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The Inventory and Distribution of Tone in Tù'un Ndá'vi, the Mixtec of Piedra Azul (San Martín Peras), Oaxaca

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by

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ABSTRACT

The Inventory and Distribution of Tone in Tù'un Ndá'vi,
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by

Simon L. Peters

This paper provides an account of the previously undescribed tone system of Tù'un Ndá'vi, the variety of Tu'un Savi (Mixtec) spoken in the community of Piedra Azul in the municipality of San Martín Peras in the Juxtlahuaca District of Oaxaca, Mexico and, more recently, throughout the Central Coast of California. Like other Tu'un Savi varieties so far described, the tone-bearing unit is the mora and tones are organized around a bimoraic constituent often referred to as the couplet. However, the tone system differs from most other previously described varieties of Tu'un Savi in several important ways. First, it does not display evidence of any tonal processes. Second, there are no tonally unspecified TBUs. Third, contour tones are not analyzed as underlying sequences of level tones, but are instead analyzed as contour units. Fourth, and finally, there is a five-way tonal contrast on the mora, which consists of three level tones (H, M, L) and two unitary contour tones (R, F). This is a higher number of contrasts than most Tu'un Savi varieties, which, with the notable exception of Yoloxóchitl Mixtec, have inventories of up to three or four level tones and no unitary contour tone

1. Introduction

The inventory and behavior of lexical and grammatical tone across the Otomanguean language family is remarkably diverse. Within the Tu'un Savi (Mixtec[1]) language group (Kaufman 2006), proposals for the number of varieties range from 52 distinct languages (Simons & Fennig 2017, based largely on Egland 1983) to 81 varieties (INALI 2008), which Josserand (1983) classifies into 12 "dialect areas" or subgroups. The tone systems of 32 varieties[2] have been described to varying degrees of detail, representing 9 of Josserand's 12 proposed dialect groups (Figure 1 and Table 1). Despite being relatively limited in size relative to the number of Tu'un Savi varieties, and imbalanced with respect to the representation of each subgroup, this sample of tone systems contains a high degree of variability in the tone inventories, tone distributions, and tonal processes. This thesis seeks to add to the body of literature on Tu'un Savi tone systems by presenting a basic analysis of

[1] A note on terminology: A common endonym that at least some Mixtec people use for their language is Tu'un Nda'vi, written here without tone diacritics to indicate that it does not refer to one specific variety (Guadalupe Joaquina 2014). *Tu'un* means 'word' or 'language' while *Nda'vi* is commonly translated as 'poor', but also as 'humble'. The stigma associated with speaking Indigenous languages in Mexico led some Na Savi (Mixtec) intellectuals and activists to popularize the alternative endonym Tu'un Savi, meaning 'language of the rain'. But because Tu'un Savi is often less recognizable to speakers, the name Tu'un Nda'vi remains prominent, with some additional emphasis on the association with humility. Here, I follow the practice of Gabriel Mendoza (UCSB), whose language is represented in these pages, by referring to his variety as Tù'un Ndá'vi, marking variety-specific lexical tones, and referring to Mixtec languages collectively as Tu'un Savi, without tone diacritics. Readers should be aware that some Mixtec individuals consider it more respectful for non-Indigenous people to use Tu'un Savi (or its variety-specific cognate) for both referents (Ventura Luna 2018). This non-community member respect form in Gabriel's variety is Tù'un Sàjvĭ.

[2] This figure includes some popular grammars that minimally contain a section that covers the tonal inventory and distribution. Three popular grammars without information on tone distribution were excluded. In this case all had 3-tone inventories of H, M, L. They include the Jamiltepec (Pensinger 1974) and Santa María Zacatepec (Towne *et al.* 2011) varieties from the Costa subgroup; and the variety spoken north of Tlaxiaco in the Western Alta subgroup (Gittlen 2016).

the Piedra Azul (San Martín Peras) tone system, describing the inventory, distribution, (lack of) tonal processes, and situating the analysis within the typology of Tu'un Savi tone[3].

The analysis argues for five underlying contrasts: three level tones /H/, /M/, /L/; and two unitary contour tones specified for direction of pitch change, one rising and one falling: /R/ and /F/. Like other Tu'un Savi varieties so far described, the tone-bearing unit is the mora and tones are organized around a bimoraic constituent often referred to as the couplet (K. Pike 1984). No tonally unspecified moras, floating tones, or tonal processes are found in the variety. On morphologically simplex disyllabic couplets, the distribution of the level tones is free while contour tones are mostly restricted to the second syllable. When a contour does occur on the first syllable of this word shape it is always /R/. Twenty basic melodies are attested in the distribution across disyllabic and monosyllabic words, although the 5 that begin in a rising contour are infrequent (see §6). While 18 of these melodies are attested on morphologically simplex disyllabic words, only 11 occur on the monosyllables, perhaps due to the relative infrequency of monosyllables in the lexicon compared to disyllables. Unlike for disyllabic couplets, contour tones in monosyllabic couplets are restricted to the first mora, though they do largely conform to the same restriction against /F/ tones in this position, with only one lexical item that presents an exception.

As in other Tu'un Savi languages and the Otomanguean family more broadly, tone serves grammatical functions in addition to lexical ones (Hollenbach 2015; Bradley & Hollenbach 1988, 1990, 1991, 1992; Macaulay 1996; Campbell 2016; Palancar 2016; Palancar & Léonard 2016; Castillo Martínez 2011; Tiburcio Cano 2017). For the purposes

[3] An earlier version of this work (Peters 2018) appears in the proceedings of the 8th Conference on Indigenous Languages of Latin America, which was held at the University of Texas at Austin, October 26-28, 2017.

of the present discussion, the role of tone in person marking, negation, aspect and mood, and derivation will not be addressed in detail. Because tonal morphemes interact with the more foundational features of the tone system and create a more complex distribution, this account largely limits itself to a characterization of the tone system as it pertains to the tonal inventory and distribution of tone across morphologically simplex couplets.

In the paper that follows, previous studies of Tu'un Savi tone are summarized in §2. Section 3 provides basic information about the community and the collaborative linguistic projects this paper emerges from before presenting a phonological sketch of the Piedra Azul variety in §4. The methodology applied in the process of data collection and analysis is described alongside the tone inventory in §5, followed by the distribution of tonal contrasts within the couplet in §6. The absence of tonal processes and the specification of all tonal contrasts are demonstrated in §7. Section 8 concludes by situating this analysis within the typology of Tu'un Savi tone and discussing its implication for Tu'un Savi tone studies.

2. Overview of the study of tone in Tu'un Savi

Kenneth Pike's (1948) seminal publication on tone prominently features one variety of Tu'un Savi alongside one variety of Mazatec, another language in the Otomanguean family. He establishes a distinction between register and contour-tone languages and classifies Tu'un Savi and Mazatec as register languages with 3 and 4 levels respectively (K. Pike 1948: 5–6), though acknowledging that the Mazatec variety has some overlap with contour-tone systems while the Mixtec variety can be understood as a "pure register-tone system" (K. Pike 1948: 12). Analyses of Tu'un Savi tone have overwhelmingly proposed series of level (i.e. register) tones to underlie surface contours (see §8), similar to tonal languages of Africa (e.g. Hyman 2010) and in contrast to tonal languages of Asia where contours are

typically analyzed as tonal units that are specified for direction of pitch change and are not decomposable into sequences of discrete pitch targets (e.g. Benedict 1948; but cf. Yip 1989).

One of the refinements that Welmers (1959) makes to Pike's classification of tone languages is the further subclassification of register tone systems into discrete level and terraced level types. In discrete level languages, the range of absolute pitch for a given tone remains relatively constant throughout a phrase, having the result that all H tones in a phrase will be higher than all M tones, and so on (Welmers 1959: 3–5). In terraced-level tone languages, on the other hand, non-low tones are either specified as 'same' or 'drop' in reference to preceding non-low tones (Welmers 1959: 4–5). The result is a downward terracing effect across the phrase also known as downstep. Despite generally being associated with Africa, Pike & Small (1974) also describe such a system for the San Juan Coatzospan variety of Tu'un Savi. Although Welmers' discussion assumes that terracing only occurs downward, iterative upstep has been described for Acatlán Mixtec (Pike & Wistrand 1974; Aranovich 1994).

Many varieties of Tu'un Savi also display floating tones; underspecified TBUs; and tonal processes such as tone spreading, tone metathesis or tone shift, upstep, and downstep (see §7 and §8). Much of the early work on Tu'un Savi explains tonal alternations in terms of "perturbations", also referred to as sandhi, though in the contemporary literature most of these phenomena are accounted for with floating tones and tone spreading rather than the categorical replacement of one tone with another, even when the term sandhi remains popular. Often, the result of these early analyses is an account of numerous rules and perturbation classes that provides little in terms of generalizability. To take one example, Overholt (1961) accounts for surface alternations in the Metlatónoc variety with 15 tone

classes whose interactions are governed by various rules and exceptions. While any explanation for the observed tonal behavior may necessitate perturbation classes, it would likely gain simplicity and elegance from including floating tones and tone spreading in the analysis, which account for surface alternations in many other Tu'un Savi varieties (e.g. Hollenbach 2004).

The representation of floating tones and tone spreading processes are predicated on two theories which were not available to all of the linguists describing Tu'un Savi tone in the 50s and 60s. The first key theory is Autosegmental Phonology (Leben 1973; Goldsmith 1976, 1990), which posits a suprasegmental tier separate from but parallel to the segmental tier. Here, nonsegmental features such as nasality and tone associate with or link to the units on the segmental tier that are able to bear them, e.g. tone-bearing units. The second prerequisite theory, underspecification (e.g. Stevick 1969; Myers 1998), then allows for some tone-bearing units (TBUs) to be unspecified for tone on the autosegmental tier. Often, though not always, these units are realized as mid tones in the surface representation (cf. Campbell 2016 on Zenzontepec Chatino). The combination of these theories allows for elegant accounts of some tonal processes, such as tone spreading, in which an underlyingly specified tone can associate with surrounding unspecified TBUs and yield contextually varying surface forms otherwise difficult to describe[4].

The relative under-description of Tu'un Savi tone systems and the theoretically dated nature of some analyses means that new thorough accounts are required, especially from

[4] Recent work with the Tù'un Ntá'ví (Mixtec) of San Martín Duraznos, despite benefiting from advances made in these previous models, appears to necessitate perturbation classes to account for the unpredictable surfacing of a floating H tone (reflex of historic word-final glottal stop) preceding certain L and M initial melodies some of the time (Hernández Martínez *et al.* 2018).

those subgroups underrepresented in the literature, in order to further develop Tu'un Savi tonal typology. In the extant literature, the Western Alta area persists as the most represented (Table 1) and is where Kenneth Pike initiated the early wave of systematic tone study (K. Pike 1948; Mak 1953, 1958; Overholt 1961; Pankratz & E. Pike 1967; E. Pike & Cowan 1967; Hunter & E. Pike 1969; Bradley 1970; Daly 1978; E. Pike & Small 1974; E. Pike & Wistrand 1974; E. Pike & Oram 1976; North & Shields 1977; E. Pike & Ibach 1978; Zylstra 1980). Despite some work in the Southern Baja area during this time, the subgroup was left largely alone until Carroll's (2015) dissertation on the Ixpantepec Nieves variety. Recently, a number of thorough descriptions by linguists at the Centro de Investigaciones y Estudios Superiores en Antropología Social (CIESAS) have marked a new wave of work on tone that is largely Indigenous authored and is beginning to balance the representation of varieties from underrepresented subgroups like Guerrero and Tezoatlán (e.g. Castillo García 2007; Santos Reyes 2009; Mendoza Ruiz 2016; León Vasquez 2017). Figure 1 (adapted from Josserand 1983: 470) shows the Tu'un Savi speaking towns for which tone descriptions exist. The visual representation provides an impression of where research on Tu'un Savi tone has been concentrated and the great number of varieties yet to be accounted for.

Although there has been a recent expansion of the descriptive literature on Tu'un Savi varieties from underrepresented subgroups, tone is not always the primary focus of these recent contributions (e.g. Reyes Basurto *et al.* 2016; Stark C. *et al.* 2013; Hernández Martínez *et al.* 2018; Ferguson de Williams 2007; Beaty de Farris *et al.* 2012), nor was it in some of the earlier descriptions (e.g. Stark Campbell *et al.* 1986; Bradley 1970). While the Eastern Alta, Guerrero, Southern Baja, Tezoatlán, and Western Alta have one or two

current, thorough descriptions with analyses based on the state of the art in tonal analysis, because tone systems can vary drastically even within the same subgroup, more of these kinds of analyses are warranted. Meanwhile, the Costa, Mixtepec, and Northern Alta subgroups are due for an updated, in-depth treatment and 3 other subgroups lack any accessible documentation of their tone systems.

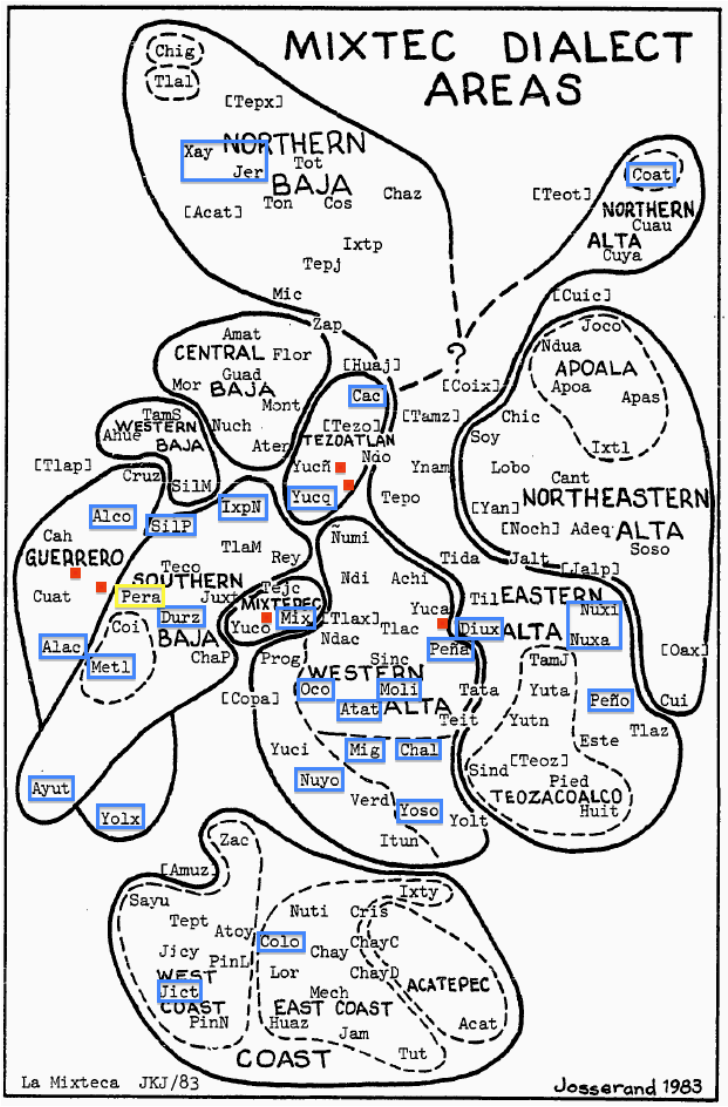

Figure 1. Adapted from Josserand (1983: 470), used with permission. Tu'un Savi varieties whose tone systems have some available description[5].

[5] Towns that Josserand's team visited are outlined in blue; towns they did not visit are represented with red dots. The location of San Martín Peras (and Piedra Azul) is outlined in yellow.

Table 1. The 32 Tu'un Savi varieties for which some tone description is available, organized according to Josserand's subgroups[6]. Abbreviations correspond to the map in Figure 1.

Subgroup (Josserand, 1983)		Variety/Village	References
Costa	*Colo*	San Juan Colorado	Stark Campbell *et al.* (1986)
(2)	*Jict*	Santa María Jicaltepec	Bradley (1970)
Eastern Alta	*Diux*	San Juan Diuxi	Pike & Oram (1976); Daly (1978)
(3)	*Nuxa* *Nuxi*	Santo Domingo Nuxaa San Andrés Nuxiño	McKendry (2013)
	Peño	Santa María Peñoles	Daly & Hyman (2007)
Guerrero	*Alac*	Alacatlatzala	Zylstra (1980)
(5)	*Alco*	Alcozauca de Guerrero	Mendoza Ruiz (2016)
	Yolx	Yoloxóchitl	Castillo García (2007); DiCanio *et al.* (2014)
	--	Tlahuapa	Reyes Basurto *et al.* (2016)
	--	Xochapa	Stark C. *et al.* (2013)
Mixtepec	*Mix*	San Juan Mixtepec	Pike & Ibach (1978)
(2)	--	Yucunany Mixtepec	Paster & Beam de Azcona (2004a, b)
Northern Alta	*Coat*	San Juan Coatzospan	Pike & Small (1974)
(1)			
Northern Baja	*Jer*	San Jerónimo Xayacatlán	Pike & Wistrand (1974);
(1)	*Xay*	Xayacatlán de Bravo	Aranovich (1994); Méndez-Hord (2017)
Southern Baja	*Ayut*	Ayutla (Tepango)	Pankratz & Pike (1967)
(6)	*Durz*	San Martín Duraznos	Hernández Martínez *et al*. (2018)
	IxpN	Ixpantepec Nieves	Carroll (2015)
	Metl	Metlatónoc	Overholt (1961)
	SilP	San Jerónimo Progreso	North & Shields (1977)
Tezoatlán	*Cac*	Santiago Cacaloztepec	Pike & Cowan (1967)
(4)	*Yucq*	Yucuquimi de Ocampo	León Vásquez (2017)
	--	San Andrés Yutatío	Ferguson de Williams (2007)
	--	San Juan Diquiyú	Santos Reyes (2009)
Western Alta	*Atat*	San Esteban Atatlahuca	Mak (1953)
(9)	*Chal*	Chalcatongo de Hidalgo	Macaulay (1996)
	Mig	San Miguel el Grande	Pike (1948)
	Moli	San Pedro Molinos	Hunter & Pike (1969)
	Nuyo	Santiago Nuyoo	Harris & Harris (n.d.)
	Oco	Santo Tomás Ocotepec	Mak (1958)
	Peña	Magdalena Peñasco	Erickson de Hollenbach (2004)
	Yoso	Santiago Yosondúa	Beaty de Farris *et al.* (2012)
	--	Santo Domingo Huendio	Becerra (2015)

[6] Each cell represents one variety. When a source mentions that data is collected from two villages that speak the same variety, both villages are listed in a single cell.

Among the most recent work is the Yoloxóchitl variety (Castillo García 2007; DiCanio *et al.* 2014) in the Guerrero subgroup, which has some commonalities to Piedra Azul Tù'un Ndá'vi. In addition to having a larger number of tonal contrasts than other varieties, the Yoloxóchitl variety also lacks any apparent indicators of privativity (unspecified TBUs), floating tones, or tonal processes, though there are some possible exceptions to this generalization (see §8). The tone system of Piedra Azul adds to the literature on the Southern Baja subgroup as well as the typological information available for Tu'un Savi tone, which is valuable for future comparative work in Tu'un Savi historical linguistics and historical comparative studies of tone more generally (Campbell, to appear). Before addressing the details of the present analysis, the following section provides some background on the diasporic community of speakers in the Central Coast region of California where this work was conducted.

3. Mixtec community in Oxnard

The community of Indigenous Mexican im/migrants and their families in California's Ventura County is 20,000 strong according to the local non-profit Mixteco/Indígena Community Organizing Project (MICOP 2015). Rivera-Salgado (2015) estimates that in California at large the population is closer to 200,000. In addition to Ñuu Savi (Mixtec), other distinct linguistic groups originating from the Mexican states of Oaxaca, Guerrero, and Puebla are also represented in Ventura County, such as Zapotec, Otomí, and Mè'phàà. The degree to which social networks converge across different linguistic and ethnic groups in the county is not yet clear to researchers, although similar communities along the West Coast of the U.S. have been the focus of some transnational scholarship (Fox & Rivera-Salgado

2004; Stephen 2007). Increasingly, Indigenous Mexican communities in California have become the focus of linguistic scholarship as well (e.g. Munro & Lopez 1999; Carroll 2015).

The linguistics field methods classes led by Eric Campbell at UCSB continues to expand this work by engaging in multifaceted community-based documentation projects (Reyes Basurto *et al.* 2016; Hernández Martínez *et al.* 2018). Close work with community partner organization MICOP and Ventura County Mixtec language activists Griselda Reyes Basurto, Carmen Hernández Martínez, and Gabriel Mendoza have created corpora of naturalistic speech, grammatical sketches, and literacy and pedagogical materials in the varieties of Tlahuapa (Guerrero), San Martín Duraznos and San Martín Peras (Southern Baja). Work on the varieties of San Juan Mixtepec (Mixtepec) and San Sebastian del Monte (Central Baja) is also developing in a multivarietal dictionary project[7], although these are by no means exhaustive of all of the varieties spoken in Ventura County. These broader collaborative language documentation and maintenance projects, of which the present tone analysis is a part, have generated several more accounts of the tone systems in the area.

The team aims to utilize language documentation methods and collaborative research frameworks to increase community access to information and public institutions via language and literacy development. Addressing language-based barriers to information and basic services may affect local trends in the shift from Tu'un Savi to Spanish and English, which has been reported to violate Fishman's (1972: 115–116) three-generation rule because some first and second generation youth become receptively bilingual in their parents' first

[7] Collaborators in the project not already mentioned include Yésica Ramírez (San Juan Mixtepec), Juvenal Solano (San Sebastian del Monte), Javier Martínez (San Martín Duraznos), Abel López (San Juan Mixtepec), and UCSB linguistics graduate students Sandra Auderset, Alexia Z. Fawcett, Jessica Love-Nichols, Kevin Schäfer, Adrienne Tsikewa, and Albert Ventayol-Boada.

language or may not learn it at all. Reports of this nature may be due to a widespread reluctance among young people to admit speaking an Indigenous language or a reporting bias that ignores the trends in households where parents are monolingual speakers of Tu'un Savi. A community language survey (PIs Campbell and Bucholtz, NSF Award No. 1660355) is presently underway to generate a more statistically informed account of language shift and language attitudes in the community to aid the MICOP and UCSB team in achieving its objectives of sociolinguistic and economic justice via language access and educational opportunity.

The present paper provides an account of the Piedra Azul (San Martín Peras) Tù'un Ndá'vi tone system based on the speech of Gabriel Mendoza, a local community organizer, activist, poet, and UCSB undergraduate student pursuing degrees in history and linguistics. Gabriel's linguistic repertoire includes English and Spanish in addition to his Tù'un Ndá'vi language, which is representative of the village of Kàjvă Ndziáá (Piedra Azul), a short distance outside the town of San Martín Peras, the seat of the municipality by the same name. There has been little documentation or description of the Tù'un Ndá'vi variety/ies spoken in the municipality of San Martín Peras (ISO 639-3: jmx), which falls within what Josserand designated the Southern Baja subgroup. Despite the absence of previous linguistic work in the municipality, some early reading primers have been made available online by the Summer Institute for Linguistics (SIL International 2018).

The following section outlines the basic segmental phonology of the language before presenting the tonal phonology in the remainder of the paper.

4. Basic phonology

This section is organized in two parts, the first providing the basics of the language's segmental phonology and the second introducing the word structure and some basic phonotactics that are helpful for understanding the subsequent analysis and discussion of the tonal phonology in the second half of the paper.

4.1 Segment inventory

The phoneme inventory of Tù'un Ndá'vi is given below, with the vowels in Table 2 and the consonants in Table 3. Because the practical orthography is used in the remainder of this paper, it is given in the tables in angled brackets < > below the IPA symbol as a reference for the reader. There are five oral vowels, three of which have nasal counterparts. A nasal mid front vowel does occur, but only as the result of a morphophonological process in which the first-person plural inclusive enclitic *=e* replaces the final nasal vowel of a root.

Table 2. Tù'un Ndá'vi vowel inventory

Oral vowels		
i <i>		u <u>
e <e>		o <o>
	a <a>	

Nasal vowels		
ĩ <in>		ũ <un>
	ã <an>	

The consonant phonemes are presented in Table 3. While the majority of work on Tu'un Savi languages posits prenasalized stops and affricates in the phoneme inventory (e.g. Longacre 1957: 9; Macaulay 1996: 18–19), in the Piedra Azul variety there is some evidence for treating these as clusters but none for treating them as unitary phonemes (see §4.2). Thus, what are here considered nasal-stop and affricate clusters are not included in the phoneme inventory. However, because the nasal consonant gives the second consonant in the cluster the impression of voicing in word initial position, the clusters are represented

distinctly in the orthography word initially: <mb> = [mp], <nd> = [nt], <ndi> = [nt^{j}], <ndzi> = [nts^{j}], <ndx> = [ntʃ]. This does not usually occur in word medial position where the nasal syllabifies as the coda of the preceding syllable (see §4.2).

Table 3. Consonant inventory

	bilabial	alveolar	palatalized alveolar	palatal (-alveolar)	velar	labio-velar	palatalized velar	glottal
obstruent	(p) <p>	t <t>	(t^{j}) <ti>		k <k>	k^{w} <kw>	(k^{j}) <ki>	ʔ <'>
affricate			ts^{j} <tsi>	tʃ <ch>				
fricative		s <s>	(s^{j}) <si>	ʃ <x>				h <j>
tap		ɾ <r>						
trill		(r) <rr>						
lateral		l <l>						
nasal	m <m>	n <n>		ɲ <ñ>				
approx	β̞ <v>			j <y>				

The table of consonant phonemes includes some sounds in parentheses that are infrequent in the lexical database, such as the bilabial <p> (and the nasal-obstruent cluster <mb> that includes it). These sounds occur word initially in a few loanwords like *páñu* 'shawl [Sp. paño = cloth, kerchief]' and *mbáa* 'co-father [Sp. compadre]', and word medially in loans such as *lompe* 'measles [Sp. sarampión]' and words of unknown origin such as *làpa* 'wet'. The trill <rr> occurs in the Spanish loanword *burru* 'donkey [Sp. burro]'. The palatalized alveolar <si> occurs in place names such as *Siókò* 'San Jerónimo Progreso' and *Siá'ă* 'Tecomaxtlahuaca' as well as a few words related to religion and spirituality, such as *Sie'é* 'The Virgin of Guadalupe' and *siú'ŭ* 'godmother'. The other infrequent palatalized alveolar <ti> (and nasal-obstruent cluster <ndi>) seem to occur only in a few words related to plants: *tiòjŏ* 'reed', *yivâ tiôó* 'type of edible plant', and *ndió'o* 'corn stalk'. The final

infrequent phoneme is the palatalized velar <ki> which occurs in the place name *Kiaà* ‘Coicoyán de las Flores’ and the word for ‘the day before yesterday’ *kiŭun*.

The approximant <v> varies between being realized as [β̞]~[b]. When it is preceded by word-medial /h/, a high level of frication and devoicing can cause the bilabial approximant to sound like [f]. The other approximant <y> /j/ is rarely realized as [ʒ], while in other varieties it is almost always realized as the fricative. The practical orthography is used in the remainder of this paper.

4.2 Word structure

The basic word consists of a bimoraic couplet (K. Pike 1948; Longacre 1957). The word structures in which the couplet manifests can be monosyllabic (n)(C)VV; or disyllabic (n)(C)V(ʔ/j)(n)(C)V (Figure 2). Medial glottal stop can occur in clusters before sonorant consonants while the laryngeal fricative can precede both sonorants and obstruents. Clusters in which the first phoneme is nasal give the following obstruent or affricate the impression of voicing. Final syllables are prominent: they freely show all tonal contrasts as well as the contrasts of nasality and phonological length, and they have greater duration in bimoraic disyllabic words.

Disyllabic	(n)(C)V(ʔ/j)(n)(C)V | | μ μ
Monosyllabic	(n)(C)VV | | μ μ

Figure 2. Bimoraic roots

As mentioned in §4.1, the tradition in Tu’un Savi descriptive linguistics has been to include prenasalized stops and affricates in the phoneme inventory. There is, however, some evidence to suggest that these actually behave phonologically as a series of two consonants

in the Piedra Azul variety. For example, in word medial contexts the nasal syllabifies as a coda of the penult, like in [konɬ.toɬ] ‘knee’ and [tʃinl̩.tʃil̩] ‘cricket’. These clusters are mostly restricted to non-velars but nasal-velar clusters are attested in fossilized compounds such as *inká* (one-CL) ‘other, another’.

The Piedra Azul variety has relatively few monosyllabic bimoraic words compared to other varieties. This is due to a historical process of intervocalic <j> insertion that affected most, but not all, bimoraic monosyllabic words. There remains a marginal vowel length contrast that can be seen in $CV_1C\ V_2V_2$ lexemes composed of fossilized morphosyntactic material plus a bimoraic monosyllable, and these contrast with $CV_1C\ V_2$ words. A few examples of this are shown in (1a–g).

(1)

a.	tsìkwɨ̌i	‘water’
	tìjkí	‘nut’
b.	tótóò	‘rapidly’
	tujtû	‘paper’
	ndó’ò	‘2PL’
c.	itsiààn	‘morning’
	ijtsiâ	‘grass’
d.	inuú	‘same’
	ìñù	‘six’
e.	Ìjtsia Tuxɨ̌i	‘Escopeta’
	ùxì	‘ten’
f.	kixáá	‘IRR.burn’
	vixá	‘wet’
g.	chìkwii	‘fox’
	chíki	‘prickly pear’
	chínchí	‘cricket’

This section has introduced the basics of Piedra Azul phonology and word structure. The following section describes the language's tonal contrasts before §6 shows the distribution of the tones on the bimoraic disyllables and monosyllables.

5. Tone inventory

The tonal inventory of Piedra Azul Tù'un Ndá'vi contains five contrasting tones: three level tones (/H, M, L/) and two contour tones (/R, F/).

Table 4. Tonal inventory

	Tone	Symbol	Orthography
Level tones	High	/H/	<á>
	Mid	/M/	<a>
	Low	/L/	<à>
Contour tones	Rising	/R/	<ă>
	Falling	/F/	<â>

The analysis was arrived at by following a workflow like those outlined in Cruz & Woodbury (2014) and Hyman (2014). The process began with wordlist elicitation using Kaufman's (n.d.) basic vocabulary for Mesoamerican cultural contexts and later also Campbell's (n.d.) more concise vocabulary. Words transcribed on index cards were grouped by pitch pattern. The different pitch patterns were then analyzed as 2-tone sequences, or melodies, whose domain is the bimoraic couplet. The inventory and distribution analysis was then tested for any evidence of floating tones, tonal processes, and underspecified tones by constructing 2-word sequences in which different tonal melodies were juxtaposed, which is discussed more in §7.

The discussion below approaches the inventory's level tones (§5.1) and contour tones (§5.2) separately, demonstrating the contrasts with minimal and near-minimal tonal pairs and arguing for the inclusion of contour tones as units rather than decomposable series of level tones.

5.1 Level tones

The inventory of level tones consists of /H/, /M/, and /L/, none of which is unspecified (see §7). Example (2) provides two minimal triplets that illustrate the 3-way contrast of level tones.

(2)	**/H/ ≠ /M/ ≠ /L/**	*íín*	‘IPFV.peel’
		iin	‘one’
		ììn	‘nine’
		níjǐ	‘thin’
		nijǐ	‘ear of corn’
		nìjǐ	‘blood’

The spectrograms for the first triplet in (2) are given in Figures 3–5 to illustrate these tonal contrasts visually. The average pitch across each monosyllabic bimoraic couplet in the minimal triplet is 138.3 Hz for /HH/ *íín* ‘IPFV.peel’, 127.4 Hz for /MM/ *iin* ‘one’, and 106.7 Hz for /LL/ *ììn* ‘nine’. The second minimal triplet contrasts each level tone preceding a /R/ tone. Spectrograms of these melodies can be seen in §5.2.1, though the example words there do not form a minimal triplet.

Figure 3 shows the spectrogram for the monosyllabic /HH/ word *íín* ‘IPFV.peel’.

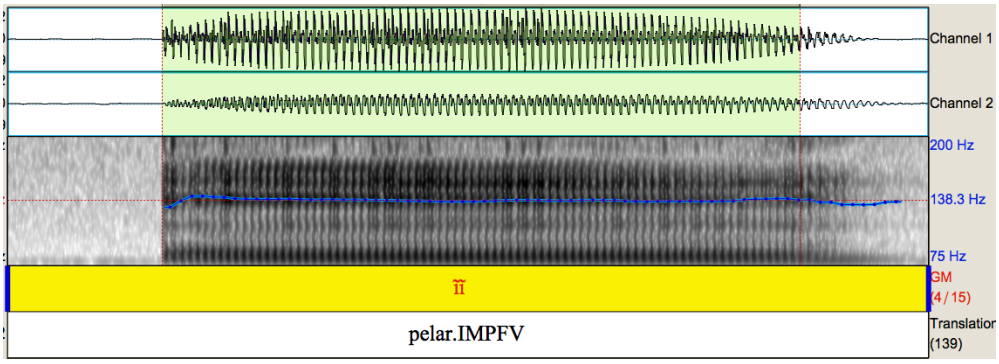

Figure 3. /HH/ *íín* ‘IPFV.peel’; mean F0=138.3 Hz

The spectrogram for the /MM/ word *iin* ‘one’ is given in Figure 4.

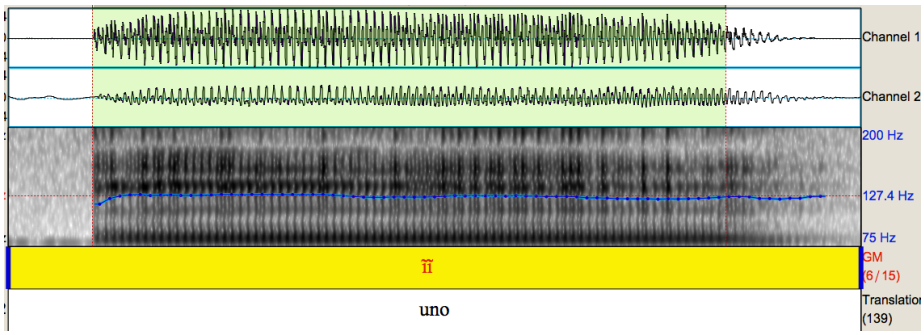

Figure 4. /MM/ *ïïn* 'one'; mean F0=127.4 Hz

Lastly, the monosyllabic melody /LL/ is shown in Figure 5. The downdrift that the final mora /L/ displays is common in both disyllabic /L.L/ and monosyllabic /LL/ melodies. It is described more in §5.2.2.

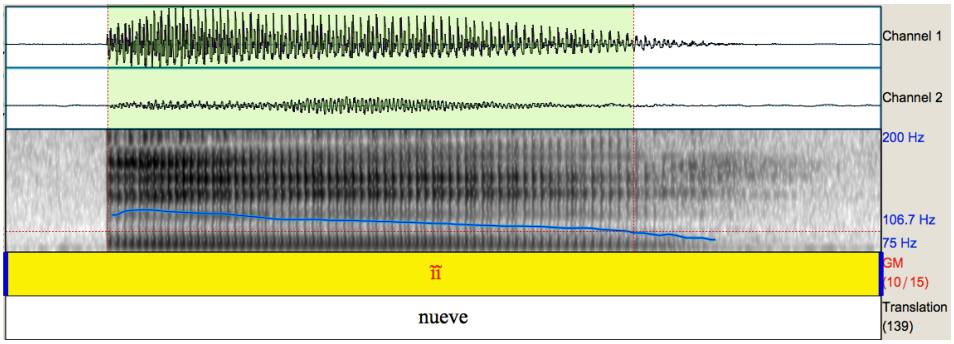

Figure 5. /LL/ *ìì̀n* 'nine'; mean F0=106.7 Hz

Minimal and near-minimal pairs in (3) show the contrast between /H/ and /M/ in initial and final syllables. The contrast in final syllable position is demonstrated following each level tone (/H/, /M/, /L/), and in initial syllable position preceding /M/ and /R/ tones.

(3)	**/H/ ≠ /M/**	*tsiò'**ó***	'flea'	*tsiò'**o***	'root'
		*y**ú**ku*	'plow harness'	*y**u**kŭ*	'mountain, wilderness'
		*yúy**ú***	'dew'	*yúk**u***	'plow harness'
		*ndiv**í***	'bright, clear'	*ndiv**i***	'beautiful'
		*t**á**jan*	'earthquake'	*t**a**xa*	'lightning'
		*xù'**ú**n*	'money'	*tù'**u**n*	'word'

*k**á**'nu*	‘large (SG)’	***a**jtun*	‘bitter’
*ch**í**jǐn*	‘fingernail’	*n**i**jǐ*	‘thin’
*ch**í**jǐn*	‘fingernail’	***i**jǐn*	‘salt’

Not all minimal and near-minimal pairs adequately demonstrate a contrast between tonal primitives because the surrounding tonal environments are not held constant. Instead, pairs might better demonstrate contrasts between melodies. Such is the case in (4), where one minimal and one near-minimal pair show the contrast between the melodies /H.M/ and /M.L/, two melodies that have the same shape but occupy different ranges in the pitch space.

(4)	**/H.M/ ≠ /M.L/**	*í'na*	‘ghost’	***i**'mà*	‘smoke’
		*kw**í**jka*	‘rich’	*kw**i**jkà*	‘comb’

The tonal near-minimal pairs in (5) show a contrast between /H/ and /M/ on both syllables at the same time, thereby also demonstrating a contrast between the melodies /H.M/ and /M.H/.

(5)	**/H.M/ ≠ /M.H/**	***í'i***	‘raw’	***i**'n**í***	‘hot’
		*nd**á**'v**i***	‘poor’	*nd**a**y**í***	‘rough’

The contrast between /H/ and /L/ is shown in (6) in initial syllable position preceding /H/, /M/, and /R/ tones, and in final syllable position following /M/. One of the near-minimal pairs shows the contrast in both syllables, thus also showing a contrast between the melodies /H.L/ and /L.H/.

(6)	**/H/ ≠ /L/**	*y**á**jǎ*	‘tongue’	*y**à**jǎ*	‘ash’
		*ch**í**nchí*	‘cricket’	*ch**ì**jchí*	‘avocado’
		*kw**í**jtsi*	‘short’	*k**ì**si*	‘pot’
		*ch**í**jǐn*	‘fingernail’	*x**ì**jǐn*	‘sharp’

	*iy**á***	‘sour’	*kwiy**à***	‘year’
	*k**ú**'**ù***	‘sick’	*x**ù**’**ú**n*	‘money’

Example (7) shows the contrast between /M/ and /L/ in initial and final syllables. The contrast in initial syllable position precedes /M/ and /R/, and in final syllable position follows /M/.

(7)	**/M/ ≠ /L/**	*v**i**jkǒ*	‘festival’	*v**ì**jkǒ*	‘cloud’
		*kin**i***	‘bad’	*kin**ì***	‘pig’
		*v**e**’e*	‘house’	*v**è**je*	‘heavy’
		*y**o**’ǒ*	‘rope’	*y**ò**jǒ*	‘moon’
		*y**u**jñǔ*	‘net’	*ñ**ù**jñǔ*	‘bee’
		*n**a**jǎ*	‘dark’	*n**ù**jǔ*	‘face’
		*y**a**jvǐ*	‘agave’	*s**à**jvǐ*	‘rain’
		*n**i**jǐ*	‘thin’	*x**ì**jǐn*	‘sharp’
		***i**jkǐn*	‘squash’	*ts**ì**jkí*	‘nut’
		*kw**i**jǐ*	‘green’	*k**ì**jǐ*	‘day’

5.2 Contour tones

The inventory of contour tones in Tù’un Ndá’vi consists of one rising tone /R/ and one falling tone /F/. On morphologically simplex bimoraic disyllabic lexemes, contour tones are mostly restricted to the second mora. Each contour varies in its realization depending on the tone that precedes it in the couplet. It is not the starting or ending pitch levels that characterize these tones, but rather their increasing or decreasing trajectory in pitch over the mora. The discussion in this section necessarily entails the distribution, although tone distribution is discussed in more detail in §6.

5.2.1 Rising tone

Following /M/ and /L/ tones, the rising contour begins at a pitch close to that of the preceding tone and rises toward a high target.

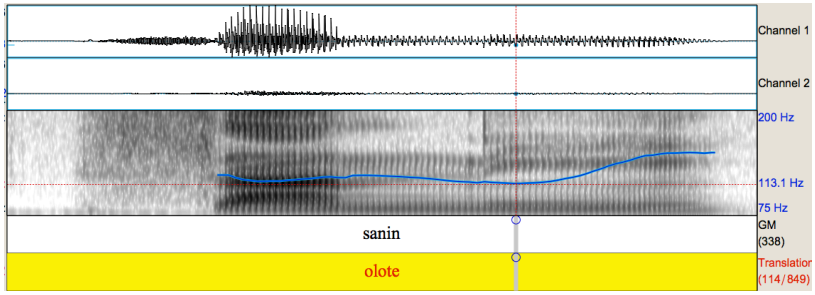

Figure 6. /M.R/ *sanǐ* 'corncob'; /R/ min F0=113.1 Hz, max F0=149.9 Hz

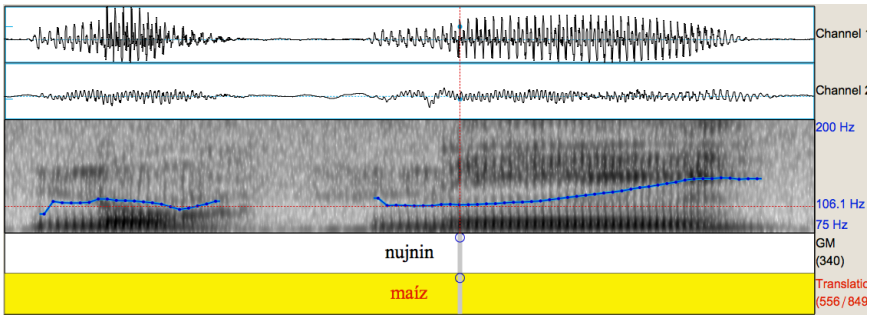

Figure 7. /L.R/ *nùjnǐ* 'corn'; /R/ min F0=106.1 Hz, max F0=135.9 Hz

In a /H.R/ sequence, the rise begins at a pitch slightly lower than the preceding /H/. Because of the allotonic variation in the realization of the rising tone, it appears that it is the upward pitch trajectory that is characteristic of this tone, rather than a discrete starting and ending pitch level. This behavior supports the analysis of contours as units, which will be discussed more in §7.

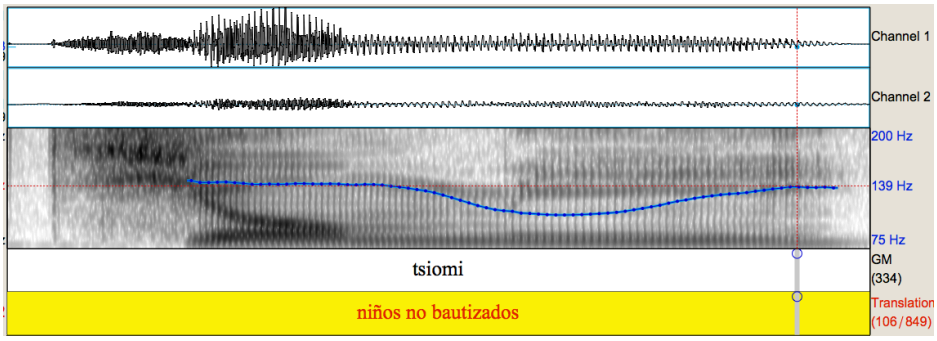

Figure 8. /H.R/ *tsiómǐ* 'unbaptized children'; /R/ min F0=109.9 Hz, max F0=139 Hz

The rising tone is contrastive in Piedra Azul Tù'un Ndá'vi, unlike in the Yucunany Mixtepec variety, in which the /L.H/ melody is realized as [L.LH] with a phonetic rise on the second mora, as shown in (8).

(8) Yucunany Mixtepec phonetic rising tones (Paster and Beam de Azcona 2004: 5)

/kùmí/ → [kùmìí] 'four'

/sàví/ → [sàvìí] 'rain'

In the Piedra Azul variety these cognate forms also have a surface representation [L.R]. In contrast to Yucunany Mixtepec, this melody does contrast with [L.H] in Piedra Azul, which can be seen in (9) below along with the contrasts between /H/ and /R/ following each of the other level tones as well.

(9)	**/H/ ≠ /R/**	*yòs**ó***	'metate'	*yòj**ǒ***	'moon'
		*vix**á***	'wet'	*ix**ǎ**n*	'corn flour'
		*chínch**í***	'cricket'	*chíj**ǐ**n*	'fingernail'
		*tsiu'**ú**n*	'black widow'	*tsiuk**ǔ***	'louse'
		*i'n**í***	'hot'	*ij**ǐ**n*	'salt'
		*ndiv**í***	'bright, clear'	*yijv**ǐ***	'petate mat'
		*tsiò'**ó***	'flea'	*ndò'**ǒ***	'tenate'
		*tsiàk**á***	'fish'	*yàjt**ǎ***	'boot' (constellation)

The contrast between /M/ and /R/ following each of the 3 level tones is shown in (10). Because /R/ contrasts with /H/ and /M/ in a variety of contexts, and because the disyllabic melodies that end in /R/ are contrastive with those melodies composed of level tones with an overall upward pitch trajectory, /R/ is considered a distinct tone in the inventory.

(10)	**/M/ ≠ /R/**	*ajt**u**n*	'bitter'	*ijt**ǔ**n*	'tree'

*tù'**u**n*	'word'	*tùj**ǔ**n*	'black'
*ndiv**i***	'beautiful'	*yijv**ǐ***	'petate mat'
*ndzì'**i***	'pimple'	*ndzìjv**ǐ***	'egg'
*xí'**i**n*	'and, with'	*yivâ tsí'**ǐ**n*	'type of edible plant'

5.2.2 Falling tone

The falling contour /F/ also follows all 3 register tones, although the /M.F/ melody is the most frequent. Following /M/, the falling tone is realized with a descending pitch beginning at the same level as the preceding /M/.

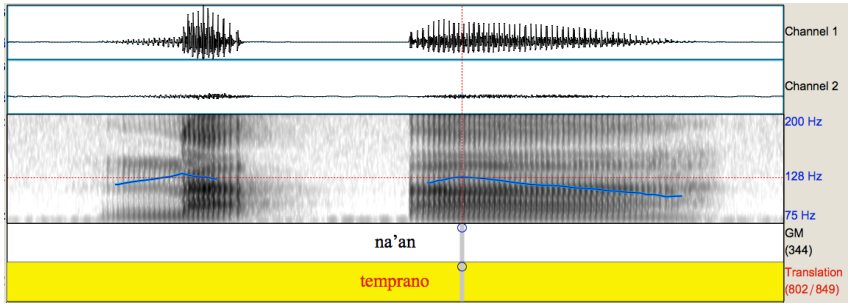

Figure 9. /M.F/ *na'â* 'early'; /F/ max F0=128 Hz, min F0=105.5 Hz

Following a /H/ (Figure 10) or /L/ tone (Figure 11), the falling trajectory begins at a level slightly higher than the preceding tone.

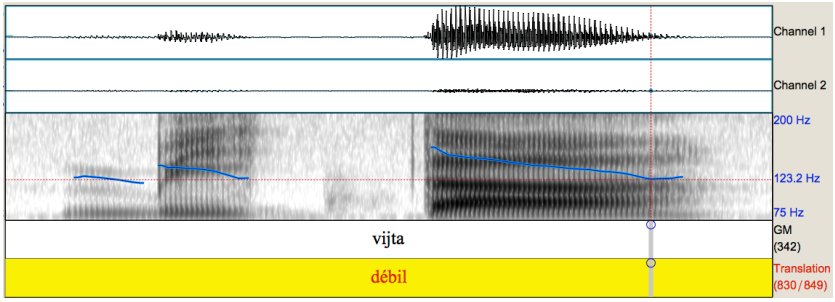

Figure 10. /H.F/ *vijtâ* 'weak'; /F/ max F0=160.1 Hz, min F0=123.2 Hz

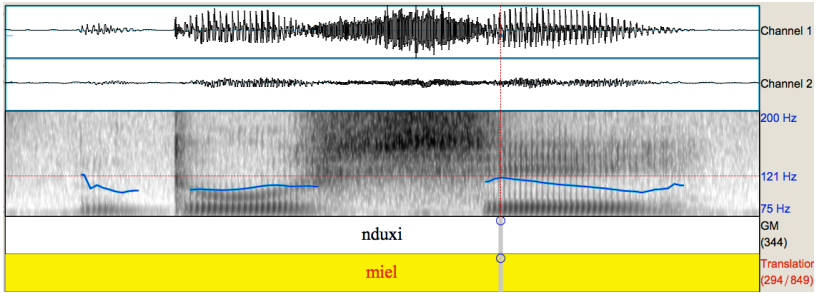

Figure 11. /L.F/ *ndùxî* 'honey'; /F/ max F0=121 Hz, min F0=103.4 Hz

Because they both have a low target, /L/ and /F/ tones share a degree of perceptual similarity in word final position, especially following /M/ and /L/ tones. As with /R/, a falling contour following a /M/ begins at a pitch close to that of the preceding tone before moving toward its target, as seen in (Figure 9). While /L/ following /M/ can evidence some degree of downdrift, it manifests at a pitch target that is lower than both the preceding /M/ and the pitch that a /F/ in the same environment ultimately reaches (Figure 12). /L/ also distinguishes itself from /F/ in this position with some accompanying creaky voice.

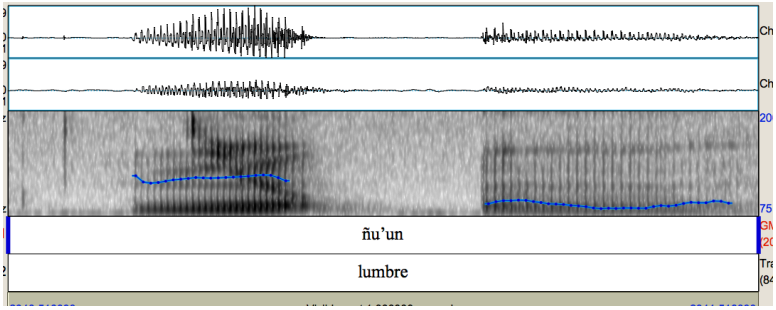

Figure 12. /M.L/ *ñu'ù* 'fire'

Word-final /L/ demonstrates a degree of downdrift and creak following another /L/ just as it does following /M/, as seen in Figure 13.

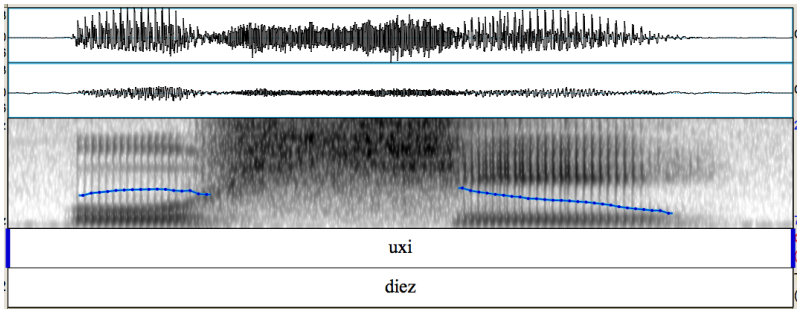

Figure 13. /L.L/ *ùxì* 'ten'

A /F/ tone is distinguished from /L/ in this same environment by beginning its downward fall from a level slightly higher than the preceding /L/, and perhaps by lacking creak, which can be seen in Figure 11. Similarly, the pitch trace for the /H.L/ word *ndzíjkà* 'wide' in Figure 14 is distinct from that of /H.F/ *víjtâ* 'weak' in Figure 10. While this /L/ tone does display some downward movement, it differentiates itself from the "true" contour tones by drifting downward from an already low target.

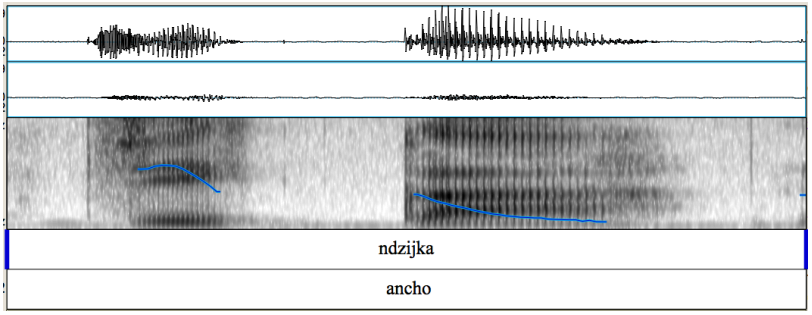

Figure 14. /H.L/ *ndzíjkà* 'wide'

The above examples show that /L/ on the second mora of a word displays some downdrift, but nevertheless contrasts with /F/. This contrast results in a symmetrical distribution of contour tones on the second mora after any of the 3 register tones in disyllabic words. A list of near-minimal pairs, some of them repeated from the figures above, are provided in (11) to demonstrate this contrast following each level tone.

(11)	**/H.F/ ≠ /H.L/**	*víjtâ*	'weak'	*ndzíjkà*	'wide'
		líkô	'type of bird'	*lá'lò*	'lizard'

/M.F/ ≠ /M.L/	*na'**â***	'early'	*ñu'**ù***	'fire'
	*us**û***	'deer'	*kas**ùn***	'toasted'
	*kajk**â***	'lime mineral'	*ndajkw**à***	'pus'
/L.F/ ≠ /L.L/	*ndùx**î***	'honey'	*ùx**ì***	'ten'

6. Tone Distribution

The 5 Tù'un Ndá'vi tones are distributed across the domain of the bimoraic couplet, which can be either disyllabic or monosyllabic (n)(C)V(ʔ/j)(n)(C)V (see §4). A sequence of 2 tones that maps onto the couplet structure constitutes a tonal melody. Of the 25 possible combinations of the 5 tones on the couplet, 20 are attested on morphologically simplex words; 18 of these occur on disyllables and 11 occur on monosyllables. Level tones are unrestricted in their distribution, but a gap does exist for monosyllables, which are rare in the lexicon (see §6.2). Contour tones are mostly restricted to the final mora in morphologically simplex disyllables where they can appear after any of the three level tones (they are, however, common in non-final position in multimorphemic forms). Conversely, monosyllabic words containing a contour tone necessitate an analysis in which the contour is associated with the first mora (see §6.2), creating an interesting phonotactic asymmetry between monosyllabic and disyllabic words.

6.1 Disyllabic words

The distribution of the 5 tones in disyllabic couplets is summarized in Table 5 and the frequency of each melody among the disyllables used in the study is given in Table 6. As has been previously stated, the level tones are freely distributed across both syllables. Contour tones, on the other hand, are mostly restricted to the second mora. Still, there are a small number of words in which a contour tone falls on the initial mora. There are a few

trends to note with respect to these melodies: (1) the contour on the first mora is always /R/, and (2) when the first mora hosts a /R/ tone the second mora is likely to host a contour tone as well. Before delving into the particulars of these melody types, each basic lexical tone melody is presented in a variety of phonological contexts.

Table 5. Tone distribution on disyllabic couplets

(C)V(C)CV		Level			Contour	
		_H	**_M**	**_L**	**_R**	**_F**
Level	**H_**	H.H	H.M	H.L	H.R	H.F
	M_	M.H	M.M	M.L	M.R	M.F
	L_	L.H	L.M	L.L	L.R	L.F
Contour	**R_**	--	(R.M)	--	(R.R)	(R.F)
	F_	--	--	--	--	--

Table 6. Melody frequencies on disyllabic couplets; total=316

Total = 316	**_H**	**_M**	**_L**	**_R**	**_F**
H_	12	32	9	7	4
M_	11	33	22	51	22
L_	9	24	26	40	8
R_	--	3	--	1	2
F_	--	--	--	--	--

The melody /H.H/ appears on a variety of disyllabic word shapes and in varied phonological contexts, shown in (12).

(12) **/H.H/**

chínchí	'cricket'	*léló*	'skunk'
chújtú	'full'	*lá'vá*	'toothless'
tsié'é	'hard'	*lúndú*	'short'
kwí'ná	'robbery'	*láxán*	'resistant'
sáví	'rainy season'	*yúyú*	'dew'

The /H.M/ melody also appears in a variety of disyllabic word shapes and phonological contexts, as seen in (13).

(13) **/H.M/**

tsiá'yi	'rotten'	*máli*	'co-mother'
ndió'o	'dry corn stalk'	*lá'nu*	'elder (n.)'
ndxíchi	'magician'	*víli*	'whistle (n.)'
xúxan	'lazy'	*yúku*	'mountain, wilderness'
sójkun	'high'	*í'i*	'raw'

Many words with the /H.L/ melody also have a word medial laryngeal segment, as seen in (14).

(14)	**/H.L/**	*kú'ù*	'sick'	*lá'lò*	'lizard'
		ndzíjkà	'wide'	*yé'è*	'clean, clear'
		Ndxióxì	'God'		

The examples in (15) show the /M.H/ melody in a variety of phonological contexts.

(15)	**/M.H/**	*tsiu'ún*	'black widow'	*ñu'ú*	'spirit'
		ndiví	'bright'	*vixá*	'wet'
		ndayí	'rough'	*yajtá*	'old'
		kaní	'long'	*i'ní*	'hot'
		ndxuxí	'hen'	*iyá*	'sour'

Examples of the melody /M.M/ are shown in (16).

(16)	**/M.M/**	*mbila*	'thick tortilla'	*leso*	'rabbit'
		taxa	'lightning'	*machi*	'cotton, wool'
		ndivi	'beautiful'	*vitsin*	'now'
		ko'nto	'hill'	*ve'e*	'house'
		kwiñu	'inflammation'	*ajtu*	'bitter'

The /M.L/ melody occurs in a range of phonological environments and includes one of only two numerals that fall outside of the /L.L/ (or monosyllabic /LL/ melody), as seen in (17).

(17)	**/M.L/**	*kinì*	'pig'	*likì*	'type of bird'
		kwiyà	'year'	*lonà*	'spotted'
		chi'yò	'nest'	*ninù*	'below'
		ndzi'ì	'puma'	*yajkwà*	'dirty'
		xa'ùn	'fifteen'	*i'mà*	'smoke'

Although relatively infrequent in the lexicon, the examples in (18) show the melody /L.H/ occurring in various phonological contexts. The words belonging to this tonal melody are all nouns, however.

(18)	**/L.H/**	*tsiàká*	'fish'	*mà'ñú*	'middle'
		tsiò'ó	'flea'	*yivâ yà'á*	'type of edible plant'
		chìjchí	'avocado'	*yùtsí*	'sand'
		xù'ún	'money'	*yòsó*	'metate'

The examples in (19) demonstrate the occurrence of the /L.M/ melody in a variety of disyllabic word shapes and phonological contexts.

(19)	**/L.M/**	*tù'un*	'word'	*làpa*	'wet'
		kìsi	'pot'	*ñà'a*	'thing'
		kò'va	'sibling (diff. gender)'	*vìxi*	'grey hair'
		tsiò'o	'root'	*vìxin*	'cold'
		sàta	'dove'	*vèje*	'heavy'

The /L.L/ melody shown in a variety of contexts in (20) contains the majority of the numerals.

(20)	**/L.L/**	*kòntò*	'knee'	*vìxì*	'sweet'
		kwè'è	'sickness; brave'	*yùjkù*	'herb'
		tsiàñì	'lover'	*iñu*	'six'
		ndziàkà	'plastic'	*ìvì*	'two'
		sàxìn	'cousin'	*ò'và*	'salty'

The /H.R/ melody is infrequent, its few examples shown in (21).

(21)	**/H.R/**	*chíjĭn*	'fingernail'	*níjĭ*	'thin'
		tsiómĭ	'unbaptized person'	*yájkă*	'dust'
		Siá'ă	'Tecomaxtlahuaca'		

The most common melody is /M.R/, shown in a variety of phonological contexts in (22).

(22)	**/M.R/**	*tojtŭn*	'firewood'	*ñu'ŭ*	'earth'
		ndujchĭ	'bean'	*vixĭ*	'pinecone'
		ndzikĭn	'horn'	*yo'ŏ*	'rope'
		ndxixĭn	'ear of corn'	*ijĭn*	'salt'
		sanĭ	'corncob'	*ixăn*	'masa (corn dough)'

/L.R/ is one of the most frequent melodies, though most of its members include some form of word medial laryngealization, whether it is an intervocalic glottal fricative or glottal stop, or a preconsonantal glottal fricative, as shown in (23).

(23)	**/L.R/**	*tàjchĭ*	'air, wind'	*nùjnĭ*	'corn'
		kòjŏ	'snake'	*vìjkŏ*	'cloud'
		kwà'ă	'much'	*yòjŏ*	'moon'
		sàjvĭ	'rain'	*ìjmă*	'wax'
		xìjtă	'tortilla'	*àsĭn*	'tasty'

As the few examples in (24) show, the /H.F/ melody is rare in the lexicon.

(24)	**/H.F/**	*kójtô*	'shirt'	*líkô*	'type of bird'
				víjtâ	'weak'
				ísâ	'day after tomorrow'

The /M.F/ melody is the most frequent of those that end in /F/, but mostly consists of nouns, as seen in (25).

(25)	**/M.F/**	*tsikâ*	'grasshopper'	*ñañî*	'brother (same gender)'
		koñû	'meat'	*yivâ*	'greens'
		xitsîn	'steep'	*usû*	'deer'
		xajtû	'pants'		

The /L.F/ melody is infrequent and consists only of a few nouns, shown in (26).

(26)	**/L.F/**	*tsìnâ*	'dog'
		tùchî	'tendon, cable'
		ndùxî	'honey'

As was previously mentioned, when a melody begins with a contour tone on a disyllabic word it is always /R/. Because such melodies are extremely infrequent, they are shown together in (27). Of these forms, at least the /R.R/ example *tsiŏtŏ* 'rat' represents a historically complex form, possibly composed of *tsìín* 'mouse' plus some modifier[8]. This melody is synchronically attested on a number of verbal forms inflected for aspect.

(27)	**/R.M/**	*xĭli*	'type of bird'	*lăxa*	'urine'
				ñŏ'o	'this'
	/R.R/	*tsiŏtŏ*	'rat'		
	/R.F/	*ndzĭjkâ*	'wall'		
		xă'ân	'lard'		

The previous examples provided support for the validity of the tonal melodies by showing their occurrence in a range of segmental phonological environments. One

[8] An alternative would be to analyze this word as consisting of the fossilized animal classifier prefix *tsì-* followed by something else, but there are many forms in the language with this fossilized prefix and none of them have a word initial /R/.

additional aspect of note regarding the distribution of the contour tones in disyllables is that /R/ in final position largely corresponds with Josserand's (1983) reconstruction of a word-final glottal stop, shown in (28). Thus the rising tone is considered to be one reflex of lost final glottal stop.

(28)

Gloss	**Josserand (1983)**	**Piedra Azul**
'masa'	*yuxẽʔ	*ixăn*
'tasty'	*aʂ̃ʔ	*àsĭn*
'nopal'	*wiʔndeʔ	*vi'ntsiă*
'animal'	*kɨtɨʔ	*kìjtsĭ*
'bean	*nduti?	*ndujchĭ*
'wood, tree'	*yutũʔ	*ijtŭn*
'egg'	*ndɨwɨʔ	*ndzìjvĭ*
'rain'	*sawiʔ	*sàjvĭ*
'four'	*kɨw̃ɨʔ	*kòjmĭ*
'wax'	*yuwẽʔ	*ìjmă*
'tortilla'	*sitaʔ	*xìjtă*
'griddle'	*xiyoʔ	*xìjyŏ*

Some exceptions that Josserand reconstructs with a final glottal stop but do not occur in the Piedra Azul variety with a final /R/ tone are given in (29). Because tone was not transcribed in most of Josserand's data, it cannot be used to surmise the reason that these forms did not participate in the historical sound change and end up with final /R/ tone. However, Campbell and Reyes Basurto (in press) note for several varieties that words with an initial /H/ tone do not show the expected reflex of *ʔ, but a word final /H/ occurs instead.

This explanation would account for the forms *yúyú* ‘dew’ and *núná* ‘IPFV.open’ in Piedra Azul, but not for *ká’nu* ‘large.SG’, *i’ní* ‘hot’, or *ndajkwà* ‘pus’.

(29)

Gloss	**Josserand (1983)**	**Piedra Azul**
‘large.SG’	*kaʔnuʔ	*ká’nu*
‘hot’	*iʔniʔ	*i’ní*
‘dew’	*yuyuʔ	*yúyú*
‘IPFV.open’	*nuneʔ	*núná*
‘pus’	*lakwaʔ	*ndajkwà*

Having described the distribution of the 5 tonal contrasts across morphologically simplex disyllabic words, the following section addresses the distribution of tone on monosyllabic couplets.

6.2 Monosyllabic words

Monosyllabic words are infrequent in the Tù’un Ndá’vi of Piedra Azul. At the time that this study initially took place, the lexical database of 357 entries contained only 41 monosyllabic CVV couplets across nominal, adjectival, and verbal word classes, in addition to a handful of CVCVV forms and a couple of nontransparent CVV roots that only occur in compounds. Currently, the expanded database contains approximately 1000 lexical items and the number of monosyllables remains around 50. The distribution[9] of the 5 tonal contrasts across this word shape is summarized in Table 7 and the frequency of each melody among the monosyllables used in this study are given in Table 8. Following, each melody is shown in the phonological contexts that are attested. The relevant monosyllables that occur

[9] The /LM/ melody is attested only in monosyllabic verb forms inflected for potential aspect. Because it is derived and cannot be considered a basic melody for monosyllabic couplets, it is not included in the table or discussed below.

in CVCVV words or in compounds are shown in boldface to aid in demonstrating infrequent melodies when possible.

Table 7. Tone distribution on monosyllabic couplets

(C)VV		Level			Contour	
		_H	**_M**	**_L**	**_ R**	**_F**
Level	**H_**	HH	HM	HL	--	--
	M_	MH	MM	ML	--	--
	L_	LH	--	LL	--	--
Contour	**R_**	--	RM	RL	--	--
	F_	FH	--	--	--	--

Table 8. Melody frequencies on monosyllabic couplets; total=41

Total = 41	**_H**	**_M**	**_L**	**_ R**	**_F**
H_	5	5	1	--	--
M_	1	6	4	--	--
L_	6	--	4	--	--
R_	--	3	5	--	--
F_	1	--	--	--	--

The monosyllabic words belonging to the /HH/ melody are given in (30).

(30) **/HH/** *ndziáá* ‘bluish black’ *léé* ‘baby’
séé ‘young man’

The /HM/ melody is shown on monosyllabic words in (31).

(31) **/HM/** *mbáa* ‘co-father’
ndúu ‘type of black bug’
ndziáa ‘where?’
kwíi ‘liquid’
kwáan ‘yellow’

The /HL/ melody only has one representative example. It is a disyllabic word with the shape CVCVV given in (32).

(32) **/HL/** *tó**tóò*** ‘rapidly’

The only example of the /MH/ melody is shown in a CVCVV word in (33). This word is likely historically complex, composed of *iin* ‘one’ and *nùjŭ* ‘face’.

(33) **/MH/** *i**nuú*** ‘same’

The examples in (34) show the /MM/ melody occurring with different vowel qualities, including nasal vowels.

(34)	**/MM/**	*chuun*	'work'	*yaa*	'white'
		xaa	'how?'	*iin*	'one'

The melody /ML/ is shown on monosyllabic couplets in (35).

(35)	**/ML/**	*kiuùn*	'day before yesterday'	*ñuù*	'village'
		saà	'bird'	*yaà*	'music'

Example (36) shows the relatively frequent /LH/ melody in various contexts.

(36)	**/LH/**	*tàá*	'dad (vocative)'	*nàá*	'mom (vocative)'
		kòó	'empty'		
		tsìín	'mouse'		
		xàá	'new'		

Examples of the melody /LL/ are given in (37). Among them is a disyllabic word with the shape CVCVV.

(37)	**/LL/**	*ndàà*	'flat, level'	*yàà*	'dusty'
		itsiààn	'morning'	*ììn*	'nine'

The melody /RM/ is shown on a CVCVV word and a monosyllable in (38).

(38)	**/RM/**	*tsì**kwǐi***	'water'	*ñŭu*	'night'

The most frequent of the complex tonal melodies, /RL/ is shown in different phonological contexts in (39).

(39)	**/RL/**	*kǎà*	'steel'	*měè*	'bull calf'
		tsiǎà	'clothing'		
		tsiŏò	'passion fruit'		

The melody /FH/ is only attested in the compound shown in (40). It is also the only melody in which a /F/ occurs on the first mora.

(40)	**FH**	*yivâ **tiôó***	'type of edible plant'

One difference between the tonal distribution on monosyllabic and disyllabic words is the behavior of contour tones. Whereas there is a large number of disyllabic words that contain a unitary contour tone, there is only a small number of monosyllables with complex tonal melodies necessitating an underlying representation that includes a contour unit. In disyllabic roots, there are 9 melodies with a contour tone, in the majority of which it appears on the final mora. In monosyllabic words, on the other hand, all 3 complex tonal melodies display their contour tone unit on the initial mora: /RM/, /RL/, and /FM/ (see §6.2.1).

Another difference between the tonal distributions of monosyllabic and disyllabic words is that there is a gap in the distribution of level tones on monosyllables and some melodies have only 1 representative example. Monosyllabic couplets occur less frequently in the lexicon than disyllables, which appears to be due at least in part to historical processes. Many Piedra Azul disyllables with medial <j> have monosyllabic cognates in the Tlahuapa Mixtec variety (Reyes Basurto *et al.*, 2016) due a historical process of intervocalic <j> insertion. Some of these cognates are provided in (41).

(41)

	Piedra Azul, Oaxaca	**Tlahuapa, Guerrero**
‘moon’	*yòjǒ*	*yôó*
‘green’	*kwijǐ*	*kwîí*
‘tongue’	*yájǎ*	*yâá*
‘youth’	*kwajǎn*	*kwâán*
‘earthquake’	*tájan*	*tâan*
‘ash’	*yàjǎ*	*yàá*
‘snake’	*kòjǒ*	*kòó*
‘salt’	*ijǐn*	*ìín*

‘face’	*nùjǔ*	*nùú*
‘rock’	*yùjǔ*	*yùú*
‘heavy’	*vèje*	*vèe*

The gaps in the attested melodies in monosyllabic words (Table 6) may simply be due to the relatively small number of monosyllabic words in the lexicon. While it is possible that some of these gaps may resolve themselves as the lexical database grows, for the time being, the /LM/ melody has only been attested on inflected verbs while /HL/ and /MH/ are each attested on only a single lexeme. As a morphologically complex derived melody, /LM/ cannot be considered basic to the distribution of tone on monosyllables.

6.2.1 Complex contours

The complex tonal melodies that are observed on monosyllables are distributionally rare and warrant closer discussion. Complex tonal melodies occur on CVV syllables that most often make up monosyllabic lexemes, but a few are either part of a compound and no longer have a lexical meaning in isolation, or are part of a CVCVV word with a fossilized classifier prefix that is no longer productive in the language.

The 3 complex tonal contours that occur on monosyllables can be further classified into concave and convex types based on the directionality of their pitch trajectories. The convex melodies are those whose pitch rises from their initial pitch before falling. Concave melodies, on the other hand, have a pitch that first falls from their starting pitch and then rises. Of the 3 complex tonal melodies in Tù’un Ndá’vi, 2 are convex (/RM/ and /RL/) and 1 is concave (/FH/).

A spectrogram representation of the convex tone melody /RM/ on a monosyllabic word is shown in Figure 15.

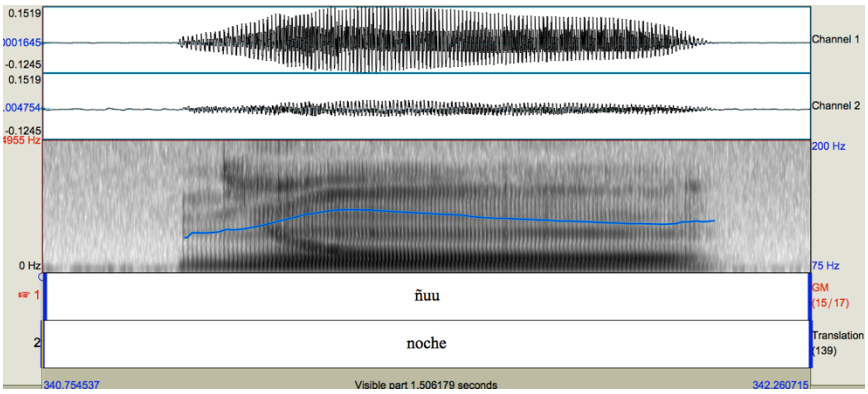

Figure 15. /RM/ *ñǔu* 'night'

The spectrogram in Figure 16 shows the same /RM/ melody on the long syllable of a CVCVV word.

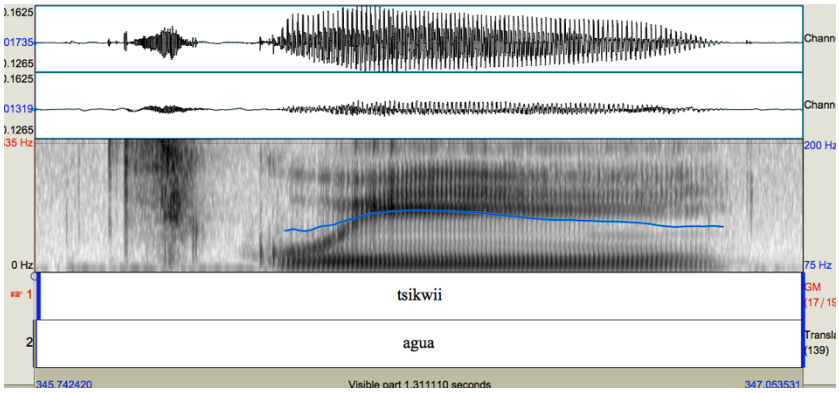

Figure 16. /RM/ *tsìkwĭi* 'water'

The convex tone melody lower in the pitch space /RL/ is shown on a monosyllabic word in Figure 17. There are no CVCVV words that bear this melody.

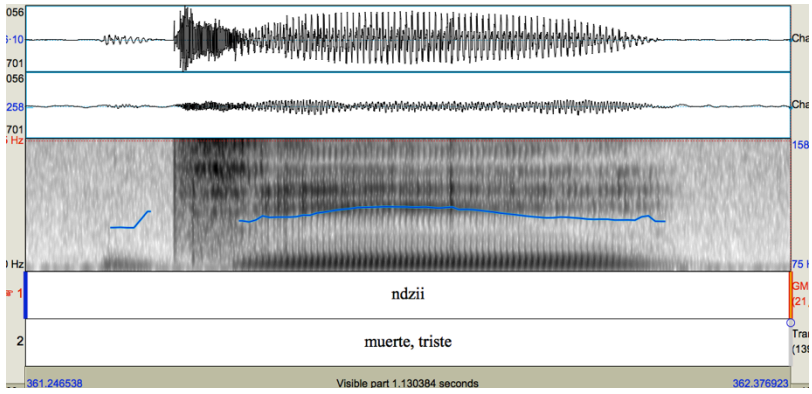

Figure 17. /RL/ *ndzĩi* 'death; sad'

The least frequent complex tonal melody and only concave contour /FH/ is shown in the spectrogram in Figure 18 on the example of a monosyllabic couplet that forms part of a compound word.

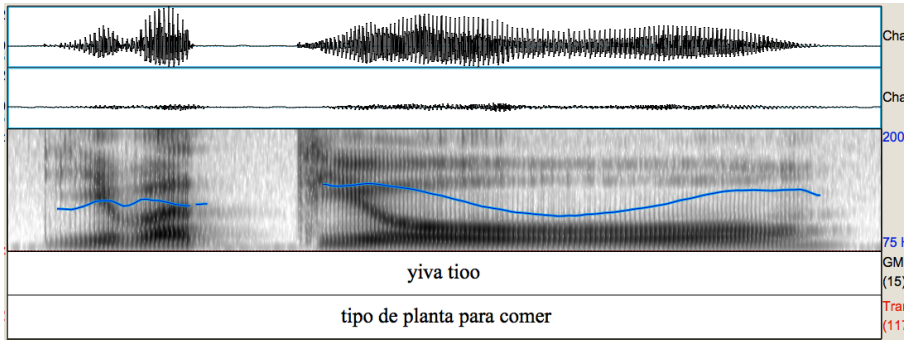

Figure 18. /FH/ *yivâ tiôó* 'type of edible plant'

These complex tonal melodies are analyzed as a sequence of a unitary contour tone and a level tone, with the contour unit on the first mora rather than the second. Although this is contrary to the distributional trend for contour tones in disyllabic couplets, the spectrograms in Figure 15–18 show that the fastest change in pitch occurs within the first mora of the CVV sequence. The subsequent fall or rise (for convex and concave melodies respectively) resembles the gradual movement of pitch between the two level targets of a CVV word that has an overall simple contour melody. The result is a distributional asymmetry between monosyllables and disyllables, such that contour tones are restricted to the initial mora in monosyllables but mostly restricted to the final mora in disyllables.

7. Tonal processes and privativity

A language can be determined to have underspecified TBUs if a TBU displays phonological inertness, lacks an apparent tone target, or is "replaced" by a spreading tone from a neighboring TBU (Myers 1998). Tonal underspecification is not uncommon among Otomanguean languages. For example, [M] is toneless Ø in Santa María Peñoles Mixtec (Daly & Hyman 2007) while [L] is toneless in Zenzontepec Chatino (Campbell 2016). For

the Tù'un Ndá'vi of Piedra Azul (San Martín Peras) there is no evidence yet found for underspecified TBUs; none of the aforementioned cues to underspecification apply to words tested in isolation or juxtaposition contexts.

Spectrograms of 3 different M-tone final melodies are shown here to demonstrate that it has a consistent target, regardless of which tone it follows. Figure 19 shows a M.M word with a pitch trace that is level and constant.

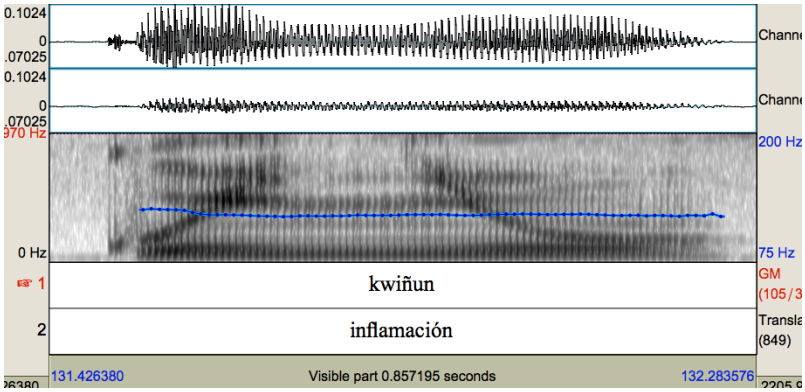

Figure 19. /M.M/ *kwiñu* 'inflammation'

Following /L/, the M tone is again realized as a constant level target, as shown in Figure 20.

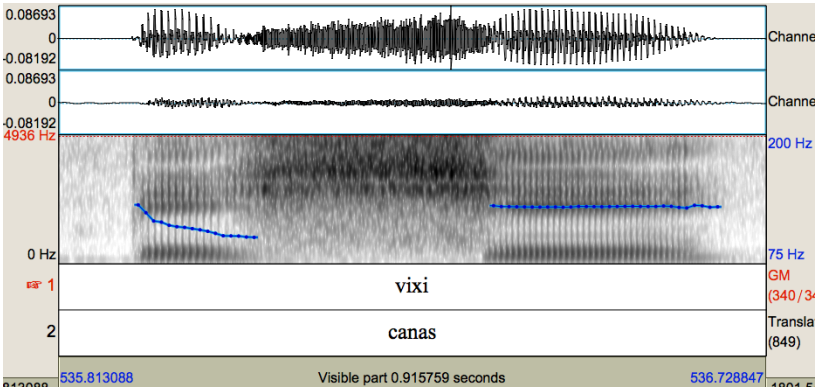

Figure 20. /L.M/ *vìxi* 'greying hair'

Lastly, following a /H/ tone, M is again realized at a level pitch target, shown in Figure 21.

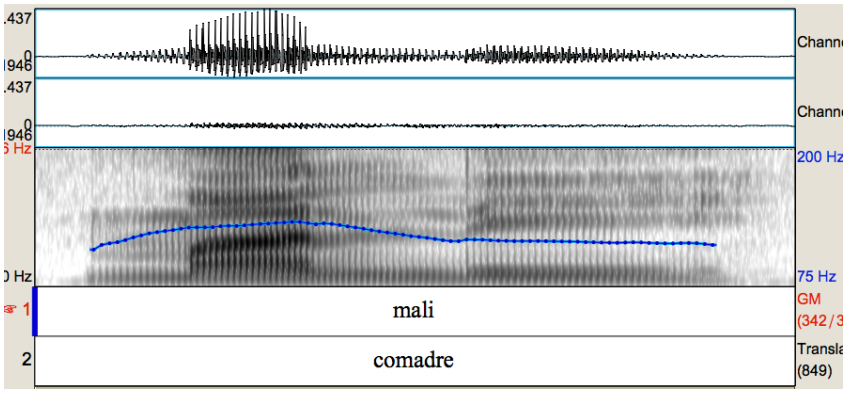

Figure 21. /H.M/ *máli* 'co-mother'

7.1 Tonal juxtaposition

Disyllabic words were tested for tonal alternations deviating from their isolation context melodies with tone frames based on the noun phrase syntax [Num N Adj]. The 15 most common disyllabic melodies were used to test each possible combination of the five tones across a word boundary. Not all melody combinations were tested due to a lack of example words that could be used to construct felicitous pairings. For each combination of melodies tested, 1 to 5 two-word combinations were recorded. The results of this exercise show no evidence of the floating tones, tone spreading, upstep or downstep found in other Tu'un Savi varieties.

The spectrogram in Figure 22 shows a /H.R/ word followed by a /M.M/ word.

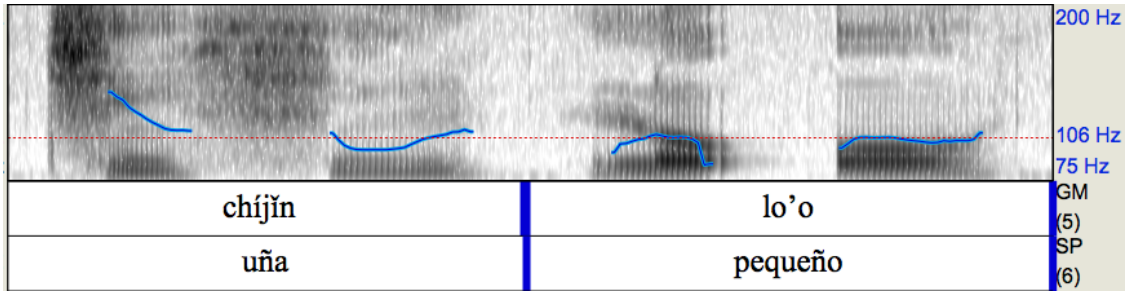

Figure 22. R#M *chíjĭn lo'o* 'small fingernail'

A word ending in a /F/ contour tone is juxtaposed with a /M.M/ word in Figure 23.

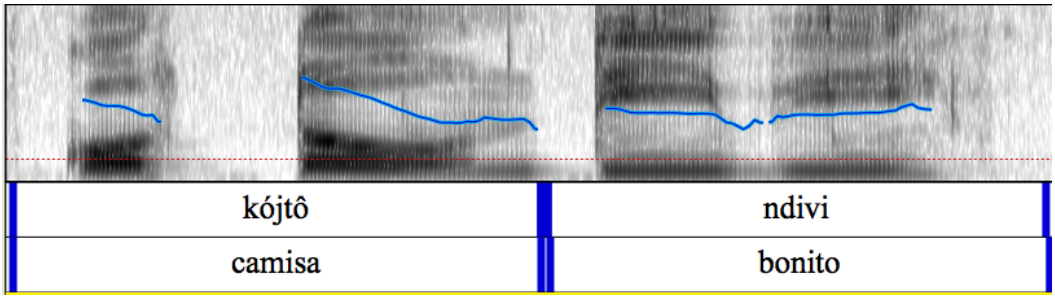

Figure 23. F#M *kójtô ndivi* 'beautiful shirt'

In the preceding Figures 22–23, the words with /M.M/ melodies preceded by contour tones /R/ and /F/ respectively show no perturbation of their initial /M/ tones. Because word-final contour tones do not display any tone spreading behavior at a word boundary, there is again no evidence that they are composed of underlying sequences. This bolsters the analysis provided in §5.2 that contour tones in this variety of Tù'un Ndá'vi are underlying units.

In Figure 24 the final /H/ tone of *yùtsí* 'sand' does not spread to the first mora of *vìxin* 'cold,' as might be expected in a variety with floating or spreading H tones. It appears, then, that there are no floating tones in Piedra Azul Tù'un Ndá'vi and all TBUs are tonally specified.

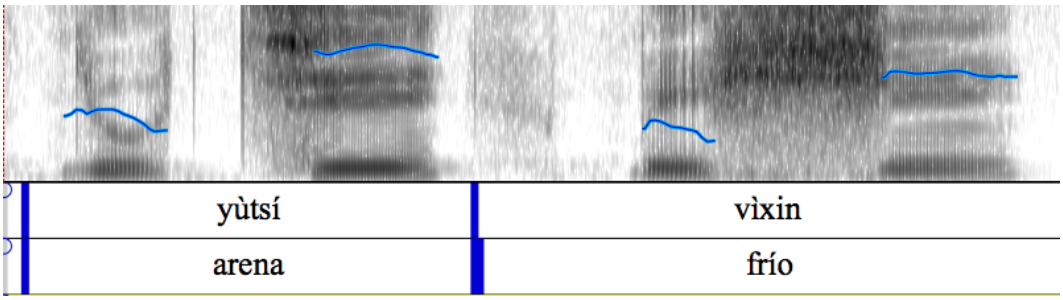

Figure 24. H#L *yùtsí vìxin* 'cold sand'

8. Discussion and conclusion

The tone system of Piedra Azul (San Martín Peras) Tù'un Ndá'vi is quite unlike the majority of other Tu'un Savi tone systems previously described in the literature. With a 5-

way tonal contrast on the mora, consisting of 3 levels (/H/, /M/, /L/) and 2 contours (/R/, /F/), it has a larger tonal inventory than most others (§5). The contour tones are analyzed as units rather than underlying sequences of level tones (§5.2), there are no tonally unspecified TBUs (§7), and there is no evidence of any tonal processes (§7.1).

The majority of documented Tu'un Savi tone systems contain 3 contrasting level tones that are distributed across bimoraic couplets (§4) resulting in 9 basic melodies. Level tones combine to form contour tones on long syllables and monosyllabic bimoraic words, as well as on short vowels in some varieties. These are often simple contours, but complex contours are not uncommon. The Tu'un Savi varieties of Santo Tomás Ocotepec (Mak 1958); Metlatónoc, Guerrero (Overholt 1961); Huajuapan (E. Pike & Cowan 1967); and San Pedro Molinos (E. Pike & Hunter 1969) all have this type of system. The descriptions of these varieties all mention upstep and/or downstep in addition to sandhi. Mixtepec Mixtec (E. Pike & Ibach 1978) and Yucunany Mixtepec Mixtec (Paster & Beam de Azcona 2004a, b) are also described with this type of system, save for the sandhi processes. The frequent appearance of contour tones on phonemically short vowels in the data of Paster & Beam de Azcona do however raise the question of whether contours could be analyzable as units in this variety.

Two other descriptions written within the early wave deviate somewhat from the type of analysis common at the time. Acatlán Mixtec (E. Pike & Wistrand 1974) is analyzed as having 3 tones and upstep terracing. E. Pike & Small (1974) describe Coatzsopan Mixtec as a more traditional downward cascading terrace-level language with only 2 tonal contrasts, H and L, which combine to form two additional contour tones.

Another body of work on Tu'un Savi tone comes from a more recent wave of analyses that, like their predecessors, find 3 contrasts, but analyze one of them (usually M) as toneless. Carroll (2015) writing on Ixpantepec Nieves Mixtec describes L tone spreading and M raising, while Daly & Hyman (2007) describe Peñoles Mixtec with M downstep and H upstep in addition to a floating L tone. In Tlahuapa, Guerrero Mixtec, Reyes Basurto *et al.* (2016) find only H upstep. McKendry (2013) accounts for floating tones as well as H, M, and L tone spreading in South-eastern Nochixtlán Mixtec. Chalcatongo Mixtec is also counted among those systems with floating H tone and L tone spreading (Macaulay 1996), although it is somewhat marked in the sense that the floating H tones link to the end rather than the beginning of the subsequent word.

Other varieties in which M has been analyzed as Ø also have floating L tone but display an asymmetrical tone distribution, such that they have only 8 basic melodies rather than 9. Among them is Magdalena Peñasco Mixtec without a L.L melody (Hollenbach 2004). This variety also exhibits L tone spreading and has floating H and L tones. Pankratz & E. Pike's (1967) account of Ayutla Mixtec only contains 6 couplet melodies made up of the 3-way tone contrast and displays downdrift across the prosodic phrase. Although it is not clear how much data the analysis is based on, the unpublished work of Harris & Harris (n.d.) on Nuyoo Mixtec shows an asymmetrical distribution that leaves only 10 of the 16 possible melodies attested for the 4-tone inventory. This account also describes a sandhi effect of a M.H melody causing a following L to be replaced with a H. Some of the most recent work is Mendoza Ruiz's (2016) description of Alcozauca, Guerrero Tu'un Savi with a 4-way tone contrast and 12 melodies attested on CVCV words but 11 on CVV.

The variety described in the literature with a tone system most similar to that of Piedra Azul (San Martín Peras) is Yoloxóchitl Mixtec (Castillo 2007). It is often referred to as having an inventory of 9 contrasting tones (4 levels: /1/, /2/, /3/, /4/; and 5 contours: /13/, /14/, /24/, /42/, /32/)[10] and 23 melodies on disyllabic stems (DiCanio *et al.* 2014, DiCanio *et al.* 2015; Palancar *et al.* 2016). The distribution of contour tones is more complex in Yoloxóchitl than in Piedra Azul. The tone system of the Piedra Azul variety mostly restricts contour tones to the final syllable of disyllabic words and has few gaps in the overall distribution, whereas Yoloxóchitl Mixtec has similar restrictions on its contours but has many gaps in their distribution. Initial syllable rising tones are attested before three of the register tones, while initial falling tones are not present at all. A falling contour is only attested after an initial /1/ and /3/, while a rising contour in second syllable position is restricted to the /4/-initial melodies (DiCanio *et al.* 2014).

There are no sandhi phenomena in either variety, though some outlier instances of H spreading to a following L are mentioned for Yoloxóchitl (Palancar *et al.* 2016: 296). Despite their different tone distributions and Yoloxóchitl's higher number of tonal contrasts, the two varieties' tone systems share properties that set them apart from those previously described for other Tu'un Savi languages. They point toward the possibility of more systems with similarly structured inventories and distributions and suggest even greater diversity within the Tu'un Savi tone typology. Further investigations into the tone systems of the Guerrero and Southern Baja subgroups and beyond may provide a more fine-grained understanding of the relationships among the varieties, or require their reconsideration.

[10] The numbers denoting the tone levels within the pitch space range from 1 (lowest) to 4 (highest).

This paper has outlined some of the previous descriptive work on Tu'un Savi tone systems and provided an analysis for a previously undescribed variety, the Tù'un Ndá'vi of Piedra Azul (San Martín Peras). With no purely phonological tonal processes, no unspecified TBUs, and a tonal inventory consisting of 3 register tones and 2 unitary contour tones, Piedra Azul Tù'un Ndá'vi adds to the picture of diversity among Tu'un Savi tone systems. As the present state of Tu'un Savi tonal typology is not a balanced representation of each subgroup, the features of the Piedra Azul tone system described here also call into question the canonical nature of the 3-tone systems that to date have been the most frequent in the tonal typology of Tu'un Savi languages.

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