A SKETCH OF MUNICHE SEGMENTAL AND PROSODIC PHONOLOGY[1]

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This paper presents a description of the segmental and prosodic phonology of Muniche, a critically endangered Peruvian Amazonian isolate. Using data from team-based fieldwork with a group of rememberers of Muniche, this paper describes the segmental inventory, syllable structure, and stress system of the language, plus a number of prosodically motivated epenthetic processes. A historical overview of the language and its contact with neighboring Kawapanan languages is also presented. Finally, the results of this study are compared with Gibson (1996), the sole previous study of Muniche phonology.

[KEYWORDS: Muniche, Amazonia, endangered language, language shift]

1. Introduction. This paper presents a phonological description of Muniche (ISO code: myr), a linguistic isolate of Peruvian Amazonia previously spoken in the settlement of Munichis, located in the southwestern part of the *departamento* of Loreto. None of the approximately ten remaining rememberers of Muniche are fully fluent (by their own judgment), but three of them retain significant knowledge of the language, and the present paper is based on collaborative work with them during June 2008, August–September 2008, and June–July 2009, in the context of the Muniche Language Documentation Project (henceforth MLDP).

We have chosen to provide an especially detailed discussion of Muniche phonology in this paper because of the extreme degree of endangerment this language presently faces. With so few remaining rememberers of Muniche,

[1] The Muniche Language Documentation Project would not have been possible without the commitment and hard work of Donalia Icahuate Baneo, Melchor Sinti Saita, and especially Alejandrina Chanchari Icahuate. We also thank Demetrio Chanchari Baneo, who played a crucial role in facilitating the project and whose deep interest in the documentation of Muniche was an important motivation for the MLDP. We would also like to thank Pilar Valenzuela for crucial information on Shiwilu. An *IJAL* associate editor and two reviewers, one anonymous and another who revealed himself as Leo Wetzels, provided careful and insightful comments that helped improve this paper considerably. The work on which this paper is based was funded by the Cabeceras Aid Project and a RAPID grant from the NSF Documenting Endangered Languages Program (BCS #0941205).

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we are aware of the grim possibility that the MLDP may be the final linguistic documentation of Muniche prior to its extinction, and with this in mind, it is our goal to provide in this paper as thorough a description as we can.

In broad terms, the present paper describes the segmental phonology, syllable structure, and prosodic system of Muniche and then compares the results of this study with Gibson (1996), which also examines Muniche segmental phonology but reaches several conclusions different from our own. More specifically, we begin the paper by providing basic background information: section **2** discusses the classification of Muniche; **3** presents historical information regarding the Muniche people and sociolinguistic information regarding the contraction of the language; and **4** provides information on the documentation project from which this paper results. The phonological inventory of the language and the major allophonic processes are discussed in **5**, while its prosodic phonology is discussed in **6**, including a description of syllable structure, the stress system, minimum word phenomena, and the prosodically motivated distribution of the glottal stop. In **7** we discuss phenomena that can be attributed to language contact or language attrition, and in **8** we compare the analyses presented in this paper with those in Gibson (1996), the sole prior phonological study of the language.

2. Linguistic classification. Muniche is treated as an isolate in all recent classifications (Campbell 1997, Kaufman 1990, Solís 2003, and Wise 1999), although Gibson (1996) notes that Muniche verbal cross-reference markers show some suggestive similarities to those proposed by Payne (1991) for Proto-Arawak. Loukotka (1968:154) classifies Muniche (which he refers to as Munichi/Balsapuertiño) as a member of a proposed "Munichi stock," along with Tabaloso, Chasutino/Cascosoa, Huatama/Otonavi, Lama/Lamista, Suchichi/Suriche, Zapaso, Nindaso, and Nomona. However, Loukotka himself notes that there are no materials on any of these languages, other than Muniche, rendering questionable both the identification of these languages as distinct languages and their supposed genetic affiliation with Muniche (with the exception of "Otonavi," which is a variety of Muniche, as discussed below). Beuchat and Rivet (1909:618) treat Muniche as a Kawapanan language, but this classification precedes the availability of Muniche linguistic data and is likely based on the geographic proximity of Muniche to the Kawapanan languages. Linguists interested in long-distance genetic relationships have classified Muniche as part of a number of speculative macro-groups, such as Greenberg's Macro-Tukanoan (Greenberg 1987), but support for groupings of this sort is generally considered weak (Campbell 1997). In sum, Muniche has not yet been convincingly shown to be related to any other language and we consider it an isolate.

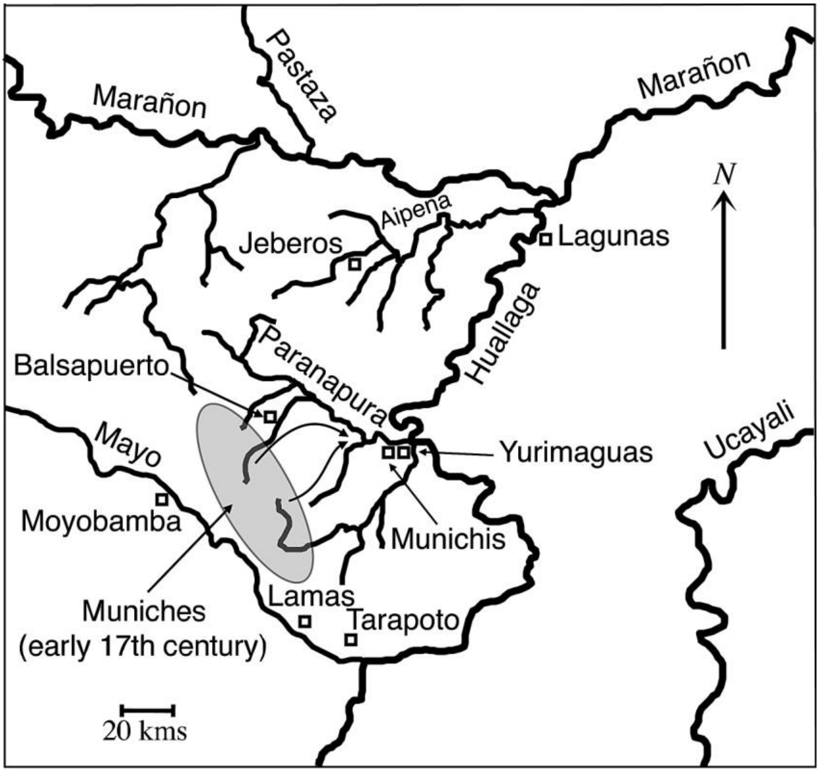

FIG. 1.—Historical and modern locations of the Muniche people.

3. Historical and sociolinguistic background.

3.1. Muniche in the colonial era. Jesuit records indicate that in the early seventeenth century, speakers of Muniche lived in the line of hills that stretch southeast from the headwaters of the Paranapura River (Veigl [1785] 2006:110); see figure 1. This area lay close to the town of Moyobamba, where Muniches were well known (Figueroa [1661] 1986:200). Muniches also lived in the Cachiyacu River basin, where a mixed Chayahuita/Muniche settlement, Balsapuerto, was documented later in the colonial period, and probably also in the southwestern part of these hills, closer to the town of Lamas (Veigl [1785] 2006:110), whose residents exploited Muniches for labor (Figueroa [1661] 1986:204).

Figueroa ([1661] 1986) indicates that in 1652, Jesuit missionaries began efforts to convince the Muniches to resettle on the Paranapura River, and that within a few years, the majority of the Muniche population relocated to a settlement upriver of the current site of Munichis. Oral histories compiled in 2009 from elderly Muniches indicate that the present community was settled in the nineteenth century by Muniches moving downriver from their previous settlement. In addition, Tessmann ([1930] 1999:171) comments that he encountered a small group of Muniches who had relocated to the lower Itaya River, near the city of Iquitos, and that language loss was already quite advanced among this group.

The Muniche people and their language have been known by a number of names. The name "Muniche" dates to the earliest colonial records (e.g., Figueroa [1661] 1986), with the variant "Munichi(s)" appearing in the nineteenth century (e.g., Anonymous 1851), presumably due to Quechua influence. The remaining speakers of the language refer to it as "Muniche" and the people as "los Muniches." The seventeenth-century residents of Moyobamba referred to Muniches as "Otonabes," a name that appears in some colonial records under a number of orthographic variants (e.g., "Otonavis" and "Otonahuis"). Some authors have identified "Paranapura" as an alternate name for Muniche (e.g., Tovar 1961:181), but this appears to be an error. Veigl ([1785] 2006:110) writes, "The Paranapura are another branch of the Xeberos.[2] They speak the same language with some dialectal variations."[3] Hervás y Panduro (1784) draws a similar conclusion, listing "Cahuapano" and "Paranapuro" [*sic*] as subdivisions of the "lengua matriz" "Chayavita" (i.e., Chayahuita/Shawi). Both authors thus identify Paranapura/o as a variety pertaining to the family now known as Kawapanan, which has two surviving members, Shawi (Chayahuita) (ISO code: cbt) and Shiwilu (Jebero) (ISO code: jeb) (Campbell 1997, Solís 2003, Valenzuela 2010, and Wise 1999). Another possible cause for confusion regarding the relationship between Muniches and the Kawapanan peoples is suggested by a comment by Steward (1948:607) that a group of Paranapuras, identified as a "Chébero" (i.e., Shiwilu) subgroup, intermarried with the Muniches, eventually adopting their language.

3.2. Language loss. Based on oral histories collected in 2008 and 2009, we estimate that the last fully fluent speakers of Muniche were born between 1915 and 1925, and that the language was moribund by the early 1930s. Our interviews suggest that by the early twentieth century, language shift was already taking place from Muniche to both Quechua (specifically, San Martin Quechua) (ISO code: qvs) and Spanish (Loreto-Ucayali Spanish) (ISO code: spq), a fact confirmed by Tessmann's ([1930] 1999:174)

[2] More commonly known in the linguistic and ethnographic literature as "Jebero." In recent years, the autonym "Shiwilu" has come into wider use (Valenzuela 2010).

[3] Original: "Otra rama de los Xeberos son los Paranapura. Hablan el mismo idioma con algunas variantes dialectales."

observations. The oldest residents of Munichis, including the speakers with whom we worked, appeared to be more comfortable in Quechua than in Spanish and explicitly confirmed our hypothesis that the shift to Quechua dominated over the shift to Spanish in the early part of the twentieth century. By the 1960s, however, Quechua appears to have also become moribund in Munichis, and the subsequent generations are monolingual in Spanish.

3.3. Previous work. Previous linguistic work on Muniche is relatively limited. The most important work is Gibson (1996), a sketch of Muniche phonology and verbal morphology based on the author's undergraduate thesis. Other than Gibson's work, documentation of Muniche is restricted to four brief word lists: Daggett (1976), Goodall (1950), Loukotka (1968), and Tessmann ([1930] 1999:171–74).

Gibson's (1996:33–41) discussion of Muniche phonology focuses on the phonological inventory of the language and the allophony and phonotactics exhibited by the segments he proposes. We discuss differences between Gibson's analyses and those presented in this paper in greater detail in **10** below.

4. Fieldwork. The fieldwork on which this paper is based was stimulated by reports to Lev Michael of a living elderly speaker of Muniche, which ran counter to speculation that the language was already extinct (Lewis 2009 and Solís 2003:168). The urgent nature of the situation prompted a one-week visit by Karina Sullón (KS) to Munichis in June 2008 to corroborate this report and ascertain the prospects for documentation work. During that visit, KS met the three rememberers with whom we subsequently worked most, Alejandrina Chanchari Icahuate, Donalia Icahuate Baneo, and Melchor Sinti Saita, all of whom expressed interest in documenting as much of the Muniche language as possible. KS returned to Munichis in August–September 2008 for a month of fieldwork, and the productivity of this fieldwork period, together with the positive attitude of the speakers toward the work and the goals of the project, prompted an intensive two-month research project in June and July 2009, which was carried out by all of the authors of this paper over an eight-week period, with the majority of the fieldwork being carried out by Stephanie Farmer and Gregory Finley. This fieldwork was organized around the explicit goal of providing the rememberers and interested community members with a bilingual Muniche–Spanish dictionary, a spelling primer, a collection of Muniche dialogues, and a non-technical description of Muniche grammar, prior to the departure of the visiting linguists in July 2009.

The three rememberers with whom we principally worked either had not used the language for most of their adult life or were never fully fluent in the language. Alejandrina Chanchari Icahuate (henceforth ACI) was born in approximately 1920 and spoke Muniche with her mother until her mother died when ACI was 14 years old. ACI subsequently spoke Muniche only sporadically and had not used the language for several decades prior to the arrival of KS in 2008. At approximately 90 years of age, ACI demonstrated some articulatory difficulties but produced utterances that exhibited the fewest structural influences from Quechua or Spanish. For example, ACI consistently treated Muniche subject markers as second-position clitics, conforming with the data in Gibson (1996), whereas our other two consultants often treated them as verbal suffixes, a reanalysis in accord with Quechua morphology.

Melchor Sinti Saita (henceforth MSS) was born in approximately 1940. MSS indicated that both of his parents spoke Muniche but that they deliberately spoke to him only in Spanish, so that he only partially learned the language. MSS evinced a great fondness for Muniche, however, and described using what he knew with his late wife and his sister. Interestingly, while MSS had less lexical recall than either ACI or DIB, and displayed greater uncertainty in grammaticality judgments, he had much better recall of everyday communicative routines and daily banter in Muniche than either ACI or DIB, and would frequently initiate brief conversations in Muniche during elicitation sessions.

Donalia Icahuate Baneo (henceforth DIB), born in 1951, was the youngest of our consultants. While DIB characterized herself as not fully fluent, she reported using her limited Muniche relatively frequently with her late mother, who was a bilingual Muniche–Quechua speaker. DIB was the clearest speaker of our three consultants and consequently produced most of the high-quality audio recordings of the language.

ACI, DIB, and MSS indicated at the outset that they wished to work together as a group in documenting the language, explaining that they would have greater success in remembering the language if they had their fellow rememberers to talk with and prompt their memories. Group work indeed proved crucial to the success of the documentation project, as the fragmentary knowledge of our three main consultants was often complementary, and prolonged discussions often triggered deeply buried memories. Note that we were careful to check most of the data that we collected at multiple points during the two-month fieldwork period, in order to confirm that the speakers' judgments and memories regarding given words and constructions were stable.

Group work focused on remembering lexical roots, especially during the early part of the field season, and the project ultimately documented some 800 roots (Michael et al. 2009*a*). Roughly 300 of these overlapped with roots given in Gibson's (1996) lexicon. As the speakers' memories of the language were stimulated over the course of the field season, work shifted increasingly to investigation of morphology and syntax (Michael et al. 2009*b* and Michael et al., in preparation), with some 740 sentences collected over the period of the project. Producing connected discourse proved to be extremely

TABLE 1
MUNICHE VOWEL INVENTORY

	Front	Central	Back
High	i	ɨ	u
Mid	e		
Low		a	

challenging for the speakers, with the result that no texts were recorded, although it was possible to construct several brief dialogues for pedagogical purposes (Michael et al. 2009*b*).

5. Phonological inventory.

5.1. Vowels. Muniche exhibits twenty phonemic consonants and five vowels. The vowels are given in table 1.

The contrast between the high unrounded vowels is demonstrated in (1), between the high non-front vowels in (2), and between the front vowels in (3).

(1*a*) [tʃapi] 'small bowl'
(1*b*) [tʃapɨ] 'thick stick'
(2*a*) [muʔtadeɾa] 'it is making noise'
(2*b*) [mɨʔteɲe] 'my wife'
(3*a*) [piɾa] 'lip'
(3*b*) [peɾa] 'where'

An acoustic vowel space is presented in figure 2. Formant measurements are averaged from 15 tokens per vowel by the same speaker (DIB). Data points were selected from phonetically long or otherwise prominent tokens of these vowels to minimize consonantal interference.

5.2. Consonants. The phonemic consonant inventory of Muniche is given in table 2. Evidence for contrasts follows below, with the examples organized to illustrate contrasts, first in voicing, then in place of articulation, and finally in manner of articulation. Whenever possible, we demonstrate contrasts both word-initially and word-internally (no consonants occur word-finally). As we discuss in **6.3** below, we do not posit contrastive glides for Muniche.

Voicing contrasts in Muniche are restricted to the velar and alveolar stops. The voiced velar stop is one of the rarest phonemes in the language, appearing in only four non-loan morphemes; it only occurs word-initially and never in consonant clusters. The contrast between voiced and voiceless velar stops (necessarily only in word-initial position), is exemplified in (4). The voiced alveolar stop, on the other hand, is much more common: it appears in 69 morphemes, occurs both word-initially and word-internally, and is often found

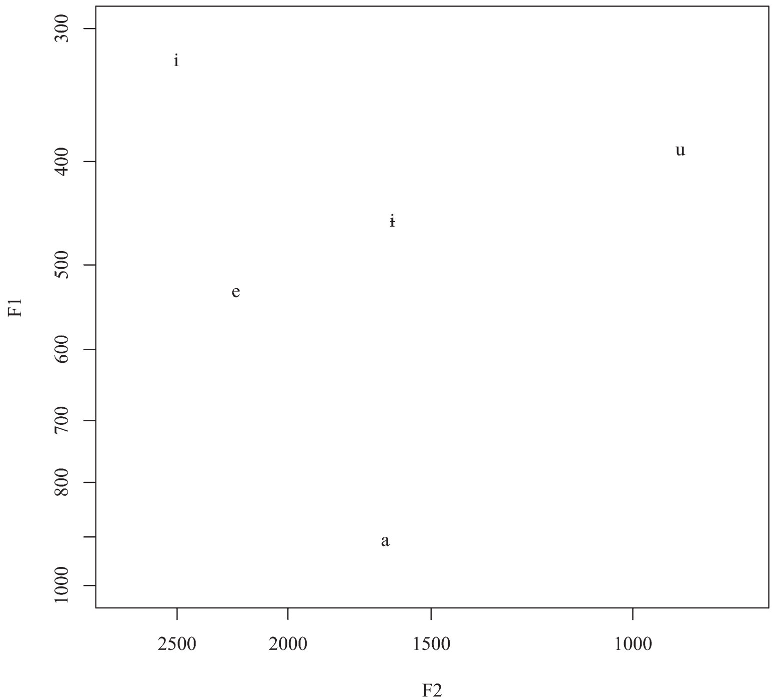

FIG. 2.—Acoustic vowel space (all measurements in Hz).

TABLE 2
MLDP CONSONANT INVENTORY
(ITALICIZED SEGMENTS ABSENT FROM GIBSON [1996])

	Bilabial	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Glottal
Stop	p	t d			c	k g	ʔ
Affricate		***ts***	*tʃ*	***tʂ***			
Fricative		s	***ʃ***	ʂ	ç		***h***
Nasal	m	n			ɲ		
Liquid		***l*** ɾ					

in consonant clusters. The voicing contrast in alveolar stops is exemplified word-initially in (5) and word-internally in (6).

(4*a*) [kawɨsti] ‘dried *macambo* (*Theobroma bicolor*) seed’
(4*b*) [gakipɨ] ‘boa’
(5*a*) [tɨɾa] ‘tongue’
(5*b*) [dɨse] ‘heart’

(6*a*) [uhunata] 'later'
(6*b*) [kɨʔhada] 'ant'

Muniche stops exhibit five places of articulation: bilabial, alveolar, palatal, velar, and glottal. The palatal stop is the only areally unusual one: (7) shows that it contrasts with /t/ and /k/ word-initially, while (8) shows the same contrast word-internally.

(7*a*) [cape] '*macana* (fish sp.)'
(7*b*) [tapɨʔsana] 'I am searching'
(7*c*) [kaʔʂu] 'branch'
(8*a*) [sicatpɨnɨ] 'buy it for me'
(8*b*) [ita] 'anteater '
(8*c*) [ika] 'avocado'

The contrastive nature of the three nasals is demonstrated word-initially in (9) and word-internally in (10).

(9*a*) [muʂʈɨ] 'bad omen'
(9*b*) [nuʔu] 'barn owl'
(9*c*) [ɲuʔu] 'day'
(10*a*) [xᵊmaːɾa] 'it hurts'
(10*b*) [xᵊna] 'house'
(10*c*) [xᵊɲata]'sweet potato'

Muniche also exhibits a surface [ŋ], but we analyze this segment as an allophone of /n/, as part of a broader pattern of allophony exhibited by this phoneme. Briefly, [n] is in complementary distribution with [ŋ], such that the velar nasal occurs before the velar stop /k/, as in (11*a*), and all fricatives, as in (11*b*)–(11*e*). Coda nasals are unattested before /ʔ/, /ʂ/, and /ʃ/ (except in two borrowings: [tanʃelina] 'mandarin orange' and [uɾanʃi] 'soft drink'). Likewise, [n] is in complementary distribution with [m] before [p], as in (12*a*), and with [ɲ] before [c], as in (12*b*). We see [n] in coda position before an alveolar stop and post-alveolar affricate in (13).

(11*a*) [tsniŋkicuʔsi] 'broom'
(11*b*) [xᵊɲaŋsu] 'drum'
(11*c*) [miŋçɨʔɨ] 'black squirrel'
(11*d*) [uŋhane] 'this'
(11*e*) [niŋxwɨ] 'large snail sp.'
(12*a*) [tʃampi] 'bat'
(12*b*) [aɲcaʔa] 'small white sloth sp.'
(13*a*) [stindiʔtʃuna] 'I want to grill'
(13*b*) [tɨntʃa] 'bench'

This behavior suggests that alveolar nasals place-assimilate to a following stop or affricate but surface as velar nasals when followed by a fricative. These facts indicate that the alveolar nasal loses its contrastiveness in coda position, an empirical fact that can be analyzed in a number of ways.[4] Due to the complementary distribution of [n] and the other nasals in coda position, we posit /n/ as the phoneme, with three allophones—[m], [n], [ɲ]—that result from place assimilation to a following oral stop, and a fourth allophone—[ŋ]—which surfaces in coda position when preceding a velar stop, or when no oral stop is available to provide the place of articulation. Although morpheme-final nasals are rare in our data set, the forms in (14) exemplify the assimilation of a coda alveolar nasal to a following bilabial stop and its realization as a velar nasal when followed by a fricative.

(14*a*) *iʔn-pa* [iʔmpa][5]
peach.palm-CL:mash
'peach palm fruit mash'

(14*b*) *iʔn-sa* [iʔŋsa]
peach.palm-CL:fluid
'peach palm fruit drink'

Significantly, /m/ does not place-assimilate to following oral stops, as exemplified in (15), nor does it surface as velar nasal when followed by a fricative, as in (16).

(15*a*) [hamteɲe] 'my son'
(15*b*) [uʔhumcume] 'before'
(15*c*) [ɨʔmkaka] '*manacaracu* (*Ortalis guttata*, bird sp.)'
(16*a*) [tmamsi] 'itch'
(16*b*) [mamça] 'grass'
(16*c*) [umhuhu] 'stingray'

Muniche exhibits a three-way contrast between alveolar, post-alveolar, and retroflex affricates. This contrast is demonstrated word-initially in (17) and word-internally in (18); note that (18*b*) and (18*c*) constitute a minimal pair demonstrating the tʃ–tʂ contrast.

(17*a*) [tsaʔa] 'corn'
(17*b*) [tʃaçu] 'thin stick'
(17*c*) [tʂaʂpɨ] 'worm'

[4] This behavior lends itself to an underspecification analysis (Steriade 1995), whereby the nasal that contrasts with /m/ is not an alveolar nasal per se but an underspecified nasal /N/. On this view, the underspecified nasal acquires its place of articulation from following oral stops or, lacking such a segment, from more general markedness principles favoring coronal nasals in onsets and velar ones in codas (Sibomana 1980 and Rice 1996). An analysis based on the structuralist precursor to the notion of underspecified segments, the archiphoneme (Martinet 1931 and Trubetzkoy 1939), is also possible.

[5] Abbreviations used are: CL = classifier; IMPF = imperfective; 2.sg = second-person singular cross-referencing marker.

(18*a*) [axᵊnedatsaʔa] ‘white’
(18*b*) [tʃatʃa] ‘star’
(18*c*) [tʃatʂa] ‘raft’

The contrast between post-alveolar and retroflex affricates is neutralized before front and central vowels: only /tʃ/ appears before the front vowels /i, e/, and only /tʂ/ appears before the central vowel /ɨ/. Note that the alveolar affricate /ts/ is unrestricted in its distribution.

Muniche exhibits a five-way fricative contrast: alveolar, post-alveolar, retroflex, palatal, and glottal. Of these segments, the glottal fricative is the only one that exhibits allophony, which we now examine before discussing the contrastive nature of the other fricatives. The velar and glottal fricatives appear in complementary distribution, the former appearing before consonants, as in (19*a*)–(19*d*), and the latter before vowels.[6]

(19*a*) [xpapa] ‘duck’
(19*b*) [xtatᵊnɨ] ‘my foot’
(19*c*) [xᵊɲana] ‘balsa tree’
(19*d*) [xwixpa] ‘toad’[7]

We posit /h/ as the phoneme and assume that the glottal fricative undergoes fortition to the velar fricative [x] before consonants.[8] Speakers’ metalinguistic

[6] A single form, [wewxɨ] ‘fan’, conflicts with this generalization. It is plausible that the /h/ in this case is assimilating to the velar place of the preceding glide. It is difficult to generalize, however, as this is the only form in our data set that exhibits an apparent /wh/ cluster; and other than *umhuhu* ‘stingray’, *unhane* ‘this’, and *tʃuthu* ‘elbow’, where /h/ surfaces as [h] in all cases, it is the only form in which /h/ appears as the second element in a consonant cluster. If we do not subscribe to the velar assimilation analysis for the problematic form, it would be necessary to conclude that the velar fricative contrasts with the glottal fricative, which we hesitate to do given speakers’ metalinguistic judgments about the two sounds.

[7] The fact that this form surfaces with the [x] rather than [h] in initial position requires that the rule selecting the allophones of /h/ apply after glide formation.

[8] Following Bladon (1986:7–8), Silverman (1997:52) observes that preaspiration and preconsonantal glottal fricatives are perceptually non-salient, and that speakers in many languages exert additional articulatory effort to emphasize the phonetic cues of preaspiration or glottal fricatives in order to overcome this perceptual weakness. In this vein, Clayton (2008:213) observes that the fortition of [h] to [x] before voiceless stops in certain varieties of Scots Gaelic involves ‘‘minimal perceptual adjustment, compared to other oral fricatives,’’ but that ‘‘the overall amplitude of [x] is substantially greater than that of [h], enhancing its perceptual value.’’ Helgason (2002:167) notes a similar process in Faroese. Our analysis of Muniche fortition of /h/ to [x] before consonants thus seems plausible on both phonetic and cross-linguistic grounds.

An alternative analysis would treat /x/ as the underlying form and consider surface [h] to result from intervocalic lenition. However, while the lenition of voiced velar fricatives to voiceless glottal fricatives due to the phonetic instability of the former is a common phonetic and diachronic process (Ohala and Solé 2010:52), the voiceless velar fricative is quite phonetically stable, and lenition of this segment to its glottal counterpart is rare.

judgments support the analysis of [x] and [h] as allophones of a single phoneme: they consider the two sounds to be the "same" in Muniche.

The fricative /ʃ/ is extremely rare and is found in only three lexical roots: the nouns *tanʃelina* 'mandarin orange' (cf. tangerina) and *uranʃi* 'soft drink' (cf. orange), and the quantifier *miɲaʃa* 'a little'. The first two are clearly loans, most proximally, from Spanish, and the third is probably a loan from a Kawapanan language (see **7** below). Regardless of its ultimate origin, the post-alveolar fricative is synchronically contrastive, as evident in (21).

Word-initial contrasts between fricatives are exemplified in (20), intervocalic contrasts in (21), and word-internal pre-consonantal contrasts in (22).

(20*a*) [suɾa] 'beard'
(20*b*) [ʂupju] 'clothing'
(20*c*) [çude] 'spine, thorn'
(20*d*) [hudiʔsana] 'I am resting'
(21*a*) [masanasana] 'I am listening'
(21*b*) [miɲaʃa] 'a little'
(21*c*) [maça] 'it is'
(21*d*) [hahaʔsana] 'I am grating'
(22*a*) [taskiʔsaɾa] 'she is running'
(22*b*) [paʂki] 'manioc'
(22*c*) [paçki] 'moon'
(22*d*) [pɨxcu] 'fishhook'

Two sites, the alveolar ridge and the palate, serve as a place of articulation for a large number of segments. We now demonstrate that all the segments distinguished by manner in these positions are in fact contrastive. Beginning with the alveolar ridge, (23) and (24) demonstrate that the nasal and voiced oral stop contrast word-initially and word-internally for this place of articulation. Examples (23*a*) and (25*a*) demonstrate the contrast between the voiced oral stop and flap word-initially, while (25*b*) and (25*c*) do so word-internally.

(23*a*) [duspa] 'mucus'
(23*b*) [nupsiʔcuʂu] 'spindle'
(24*a*) [tʃadestɨ] 'spider'
(24*b*) [kaneku] 'cup'
(25*a*) [ɾuku] 'small tail'
(25*b*) [maɾa] 'it is'
(25*c*) [tʃᵊmada] 'bird sp. (*Penelope jacquacu*)'

Muniche also contrasts the alveolar flap and lateral approximant, as demonstrated word-internally in (26). The latter is an uncommon sound in the language and may stem from language contact, as discussed in **7**.

Contrast between the palatal stop and fricative is demonstrated in (27), and a pair contrasting the glottal stop and fricative word-internally is given

TABLE 3
MUNICHE SYLLABLE TYPES

	Word-Initial	Gloss	Word-Internal	Gloss
V	*a.paʔ.ne*	'I'	Not attested	
CV	*ɲu*	'louse'	*ste.de*	'pepper'
VC	*uts.pa*	'two'	Not attested	
CVC	*ham.te.ɾa*	'his/her child'	*tʃa.jax.tɨʔ.ma*	'knitting'
CCV	*tɾa*	'toad sp.'	*snin.stɨ.ʔɨ*	'*ungurahui*, palm sp.'
CCVC	*stax.na*	'cramp'	*paʔ.ʂnap.dic.pɨ*	'start the fire!'

in (28). (Further discussion of the phonemic status of the glottal stop and its relation to metrical structure appears in **6.6**.)

(26*a*) [maɾa] 'it is'
(26*b*) [pɨwala] 'iguana'
(27*a*) [ɾaneʔca] 'there'
(27*b*) [mɨʔça] 'wind'
(28*a*) [umhuhu] 'stingray'
(28*b*) [puʔu] 'meat'

6. Prosodic phonology.

6.1. Syllable structure. Muniche exhibits V, VC, CV, CVC, CCV, and CCVC syllables on the surface. All types of syllables can occur word-initially, but onsets are required word-internally on the surface, and word-final codas are unattested.[9] Table 3 shows examples of all possible syllable types in Muniche; words are given in their surface phonetic form.

All consonants are licensed in simple onsets, although /ʔ/ does not occur word-initially. Complex onsets are restricted to a maximum of two consonants ($C_1C_2V(C)$), with the following restrictions: (1) C_1 cannot be a voiced segment; (2) C_2 cannot be a fricative; (3) neither C_1 nor C_2 can be a glottal stop; and (4) it is not permissible for C_1 and C_2 to both be fricatives or both be affricates. Figure 3 indicates the attested consonant clusters: those indicated by O are found in syllable onsets, whereas those marked by M only appear in word-internal heterosyllabic clusters.

Muniche permits a wide variety of segments in coda position, including voiceless stops. The only segments not found in coda position are the voiced stops /d/ and /g/, the liquids /l/ and /ɾ/, and the voiceless consonants /tʂ/ and /ʃ/. In addition to the restrictions on onsets and codas, there are further restrictions on word-internal consonant clusters: the only permissible coda

[9] There are two marginal exceptions to the latter generalization, forms that exhibit a /tʃ/-final alternant in free variation with a vowel-final form: [kutʃ ~ kutʃi] 'pig' and [kitʃ ~ kitʃi] 'grandfather'.

Second consonant

First consonant	m	n	ɲ	p	t	d	c	k	ts	tʃ	tʂ	s	ʂ	ç	h	ɾ
m			M	M	M		M	O		M		M		M	M	M
n				M	M	M	M	M	M	M	M	M		M	M	
p	M	O			M	M	O			O	O	M	M	M		O
t	O	O		O		O	O								M	O
d																M
c				O												
k	O	O	O		O	M										
ʔ	M	M	M	M	M		M	M	M	M		M	M	M	M	
ts	O	O		O		O										
tʃ	O	O	O	O	O	M		O								
s	O	O		O	O		O	M								
ʂ	O	O	O	M	O			M								M
ç	O	M	O	O	M		M	M								
h	O	O	O	O	O		M		M							M

FIG. 3.—Attested consonant clusters.

consonants preceding a complex onset are nasals and /ʔ/.[10] The attested word-internal complex onsets are all sibilant-initial: /st/, /sm/, /ʂm/, and /ʂn/, as exemplified in (29).

(29*a*) *snin.stɨʔɨ* ‘palm sp.’
(29*b*) *rɨʔ.smaʔ.sa.na* ‘I am breathing’
(29*c*) *niʔ.ʂma* ‘beverage’
(29*d*) *paʔ.ʂnap.dic.pɨ* ‘light the fire!’

6.2. Articulation of consonant clusters. In pairs of voiceless stops, both are released, with audible aspiration between them. The only exception to this rule is the cluster /pt/, in which the /p/ is unreleased (/pk/ does not appear in the data but may behave similarly). This may be a result of the short VOT of /p/ in the language (8 ms) compared to that of other voiceless stops (/t/, VOT = 13 ms; /k/, VOT = 30–50 ms).

[10] Glottal stops and nasals co-occur in codas in some cases, such as (14), as a result of prosodic considerations that we discuss in **6.6** below. We do not treat the resulting surface complex codas as constituting a distinct syllable type, however, because they arise from surface prosodic, and not segmental, processes.

Clusters in which the second element is voiced are generally produced with an intervening excrescent central vowel, regardless of the first consonant. The word *snuku* 'heron', for example, surfaces as [sᵊnuku]. These vowels are clearly not syllabic, as they do not affect the placement of stress (see **6.5**). The excrescent vowels found in [sᵊm] and [çᵊm] clusters are substantially shorter (10–20 ms) than those in other consonant clusters (e.g., [xᵊm], [ʂᵊm], [xᵊn], [tᵊd] clusters) in which the excrescent vowel has a duration of at least 35 ms.

6.3. Glides and complex syllabic nuclei. We do not posit glides as part of the Muniche phonemic inventory; rather, we argue that all surface glides arise from underlying high vowels. This process of glide formation satisfies surface constraints on syllable structure. We consider all tautosyllabic surface sequences of vocoids (i.e., vowels or glides) to consist of glide-vowel or vowel-glide sequences; Muniche does not permit complex syllabic nuclei on the surface.

Glides can be omitted from the Muniche phonemic inventory because all surface glides can be predicted on the basis of constraints on syllable structure, and it is never necessary to posit a difference between VG or GV sequences, on the one hand, and VV sequences, on the other (e.g., between [ai] and [aj] or [ia] and [ja]). The existence of a contrast between glides and the corresponding high vowels would have empirical consequences, among other things, for stress assignment (see **6.5**). We can account for all surface glides by positing: (1) a constraint against complex syllabic nuclei; (2) a requirement that all syllables, apart from word-initial ones, have onsets; and (3) a preference for onsets (simple or complex) over codas (simple or complex). A surface form such as [smej.sa.mɨ.pɨ] 'Are you irritated?' would thus derive from /smeisamɨpɨ/ in order to avoid a complex nucleus *[smei.sa.mɨ.pɨ] or an onset-less word-internal syllable *[sme.i.sa.mɨ.pɨ]. We can see the role of the second of these restrictions with the form /tʃuʔui/ 'parrot sp.', which surfaces as [tʃuʔ.wi] rather than *[tʃuʔ.uj], since the latter would violate the requirement that syllables have onsets. The role of this constraint is also evident in the surface realization of the word /paiuluʔu/ 'pottery glaze', which surfaces as [pa.ju.lu.ʔu]. Note that the unattested surface form *[pa.iw.lu.ʔu], although it satisfies the constraint against complex nuclei, fails to provide an onset for the second syllable from the left. Finally, consider the form /piiʔhi/ 'marmoset', which surfaces as [pjiʔ.xi] and not *[pijʔ.xi], since the latter adds a segment to the coda of the first syllable, while the attested form adds a segment to the onset, in accord with the preference in (3). It would, of course, be possible to adopt a more surface-transparent treatment of glides in Muniche, in which case we would additionally posit the glides /w/ and /j/ in the phonemic inventory of the language. Since surface glides can be systematically derived from high vowels, however, we do not do so, for reasons of analytical parsimony.

As would be expected from this discussion, phonemic representations given in this paper do not include glides but rather the high vowels from which surface glides derive. Note that when syllable boundaries are included in the phonemic representation of a given form, the structure of the word's syllables should be evaluated with respect to the surface form (e.g., [wɨ.ma.ʔa], from the corresponding phonemic representation with syllable boundaries, included *uɨ.ma.ʔa* '*paiche* (*Arapaima gigas*, fish sp.)').

6.4. Minimum word phenomena. There is evidence that Muniche historically exhibited a bimoraic minimum word requirement. The synchronic evidence for this requirement is the fact that the smallest words are, with two exceptions discussed below, either disyllabic words or monosyllabic words with complex onsets, as exemplified in (30), which we argue resulted from syncope that affected historically CVCV words (see **6.6**). For purposes of the minimum word requirement, these forms still pattern with bimoraic words.

(30*a*) [tsᵊma] 'mosquito'
(30*b*) [tpɨ] 'pineapple'
(30*c*) [kta] 'horsefly'
(30*d*) [scu] 'smoked fish'
(30*e*) [sta] '*Genipa* sp.'
(30*f*) [tᵊɾa] 'toad sp.'
(30*g*) [tᵊdɨ] 'fart'
(30*h*) [tcu] 'water snail'
(30*i*) [xᵊna] 'house'

Evidence that forms like those in (30) were affected by syncope can be found in Tessmann's ([1930] 1999) Muniche word list, which includes words with full vowels, as in (31), which correspond either to excrescent vowels or fully deleted vowels in the counterpart words in the MLDP data set. The difference between the modern forms and Tessmann's forms, which were collected in approximately 1925, supports the idea that historically disyllabic CVCV forms reduced to monosyllabic CCV forms. It should be noted that Tessmann used at least six unique (orthographic) vowel qualities in representing the vowels that underwent syncope; and pairs like (31*b*) and (31*e*) show that the vowel qualities are not predictable from their environments, leading us to conclude that these were full phonemic vowels and not simply Tessmann's way of representing excrescent vowels. Tessmann's forms are given with the vowels of interest in boldface, adjacent to phonetic representations of the corresponding modern Muniche forms.

(31*a*) *x**ō**wá* [xwa] 'sun'
(31*b*) *x**e**ná* [xᵊna] 'house'
(31*c*) *müig**ü**mátše* [mɨxᵊmɨtʂɨ] 'woman'
(31*d*) *ūtš**u**ma* [utsᵊma] 'three'

(31*e*) *tšwíx**a**na* [tʃwixᵊna] ‘Paranapura River’
(31*f*) *tsaáx**o**wa* [tsaxwa] ‘five’

If we accept the preceding historical account for apparent exceptions to the minimum word requirement, two problematic forms nevertheless remain: the monosyllabic free forms *ɲu* ‘louse’ and *ca* ‘feces’. These exceptions may be explained by their former status as inalienably possessed nouns, which entails that they appeared only as parts of minimally disyllabic forms. With the attrition of the alienable/inalienable distinction in the language (see Michael et al., in preparation), these roots began to appear as monosyllables, without possessive morphology. It is also possible that these forms formerly exhibited long vowels, which have been lost in modern Muniche (see **6.7**).

6.5. Stress. Muniche words exhibit one of two trochaic stress patterns, depending on word class: verbs and adjectives exhibit a left-to-right trochaic pattern, while nouns, interjections, and adverbs exhibit a right-to-left trochaic pattern. We begin with a discussion of the acoustic correlates of stress and then present analyses of the two stress patterns.

The primary acoustic correlate of stress in Muniche is pitch. The syllabic nuclei of stressed closed syllables exhibit level pitch that is high in comparison to unstressed syllables in the word, while nuclei of stressed open syllables typically exhibit a high but falling pitch. The phonetically longer the vowel is in an open stressed syllable, the more likely it is to exhibit a falling pitch. Vowels in longer words are comparatively shortened and are therefore more likely to exhibit a level pitch. When the coda of a stressed closed syllable is sonorant, as in *ˈtʃampi* ‘bat’, pitch will often be level over the vowel and drop over the consonant.

Length is a secondary correlate of stress: vowels in stressed open syllables are often lengthened, and when primary stress falls on an open syllable, it is reliably the longest in the word.[11] The lengthening effects of stress in open syllables tend to be more pronounced when the stressed vowel precedes a voiced consonant, as in (32).[12] The length of vowels in closed syllables, however, is largely unaffected by stress.

(32*a*) [ˈxᵊmaːɾa] ‘it hurts’
(32*b*) [ˈhiːnu] ‘dog’
(32*c*) [ˈiːdɨ] ‘water’
(32*d*) [ˈtᵊdaːna] ‘peccary’

[11] Stressed syllables of the form ˈCVʔV# do not exhibit lengthening. This result is consistent with the analysis of CVʔV# sequences that we present in **6.6**, where we argue that the glottal stop present in these sequences, and not lengthening, was the mechanism by which syllables were rendered heavy.

[12] Note that we indicate phonetic lengthening in the set of forms in (32); the other phonetic representations in this paper are not as narrow.

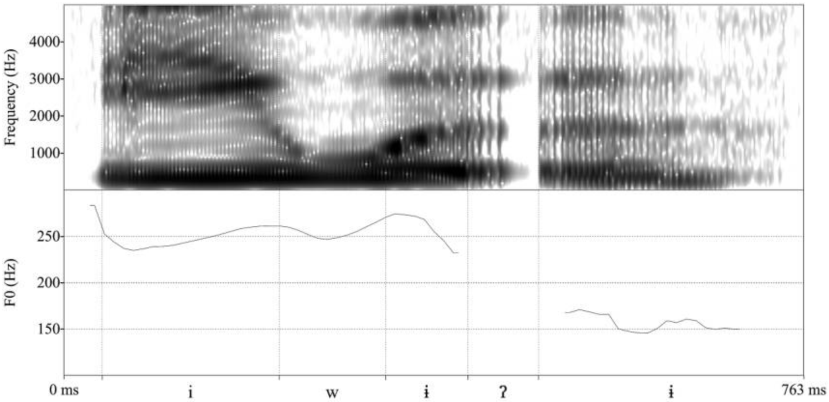

FIG. 4.—Pitch trace for *iwɨʔɨ*.

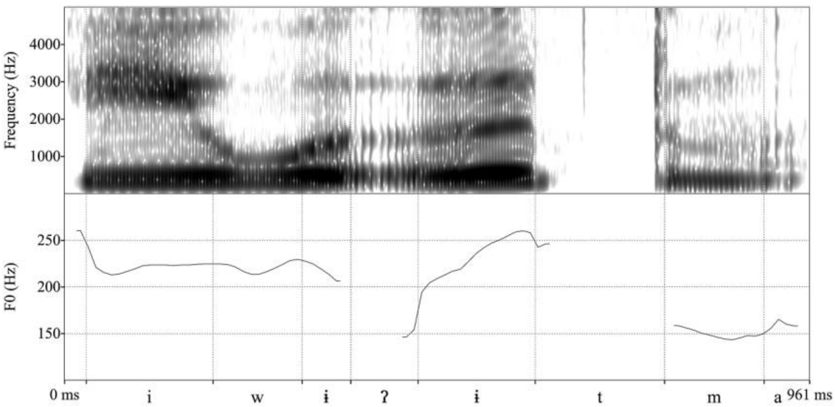

FIG. 5.—Pitch trace for *iwɨʔɨtma*.

In figures 4–6, we present three spectrograms with F0 traces that demonstrate that pitch is a correlate of stress, for the forms [iˈwɨ.ʔɨ] 'person' in figure 4, [i.wɨˈʔɨt.ma] 'people' in figure 5, and the verb [ˈʂaʔ.teˌwɨ.di] 'let's eat' in figure 6. Comparison of figures 4 and 5 reveals the shift in the pitch peak of the word *iwɨʔɨ* 'person' under the addition of the plural suffix *-tma*. For both forms, the pitch peak is penultimate, shifting its position relative to the root in *iwɨʔɨtma* in accord with the trochaic stress pattern we describe in **6.5.1**. For *iwɨʔɨ*, pitch reaches a maximum of 275 Hz on the second syllable from the left and subsequently falls, while for *iwɨʔɨtma*, stress shifts one syllable to the right, with the pitch reaching a maximum on the third syllable from the left.

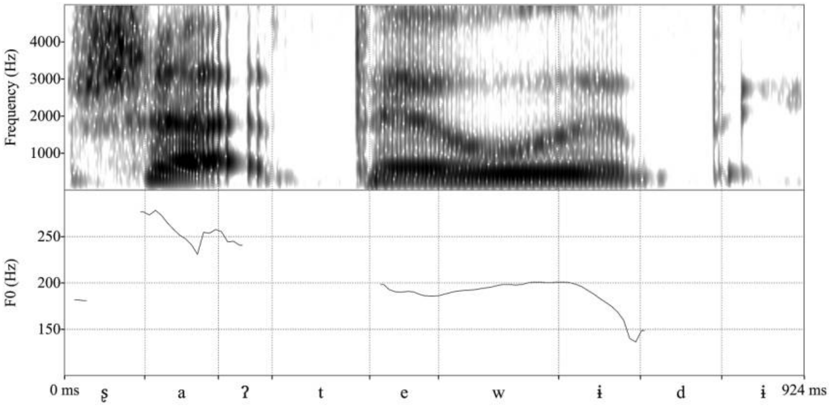

FIG. 6.—Pitch trace for *ʂaʔtewɨdɨ*.

Note that because the stressed syllable in *iwɨʔɨtma* is closed, the pitch does not fall across the vowel, in contrast to the behavior of the pitch peak in *iwɨʔɨ*; in fact, it even rises slightly as an effect of coming out of the glottal closure.

The verb *ʂaʔtewɨdɨ* 'let's eat' in figure 6 exhibits both primary and secondary stress (as predicted by the analysis presented in **6.5.2**). The first syllable bears the primary stress and exhibits the highest pitch in the word.[13] Stress also occurs on the penultimate syllable, whose pitch peak is not much higher than the preceding syllable but does fall at the end. As its pitch is significantly lower than that of the first syllable, we consider this a secondary stress. Any vowels that we mark with secondary stress exhibit similar phonetic indications of stress.

Although the modern stress system is not strictly quantity-sensitive, there is a strong tendency for stressed syllables to be either closed or to exhibit vowel lengthening, when open. In **6.7**, we discuss these synchronic facts in light of a historical requirement that stressed syllables surface as heavy.

6.5.1. Nouns. Nouns generally exhibit primary stress on the penultimate syllable, with secondary stresses appearing on alternating syllables to the left of the penult. In general, then, disyllabic nouns are stressed on the leftmost syllable, as in (33), and trisyllabic nouns on the middle one, as in (34). Four-syllable nouns are generally stressed on the leftmost and penultimate syllables, with primary stress falling on the latter, as in (35).

(33*a*) *ˈpuʔ.pi* 'butterfly'
(33*b*) *ˈtʃum.pe* 'knife'

[13] The rapidly falling F0 on this syllable is an effect of the glottal closure; being in a closed syllable, the vowel is short and pitch is perceived as level high.

TABLE 4
NOMINAL STRESS AND PROSODIC STRUCTURE

1σ	2σ	3σ	4σ
(ˈσ)	(ˈσ σ)	σ (ˈσ σ)	(ˌσ σ) (ˈσ σ)

(33*c*) *ˈɨda.na* 'peccary'
(33*d*) *ˈiu.se* 'thank you'
(34*a*) *tsiˈtsu.tɨ* 'bird sp.'
(34*b*) *tuʂ̺ˈni.ka* 'white piranha'
(34*c*) *aˈɲi.ʔi* 'tinamou sp.'
(34*d*) *tʃuˈɲa.ʔa* 'oropendola sp.'
(35*a*) *ˌpa.iuˈlu.ʔu* 'pottery glaze'
(35*b*) *ˌtʃa.depˈɾɨʂ̺.nɨ* 'my ribs'
(35*c*) *ˌtʃa.tʃaˈpɨ.ʔɨ* 'flower'
(35*d*) *ˌi.matʃˈki.ki* 'fish sp.'

The stress pattern exhibited by these forms, summarized in table 4, is consistent with the right-to-left formation of disyllabic trochees. Since monosyllables are stressed, we conclude that degenerate, monosyllabic feet are permitted in such words to guarantee stress on prosodic words.

The metrically regular nature of this trochaic stress pattern is made clear by stress shift under morphological augmentation. The stress shift experienced by a disyllabic noun under addition of a possessive clitic is given in (36), while (37) shows the stress shift experienced by a trisyllabic form under the addition of the plural *-tma*.

(36*a*) *ˈi.dɨ* 'water'
(36*b*) *iˈte.ɾa* 'his/her water'
(37*a*) *ipˈse.ɲe* 'my load'
(37*b*) *ˌip.seˈɲet.ma* 'my loads'

6.5.2. Verbs and adjectives. Verbs and adjectives[14] generally exhibit primary stress on their leftmost syllable, with secondary stresses on alternating odd-numbered syllables from the left edge of the word, save that no Muniche verbs exhibit final stress. This stress pattern is exemplified in (38)–(42) for verbs between two and six syllables (the minimum and maximum attested sizes). This stress pattern is consistent with the left-to-right footing of disyllabic trochees, and a prohibition on degenerate feet, as schematized in table 5.[15]

[14] Muniche exhibits a small number of underived adjectives and an open set of deverbal adjectives. Stative predicates, such as *tʃpɨ* 'be drunk', form a subclass of verbs. As verbs, these roots can function predicatively but not attributively. To do so, they must be derived with the deverbal adjectivizer *-tsaʔa*, which allows them to modify nouns, as in *tʃpɨtsaʔa itʂ̺ɨ* 'drunken man'.

[15] There are only two forms in our data set that do not conform to this generalization but instead exhibit an iambic pattern, given in (84). These forms could be analyzed as exhibiting

TABLE 5
REGULAR METRICAL STRUCTURE IN VERBS

2 σ	3 σ	4 σ	5 σ	6 σ
(ˈσ σ)	(ˈσ σ) σ	(ˈσ σ) (ˌσ σ)	(ˈσ σ) (ˌσ σ) σ	(ˈσ σ) (ˌσ σ) (ˌσ σ)

(38*a*) *ˈtma.ɾa* ‘it is delicious’
(38*b*) *ˈxma.ɾa* ‘it hurts’
(39*a*) *ˈuʔ.sa.ɾa* ‘he is crying’
(39*b*) *ˈptʃi.mɨ.ɾa* ‘it smells good’
(40*a*) *ˈtɨ.staˌmɨ.ɾa* ‘they tore it apart’
(40*b*) *ˈmuʔ.tsiʔˌsa.ɾa* ‘they are playing’
(41*a*) *ˈtʂɨ.naˌmɨ.ɾa.nɨ* ‘it pricked me’
(41*b*) *ˈtʃpɨ.naʔˌsa.ɾa.nɨ* ‘he is hitting me’
(42*a*) *ˈmai.naˌsu.tɨˌnɨ.pɨ* ‘I will visit you’
(42*b*) *ˈtu.iaˌsiʔ.tʃuˌma.na* ‘I want to farm’

A number of lexically stressed suffixes perturb this simple trochaic pattern: the perfective/interrogative *-me*, the realis *-ma*, and the deverbal adjectivizer *-tsa*. The interaction between the lexical stress associated with these morphemes and the regular trochaic pattern reveals two additional characteristics of the verbal metrical system: (1) verb roots must bear stress, and (2) in some cases, a syllable may be epenthesized in word-final position to resolve the conflict posed by the prohibition against verb-final stress and the presence of lexically stressed suffixes in word-final position.

We illustrate the effect of these lexically stressed suffixes on the basic trochaic pattern with the five-syllable forms in (43)–(45), for which stress falls on the fourth syllable from the left, rather than the expected third syllable. We assume that in such cases, the foot containing the lexically stressed suffix is iambic instead of trochaic.[16]

(43*a*) *ˈknɨ.diʔ.saˌme.pɨ* ‘are you choking?’
(43*b*) *ˈstɨ.nɨ.çuˌme.ɲe* ‘I want to sleep’
(44) *ˈa.teʔ.çuˌma.na* ‘it is dirty’
(45) *ˈah.ne.daˌtsa.ʔa* ‘white’

---

lexical stress on the second syllable of the root, which triggers rightward movement in the adjacent foot to avoid a stress clash.

(84*a*) [naˈwɨʔ.kiˌsa.ɾa] ‘there is lightning’
(84*b*) [aʔˈtʃix.taˌme.ɲe] ‘I sneezed’

Incidentally, it is not difficult to account for the lexical stress on these roots. The form in (84*a*) simply has the addition of verbal morphology to the noun [naˈwɨʔ.ki] ‘lightning’, and the form in (84*b*) is clearly onomatopoeic, with stress appearing on the more forceful “syllable” of the sneeze.

[16] An alternative analysis is that the pattern remains trochaic but the foot containing the lexically stressed suffix does not abut the foot to its left, skipping a syllable.

The requirement that verb roots bear stress is evident in verbs with monosyllabic roots that are followed by lexically stressed suffixes. In such cases, stress falls on the root, as in the attested (*a*) forms of (46)–(50) below, instead of on the lexically stressed suffix, as in the unattested (*b*) forms. Were stress to fall on the lexically stressed suffix in words of this type, an iambic foot would result, and the root would be unstressed. The fact that this does not occur indicates that the requirement that roots be stressed overrides the requirement that lexically stressed suffixes surface with stress.

(46*a*) *ˈkuɨ.me.ɲe* 'I cut myself'
(46*b*) **kuɨˈme.ɲe*
(47*a*) *ˈça?.ma.ɾa* 'it entered'
(47*b*) **ça?ˈma.ɾa*
(48*a*) *ˈpi.ma* 'killed'
(48*b*) **piˈma*, **piˈma.?a*
(49*a*) *ˈpah.tsa* 'many'[17]
(49*b*) **pahˈtsa*, **pahˈtsa.?a*
(50*a*) *ˈmɨ.tsa* 'big'[18]
(50*b*) **mɨˈtsa*, **mɨˈtsa.?a*

The conflict posed by word-final, lexically stressed suffixes and the prohibition on word-final stress is resolved in a number of ways. In the case of the perfective *-me*, the lexical stress is simply deleted. If word-final *-me* forms part of a disyllabic foot, as in (51), regular trochaic stress results, instead of the iambic stress pattern that would result if stress survived on the perfective suffix. If *-me* does not form part of a disyllabic foot, as in (52), the word ends in a sequence of two unstressed syllables.

(51) *ˈtu.saˌsi?.me* 'gardened'
(52) *ˈua?.sa.me* 'sucked'

In the case of the realis *-ma* and the adjectivizer *-tsa*, in contrast, the conflict is resolved by word-final epenthesis of the syllable *?a*, as in (53) and (54), which resolves the conflict by shifting the lexically stressed suffix to penultimate position, from word-final position.

(53*a*) *ˈi̧ʂ.ka?ˌma.?a* 'is jumping'
(53*b*) *ˈtʃuh.tɨˌma.?a* 'it is making smoke'
(54*a*) *ˈme.tʃa?ˌtsa.?a* 'beautiful'
(54*b*) *ˈʂ̧a?.de?ˌtsa.?a* 'for eating'

Two sources of evidence corroborate that the final *?a* syllables in forms like those in (53) and (54) are epenthesized to repair word-final stress: (1) forms in which stresses stemming from word-final *-ma* and *-tsa* are suppressed for

[17] This adjective is derived from the intransitive verb *pah* 'be numerous'.

[18] The apparent root *mɨ* in *mɨtsa* does not appear with any other affixes in our data set.

independent reasons and (2) forms in which another morpheme follows the lexically stressed morpheme. Both classes of forms lack word-final stress, and we find that syllable epenthesis does not occur.

The first class of forms consists of disyllabic verbs with monosyllabic roots, which are obligatorily stressed, overriding the lexical stress of suffixes *-ma* and *-tsa*, as in (55) and (56). These forms lack the word-final *ʔa* epenthesis that surfaces when these suffixes produce word-final stress, suggesting that such stress conditions the epenthetic process.

(55*a*) *ˈtʃu.ma* ‘it is good’
(55*b*) *ˈpi.ma* ‘killed’
(56*a*) *ˈpah.tsa* ‘many’
(56*b*) *ˈmɨ.tsa* ‘big’

In the second class of forms, the lexically stressed suffixes retain their stress but do not appear word-finally. These forms likewise lack word-final *ʔa* epenthesis, as in (57),[19] confirming that word-final stress conditions *a* epenthesis.[20]

(57*a*) *ˈa.tasˌma.ɾa* ‘(s)he is walking’
(57*b*) *ˈtʃu.çuˌma.na* ‘I am happy’

Note that DIB, the youngest speaker, tended to apply word-final syllable epenthesis even to disyllabic forms, such as those in (58), which presumably constitutes an instance of attrition-induced overgeneralization (Campbell and Muntzel 1989).

(58*a*) *ˈpah.tsa.ʔa* ~ *ˈpah.tsa* ‘many’
(58*b*) *ˈtʃu.ma.ʔa* ~ *ˈtʃu.ma* ‘it is good’
(58*c*) *ˈtsa.ma.ʔa* ~ *ˈtsa.ma* ‘it is finished’

6.6. Distribution of the glottal stop. We treat the glottal stop as a phoneme because its distribution is not entirely predictable. However, we show in this section that its distribution is significantly dependent on prosodic and morphological factors. In particular, glottal stops are associated with stressed syllables, and they also surface at boundaries between verb roots and verbal suffixal morphology.

Synchronically, the glottal stop shows a statistically significant association with stressed syllables, with stressed syllables often being closed by glottal stops, as in (59).

[19] Note that the additional morphology in question is always verbal subject person clitics and, as such, can only co-occur with the realis *-ma* and not the adjectivizer *-tsa*.

[20] It is likely that the phenomenon of final syllable epenthesis described here had its origins in the historical requirement that stressed syllables be heavy, which triggered final glottal stop epenthesis and ultimately led to word-final VʔV sequences (see **6.6**). In the case of the realis and adjectivizer, this process ultimately resulted in a word-final epenthetic *ʔa* syllable when these suffixes bore stress word-finally.

TABLE 6
CONSONANT FREQUENCY IN STRESSED SYLLABLE CODAS (%)

p	t	d	k	ʔ	ts	tʃ	s	ʂ	ç	h	m	n/ɲ	j	w
4.2	2.7	0.4	2.7	49.4	0.8	0.8	6.2	5.4	2.3	12.7	3.9	6.2	0.4	1.9

(59*a*) *ˈtʃuʔ.ui* 'parrot sp.'
(59*b*) *naˈneʔ.ca* 'here'
(59*c*) *ˌdeʔ.cuhˈtɨʔ.ma* 'fishnet'

Seventy-six percent of coda glottal stops in our data appear in stressed syllables, and the glottal stop is the most common coda in stressed syllables, constituting nearly half of all of them, as evident in table 6. The next most common coda segment, the glottal fricative, appears in coda position in only 12.7% of stressed syllables. These facts are consistent with a historical preference that stressed syllables be closed, with coda epenthesis of the glottal stop serving to close otherwise open stressed syllables. We return to this point in **6.7** below. Note that the realization of glottal stops associated with stress is somewhat variable, and they are sometimes reduced to creakiness on the preceding vowel or omitted entirely in fast speech.

Synchronic evidence that glottal stops are partially conditioned by stress is found in stress shifts between inflected and uninflected nouns. (Verbs do not provide useful evidence, as changes in inflection usually do not shift the left-to-right verbal stress pattern.) In (60*b*), for example, a glottal stop appears in the coda of a previously open syllable, shown in (60*a*), when stress shifts to it due to the addition of the classifier *-sa*. (Note that a glottal stop does not appear in the coda of the stressed syllable of (60*a*) because it is already closed.)

(60*a*) *ˈmak.na* '*sachapapa* (tuber sp.)'
(60*b*) *makˈnaʔ.sa* '*sachapapa* drink'

Stress-related glottal stops even occur, albeit rarely, in syllables already closed by nasals. In (61*a*) below, a nominal root appears with the mash classifier *-pa* and, in (61*b*), with the fluid classifer *-sa.* With these monosyllabic classifiers, stress appears on the root and a glottal stop is inserted, while the disyllabic classifier *-stɨʔɨ* shifts stress away from the root and the glottal stop does not appear.

(61*a*) *ˈiʔn.pa* 'peach palm fruit mash'
(61*b*) *ˈiʔn.sa* 'peach palm fruit drink'
(61*c*) *inˈstɨ.ʔɨ* 'peach palm fruit (still on the tree)'

The second major conditioning factor on the distribution of Muniche glottal stops is morphological structure. In particular, it is very common for glottal stops to appear at the boundary between verb roots and the suffixes that follow them, as in (62). The realization of the glottal stop in this position is highly dependent on speech rate and is often elided in rapid speech.

(62) [nuhnaʔsara]
nuhna-sa=ra
fill-IMPF=2.sg
'S/he is filling'

Another large set of glottal stops are found in word-final V_iʔV_i sequences (henceforth "VʔV" sequences), which arise from a number of predictable processes.[21] We showed in **6.5.2** that some VʔV sequences result from word-final *ʔa* epenthesis associated with the deverbal adjectivizer *-tsa* and the realis *-ma*; in **7** below, we argue that VʔV sequences constitute a target word shape for loanwords; and in Michael et al. (in preparation), we show that VʔV sequences are involved in nominal diminution. In **6.7**, we discuss a historical prosodically motivated process responsible for word-final VʔV sequences.

Despite the fact that the considerable majority of glottal stops in the MLDP data set can be accounted for by recourse to explanations based on prosodic or morphological structure, there remain glottal stops that cannot be accounted for in these ways, either because they appear in codas of unstressed syllables, as in (63), or in onsets other than those found in word-final VʔV sequences. Data like these indicate that we must treat the glottal stop as a phoneme.

(63*a*) *tsaʔˈtsa.ra* 'lemon'
(63*b*) *çaʔˈmiin.tʂɨ* 'youngster'

6.7. Prosodic consequences of a historical weight-to-stress requirement. In this section, we present a historical account of an aspect of Muniche prosody that relates a number of otherwise disparate facts about the prosodic structure of modern Muniche words, including the prevalence of word-initial consonant clusters (**6.1**) and word-final VʔV sequences (**6.5.2**), the high frequency of glottal stops in the codas of stressed syllables (**6.6**), and the fact that CCV words satisfy the bimoraic minimum word requirement (**6.4**). We argue that this set of facts has a common origin in the interaction between: (1) the emergence of a requirement that stressed syllables be heavy (i.e., satisfy a weight-to-stress requirement); (2) restrictions on permissible complex onsets; and (3) two options for statisfying the weight requirement on stress syllables: (*a*) epenthesis of coda glottal stops or, preferentially, (*b*) lengthening the vowels of stressed syllables. We propose that the vowel-lengthening process involved the acquisition of a mora from the

[21] Apart from those appearing in these word-final VʔV sequences, intervocalic glottal stops are extremely rare in our data set: *puʔutna* 'zapote (fruit sp.)', *aʔi* 'rain', *tʂiʔa* 'aunt' (< Spanish? *tía* 'aunt'), *tsaʔamunɨ* 'cornfield' (cf. *tsaʔa* 'corn').

TABLE 7
MODERN CCV FORMS AND THEIR HISTORICAL ANTECEDENTS

Historical Form	Pre-Modern Form	Modern Form	Gloss	Licit Onset
**tVˈɾa*	*ˈtɾaː*	*ˈtɾa*	'toad sp.'	*tɾ*
**tVˈde*	*ˈtdeː*	*ˈtde*	'brother-in-law'	*td*
**hVˈna*	*ˈhnaː*	*ˈhna*	'house'	*hn*
**tVˈpɨ*	*ˈtpɨː*	*ˈtpɨ*	'pineapple'	*tp*
**cVˈpi*	*ˈcpiː*	*ˈcpi*	'tick'	*cp*

nucleus of the unstressed syllable immediately to the left of the stressed syllable, which resulted in the syncope of the unstressed vowel. We also argue that in the pre-modern period, Muniche exhibited contrastive vowel length, which was subsequently lost in the modern period.

We begin by considering the role of the restrictions on complex onsets in determining the choice between glottal stop epenthesis and vowel-lengthening strategies, noting that words may exhibit complex onsets or word-final VʔV sequences, but very rarely both, and this complementary distribution can be predicted on the basis of the segmental characteristics of a given word's onsets (excluding words that exhibit word-final VʔV sequences for reasons other than strictly prosodic ones, such as loanwords; see **7** below). Specifically, the vast majority of words that exhibit word-final VʔV sequences also exhibit pairs of onsets (C_1, C_2) in their leftmost two syllables, $C_1V_1C_2V_2$ . . . , that would, under syncope of the vowel in the leftmost syllable, produce illicit word-initial complex consonant clusters (**6.1**),[22] *$C_1C_2V_2$ . . . (we discuss a pair of systematic exceptions to this generalization at the end of this section).

Temporarily restricting our attention to CCV and CVCVʔV forms, we present an account of how words of these shapes developed from historical CVCV forms via syncope and glottal stop epenthesis. Beginning with modern CCV forms, we infer historical CVCV forms with stress on the final syllable, like those given in table 7, where syncope of the first vowel reduced them to their modern forms (we return to the pre-modern forms below). Likewise, we infer that modern CVCVʔV forms developed from historical disyllabic forms like those given in table 8, which also exhibit rightmost stress. Crucially, the historical disyllabic forms in table 8 exhibit pairs of onsets (and in some cases, initial syllable codas) that would, under syncope of the first vowel, result in illicit complex onsets (the rightmost column of each table shows whether the pairs of onsets in the historical forms constitute permissible complex onsets or not). If this reasoning is correct, historical CVCV

[22] The complex onsets permitted in Muniche are described in **6.1** above. In brief, they are maximally biconsonantal, mostly of increasing sonority, and pairs of nasals and pairs of affricates are not permitted.

TABLE 8
Modern C(C)VCVʔV Forms and Their Historical Antecedents

Historical Form	Pre-Modern Form	Modern Form	Gloss	Illicit Onset
**nihˈtsa*	*nihˈtsaʔ*	*nihˈtsa.ʔa*	'sweet plantain'	*nhts*
**traˈku*	*traˈkuʔ*	*traˈku.ʔu*	'bee sp.'	*trk*
**tsuˈtsu*	*tsuˈtsuʔ*	*tsuˈtsu.ʔu*	'gnat'	*tsts*
**ɲiˈma*	*ɲiˈmaʔ*	*ɲiˈma.ʔa*	'husband'	*ɲm*
**spuˈti*	*spuˈtiʔ*	*spuˈti.ʔi*	'cigar'	*spt*

forms underwent syncope that reduced them to CCV forms, except when this process would have resulted in impermissible complex onsets, in which case glottal stop epenthesis produced CVCVʔ forms.

The reason for the development of CCV and CVCVʔV forms—the emergence of a weight-to-stress requirement—is intimated by two converging pieces of evidence: (1) the fact that CCV words in Muniche satisfy the minimum word requirement otherwise satisfied only by disyllabic words or larger (see **6.4**) and (2) the fact that glottal stops, like those found in word-final VʔV sequences, are statistically associated with codas of stressed syllables (see **6.6**). The former fact suggests that CCV forms patterned with disyllables (i.e., were heavy), while the latter fact suggests that CVCVʔV forms arose from the creation of closed syllables, likewise a link to heavy syllables. (Below, we argue that the final vowel in these forms is an echo vowel and that, in the pre-modern period, the final syllables of these forms were closed with a glottal stop.) These facts together suggest that the emergence of CCV and CVCVʔV forms from CVCV forms was the result of a requirement that the rightmost syllable of the CVCV forms be heavy. This conclusion entails that in the period that this requirement held (i.e., the pre-modern period), the forms in question surfaced as CCVː and CVCVʔ, where the rightmost syllable is heavy in both cases. The most obvious explanation for this requirement is that the rightmost syllables of the original CVCV forms were stressed, as indicated in tables 7 and 8, and that a weight-to-stress requirement became operative in the language in the pre-modern period, resulting in syncope or glottal stop epenthesis.

We now consider in greater detail the development of each of the word shapes resulting from the emergence of the weight-to-stress requirement, beginning with CCV forms. Since we posit that heavy CCV forms developed from CVCV forms via syncope, this suggests a relationship between the syncope of the first vowel and the weight of the second. The simplest explanation for this process is that the vowel in the nucleus of the rightmost syllable linked to the mora of the syllabic nucleus to its right, whose vowel delinked from that same mora. The result was syncope of the leftmost vowel and lengthening of the rightmost one.

(64) C V C V

μ μ

Note that this account for the development of modern CCV forms entails that, first, Muniche exhibited contrastive vowel length in the pre-modern period and, second, that this vowel length contrast has been lost in the modern period. These conclusions are in fact fortuitous, since they provide an explanation for the existence of modern CVCV forms, which, given our analysis to this point, should have all become either CCV or CVCVʔV. Providing we assume that, historically, stress was quantity-sensitive in Muniche, we can explain modern disyllabic forms (whose first syllables all exhibit phonetically long vowels, e.g., [ˈhiːnu] 'dog') to have originated from words that historically exhibited PHONEMICALLY long vowels in their leftmost syllables, and which also bore stress on those heavy syllables, e.g., *ˈ*hiːnu*. Forms such as these would have satisfied the weight-to-stress requirement as they were, triggering neither syncope nor glottal stop epenthesis. The absence of modern CVˈCV forms suggests that word-final heavy syllables did not exist in Muniche prior to the emergence of the glottal epenthesis process, which we discuss next.

We now consider the development of modern CVCVʔV forms from historical CVCV forms, which we attribute to glottal stop epenthesis in (word-final) coda position, an alternative strategy for rendering stressed syllables heavy when syncope was blocked, for reasons already discussed. As mentioned above, 49.4% of stressed closed syllables are closed with glottal stops (see **6.6**), and often disappear when stress shifts (**6.6**), suggesting that many coda glottal stops are, or were historically, epenthesized to render stressed syllables heavy. Taking this into account, our account of the emergence of CVCVʔV from CVCV forms is as follows: first, we assume that the affected CVCV forms bore rightmost stress (as in the case of CVCV forms that reduced to CCV), but that they were unable to undergo syncope/vowel lengthening due to the illicit nature of the resulting complex onset. In these cases, glottal stops were epenthesized to create heavy syllables, resulting in pre-modern CVˈCVʔ forms. Since the modern counterparts of these forms exhibit a final vowel, we must assume that an echo vowel eventually surfaced following the glottal stop, probably as a post-lexical phenomenon arising from articulatory characteristics of the glottal stop, a common process cross-linguistically (Borroff 2007 and Hall 2003) and in nearby languages such as Chamicuro (Parker 1994). Eventually this echo vowel was reanalyzed as a phonemic vowel, presumably after the requirement that stressed syllables in the language surface as heavy came to be less stringent in the modern period. Note that although we have focused here on coda glottal stop epenthesis in word-final open stressed syllables, it follows from the modern distribution of glottal stops that word-internal stressed syllables experienced the same process when syncope was blocked.

TABLE 9
MODERN CCVCV FORMS AND THEIR HISTORICAL ANTECEDENTS

Historical Form	Pre-Modern Form	Modern Form	Gloss	Licit Onset
**kVˈɲi.ɲi*	*ˈkɲiː.ɲi*	*ˈkɲi.ɲi*	‘cicada’	*kɲ*
**tsVˈna.ma*	*ˈtsnaː.ma*	*ˈtsna.ma*	‘bee sp.’	*tsn*
**ʂVˈma.ta*	*ˈʂmaː.ta*	*ˈʂma.ta*	‘caiman’	*ʂm*
**tVˈda.na*	*ˈtdaː.na*	*ˈtda.na*	‘peccary’	*td*
**hVˈpu.me*	*ˈhpuː.me*	*ˈhpu.me*	‘fariña’	*hp*

TABLE 10
MODERN CVCVʔCV FORMS AND THEIR HISTORICAL ANTECEDENTS

Historical Form	Modern Form	Gloss	Illicit Onset
**na.ˈuɨ.ki*	*na.ˈuɨʔ.ki*	‘lightning’	*nw*
**pi.ˈçu.si*	*pi.ˈçuʔ.si*	‘made bed’	*pç*
**naʂ.ˈta.ki*	*naʂ.ˈtaʔ.ki*	‘gnat’	*nʂt*
**tsi.ˈpɨ.sa*	*tsi.ˈpɨʔ.sa*	‘beer type’	*tsp*

Our discussion to this point has focused on originally disyllabic forms, but it is clear that originally trisyllabic forms also underwent initial syllable syncope to produce modern disyllabic forms with complex onsets, as in the forms given in table 9. Note that our analysis entails that trisyllabic forms bore default stress on their middle syllable, a conclusion supported by the fact that for forms that were unable to undergo syncope due to constraints on the structure of the resulting complex onset, CVCVʔCV forms resulted, and not CVCVCVʔV forms. Table 10 shows several CVCVʔCV forms that would have created an illicit consonant cluster had the first vowel of historical CVCVCV forms been syncopated.

Summarizing this account, then, we argue that, historically, Muniche exhibited contrastive long vowels and a quantity-sensitive stress system with default stress on the rightmost syllable in disyllables and on the middle syllable of trisyllables. In the pre-modern period, a weight-to-stress requirement arose, which was preferentially satisfied by syncope of the vowel preceding the stressed syllable and corresponding vowel lengthening in the stressed syllable, or by coda glottal stop epenthesis when syncope would have produced illicit complex onsets. Subsequently, in the modern period, contrastive vowel length was lost and the weight-to-stress requirement was considerably relaxed, although the traces of its former effect are still easily visible. In particular, we find: (1) that modern CCV forms are not forbidden despite the Muniche modern disyllabic minimum word requirement, since they were formerly bimoraic CCVː forms, and because the minimum word requirement was presumably

TABLE 11
Historical Disyllabic and Trisyllabic Forms and Their Modern Reflexes

Historical Form	Pre-Modern Form	Modern Form	Example	Gloss
CVˈCV	ˈCCVː	ˈCCV	*ˈcpi*	'tick (insect)'
	CVˈCVʔ	CVˈCVʔV	*tɨˈna.ʔa*	'fish sp.'
ˈCVː.CV	ˈCVː.CV	ˈCV.CV	*ˈpa.pa*	'vulture'
ˈCVC.CV	ˈCVC.CV	ˈCVC.CV	*ˈɲuh.pa*	'throat'
CVˈCV.CV	ˈCCVː.CV	ˈCCV.CV	*ˈkni.ni*	'cricket sp.'
	CVˈCVʔ.CV	CVˈCVʔ.CV	*piˈçuʔ.si*	'bed'
ˈCVː.CV.CV	ˈCVː.CV.CV	ˈCV.CV.CV	*ˈtʃa.kɨ.pɨ*	'tree sp.'
CVˈCVː.CV	CVˈCVː.CV	CVˈCV.CV	*tsiˈtsu.tɨ*	'bird sp.'
CVːˈCVː.CV	CVːˈCVː.CV	CVˈCV.CV	*tsiˈtsu.tɨ*	'bird sp.'
ˈCVC.CV.CV	ˈCVC.CV.CV	ˈCVC.CV.CV	*ˈtʃaʂ.mɨ.tʂɨ*	'young woman'
CVˈCVC.CV	CVˈCVC.CV	CVˈCVC.CV	*tʃaˈpɨʂ.na*	'seat'
CVCˈCVC.CV	CVCˈCVC.CV	CVCˈCVC.CV	*munˈtap.sa*	'Yanayacu Ck.'
CVCˈCVː.CV	CVCˈCVː.CV	CVCˈCV.CV	*maçˈta.nu*	'turtle sp.'
CVːˈCVC.CV	CVːˈCVC.CV	CVˈCVC.CV	*tʃaˈpɨʂ.na*	'seat'

originally a minimum bimoraic one; (2) glottal stops are found frequently in coda position in stressed syllables; and (3) there is a nearly complementary distribution between complex onsets and word-final VʔV sequences, in the case of historical disyllables, or medial syllables with glottal codas, in the case of historical trisyllables.

Concomitant with changes in word shape, the Muniche stress system underwent changes. To focus momentarily on disyllables: stress went from a quantity-sensitive pattern with default rightmost stress in historical disyllables to a quantity-insensitive one with default leftmost stress in modern disyllables, as evident in table 11. Historical disyllables with rightmost stress were eliminated by becoming monosyllables through syncope or by becoming trisyllables through word-final glottal epenthesis, and the subsequent emergence of word-final echo-vowels in the modern period. Modern disyllables with leftmost stress are reflexes of historical ˈCVC.CV and ˈCVː.CV forms, or historical CVˈCV.CV trisyllables that experienced syncope (*ˈkni.ni* 'cricket sp.' < **kVˈni.ni*). The stress pattern of historical and modern trisyllables remained the same, with stress falling on the medial syllable, except when the leftmost syllable was heavier than the medial syllable, which drew stress to the leftmost syllable. We infer that forms of the latter type are the source of the relatively rare exceptions to the modern right-to-left trochaic stress pattern discussed in **6.5** above (e.g., *ˈtʃa.kɨ.pɨ* 'tree sp.' < **ˈtʃaː.kɨ.pɨ* and *ˈtʃaʂ.mɨ.tʂɨ* 'young woman' < **ˈtʃaʂ.mɨ.tʂɨ*). Note, finally, that certain modern prosodic patterns are consistent with more than one historical prosodic pattern. For example, the modern *tsiˈtsu.tɨ* 'bird sp.' may have had either **tsiːˈtsuː.tɨ* or **tsiˈtsuː.tɨ* as its historical source, since either form would have had the correct stress pattern and each would have reduced, under the loss of contrastive vowel length, to the attested modern form. In such cases, the same modern form is given in table 11 for both of the two possible historical patterns.

A final empirical issue remains: the neatness of the complementary distribution on which the preceding analysis is based. If we examine the 121 forms with word-final VʔV sequences in our data set, 15 forms superficially violate the posited complementarity between complex word-initial onsets and word-final VʔV sequences. Of these, six are forms with BOTH complex word-initial onsets and word-final VʔV sequences, and nine are cases in which the otherwise expected syncope fails to obtain, despite the words exhibiting C_1,C_2 pairs that would have resulted in well-formed word-initial complex onsets under syncope, and we instead encounter word-final VʔV sequences. We now argue that almost all of these cases can be explained as the results of additional systematic properties of Muniche prosody.

Turning first to the six forms that exhibit BOTH complex word-initial onsets and word-final VʔV sequences, we find that five of them exhibit cross-linguistically common complex onsets (Morelli 1998)—either fricative-oral stop or fricative-nasal stop clusters or, in one case, a stop-liquid cluster: *xmasiʔɨ* 'sickness', *xpuʔu* 'scorpion', *spuʔu* 'squirrel', *sputiʔi* 'cigarette', and *trakuʔu* 'black bee'. It is plausible, therefore, that these complex onsets were permitted in Muniche prior to the appearance of syncope in the language. If this is correct, only a single form remains inexplicable: *tsdɨʔɨ* 'rat'.

Turning to the nine forms where expected syncope fails to obtain, we see that a striking pattern emerges: in all cases, syncope would have resulted in homonymy or very near homonymy.

For example, if syncope, rather than glottal stop epenthesis, had affected the pair *tʃaɲaʔa* < **tʃaɲa* '*tinaja* (type of vessel)' and *tʃuɲaʔa* < **tʃuɲa* 'bird sp. (*Icteridae*)', the homonym *tʃɲa* would have resulted and, similarly, the pair *tunaʔa* < **tuna* '*huicungo* (palm sp.)' and *tɨnaʔa* < **tɨna* '*bujurqui* (fish sp.)' would have reduced to the homonym *tna*. Likewise, had the form *tʃapiʔi* < **tʃapi* 'basket' undergone syncope, it would have become homonymous with *tʃpi* 'cricket'. Similarly, the forms *kinaʔa* '*caimito* (tree sp.)' and *kiɲaʔa* '*sachamangua* (tree sp.)' would have become very nearly homonymous. This leaves one exception unaccounted for, *tʃaɲɨʔɨ* 'necklace', which resembles the first pair of forms in which syncope was apparently blocked. It is, of course, possible that in the latter three cases, words formerly existed in Muniche that would have resulted in true homonyms under syncope but which we were unable to obtain due to the advanced attrition of the language. In any case, these data are strongly suggestive of the fact that syncope was blocked in Muniche when it would result in homonymy. It is worth noting in this regard that there is not a single homonym in the entire data set we obtained. Note that homophony avoidance has been given as a reason for the failure of expected syncope to obtain in a diverse set of languages (see, e.g., Blevins and Wedel 2009, Crosswhite 1999, Gessner and Hansson 2004, and Kenstowicz 2005).

7. Language contact phenomena. While it is clear that Muniche has borrowed lexical items from Quechua and Spanish, it is the Kawapanan languages that appear to have had the most profound effects on Muniche, influencing both its prosodic system and segmental inventory. There is also clear evidence that several words of ultimately Spanish origin were borrowed via Kawapanan languages.

Before we turn to the linguistic data, it is helpful to recall that Muniche territory bordered traditional Kawapanan territory, including that of the Shawis and Shiwilus, the two surviving modern Kawapanan peoples. Early colonial records describe intermarriage between Muniches and Kawapanan peoples, and in at least one known case, a large group of Shiwilus linguistically assimilated to Muniche (see **3.1** above).

The influence of the Kawapanan languages on the segmental phonology of Muniche includes the introduction of /l/ and /ʃ/ into the Muniche phonological inventory. Evidence for the Kawapanan origin of Muniche /l/ comes from its concentration in Kawapanan loanwords, including words of ultimately Spanish origin. We find, for example, Spanish loanwords in Muniche that exhibit /l/, where the original Spanish forms exhibit /ɾ/ or /d/, as in (65) and (66). Muniche, however, possesses both the /ɾ/ and /d/, which surface in other Spanish loans, such as *idɾu* 'airplane' (cf. *hidro*(*avión*) 'aquatic plane') and *dominkuʔu* (cf. *domingo* 'Sunday' [Gibson 1996:87]).

(65) *siɲulaʔa* '*señora*' (cf. Spanish *seɲoɾa* 'mature woman')
(66) *lansa* 'dance' (cf. Spanish *dansaɾ* 'dance')

The fact that these forms exhibit /l/ where the original Spanish forms exhibit /ɾ/ and /d/ suggests that they were borrowed via a language that possessed /l/ but lacked both /ɾ/ and /d/. The only language spoken in the vicinity that exhibits this set of traits is Shiwilu, making this language the likely source for these forms (note that we know Spanish *señora* to have been borrowed into Shiwilu as *səɲulaʔ* [Bendor-Samuel 1958:24]). Another of the small number of Muniche forms that exhibit /l/ is likewise an apparent loan from a Kawapanan language: *pɨuala* 'iguana'—compare Shawi *pɨwaɾa* 'iguana' (Hart 1988:179)—and Shiwilu *pek'kwala* 'iguana' (Pilar Valenzuela, personal communication).[23] The small number of other Muniche forms exhibiting /l/

[23] The reader will note that the Muniche form more closely approximates the Shawi form, which lacks the /l/. Recent descriptions of Shawi (e.g., Hart, Long de Hart, and Gordon de Powlison 1976) do not include /l/ in the phonological inventory of the language, but records from

(see **5.2**) are likewise plausible Kawapanan loans, but the lexical resources currently available on the Kawapanan languages are insufficient to make a determination.

The presence of the post-alveolar fricative /ʃ/ in the Muniche phonological inventory is likewise attributable to borrowing, given that it only occurs in three probable loans: *uranʃi* 'soda pop' (presumably an early twentieth-century brand name, and ultimately from English *orange*); *tanʃelina* 'orange' (ultimately from Spanish *tangerina*, probably via Shiwilu, given the presence of /l/ in the form); and *miɲaʃa* 'a little'. The precise origin of the latter form is unclear, but it should be noted that *-ʃa* is a diminutive in Shiwilu (Bendor-Samuel 1958:37) and that it resembles Shawi *miaʒin* 'a little'.

There are also suggestive similarities between Muniche and Shawi in the prosodically motivated distribution of glottal stops. Recall that glottal stops tend to appear as codas of stressed syllables in Muniche, a pattern for which we have tentative evidence in Shawi as well. In Shawi, glottal stops appear solely in coda position (Barraza 2005:48 and Hart, Long de Hart, and Gordon de Powlison 1976:3), and an examination of Hart's (1988) Chayahuita dictionary reveals that glottal stops are almost exclusively restricted to the codas of the first and/or final syllable of a word. This distribution strongly suggests that metrical factors condition the distribution of glottal stops in the language. No published study of Shawi stress exists, but given the seemingly metrically governed distribution of glottal stops in the language, it is reasonable that glottal stops are associated with stressed syllables in Shawi, as they are in Muniche. If so, it is plausible that contact with Shawi influenced the development of a similar association of stress and glottal stops in Muniche.

A final phenomenon that we attribute to contact with Kawapanan languages concerns target word shapes for loanwords: all loanwords, other than very recent or nonce borrowings, exhibit a final VʔV sequence, as in (67).

(67*a*) *punkuʔu* 'door' (cf. Quechua *punku*)
(67*b*) *pistaʔa* 'party' (cf. Spanish *fiesta*)

Note that this word shape resembles the consequences of historical word-final stress, which we discussed in **6.6** above. However, neither of the forms given in (67) exhibit final stress in the source languages. We suggest, instead, that this word shape resulted from the generalization to all loanwords of a pattern of phonological adaptation of glottal-stop-final loanwords from Kawapanan languages. Two loans of Kawapanan origin are given in (68); both are glottal-stop-final in the modern Kawapanan languages and exhibit an apparent epenthetic vowel in the modern Muniche forms.

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the early colonial period regularly represent Shawi words with an orthographic <l> (see Beuchat and Rivet 1909). It is unclear at this point if this discrepancy reflects a sound change, or if there formerly existed varieties of Shawi that exhibited /l/ but which subsequently became extinct.

(68*a*) *uɨmaʔa* ‘*paiche* (*Arapaima gigas*, fish sp.)’ (cf. Shawi *wɨmaʔ* [Hart 1988])
(68*b*) *siɲulaʔa* ‘young woman’ (cf. Shiwilu *səɲulaʔ* [Bendor-Samuel 1958:24])

It is plausible that the borrowing of glottal-stop-final words from the Kawapanan languages, like those in (68), was sufficiently common that the resulting word-final VʔV sequences came to be indexical of Kawapanan loans, ultimately resulting in this word shape being interpreted as a marker of Kawapanan loanword status, which eventually came to be applied to Kawapanan loanwords even when the original phonological environment for epenthesis did not obtain. Under this account, the final stage of this process would have been the extension of this marking to all loanwords, regardless of their status. Further lexical work on Kawapanan languages, especially Shiwilu, would make it possible to evaluate this hypothesis.

8. Comparison of MLDP results with Gibson (1996). The phonological inventory that we propose for Muniche differs from that proposed by Gibson (1996) (henceforth GIB) in that we include five consonant phonemes absent from Gibson's consonantal inventory (see table 2 above) and propose a high central unrounded vowel /ɨ/ in place of the high back unrounded vowel /ɯ/ posited by Gibson. The purpose of this section is to discuss these differences and provide explanations for them.

We show that some of the differences between the MLDP and GIB inventories reflect analytical choices, while others probably stem from differences in the size of the data sets on which the two studies are based. The MLDP lexicon contains approximately 800 roots (excluding nonce borrowings), while the GIB data set contains 560 roots (likewise excluding nonce borrowings). Certain rare segments were therefore minimally attested in the GIB data set. Other differences between the inventories, however, appear to stem from empirically more significant factors, including dialectal variation and the consequences of language shift.

The first two differences between the MLDP and GIB phonological inventories that we address are neutralizations in the GIB inventory of contrasts that are present in the MLDP inventory. The first of these involves the absence of the glottal fricative /h/ from the GIB inventory. Examining all the instances of /h/ in the MLDP data set, we find that they invariably correspond to GIB /ç/, as in (69) and (70).

(69*a*) *hinu* [hinu] ‘dog’ (MLDP)
(69*b*) *çinu* ‘dog’ (GIB:89)
(70*a*) *hna* [xna] ‘house’ (MLDP)
(70*b*) *çna* ‘house’ (GIB:89)
(71*a*) *çua* [çwa] ‘cotton’ (MLDP)
(71*b*) *çuwa* ‘cotton’ (GIB:89)

Since MLDP /ç/ likewise maps to GIB /ç/, as in (71), the distribution of /ç/ in the GIB data set can be analyzed as the result of an unconditioned neutralization of the /h/–/ç/ contrast found in the MLDP data set. Note that, in addition, GIB does not mention the velar fricative [x], which we analyze as an allophone of /h/.

The second difference we consider involves the absence of the retroflex affricate /tʂ/ from the GIB data set. All but one instance of /tʂ/ in the MLDP data set corresponds to /tʃ/ in the GIB data set (where parallel forms exist in the two data sets), as in (72) and (73).[24] Given that all instances of /tʃ/ in the MLDP data set correspond to /tʃ/ in the GIB data set, as in (74) and (75), the absence of /tʂ/ in the GIB data set can be understood as the consequence of an unconditioned neutralization of the /tʂ/–/tʃ/ contrast found in the MLDP data set.

(72*a*) *tʂupɨ* 'path' (MLDP)
(72*b*) *tʃupɯ* (GIB:86)
(73*a*) *mɨhmɨtʂɨ* 'woman' (MLDP)
(73*b*) *mɯçmɯtʃɯ* (GIB:92)
(74*a*) *tʃusɨ* 'fire' (MLDP)
(74*b*) *tʃusɯ* (GIB:86)
(75*a*) *tʃatʃapɨʔɨ* 'flower' (MLDP)
(75*b*) *tʃatʃapɯʔɯ* (GIB:84)

There are two logical possibilities for how these differences between the MLDP and GIB data sets arose. Either: (1) the /h/–/ç/ and /tʂ/–/tʃ/ contrasts present in the MLDP data set were neutralized for the speaker who was the source for the GIB set—which, in turn, could be due to (*a*) language obsolescence or (*b*) dialectal divergence prior to language obsolescence; or (2) the contrasts present in the speech of the three speakers who contributed to the MLDP data set were an innovation that emerged, presumably, in the latter stages of obsolescence.[25]

First we rule out the second possibility: that the /h/–/ç/ and /tʂ/–/tʃ/ contrasts are obsolescence-induced innovations. Recall that /h/ and /ç/, as well as /tʂ/ and /tʃ/, are contrastive in the MLDP data set, which entails that

[24] The single pair of forms that violates the tʂ:tʃ correspondence between the MLDP and GIB data sets is *tʂaʂɨ* (MLDP) : *tsaʂɯ* (GIB:98) 'chest'. There is a tendency for /tʂ/, rather than /ts/, to appear before /ʂ/ in the MLDP data set, suggesting that the /tʂ/ in the MLDP form may be the result of retroflexion harmony.

[25] A third logical possibility is that these contrasts were present in the speech of Gibson's consultant, Victoria Huancho, but that he failed to perceive the relevant contrasts. We find this possibility very unlikely. Given that Gibson is a native English speaker and a competent speaker of Peruvian Spanish, and thus familiar with [h] and [x] (the two allophones of the Muniche /h/ found in the speech of our speakers), it is highly improbable that he mistook these segments for the considerably less familiar palatal fricative. Similarly, we find it improbable that Gibson failed to distinguish /tʂ/ from /tʃ/, given that his perception of /ʂ/, the fricative counterpart of the affricate /tʂ/, coincides with our own.

their respective distributions are not conditioned. However, the claim that the /h/–/ç/ and /tʂ/–/tʃ/ contrasts are obsolescence-induced innovations amounts to the claim that these are the results of unconditioned splits of the /ç/ and /tʃ/ phonemes found in GIB data set. Consider, however, the sheer implausibility that the three speakers with whom we worked would spontaneously differentiate /ç/ into /ç/ and /h/, and /tʃ/ into /tʂ/ and /tʃ/, with no conditioning environment to guide them, and then maintain those splits consistently both across the three speakers and across time, during the two months of fieldwork.

This leaves the neutralization analysis as the only plausible alternative for the differences in question, which we now argue are due not to language obsolescence but rather to Muniche dialectal diversity. The evidence against these mergers being the result of language obsolescence includes the fact that the speaker with whom Gibson worked, Victoria Huancho, was significantly more fluent in Muniche than the three rememberers with whom we worked, and that the putative /h/–/ç/ merger is not consistent with common patterns in language shift.

The data in GIB show that Victoria Huancho retained considerable knowledge of many constructions of which our speakers retained only fragmentary knowledge. Moreover, Huancho was comfortable with producing short narratives, while our speakers consistently said that they were unable to do this. These facts, together with observations provided by Gibson (1996:20, 29), suggest that Huancho was substantially more fluent than the three rememberers who contributed to the MLDP data set. We find it implausible that our rememberers would retain phonemic contrasts lost by a more fluent speaker. Moreover, it is typical in situations of phonological inventory reduction during language shift for the segments retained in obsolescent languages to be ones SHARED by the languages involved in the language shift situation (Campbell and Muntzel 1989:186–87). This makes it unlikely that the historically prior /h/–/ç/ contrast (with [h] and [x] as allophones of /h/) would neutralize to /ç/ because of a shift to either Spanish or Quechua, rather than neutralizing to /h/ or /x/, since /ç/ is absent from Spanish and Quechua phonological inventories, while /x/ is present in Spanish and /h/ in Quechua.[26] The /tʂ/–/tʃ/ merger is compatible with language shift, but we consider Victoria Huancho's superior fluency to weigh heavily against a language shift explanation.

The preceding reasoning suggests that the neutralizations in question were the result of diachronic developments prior to language shift. If this inference is correct, we are led to conclude that there were at least two major dialects of Muniche—one exhibiting the neutralizations in question and the other

[26] It should be noted that despite this general tendency, there are documented instances of overgeneralization of marked segments in the phonological inventories of obsolescent languages (e.g., Campbell and Muntzel 1989) that may be related to speakers' efforts (conscious or otherwise) to distinguish the moribund language from the dominant language.

not. The paucity of reliable historical sources on the language makes this hypothesis difficult to evaluate.[27] Nevertheless, historical sources suggest that there were at least two major Muniche subgroups, which supports the notion that Muniche was dialectally diverse. Hervás y Panduro (1784:61), Velasco ([1788–89] 1981:547), and Maroni ([1738] 1988:108) all distinguish two Muniche subgroups: Hervás identifies two dialects, Muchimo and Otonabe; Maroni identifies two formerly geographically distinct subgroups, the Muniches and the Otonavis; and Velasco identifies two subgroups of uncertain nature, the Churitunas and the Otonanvis. It is also worth noting that, apart from the main Muniche settlement on the Paranapura, the mixed Muniche–Shawi settlement of Balsapuerto on the Río Cachiyacu may have been the source of contact-induced dialectal diversity, as may have been the influx of Shiwilu speakers into the Muniche population in the early seventeenth century mentioned by Steward (1948:607).

We now consider two segments that are probably absent from the GIB phonological inventory for reasons of data set size. The first is the lateral approximant /l/, which despite being absent from the GIB consonantal inventory is found in two words in the GIB data set (apart from Spanish loans), corresponding to (76*a*) and (76*c*) below (GIB:95, 100). In both cases, the forms appear with annotations that suggest that Gibson doubted the accuracy of these forms. The MLDP encountered exactly these forms, however, indicating that the presence of [l] in these forms is robust, and in addition we encountered two other words (76*b* and 76*d*) that also exhibit laterals. This segment is undeniably rare in Muniche but, as discussed in **5.2**, is contrastive with both /ɾ/ and /d/.

(76*a*) *pɨuala* 'iguana'
(76*b*) *uali* '*sierra cunche* (fish sp.)'
(76*c*) *uelistɨ* '*airambo* (*Phytolacca rivinoides*, plant sp.)'
(76*d*) *paiuluʔu* 'pottery glaze'

The post-alveolar fricative /ʃ/ is another rare segment that Gibson did not include in his phonological inventory. We found this segment in two assimilated loans (77*a* and 77*b*) and one possible loan (77*c*).[28] Gibson additionally

[27] Goodall (1950) lists several forms that exhibit /h/ where the MLDP forms exhibit /h/ and the corresponding GIB forms exhibit /ç/, suggesting that this data was drawn from the dialect conforming to that represented by the MLDP data set. Unfortunately, Goodall's data set uniformly neutralizes the /h/–/ç/ contrast to /h/, which does not allow us to determine if that data set corresponds to the dialect the MLDP data set draws from, or whether Goodall failed to distinguish /h/ and /ç/.

[28] This may be a loan from a Kawapanan language, all of which include /ʃ/ in their consonantal inventories. Note the similarity with the Shawi word *miaʒin* 'a little'.

lists the loanword *ʃiwi* 'tamandua (*Tamandua tetradactyla*)' (GIB:97).[29] While it seems probable that the post-alveolar fricative was introduced into the language via loanwords, it is now contrastive (see **5.2**). No doubt the fact that he only encountered this segment in a single loanword led Gibson to exclude it from the inventory of the language. The existence of fully assimilated loanwords like (77*a*) and (77*b*) and forms like (77*c*), which exhibit this segment, led us to include it in the inventory.

(77*a*) *tanʃelina* 'mandarin orange' (from Spanish *tangerina*)
(77*b*) *uɾanʃi* 'soft drink' (probably from English *orange*)
(77*c*) *miɲaʃa* 'a little'

Finally, we consider a segment that is absent from the GIB inventory that we believe reflects a difference in analysis: the alveolar affricate /ts/. Significantly, /ts/ sequences are present in the lexical data that Gibson provides—including, crucially, in word-initial position, as in (78).[30]

(78*a*) *tseʔsu* 'agouti' (GIB:98)
(78*b*) *tspena* '*paujíl* (*Mitu tuberosa*)' (GIB:98)

The fact that Gibson does not include /ts/ in his phonemic consonantal inventory suggests that he considers surface [ts] sequences to be stop-fricative sequences (see also GIB:41) rather than affricates. This is not an attractive analysis for the MLDP data set, since there are no other stop-fricative onsets in word-initial position. Affricates in word-initial position (i.e., tʃ and tʂ), on the other hand, are plentiful, which makes the analysis of surface [ts] sequences as realizations of the affricate /ts/ the phonotactically most parsimonious account.

We might ask if the GIB data exhibit the same phonotactic restriction on word-initial stop-fricative sequences, and the answer appears to be "mostly." Aside from [ts] sequences, stop-fricative sequences are absent from the GIB data in word-initial position, with a single exception: there are three instances of word-initial /pç/ sequences, as in (79).

(79*a*) *pça* 'hide (v. tr.)' (GIB:95)
(79*b*) *pçati* 'hide (v. refl.)' (GIB:95)
(79*c*) *pçiçiʔi* 'marmoset' (GIB:95)

Two observations are relevant here. First, we find no /pç/ sequences in the MLDP data set, and /pç/ sequences in the GIB data set correspond to /pi/ sequences in the MLDP data set, as in (80). It should be noted that frication of palatalized glides is characteristic of the Loreto dialect of Spanish spoken

[29] The word *ʃiwi* is found in at least Loreto Spanish, San Martin Quechua, and Shawi (Hart 1988:452). Since Muniche has been in contact with all three of these languages, it is difficult to ascertain the precise source of the loan. Our thanks to an *IJAL* associate editor for bringing the presence of this form in Shawi to our attention.

[30] It should be noted that there is considerable reduction of MLDP /ts/ to GIB /s/, e.g., *tsaʔa* 'corn' (MLDP), *saʔa* 'corn' (GIB:96); *uʔtsa* 'be night (v.)' (MLDP), *uʔsa* 'be dark (v.)' (GIB:99).

in Muniche, which may have led Gibson to transcribe the sequences in question as stop-fricative sequences.

(80*a*) [pja] 'hide'
(80*b*) [pjiʔxi] 'marmoset'

Second, Gibson (1996:41) omits stop-fricative sequences from his inventory of root onsets, which suggests that he regarded word-inital stop-fricative sequences as marginal himself.

In summary, an analysis of surface [ts] sequences as underlying stop-fricative sequences is not consistent with the phonotactics of the MLDP data set. Moreover, the marginal status of stop-fricative sequences in the GIB data set favors the affricate analysis for surface [ts] sequences, even for the GIB data.

We turn finally to the single difference between the MLDP and GIB vowel inventories: the status of the high non-front unrounded vowel. Acoustic measurements that we made show the segment that GIB treats as a high back unrounded vowel to be, in fact, a high central unrounded vowel. The formant measurements presented in **5.1** unambiguously show this vowel to be central, as represented in (81*a*) and (82*a*), rather than back, as represented in (81*b*) and (82*b*) by GIB. Without comparable recordings, it is not possible to determine if the difference in the analysis of this segment is due to dialectal differences or due to differences in perception between the two sets of researchers.

(81*a*) *ɨʔma* 'salt'
(81*b*) *ɯʔma* 'salt' (GIB:87)
(82*a*) *pɨmɨ* 'soil'
(82*b*) *pɯmɯ* 'soil' (GIB:95)

9. Concluding observations. This paper has provided a description of the segmental and prosodic phonology of Muniche, building upon previous work by Gibson (1996). Throughout the paper, we have presented as detailed a description as possible, given the advanced state of attrition of the language, motivated by the fact that further work on the language is unlikely.

We acknowledge our debt to Gibson's work and, at the same time, observe that the present work augments existing documentation of Muniche phonology by working with a larger lexical data set; by making use of phonetic analyses; by broadening the scope of the study to include prosodic phenomena; and by considering the role of language contact and language history in understanding the current state of the language.

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