitch can vary with stress/phrasal accent in English (Campbell and Beckman 1997) but tone in Mong (Andruski and Ratcliff 2000)
  - Some studies have identified distinct acoustic correlates of stress and tone, e.g. among languages of Mexico: Zapotec (Chavez Peón 2008), Balsas Nahuatl (Guion et al 2009), Ixcatec (DiCanio 2012), and Raramuri (Caballero and Carroll submitted)
  - But to the best of my knowledge, a comparable study in a Mixtec language has not yet appeared

Here I show that Ixpantepec Nieves Mixtec has both stress and tone as phonologically distinct systems, distributed independently and distinguishable acoustically.

1. Provide an overview of the general phonological properties
2. Discuss the phonological distribution of tone and some phonetic observations
3. Describe the placement of stress, its acoustic realization, and its phonological effects
4. Discuss directions of further research

## II. Phonological overview

- Like in many other Mixtec varieties (e.g. Mak 1953, Macaulay 1995, Gerfen 1999), a bimoraic canonical root features prominently in the morphology and phonology
- Only Vs are moraic; no CC clusters in native lexicon: (C)VV, (C)VCV
- Both nasalization and glottalization are morpheme properties:
  - All voiced segments within a morpheme must share any nasalization<sup>2</sup>

(1)	Nasal:	ĩĩ	sãʔã	nãná	kũnĩ	hãʔmã
		‘one’	‘smell’	‘mother’	‘yesterday’	‘clothing’

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<sup>2</sup> In order to leave room for tone marks, I mark nasalization with ogoneks underneath the vowels, or leave it unmarked in phonemic transcriptions where it is derivable from nasal consonants.

Oral:	īī	sàʔà	tátá	lā <sup>n</sup> dì	hāʔvà
	‘EX’	‘foot’	‘father’	‘belly’	‘frog’
Illicit:	*iʔi	*naʔa	*naʔa	*kisʔ	*līna

- Glottalization is typically expressed (and transcribed here) as a glottal stop after first V, but it can be more diffuse creakiness
- Neither glottalization nor nasalization is permitted in roots with medial voiceless C

- The vowel pairs within canonical roots are tightly associated
  - Vowels are generally identical when there is no medial consonant
    - among (C)VV roots, vowels are always identical
    - in a sample of 103 (C)VʔV roots, only 11 are not identical, and several of these alternate with forms that have a medial C or maintain identical Vs:

(2)	~CV <sub>i</sub> ʔCV <sub>j</sub>	[haʔi] ~ [haʔzi]	‘child’	[kaʔi] ~ [kaʔzi]	‘paint (v)’
	~CV <sub>i</sub> ʔV <sub>i</sub>	[ʃiʔa] ~ [ʃaʔa]	‘hawk’	[kiʔa] ~ [k <sup>h</sup> aʔa]	‘cross-sibling’

- There is a pressure for identity even across a medial consonant
  - in a sample of 212 CVCV roots, almost 50% (103) have identical vowels
  - a few suppletive realis-irrealis verb pairs maintain identical vowels despite a vowel change

(3)	kìjī	‘sleep.REAL’	kījī	‘make.REAL’	sīsī	‘eat.bread.REAL’
	kùhù	‘sleep.IRR’	kāhā	‘make.IRR’	kūsū	‘eat.bread.IRR’

- Vowel length is strongly associated with word prosody
  - Near-minimal pairs for length are only available in multi-morphemic pairs

(4)	ī-ḗàà	‘tomorrow’	kúná	‘deep’	nì-sì-kāā	‘stood’
	īī ḗāā	‘one man’	kū-nāá	‘become-tired’	nì-sìkā	‘walked’

- I will treat CV<sub>i</sub>V<sub>i</sub> and CV<sub>i</sub>ʔV<sub>i</sub> roots as monosyllabic with long vowels, though there are other possible analyses

### III. Tone

#### A. Contrasts

There is a three-way height-based tone contrast on vowels in all prosodic positions, realizing both lexical and morphological distinctions.

- Tone is lexically contrastive in:

- The whole root together

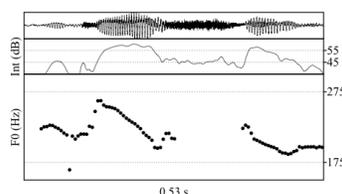
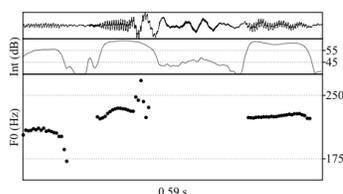
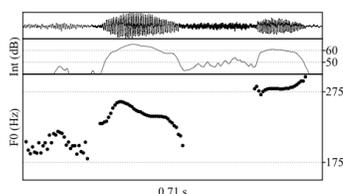
(5) HH: kǐjí ‘sleepyhead’ MM: kǐjǐ ‘make.REAL’ LL: kǐjǐ ‘sleep.REAL’  
 [OO MIN0390:14:12.7] [MC MIN0329:9:20.5] [MC MIN0329:9:47.9]

- Root-initial position

(6) HM: jǔǔǔ ‘drag.IPFV’ MM: jǔǔǔ ‘drag’ LM: nǔǔǔ ‘tooth’  
 [MC MIN0325:9:54.4] [MC MIN0325:10:22.1] [MC MIN0042:22:33.5]

- Root-final position

(7) MH: ʰdǐjǐ ‘blue’ MM: ʰdǐjǐ ‘pulque’ ML: ʰdǐjǐ ‘corn cob’  
 [MC MIN0296:12:24.4] [MC MIN0296:3:30.7] [MC MIN0082:1:29.9]



- Surface tone also affected by morphological tone (e.g. IPFV H) and sandhi.

- Prefixes

	(morphological: IPFV H)	(lexical)	(sandhi: L tone spreading)
(8)	ká-sikā = nā	kā-kākā = nā	nǐ-kà-kānā = nā
	IPFV\PL-walk.REAL = 3PL	PL-walk.IRR = 3PL	PFV-PL-exit = 3PL
	‘they are walking’	‘they will walk’	‘they went out’
	[MC MIN0476:7:02.0]	[MC MIN0476:16:25.8]	[MC MIN0478:12:19.6]

- When enclitics do not alter the base, they bear single tones

(9) mēē = ndó 2PL mēē = nā 3PL mēē = ndyǐ 1PL.EXCL  
 [OO MIN0038:19:00.4] [OO MIN0038:20:23.3] [OO MIN0038:18:12.2]

- But when the base is altered, some tone contours may appear

(10)	nǐ-ʰdǐ-lók = ǐ	sà? = ǔ
	/nǐ-ʰdǐ-lókó = ǐ/	/sà?à = ǔ/
	PFV-INCH-crazy = 1SG	foot = 2S
	‘I’ve gone crazy’	‘your foot’
	[MC MIN0478:4:52.5]	[MC MIN0335:0:26.8]

- In one way tone is prosodically conditioned: CVV as independent words cannot be LL, taking ML surface tone (cf. San Andres Yutatio (Williams 2007))

(11) /ʒùù/ [ʒùù] 'stone' /nì/ [nì] 'blood'

Tone is not dependent on other aspects of prosody, i.e., it is lexically governed.

## B. Acoustics

- A preliminary comparison of tone contrasts suggests:
  - Pitch is the primary indicator of the tone categories
  - There is no apparent association with onset phonation
- However, L tone is additionally often:
  - breathy when not in a glottal syllable
  - with a falling contour, even on short vowels
- Breathiness varies by:
  - Morpheme shape: more in CVV and CVCV
  - Speaker: more by OO than MC
  - Context: especially apparent when hyperarticulated

(12) /ʒùù/ [ʒùù] 'stone' [OO MIN0061:9:11.8]  
 [MC MIN0330:2:28.8]  
 (13) /nì/ [nì] 'blood' [OO MIN0026:1:19.4]  
 [MC MIN0330:2:57.0]  
 (14) /tʰìnà/ 'dog' [OO MIN0044:0:13.4]  
 [MC MIN0124:5:28.9]  
 (15) /vìfi/ 'sweet' [MC MIN0296:16:08.9]

- Tonal coarticulation observed:
  - Perseverative coarticulation (into early part of vowel) is widespread
  - Anticipatory coarticulation is observed within roots.

## IV. Stress

### A. Stress Placement

Stress is determined morphologically:



## B. Acoustics

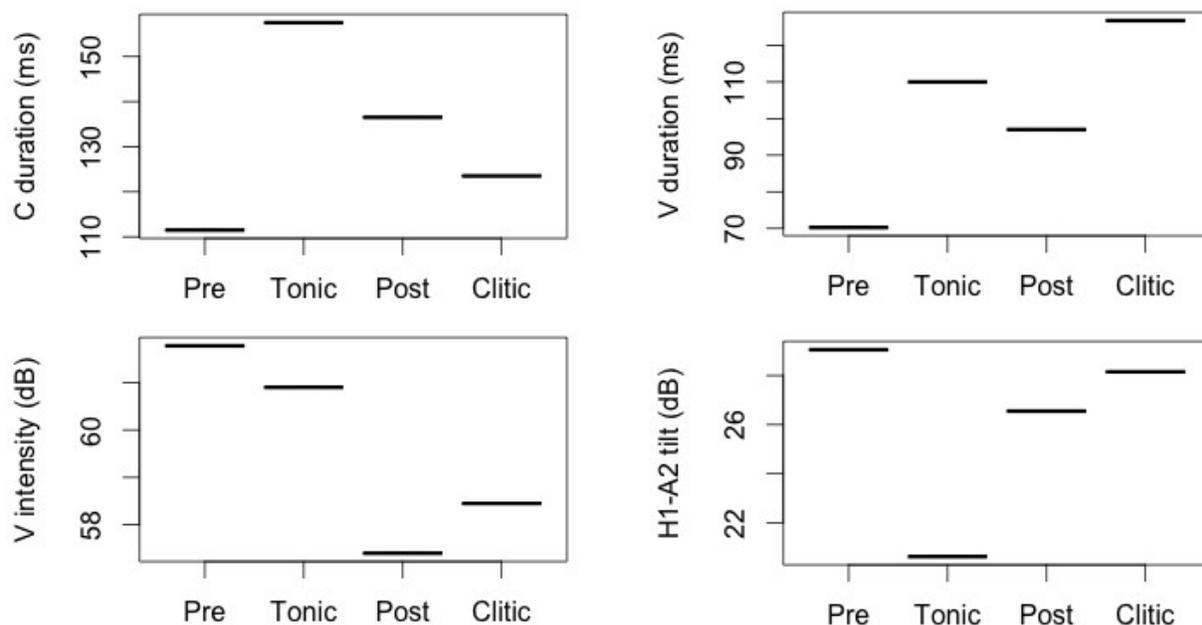
A preliminary check of the acoustic correlates of stress:

- Considered four measures cross-linguistically associated with stress (Guion et al. 2009)
  - Onset duration: typically longer under stress
  - Vowel duration: typically longer under stress
  - Average intensity (in vowel): typically higher under stress
  - Mid-band spectral tilt (H1-A2): typically lower under stress
- Considered short vowels in four prosodic positions
 

sì- sī.sī = sī            'he would eat'

HAB-eat.bread.REAL = 3HON

  1. Pre-tonic syllable (word-initial prefix or phrase-initial clitic: **sì**-sī.sī = sī)
  2. Tonic syllable (root-initial: sì-**sī**.sī = sī)
  3. Post-tonic syllable (root-final: sì-sī-**sī** = sī)
  4. Clitic (immediately after root: sì-sī.sī = **sī**)
- Four tokens in each position (data in Appendix), not matched for tone, but matched for:
  - vowel type
  - onset consonant
  - following consonant (except for the word-final clitic)
- Results: for C duration, intensity, and tilt, Tonic stand out in expected direction



- The observed longer C duration, ~~higher intensity~~, and lower spectral tilt are typical of stressed syllables cross-linguistically
  - suggests stress is the correct phonetic typological category

Stress seems to be cued primarily by intensity profile, and secondarily by C duration, though V duration (and perhaps other correlates) may still play some role.

### C. Phonological effects

Even if phonetic vowel duration turns out to not correlate with stress, categorical vowel length as well as glottalization are strongly associated with stress.

- Compounds have stress only on the second member, even though this is often not the semantic head.

(18)	kūnī('hòʔō)	'listen.IRR'	<	kūnī	'see.IRR'	hòʔō	'ear'
	sì('vàʔā)	'die.REAL well'	<	sìʔì	'die.REAL'	vàʔā	'good'
	kīvī('lóʔò)	'little sister'	<	kīʔvì	'sister'	lóʔò	'little.SG'
	hīkò('ⁿdáʔà)	'wrist'	<	hīkò	'neck'	ⁿdāʔà	'hand'
	vī('ɲūʔù)	'church'	<	vēʔē	'house'	ɲūʔù	'religious'

- The stress loss on the first member of the compounds conditions certain reductions:
  - Glottal stops are licensed only in stressed syllables

(19)	(kūnī)	nì(kākū)	(īī)	kīvī('lóʔì)	cf.	('kīʔvì)
	/kūnī	nì-kākū	īī	kīʔvì-lóʔò = ì/		kīʔvì
	yesterday	PFV-born	one	sister-little.SG = 1SG		sister
	'Yesterday my baby sister was born'					
	[MC MIN0122:3:00.4]					[MC MIN0122:3:13.7]

(20)	nì-sì-('vàʔā) = ɲá	cf.	nì-('sìʔì) = rà
	/nì-sìʔì-vàʔā = ɲá/		/nì-('sìʔì) = rà/
	PFV-die.REAL-good = 3SG.F		PFV-die.REAL = 3SG.M
	'she died well'		'he died'
	[OO MIN0076:16:18.8]		[MC MIN0329:1:51.7]

(21)	(tʃī)	ⁿdā('táʔā)nā	cf.	hīkò-('ⁿdáʔà)
	/H\ tʃī	ⁿdāʔà-táʔā = nā/		hīkò-ⁿdāʔà
	IPFV\hold	hand-RECP = 3PL		neck-hand
	'they are holding hands'			'wrist'
	[OO MIN0169:4:08.4]			[MC MIN0002:10:36.6]

- (22) **tù**(<sup>n</sup>dáʔvī) cf. <sup>n</sup>dākā-(tùʔū)  
 /tùʔū-<sup>n</sup>dáʔvī/ /<sup>n</sup>dākā-tùʔū/  
 word-humble request-words  
 ‘Mixtec language’ ‘ask’  
 [MC MIN0010:26:15.5] [MC MIN0400:3:39.1]
- (23) há(kānā) (īī) (īī) **sà**(vəlīā) cf. (‘sàʔ = ú)  
 /H\hà-kānā īī īī **sàʔà**-vəlí = ā/ /sàʔà = ú/  
 IPFV\CAUS-exit one one foot-little.PL = 3SG.F foot = 2SG  
 ‘Está tratando de tirar sus pasitos’ ‘your foot’  
 [MC MIN0476:5:48.3] [MC MIN0335:0:26.8]
- Long vowels are licensed only in stressed syllables (e.g. seen above also)
- (24) **nù** (kāā) (kwàʔā) (ʒítò) cf. **nàkū**(núú)rí (**nūú**) (ʒítò)  
 /**nūù** kāā kwàʔā ʒítò / **nà-kū-nūù** = rí **nūù** ʒítò/  
 on be.loc many tree REP-INCH-on = 3AN on tree  
 ‘where there are many trees’ ‘it got on the tree too’  
 [MC MIN0385:6:09.8] [MC MIN0385:7:00.6]
- (25) **kò** (tʃūū)rā cf. (**kòō**) (ʒòò)  
**kòō** H\tʃūū = rā **kòō** ʒòò  
 NEG IPFV\work = 3SG.M NEG moon  
 ‘he doesn't work’ ‘the moon isn't out’  
 [OO MIN0397:6:07.9] [MC MIN0010:20:11.6]
- Pretonic vowels are often reduced or deleted
- (26) **mān**(sáná) **kítí**(kārí) **ʃin**(ʒítò)  
**mānsáná** H\kā-tā-kāà = rí **ʃinì** = ʒítò  
 apple IPFV\INCH-?-be.loc = 3RND head = tree  
 ‘the apple is hanging from the tree’ (3RND: class of round objects)  
 [OO MIN0048:2:25.9]
- (27) ʒūú tʃ(kwíí)  
 ʒūú tʃikwíí  
 edge water  
 ‘the water's edge’  
 [MC MIN0385:8:18.4]

- (28) <sup>n</sup>**di**(kōó)rā                      t̥i            **kini**(kāà)rà  
<sup>n</sup>do-kōó = rā                      t̥i            kā-nā-kāà = rā  
 INCH-sit = 3SG.M            and            INCH-on-be.loc = 3SG.M  
 ‘he got up and sat’  
 [MC MIN0385:6:30.2]
- (29) **siti**(nūū)                                      (t̥ina) (ini)    nù            **kini**(kāà)                      (hā?và)  
 H\sì-tō-nūū                                      t̥ina    ini            nūū            H\kā-nā-kāà                      hā?và  
 IPFV\REAL-TO-descend            dog    inside    where    IPFV\INCH-on-be.loc    frog  
 ‘the dog is looking into where the frog is’  
 [MC MIN0385:0:11.7]

## V. Conclusion

Stress and tone are independent phenomena in Ixpantepec Nieves Mixtec, in that:

- stress is predictable and cued primarily intensity profile and consonant duration,
- while tone is lexically determined and cued primarily by pitch.

Further questions:

1. Are there secondary stresses/unstressed feet?  
 e.g. harmony in pretonic vowels, perhaps duration/intensity differences
2. The distribution of vowel phonation deserves further study
  - The loss of glottalization is gradient (stop → creak → modal) and variable (OO more than MC, greater with higher speech rate, etc.).
  - Subtle breathiness might be more wide-spread than just in hyperarticulated L forms, or it might be limited to a particular set of L-tone roots
3. Are consonant co-occurrence restrictions and consonant lenition alternations associated with stress, or simply some combination of morpheme structure and phrasal prosody?

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## Appendix

### Tokens for acoustic measurements

pre-tonic	tonic	post-tonic	clitic
<p>sì-sìsì = sī MC MIN0479:4:16.3 C: 171 ms V: 107 ms Int: 56.4 dB H1-A2: 28.8 dB</p>	<p>sì-sìsì = sī MC MIN0479:4:16.3 C: 203 ms V: 139 ms Int: 58.1 dB H1-A2: 27.0 dB</p>	<p>sì-sìsì = sī MC MIN0479:4:16.3 C: 154 ms V: 107 ms Int: 57.7 dB H1-A2: 25.0 dB</p>	<p>sì-sìsì = sī MC MIN0479:4:16.3 C: 158 ms V: 149 ms Int: 57.3 dB H1-A2: 22.2 dB</p>
<p>sì sísí = nā MC MIN0475:12:09.0 C: 120 ms V: 58 ms Int: 50.8 dB H1-A2: 32.5 dB</p>	<p>sì sísí = nā MC MIN0475:12:09.0 C: 119 ms V: 70 ms Int: 58.7 dB H1-A2: 16.5 dB</p>	<p>sísí = sī MC MIN0474:13:32.5 C: 91 ms V: 52 ms Int: 51.2 dB H1-A2: 34.2 dB</p>	<p>sísí = sī MC MIN0474:13:32.5 C: 98 ms V: 116 ms Int: 54.0 dB H1-A2: 34.5 dB</p>
<p>sìsìá?ā = ì OO MIN0090:0:25.2 C: 86 ms V: 35 ms Int: 68.1 dB H1-A2: 29.2 dB</p>	<p>sísí = ní OO MIN0090:4:10.3 C: 156 ms V: 48 ms Int: 69.4 dB H1-A2: 26.8 dB</p>	<p>káchí = sī kīsī = sī OO MIN0397:0:29.9 C: 191 ms V: 75 ms Int: 67.2 dB H1-A2: 30.0 dB</p>	<p>káchí = sī kīsī = sī OO MIN0397:0:29.9 C: 123 ms V: 109 ms Int: 68.1 dB H1-A2: 37.9 dB</p>
<p>na-ndokoo = an MC MIN0325:1:48.4 C: 69 ms V: 81 ms Int: 71.8 dB H1-A2: 25.7 dB</p>	<p>náná nì nānā = nā MC MIN0478:10:47.4 C: 152 ms V: 183 ms Int: 57.4 dB H1-A2: 12.2 dB</p>	<p>náná nì nānā = nā MC MIN0478:10:47.4 C: 110 ms V: 154 ms Int: 53.5 dB H1-A2: 17.0 dB</p>	<p>náná nì nānā = nā MC MIN0478:10:47.4 C: 115 ms V: 133 ms Int: 54.4 dB H1-A2: 18.0 dB</p>