

Tikuna, a ten-toneme language in Amazonia

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Abstract: Tikuna (isolate, western Amazonia) has been known since the 1950s to be one of Amazonia’s richest tone languages. However, no agreement has been reached yet as to how many underlying tonemes are needed to account for the large number of tones it displays on the surface. Based on first-hand data collected from 2015 to 2018, I show that the variety of Tikuna spoken in the community of San Martín de Amacayacu (Colombia) features an inventory of ten (level and contour) tonemes in stressed syllables, and six (level) tonemes in unstressed syllables. The tonal and phonational realizations corresponding to these numerous tonemes are illustrated on real samples. I argue that a more economical underlying inventory cannot successfully account for the attested contrasts and surface realizations. Such a rich toneme inventory is cross-linguistically extremely rare, and unique in South America.

Keywords: Tikuna (Western Amazonia); suprasegmental phonology; tonology; tone and toneme inventory; creaky-voice phonation

1. Introduction¹

Tikuna² (western Amazonia, isolate; ISO 639-3: tca) has been known to feature an unusually rich toneme inventory for Amazonia since D. Anderson (1962) and L. Anderson’s (1958, 1959) pioneering work in the 1950s. L. Anderson’s brief description of the language’s tones and

¹ I wish to express here my most heartfelt thanks to Loida and her family, Javier, Eulalia, James, and my other friends and collaborators from San Martín de Amacayacu—this work would not exist without them. I am also deeply indebted to Jean-Pierre Goulard for his invaluable help during my very first steps in San Martín, and want to show my gratitude to the many people who have so patiently contributed to my understanding of Tikuna tonology (in particular: Denis Creissels, Antoine Guillaume, Larry Hyman, María Emilia Montes Rodríguez, Nicholas Rolle, and Amalia Skilton). Finally, I would like to thank Françoise Rose and three anonymous reviewers for valuable reading suggestions and comments on earlier versions of this paper. This research was funded by Université Lumière–Lyon 2 (doctoral research contract, 2015–2018) and ASLAN Labex (mobility grants).

² I use the orthographic form “Tikuna” (instead of the alternative form “Ticuna”) throughout this study in accordance with Article 20 of an agreement taken by Tikuna education professionals and leaders from Brazil, Peru, and Colombia at a meeting held on December 16–17, 2010 in the Tikuna community of Macedonia (Amazonas, Colombia) (see Santos Angarita 2015).

tonemes in an introduction to a short Tikuna lexicon (1958: 3-4) was the first mention in the literature of Tikuna being a tonal language—and, what is more, a fairly complex one. L. Anderson (1959: 76-77) was also the first to draw attention to the absolute uniqueness of the Tikuna tonological inventory in the South American continent. Half a century later, Hyman, in an overview of South American toneme inventories (2010: 391), again notes Tikuna's uniqueness within its continent.

As Hyman (2010: 377) observed, however, there is no agreement as to the exact number of tones and tonemes of Tikuna nor as to how to describe them. L. Anderson, in a relatively detailed account of his analysis (1959: 80-93), argued for five tonemic values that can combine to yield a minimum of twelve different tones. Montes Rodríguez (1995: 75) later described the Tikuna tonological system as being analyzable by means of only three underlying tonemic units yielding more than ten tones on the surface.

In this paper, I argue that the Tikuna variety spoken in San Martín de Amacayacu (SMA; Amazonas, Colombia, see Map 1 below) is to be analyzed as featuring ten underlying values—*i.e.* ten tonemes—in stressed syllables and six in unstressed syllables. This inventory is summed up in Table 1. This new analysis is based on first-hand data from four main consultants that I collected over six months work in SMA between 2015 and 2018. The resulting inventory is larger than both Montes Rodríguez' (1995) and L. Anderson's (1959), although to some degree similar to the latter.

Toneme inventory	
in stressed syllables	in unstressed syllables
<i>Pitch-related distinctive properties</i>	
$/^{36}/$	$/^5/$
$/^{52}/$	$/^4/$
$/^{34}/$	$/^3/$
$/^{43}/$	$/^1/$
$/^3/$	$/^{1/4}/$
$/^{31}/$	
$/^2/$	
$/^{21}/$	
<i>Phonation-related distinctive properties</i>	
$/^{MC}/$	$/^C/$
$/^{CM}/$	

Table 1: SMA Tikuna toneme inventory³

I thus show the toneme inventory of SMA Tikuna to lie at a typological extreme of complexity, as exceedingly few languages in the world have been reported to feature ten or more tonemes. I further confirm L. Anderson's and Hyman's statements as to Tikuna's areal uniqueness: not only does Tikuna have a larger toneme inventory than any other South American language, but there is a surprisingly wide gap between its ten tonemes and the three to four tonemes of the next richest South American toneme inventories.

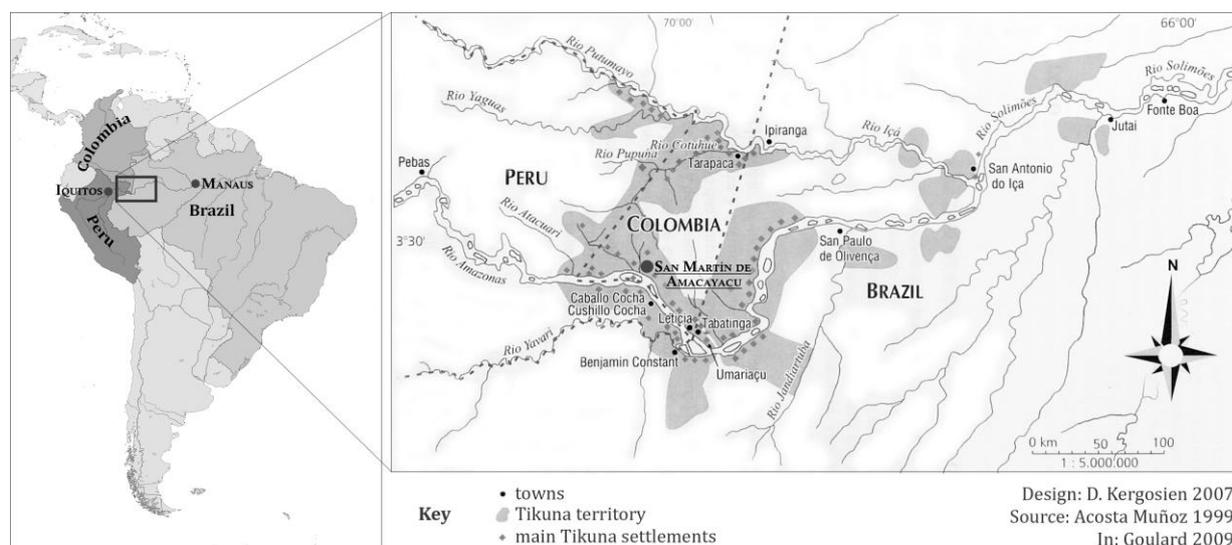
³ My transcription conventions for tones and tonemes are broadly based on Chao's (1930) numerical notation. Superscript numbers—from $\langle^1\rangle$ to $\langle^6\rangle$ —refer to relative pitch heights separated by roughly equal intervals. Superscript $\langle^1\rangle$ stands for the lowest pitch level, superscript $\langle^6\rangle$ for the highest pitch level. Level pitch is conveyed by a single number. Contour pitch is rendered by a sequence of two numbers, implying that pitch starts from the pitch level of the first number and goes up or down to the pitch level of the second number. Superscript letters are only used in phonological transcription and refer to syllabic phonation patterns. Superscript $\langle^M\rangle$ stands for modal phonation, superscript $\langle^C\rangle$ for creaky voice phonation. Level creaky-voiced phonation is conveyed by $/^C/$ (corresponding to $[\text{V̥}]$ phonetically). Modal-to-creaky-voiced and creaky-voiced-to-modal phonation contours are respectively rendered by the sequences $/^{MC}/$ ($[\text{V̥Ṽ}]$) and $/^{CM}/$ ($[\text{ṼV̥}]$).

After introducing the language and the data underlying this study (Section 2), I will sketch an outline of SMA Tikuna non-tonal phonology (Section 3). This will set the stage for an analysis of SMA Tikuna's toneme inventory in stressed syllables (Section 4) and unstressed syllables (Section 5). I will then illustrate with concrete samples the phonetic realization of the identified tonemes (Section 6). In the final part of this paper, I will discuss a few major asymmetries of SMA Tikuna's toneme inventory and assess the language's tonological complexity from both a typological and an areal perspectives (Section 7), before concluding (Section 8).

2. Language and data

2.1. Tikuna, Amazonia's most widely spoken language?

Out of a minimum of 68,500 ethnic Tikunas (Instituto Socioambiental 2018), at least 48,500 are speakers of the Tikuna language (Simons & Fennig 2018). These figures, while open to caution, give an indication of the considerable number of speakers of Tikuna, which is likely to be the indigenous language with most speakers in the Amazonian rainforest (Aikhenvald 2012: 5). As shown in Map 1, the Tikunas are spread over a large territory along the Putumayo-Içá and Amazon (or Amazonas-Solimões) rivers from Peru and Colombia down to Brazil. Significant Tikuna groups are also found in major cities outside of this territory, such as Iquitos and Manaus. Most Tikuna speakers are bilingual—to varying degrees—in the national language of their country, Spanish (in Peru and Colombia) or Portuguese (in Brazil). In the Colombian community of San Martín de Amacayacu (SMA), on whose speech variety the present study is focused, a minimum of 500 people, out of ca. 630 inhabitants, are active speakers of Tikuna, a majority of them bilingual in Spanish. SMA inhabitants who do not speak Tikuna are, for the most part, non-Tikuna adult men (*e.g.* non-indigenous Colombians or Brazilians) and children of mixed Tikuna and non-Tikuna couples.



Map 1: Location map of the main areas populated by the Tikunas
(Right-hand map: courtesy of Jean-Pierre Goulard)

Due to the extension of the area where it is spoken, Tikuna experiences a wide array of sociolinguistic situations. While it is slowly being replaced by Spanish and Portuguese in certain social contexts and in a few geographic areas, it remains as a whole a fairly vital language that Ethnologue characterizes as “developing” (Simons & Fennig 2018). As far as can be assumed from the existing literature (see in particular Montes Rodríguez 2004-2005, Santos Angarita 2005) and from speech productions from several Tikuna varieties I have had access to, Tikuna seems to display surprisingly little dialectal variation across its territory. This relates to the fact that its territorial expansion is a recent phenomenon that essentially took place in the 19th century (Goulard 1994: 326). The language does exhibit some variation however, even within a single speech community, as the analysis of the SMA Tikuna toneme inventory will itself reveal (see Section 4.2.). Long considered an isolate, Tikuna has been recently argued to belong to a single language family together with Yuri (†) and the so-called “Caraballo” (or “Carabayo”) language (Carvalho 2009, Goulard & Montes Rodríguez 2013, Seifart & Echeverri 2014). More work is needed to confirm or disprove these promising hypotheses.

Little descriptive work is available on Tikuna. The most extensive linguistic works are Montes Rodríguez (1995) for phonological description, Montes Rodríguez (2005) for morphosyntactic description,

Bertet (2020) for both phonological and morphosyntactic description, and Anderson & Anderson (2017) for lexicographical description. Skilton (2019) is a fine-grained semantic and pragmatic analysis of the system of demonstratives of the Cushillococha (Peru) variety of Tikuna. Leaving aside its tonological complexity, Tikuna exhibits a relatively unsurprising phonological system for western Amazonia (Aikhenvald 2012: 99-116). Tikuna morphology, like that of most of its surrounding languages, is moderately agglutinative. Tikuna features a few typologically uncommon morphosyntactic phenomena, such as nominal tense (Skilton 2018, Montes Rodríguez 2019, Bertet 2020: 188-191) and a largely pragmatic use of its grammatical system of nominal agreement classes (Bertet forthcoming), but its tonological system is without a doubt one of its major typological and areal singularities.⁴

2.2. Data collection

I collected the data on which this study is based as part of a doctoral research project whose overall goal was to provide a general description of the SMA variety of Tikuna (Bertet 2020). I started collecting Tikuna data in SMA in 2015 and later made three additional working trips there until 2018 for a total of a bit over six months. This project was exclusively focused on the speech community of SMA in order to minimize the distortion effects of dialectal variation in the description.⁵

Systematic work on SMA Tikuna tonology, through elicitation in particular, was done primarily with Javier Sánchez Gregorio (♂, 34 y/o; hereafter identified as JSG). Additional work with Loida Ángel Ruiz (♀, 50 y/o; hereafter identified as LAR), Eulalia Ángel Ruiz (♀, 45 y/o), and James Gregorio Sánchez (♂, 27 y/o) also significantly contributed to my understanding of SMA Tikuna tonology.⁶ Regular work with seventeen more speakers—involving the full transcription and translation of a 5-hour

⁴ For short introductions to Tikuna and its sociolinguistic context, see Bertet, Ángel Ruiz & Ángel Ruiz (2019) and Montes Rodríguez (forthcoming).

⁵ Note that SMA is one of the two Tikuna speech communities where Montes Rodríguez collected most of her first-hand data regarding tonological issues (see Montes Rodríguez 1995: 23–25).

⁶ JSG and LAR spent their childhood and have lived most of their lives in SMA. Eulalia Ángel Ruiz and James Gregorio Sánchez, although they spent their childhood in SMA and identify themselves as natives of SMA, have both also lived a number of years in other places, mostly in Tikuna communities where somewhat different Tikuna varieties are spoken.

(or 30,000-word) corpus—and daily conversations with these and a few more speakers have revealed minor inter-speaker variation as to toneme inventory and tonal realizations, but have as a whole confirmed analyses based on data from the first four speakers above.

Most of my recordings were made using a Shure BETA 53 headworn microphone connected to a ZOOM Q8 video and audio recorder. Using a headworn microphone enabled fairly good quality of recording—suitable for tonal analysis—although it did not completely cancel out background noises typical of the SMA environment. The tonological analysis presented here was initially based on my own auditory perception of SMA Tikuna tones. The speech analysis program Praat was then used to verify the accuracy of my auditory perception, and draw the graphs in Section 6.

3. An outline of SMA Tikuna non-tonal phonetics and phonology

The following is a summary of SMA Tikuna's non-tonal phonology meant to serve as a minimal background to the core part of this paper dedicated to tonal phenomena (Sections 4 and 5). For a detailed treatment of the language's non-tonal phonology, see Bertet (2020: 63-90, 118-124). Note that very recent borrowings from Spanish—which do display a few phonological, but no tonological, peculiarities—will not be taken into account in this study (see Bertet 2020: 149-151).

3.1. Inventory of segmental phonemes and their main phonetic realization

The inventory of SMA Tikuna segmental phonemes is presented in Tables 2 and 3. The symbols used to transcribe these phonemes are the International Phonetic Alphabet (IPA) representation of their main allophone as they appear in non-nasal syllables (on nasality and allophones found in nasal syllables, see Section 3.2.2.).

Manner of articulation	Place of articulation					
	bilabial	alveolar	palatal	labial-velar	velar	glottal
voiceless	/p/	/t/	/tɛ/	/ɸ ^w /	/k/	/ʔ/
voiced	/b/	/d/	/dʒ/	/w/	/g/	
(fricative)						(/f/) ⁷

Table 2: SMA Tikuna consonant phonemes

Height	Place of articulation		
	front	central	back
high	/i/		/u/ /u/
mid		/e/	/o/
low		/a/	

Table 3: SMA Tikuna vowel phonemes

Phoneme /d/, whether word-initially or word-medially, is realized as [d̪] in stressed (non-nasal) syllables and [r] in unstressed (non-nasal) syllables. No other phoneme has notable obligatory allophones in non-nasal syllables. Phoneme /ɸ^w/ is occasionally realized as [k^w], mostly in the speech of older speakers.

3.2. Syllables, prosodic words, and non-tonal syllable-level phonology

3.2.1. Structure of the syllable and the prosodic word

Three types of syllables need to be distinguished within the prosodic word, *i.e.* the combination of a stressed (or stressable)⁸ syntactic word and its hosted clitics if present. Their respective phonological structures are detailed in Table 4. A well-formed prosodic word consists of a single stressed syllable and (optionally) one or more unstressed syllables.

⁷ I have found /f/ in a single morpheme (/o³¹ho¹ho³/ [ʔ³¹ho¹ho³] ‘nocturnal rodent sp.’, after the [hɔhɔhɔhɔ] noise it makes according to JSG). Montes Rodríguez (2002:103) implies that no other Tikuna morpheme exhibits this phoneme.

⁸ Some function words, although they are most frequently left unstressed, *may be stressed* under certain circumstances, *e.g.* in careful speech. Examples of such words are /~ba³ru³/ [mã³ru³]~[mã³ru³] ‘PRF’; /~e³ru⁴/ [ẽ³ru⁴]~[ɲẽ³ru⁴] ‘because’; and /du²¹/ [ru¹](~[d̪u²¹]) ‘and’. These stressable words can serve as hosts for unstressable clitics and are thus to be considered as prosodically independent syntactic words just like regularly stressed words.

	Syllable type		
	pre-tonic	stressed	post-tonic
Segmental components	(C)V	(C)V ₁ (V ₂)(?) [stress]	(C)V(?)
Suprasegmental components	[±nasal] [toneme]	[±nasal] [toneme]	[±nasal] [toneme]
Amount within prosodic word	none, one, or several	one	none, one, or several

Table 4: Phonological structure of SMA Tikuna syllables

Some combinatorial restrictions apply to Table 4, of which the following are the most salient. The phoneme / ϕ^w / is absent from unstressed syllables. The vowel /o/, while ordinary in stressed syllables, is only marginally present in unstressed syllables. In unstressed syllables again, /tɛ/, /dz/, and /w/ are incompatible with nasality. Nasality is not a relevant feature in onsetless pre-tonic syllables, which are commonly slightly nasalized and breathy-voiced (see example (1j.) in Section 3.3.). In stressed syllables, position /V₂/ is restricted to /i/ or /u/ and is allowed only if /V₁/ is /a/; the resulting sequences /ai/ and /au/ are realized as diphthongs [a \bar{i}] and [a \bar{u}] respectively. An empty onset /^C/ in stressed syllables (whether nasal or oral) is automatically realized as [ŋ] (see examples (1c.) and (1j.) in Section 3.3.).⁹ Whether in stressed or unstressed syllables, the phonemes /k/ and /g/ are incompatible with nasality. In both stressed and unstressed syllables again, syllable-final /ʔ/ may surface under certain conditions with a following epenthetic vowel (see examples (1e.) and (1g.) in Section 3.3.). Finally, a few phonotactic restrictions apply to certain /C+V/ and /C+V₁V₂/ combinations. For instance, / ϕ^w / cannot combine with /o/ nor /u/, /w/ cannot combine with /u/, and bilabial and labial-velar consonants cannot combine with the sequence /au/.

From a morphosyntactic perspective, pre-tonic syllables are (part of) syntactically independent proclitics; stressed syllables are (part of) syntactically independent words; and post-tonic syllables belong to polysyllabic syntactically-independent words or are (part of) bound morphemes or enclitics.

⁹ On this surface rule of epenthetic [ŋ] insertion in onsetless stressed syllables, see Bertet (2020: 70, 87, 162–166). As pointed out to me by Shelece Easterday, a largely identical process is reported in North Samoyed languages (Sammallahti 1988: 497–498, Ackerman & Salminen 2009: 762).

3.2.2. Nasality

I analyze nasality as a suprasegmental feature of syllables rather than a feature of consonants or vowels.¹⁰ This is the reason why no nasal segments are to be found in Tables 2 and 3 above. A syllable is either entirely non-nasal or entirely nasal, *i.e.* its surfacing segments are either all of them oral or all of them nasal. Note, interestingly, that this rule prohibits syllables phonetically composed of an oral voiceless stop and a nasal vowel (*e.g.* *[pã]). The only exception to this rule occurs in stressed non-nasal syllables that lack an underlying onset, as these surface with an epenthetic onset [ŋ] preceding their non-nasal nucleus (see example (1c.) in Section 3.3.). Nasality is a strictly lexical property of syllables; no single process in the language converts a non-nasal syllable into a nasal syllable or the other way around. In phonological notation, I transcribe the syllabic feature [+nasal] by means of a tilde symbol /~/ preceding nasal syllables; syllables that lack it are [–nasal].

In a nasal syllable, all consonants are realized as a nasal allophone that retains their place of articulation (except for /ʔ/, which remains unchanged in this context). Phoneme /b/ is then realized as [m], /d/ as [ɲ], /dʒ/ as [ɲ], and /w/ as [w̃].¹¹ Apart from velum lowering, nasal allophones of vowels essentially maintain the articulatory features of their oral counterpart.

3.2.3. Stress

Stress is a word boundary marker (Trubetzkoy 1939: 255-246, Hyman 1977: 37-40) that automatically falls on the first syllable of prosodically independent syntactic words—*i.e.* all words to the exclusion of clitics.

¹⁰ Analyses of nasality as a suprasegmental feature, rather than as a feature of vocalic or consonantal segments, have been proposed for a number of Lowland South American languages, including languages from the Eastern Tukanoan (see Stenzel 2007: 340–345) and the Tupi-Guaranian (see Rose 2008: 439) subfamilies. Note, however, that the domain of suprasegmental nasality in Eastern Tukanoan and Tupi-Guaranian languages is larger than the syllable (*e.g.* the morpheme or the phonological word). For cases of languages that can be argued to display suprasegmental nasality with the syllable as its domain, see Piggott (2003: 387–393).

¹¹ It is in principle undecidable, based on language-internal evidence only, whether an onset consonant in nasal syllable should be represented phonologically as a voiceless or as a voiced consonant (*e.g.* whether [mã] is the realization of /~pa/ or /~ba/). Readers interested in this issue may consult Bertet (2020: 86–90) for a more detailed discussion. For the sake of simplicity, I arbitrarily represent onsets in nasal syllables as underlying voiced consonants in this paper (*e.g.* [mã] as /~ba/). This is the reason why the question of the realization of voiceless onsets in nasal syllables is not touched upon here.

The most salient phonetic correlates of stress are increases in intensity and duration. Stressed syllables are often phonetically realized with a comparatively higher intensity as compared to unstressed syllables. They also tend to surface with a significantly longer vowel nucleus, although this increase in duration is subject to certain restrictions—in particular, stressed vowel nuclei are usually realized as short before pause.¹² Stress is not associated with a typical, distinctive effect on pitch, such as *e.g.* a systematic increase or decrease of fundamental frequency (F0).

3.3. What SMA Tikuna prosodic words typically look like

The following examples briefly illustrate the descriptive phonetic and phonological statements made in Sections 3.1. and 3.2. by presenting a variety of typical SMA Tikuna prosodic words:

(1) a.	/to ^{MC} /	[t̥õ]	‘kinkajou’
b.	/~ʔi ⁴³ /	[ʔi ⁴³]	‘building’
c.	/au ²¹ /	[ŋa ²¹]	‘to be worn out’ ¹³
d.	/~du ³⁴ /	[pũ ³⁴]	‘to put (pl.)’
e.	/waʔ ⁴³ /	[wa ⁴³ ʔu ³]	‘to be black’
f.	/ʔai ³¹ du ⁵ /	[ʔai ³¹ ru ⁵]	‘dog’
g.	/ku ⁴³ ~ba ⁷⁴ /	[ku ⁴³ mã ⁴ ʔã ³]	‘with you’
h.	/pe ³ -e ⁴ /	[pe ³ ẽ ⁴]	‘your (pl.) mother’
i.	/ko ³ pi ³ wa ³ da ¹ /	[kõ ³ pi ³ wa ³ ra ¹]	‘capybara’
j.	/i ⁵ =~da ⁴ =u ³ /	[i ⁵ pã ⁴ ŋu ³]	‘he arrives’
k.	/tea ³ =dza ¹ =ku ³¹ -ʔda ¹ ~ʔu ¹ /	[tea ³ dza ¹ ku ³¹ ʔra ¹ ʔũ ¹]	‘I am like you’
l.	/~du ³ =~da ⁴ =~ʔa ³ ~de ⁴ ta ¹ -gu ⁴ /	[pũ ³ pã ⁴ ʔã ³ pẽ ⁴ ta ¹ gu ⁴]	‘he shoes them away’

¹² Contrast for instance the duration correlates of stress in examples (1g.) and (1j.) in Section 3.3., where (1j.) is implicitly followed by a pause. The stressed vowel nucleus /u/ is realized [u:] in /ku⁴³~ba⁷⁴/ (1g.), where it is not followed by a pause, while it is realized [u] in /i⁵~da⁴u³/ (1j.), where it is followed by a pause.

¹³ Although verbs in SMA Tikuna more frequently bear finite morphology (as in (1j.) and (11.)) than not in discourse, they may also be used on their own (*i.e.* without any finite morphology) as zero-derived nominalizations, sometimes with lexicalized meanings. Thus, the verb /ʔe^{wc}/ ‘shoot, hunt’ may function nominally with the meaning ‘(act of) shooting or hunting’. Likewise, the verb /ʔe^{wc}/ ‘know’ may function nominally with the meaning ‘(state of) knowing, knowledge’, and the verb /tei⁴³bu¹/ ‘eat’ with the lexicalized meanings ‘meal’ or ‘food’. Most verbs in this paper are displayed for convenience in their zero-derived nominalized form (*i.e.* without any finite morphology). I gloss such verb forms, somewhat arbitrarily, with English infinitives.

4. Toneme inventory in stressed syllables

The Toneme Bearing Unit (TBU) in SMA Tikuna is the syllable. Each and every underlying syllable bears a toneme whose value is primarily specified by the lexicon, although this toneme may be secondarily affected by morphosyntactically-conditioned processes (see Section 4.2.).

Stressed syllables display one of ten different tonemic values, as shown in Table 5. Note that the major phonetic exponent of eight of these tonemic values is pitch, while that of the last two is phonation (see Section 4.3.).

Toneme	Typical realization
<i>Pitch-related distinctive properties</i>	
/ ³⁶ /	[³⁶] contour tone
/ ⁵² /	[⁵²] contour tone
/ ³⁴ /	[³⁴] contour tone
/ ⁴³ /	[⁴³] contour tone
/ ³ /	[³] register tone
/ ³¹ /	[³¹] contour tone
/ ² /	[²] register tone
/ ²¹ /	[²¹] contour tone
<i>Phonation-related distinctive properties</i>	
/ ^{MC} /	modal to creaky-voiced contour phonation ¹⁴
/ ^{CM} /	creaky-voiced to modal contour phonation

Table 5: SMA Tikuna toneme inventory in stressed syllables

¹⁴ Phonation contours, defined as a type of suprasegmental phonological units whose realization involves the presence of “multiple laryngeal specifications [...] on a single prosodic unit” (DiCano 2009:163), are poorly attested cross-linguistically. They are reported, for example, in Chong, an Austroasiatic language spoken in Thailand and Cambodia that exhibits a breathy-to-tense (contour) phonation type contrasting with a modal, a tense, and a breathy (level) phonation types (DiCano 2009).

The phonological status of tonemes /⁵²/, /³⁴/, /⁴³/, /³/, /³¹/, /²/, /²¹/, and /^{MC}/ will be discussed first (Section 4.1.). That of tonemes /³⁶/ and /^{CM}/ will be discussed more at length in a separate section (Section 4.2.).

4.1. Eight tones, eight tonemes

The distinctiveness of eight tonetic realizations—and therefore the existence of at least eight tonemic values—in stressed syllables rather straightforwardly follows from such sets of (near-)minimal pairs as the following:

- (2)
- | | | |
|----|----------------------|---|
| a. | [⁵² tʰu] | ‘to drag’ ¹⁵ |
| b. | [³⁴ pa] | ‘to be full (sth.)’ |
| c. | [⁴³ pa] | ‘to be dry’ |
| d. | [³ pa] | ‘Dad!’ ¹⁶ |
| e. | [³¹ ?a] | ‘to get burnt’ |
| f. | [² ?a] | ‘to twitter’ |
| g. | [²¹ pa] | ‘to be tired’; ‘to smell (intrans.)’; ‘to shake (trans.)’ |
| h. | [²¹ pã] | ‘to cling on’ |
- (3)
- | | | |
|----|-----------------------|-----------------------------------|
| a. | [⁵² uβw̃] | ‘to write (trans.)’ ¹⁷ |
| b. | [³⁴ ṽ] | ‘to put.PL’ |
| c. | [⁴³ ṽ] | ‘bat sp.’ |
| d. | [³ ṽ] | ‘to be very angry’ |
| e. | [³¹ mũ] | ‘to catch (with a fishing spear)’ |
| f. | [² mũ] | ‘to send’ |
| g. | [²¹ ṽ] | ‘nasal mucus’ |
| h. | [²¹ mũ̃] | ‘to eat (a raw fruit)’ |
- (4)
- | | | |
|----|-----------------------|-------------------------------|
| a. | [⁵² gã] | ‘to tear’ |
| b. | [³⁴ ḍã] | ‘to be red’ |
| c. | [⁴³ ḍã] | ‘to touch’ |
| d. | [³ ḍã] | ‘to be grey’ |
| e. | [³¹ ?ar̃] | ‘jaguar’; ‘to dig’; ‘to hate’ |
| f. | [² ḍã] | ‘to see’ |
| g. | [²¹ teã] | ‘to be bored’ |
| h. | [²¹ gã] | ‘to be cold (sth.)’ |

¹⁵ Very few monosyllabic morphemes bear toneme /⁵²/, which is why instances of this toneme in sets (2) and (3) differ widely from the other items in their respective sets.

¹⁶ This form is a vocative obtained from the independent noun /⁵pa³pa⁵/ [pa³pa⁵] ‘dad’ through a regular process of truncation (Bertet 2020:127–128).

¹⁷ [uβ̃] is an allophone of /w/ before [u].

I have found no set of strictly minimal pairs that would illustrate all of these eight contrasts at a time with the exact same segmental string. This is in fact to be expected: when a single phonological parameter exhibits such a rich inventory of values, complete sets of strictly minimal pairs illustrating the contrasts of all of these values are rarely to be found, simply because the probability of coming across lexical gaps inevitably increases together with the size of the set being looked for. However, I could easily constitute sets of tonological strictly minimal pairs of up to six items—whether through elicitation or not. A sample of ten such sets is given in Table 6.

As can be seen in Table 6, my data do not reveal any pattern of complementary distribution according to syllables' segments among the eight tones under study in this section. Such a pattern would have shown certain tones to be allotones of a single toneme, which would have reduced the inventory of tonemes to less than eight items. On the contrary, the absence of any such complementary distribution implies that all of these eight tones must contrast phonologically with one another. Missing combinations of a given (elsewhere attested) toneme with a given (elsewhere attested) segmental syllable are to be interpreted as mere lexical gaps.¹⁸ Indeed, while a few phonotactic restrictions do apply to certain segmental combinations within a single syllable (as was mentioned in Section 3.2.1.), there seems to be nearly no phonotactic restriction at all as to the combination of any given toneme with any given segmental string forming a phonotactically viable syllable (for a minor case of such a restriction involving /ʔ/, however, see end of Section 7.1.).¹⁹

¹⁸ During our working sessions, JSG was in fact perfectly able to repeat or make up such combinations, even though he would eventually reject them as non-sensical. This observation is of course not definitive evidence as to the phonological status of the eight tones under scrutiny here, but would be less expected if those combinations actually violated phonological rules instead of merely happening to be absent from the lexicon.

¹⁹ This is particularly surprising in the case of syllables ending with a glottal stop. In such syllables the vowel nucleus is realized as short—[(C)V(V)ʔ.-]—so that tonal contours are almost imperceptible on the surface and tonological contrasts usually enhanced by distinctive contour properties become extremely hard to detect. However, words such as [ˈd̪aʊʔ³⁴.m̪ɛ̃ʔɛ̃³] ‘to paint somebody’s hand red’ and [ˈd̪aʊʔ⁴³.m̪ɛ̃ʔɛ̃³] ‘to touch somebody’s hand’ do contrast with each other phonologically, at least in careful speech. It should be noted, though, that such contrasts were obtained through elicitation.

Segments	Tone							
	[⁵²]	[³⁴]	[⁴³]	[³]	[³¹]	[²]	[²¹]	[^{MC}]
[pa]		‘to be full’	‘to be dry’	‘dad!’			‘to be tired’	‘to cling on’
[mã]		‘to chop up’	‘to be sad’	‘mum!’		‘to germinate’		‘to kill’
[mũ]		‘to be numerous’		‘to weave’	‘to spear’	‘to send’		‘to eat’
[tɔ]			‘to plant’		‘to fetch’	‘to sit’	‘other’	‘kinkajou’
[tu]	‘to drag’				‘to perch’	‘to choke’		‘tree sp.’
[ɲã]		‘to be hot’	‘to be spicy’		‘tree’		‘other.F/M’ ²⁰	‘to tie’
[tei]		‘to stand’	‘to chew’				‘tree sp.’ ²¹	‘to be tasty’
[ka]				‘to lie down’	‘to wake (trans.)’	‘to stab’	‘to ask’	‘a fruit’
[ɲu]	‘owl sp.’			‘to arrive’	‘to fall’	‘a fruit’	‘to ferment’	‘to learn’
[ʔɔ]			‘to vanish’	‘to go out (a fire)’	‘not to feel like doing sth.’	‘to bear fruits’		‘to be wounded’

Table 6: Sets of SMA Tikuna tonological minimal pairs in stressed syllables

N.B.: this table provides the approximate meaning—only one of them for items with several meanings—of given combinations of segments and tones. Thus [‘pa³⁴] means ‘to be full’, [‘mã²] means ‘to germinate’, etc. An empty cell does not necessarily imply that the corresponding combination does not exist, but only that it is unattested in my data. Note that because they are meant to be taken as pre-phonological data that should not prejudice the phonological analysis, words in this table are displayed in phonetic notation.

²⁰ See note 22 below.

²¹ *Eschweilera* sp.

4.2. Two less easily established tonemes

So far, I have only been discussing eight out of the ten tonemes listed in Table 5. The tonological status of tones [³⁶] and [^{CM}] is a slightly more delicate issue to settle.

The only monosyllabic lexemes containing toneme /³⁶/ I have come across thus far are /'~dai³⁶/ ['ṽāi³⁶] ‘other.N’,²² /'~du³⁶/ ['ṽũ³⁶] ‘all around here’, and /'dʒe³⁶/ ['dʒe³⁶] ‘all around there’. The following is a set of tonological (near-)minimal pairs that illustrates the contrast between a non-derived toneme /³⁶/ and the other nine tonemes (partially repeated from Table 6):

- | | | | |
|-----|----|-----------------------|---------------|
| (5) | a. | ['ṽāi ³⁶] | ‘other.N’ |
| | b. | ['bar ⁵²] | ‘not even’ |
| | c. | ['ṽāi ³⁴] | ‘to be hot’ |
| | d. | ['ṽāi ⁴³] | ‘to be spicy’ |
| | e. | ['taʊ ³] | ‘to be grey’ |
| | f. | ['ṽāi ³¹] | ‘tree’ |
| | g. | ['tai ²] | ‘to be hard’ |
| | h. | ['ṽāi ²¹] | ‘other.F/M’ |
| | i. | ['ṽāi] | ‘to tie’ |
| | j. | ['dʒaʊ] | ‘to glow’ |

In the speech of some SMA Tikuna speakers—among whom JSG—toneme /^{CM}/ has merged both phonologically and phonetically into toneme /²/. This implies that the toneme inventory of these speakers in stressed syllables only includes nine tonemes, instead of ten in other SMA Tikuna speakers. In those SMA Tikuna speakers—such as LAR—who have not merged /^{CM}/ into /²/, toneme /^{CM}/ is only found in a handful of

²² The gloss ‘N’ stands for ‘neuter’. SMA Tikuna exhibits a complex system of gender-like agreement involving five nominal classes that I label feminine (F), masculine (M), neuter (N), salientive (S), and non-salientive (NS) (see Bertet forthcoming). The modifier meaning ‘other’ has a partially suppletive paradigm: /'to²¹gu³?e¹/ ‘other.S’; /'~dai²¹/ ‘other.F/M’; /'~dai³⁶/ ‘other.N’; /'to²¹/ ‘other.NS’. Note that although /'~dai²¹/ ‘other.F/M’ and /'~dai³⁶/ ‘other.N’ are of course extremely likely to have been etymologically related diachronically, there is no reason to believe that /'~dai³⁶/ ‘other.N’ is derived from /'~dai²¹/ ‘other.F/M’ *synchronically*, given that toneme /³⁶/ is never productively derived from toneme /²¹/ through tonological alternation in today’s SMA Tikuna. The toneme of /'~dai³⁶/ ‘other.N’ is thus to be considered as a non-derived, lexical specification.

monosyllabic lexemes.²³ The following is a set of tonological (near-)minimal pairs that illustrates the phonological contrast between a non-derived toneme /^{CM}/ and the other tonemes:

- (6)
- | | | |
|----|-------------------------|--|
| a. | ['dzɛ̃ ³⁶] | ‘all around there’ |
| b. | ['tɬu ⁵²] | ‘to drag’ |
| c. | ['teɔ̃ ³⁴] | ‘to keep one’s mouth open’ |
| d. | ['teɔ̃ ⁴³] | ‘to stay.PL’ |
| e. | ['tɬu ³] | ‘to hang’ |
| f. | ['tea ³¹] | ‘to swell up’ |
| g. | ['tea ²] | ‘to color’ |
| h. | ['tea ²¹] | ‘to stir with water’ |
| i. | ['teɔ̃ ⁰] | ‘to be white’ |
| j. | ['teɔ̃ ⁰] | ‘to open (a carved tree trunk to make it into a canoe)’ |

Tonemes /³⁶/ and /^{CM}/ are more common in synchronically unanalyzable disyllabic words such as those shown in examples (7) and (8):

- (7)
- | | | |
|----|--|------------|
| a. | ['ɸ ^{wɛ̃} . ³⁶ dzu ⁴] | ‘fish sp.’ |
| b. | ['waɪ ³⁶ ra ³] | ‘açai’ |
| c. | ['ʔã ³⁶ wɛ̃ ¹] | ‘coal’ |
- (8)
- | | | |
|----|--|-----------------|
| a. | ['bɛ̃ ^e .ru ⁵] | ‘butterfly’ |
| b. | ['mũ ^ũ ʔku ³] | ‘horsefly’ |
| c. | ['tʔa ^a .wa ¹] | ‘to be thirsty’ |

Tonemes /³⁶/ and /^{CM}/ can also be shown to contrast with each other and all other tonemes by sets of unanalyzable disyllabic near-minimal pairs. Such complete sets as the one presented in (9) to illustrate the contrast of /³⁶/ with six other tonemes are rare, however:

²³ Examples of such lexemes, besides the ones given in (5j.) and (6j.), are /'be^{CM}/ ['bɛ̃ɛ̃] ‘to flutter’, /'teu^{CM}/ ['tẽũ] ‘to raise up its paws (an animal)’, and with a final glottal stop, /'u^{CM}/ ['ɲũ.ʔu³] ‘to bristle its hair (an animal)’, /'tee^{CM}/ ['tẽɛ̃.ʔɛ̃³] ‘to open (a carved trunk to make it into a canoe)’ (a synonym of /'teo^{CM}/), /'tei^{CM}/ ['tẽĩ.ʔi³] ‘to give a burning sensation’, /'teu^{CM}/ ['tẽũ.ʔu³] ‘to be leafless’, and /'teu^{CM}/ ['tẽũ.ʔu³] ‘to follow’ or ‘to rise’.

- (9)
- | | | |
|----|---|------------------------------------|
| a. | [¹ kɸ ^{·36} (wa ¹)] | ‘heron’ |
| b. | [¹ kɸ ^{·34} (ŋũ ³)] | ‘tongue’ |
| c. | [¹ kɸ ^{·43} (dza ¹)] | ‘caiman’ |
| d. | [¹ kɸ ^{·3} (ri ⁵)] | ‘white person’ |
| e. | [¹ kɸ ^{·31} (wi ⁵)] | ‘fruit sp. (<i>Garcinia</i> sp.)’ |
| f. | [¹ kɸ ^{·2} (w̃βu ⁴)] | ‘deer’ |
| g. | [¹ kɸ ^{·21} (i ⁵)] | ‘far away’ |

Yet tonemes /³⁶/ and /^{CM}/ are less frequent as primary, lexical tonemes than as secondary, morphotonologically derived tonemes. I shall briefly deal here with SMA Tikuna morphotonological alternations (for a detailed and exhaustive account, see Bertet 2020: 128-143). These cases of morphosyntactically conditioned tonological alternations have been alluded to in previous works on Tikuna without being clearly identified as such (see in particular Anderson 1962: 369). The following will quickly show that in addition to featuring a large toneme inventory, SMA Tikuna also regularly makes use of tonemes as direct exponents of grammatical features. My main point here, however, is to prevent the misconception that [³⁶] and [^{CM}] are mere allotones of /^{MC}/ and /²¹/, as these morphotonological alternations could lead to believe.

SMA Tikuna exhibits at least two contexts in which what can be shown to be morphotonological alternations occur. In these contexts, a syllable’s lexical—or “primary”—toneme is replaced by its morphotonologically corresponding—or “secondary”—toneme.

The first of these two contexts is verbal incorporation and verbal suffixation—*i.e.* binding of a bound morpheme to a verb. Some lexically specified bound morphemes, whether bound nouns or suffixes, trigger the replacement of toneme /^{MC}/ by toneme /³⁶/ (and, somewhat optionally, the replacement of /⁴³/ by /³¹/) in an immediately preceding monosyllabic verb. Thus, in example (10a.), the primary toneme /^{MC}/ of the verb /¹u^{MC}/ ‘to hurt’ alternates with /³⁶/ when immediately attached the bound noun /-pu¹tu³we³/ ‘belly’, which is lexically specified as being a trigger of this morphotonological alternation. Note that this alternation does not take place in (10b.), as /-pa³da¹/ ‘leg’ is not a trigger of this alternation:

4.3. Why I treat phonation-related phenomena as exponents of “tonemes”

What has been transcribed as [̤] in the sets of (near-)minimal pairs shown in examples (2-6) is creaky voice phonation. Accordingly, what distinguishes the words that bear this diacritic from the other ones in their respective sets is not a tonal or pitch-related feature, but a *phonational* feature. In SMA Tikuna phonology, however, phonation does not appear to be a separate parameter from pitch. Pitch has no phonological relevance in syllables that involve creaky voice phonation: no pair of syllables featuring /^{CM}/ or /^{MC}/ consistently contrast for pitch properties under any conditions. Conversely, phonation is but marginally relevant—only to the extent that it is *not* creaky-voiced—in syllables where pitch is the foreground distinctive feature: in these syllables, phonation is normally modal.

In other words, the two phonological units that involve creaky voice phonation (/^{CM}/ and /^{MC}/) and the eight phonological units that rely on pitch-related exponents (the eight tonemes in the narrow sense) stand in absolute complementary distribution. The phonological units /^{CM}/ and /^{MC}/ thus appear to pattern with the tonemes in the narrow sense into a single contrasting phonational-tonological paradigm, phonetically heterogeneous but functionally homogeneous. This explains why, by extension and for simplicity’s sake, I treat /^{CM}/ and /^{MC}/ as ‘tonemes’ from a phonological perspective.

In fact, it is not surprising, from a typological perspective, for both mainly pitch-related and mainly phonation-related phonetic properties to be involved in the realization of separate units making up a single phonological paradigm. This situation is especially well attested in the languages of mainland Southeast Asia, to the point that Bradley (1982:vi-viii), later followed by other authors working in that region (*e.g.* Brunelle *et al.* 2020: 347), has proposed to subsume tone and phonation under the hybrid label “tonation” (along with a few other laryngeal properties). For instance, not only are “three of the six tones [of] Northern Vietnamese [...] systematically realized with a laryngealized voice quality in sonorant-final syllables”, but in fact “perceptual research has shown that the strong glottalization of the low glottalized tone [of Northern Vietnamese] is normally sufficient for identification, to the point of largely overriding

pitch cues” (Brunelle *et al.* 2020: 349). Nevertheless, although the most salient phonetic property of the Northern Vietnamese low glottalized “tone” would appear to be a phonational one, this “tone” could still be rightly termed a “toneme” from a phonological perspective, since it aligns functionally with the other tonemes (in a narrower sense) of the language. Thus, while the functional alignment of pitch-related and phonation-related phonetic properties at the phonological level (in other words, the existence of “phonational tonemes”) attested in SMA Tikuna is likely atypical for Amazonia (it is not reported in Hyman’s (2010) survey of South American tone languages), this situation is far from unattested cross-linguistically.

4.4. Discarding two “reductionist” hypotheses: allotones according to vowel length and contour tones as combinations of level tonemes

I shall finally deal with two interesting hypotheses that could have resulted in reducing the total number of underlying tonemes needed to account for tonal contrasts in stressed syllables, but that do not receive significant support from my data. This section is meant to show why a ten-toneme analysis is arguably the most appropriate for today’s SMA Tikuna stressed syllables.

First, SMA Tikuna has been said to exhibit a contrast for vowel length (*i.e.* underlyingly short *vs* long vowels) in stressed syllables (Montes Rodríguez 1995: 56-57). If this is true in today’s SMA Tikuna, one should test the hypothesis that at least some pairs of tones might in fact be allotonic realizations of a single toneme conditioned by vowel length. A toneme can indeed be expected to have different tonetic realizations according to whether the syllable it links to is mono- or bimoraic.

However, I have found no evidence in support of an underlying length contrast in contemporary SMA Tikuna. All segmentally-comparable stressed syllables have virtually the same average duration. To quickly test this claim initially based on my own perception, I examined four short recordings in which JSG carefully pronounces, in a row and at a roughly steady pace, series of items featuring all the tonemes (but /^{CM}/, a toneme absent from JSG’s speech). Each of these recordings contains sets of tonological near-minimal pairs (see examples (26) and (27) below for a

whole transcription of two of them). These samples provide stressed vowels in comparable environments illustrating all the tonemes (but /^{CM}/) at least four times each. With the help of the speech analysis program Praat, I measured the duration of all the stressed vowels in the four samples from the consonantal explosion that precedes them up to the consonantal implosion that follows them. I then calculated the average duration of these vowels in relation to each toneme. The results of this short experiment are shown in Table 7.

Toneme	Average duration of vowel nucleus
/ ³⁶ /	0.23 sec
/ ⁵² /	0.24 sec
/ ³⁴ /	0.24 sec
/ ⁴³ /	0.24 sec
/ ³ /	0.24 sec
/ ³¹ /	0.26 sec
/ ² /	0.25 sec
/ ²¹ /	0.25 sec
(/ ^{MC} /	0.29 sec)

Table 7: Average duration of vowel nucleus (in stressed syllables, non-pausally) as a function of the toneme of the corresponding syllable in four audio samples

In the four samples under study, all the tonemes are identically associated to an average vowel nucleus duration of 0,23-0,26 second.²⁵ I take this as clearcut evidence for there being no correlation between tones and different vowel nucleus durations in today's SMA Tikuna. If all the tones are realized with the same average duration, then it cannot be true that certain tones are in fact allotones of a single toneme conditioned by the vowel nucleus' underlying length.

Note that immediately before pause, the duration of the vowel nucleus of stressed syllables that do not contain an underlying glottal stop does tend to vary depending on the toneme of the syllable they belong to. In this context, tonemes /⁴³/ and /^{MC}/ in particular tend to correlate with a shorter duration of the vowel nucleus than the other tonemes. Thus, words such as /'~ba⁴³/ ['mã⁴³#] 'to be sad' or /'~ba^{MC}/ ['mã^{MC}#] 'to kill' can be realized as perceptibly shorter than /'~ba³⁴/ ['mã³⁴#] 'to chop up' or /'~ba²/ ['mã²#]

²⁵ The higher value corresponding to toneme /^{MC}/ is probably not significant. It was virtually impossible to tell with precision on a spectrogram where a consonantal implosion occurred after a heavily laryngealized vowel.

‘to germinate’. These optional phonetic duration differences completely disappear non-pausally, however, and are not the stable exponents of underlying length contrasts.

To reduce the toneme inventory of SMA Tikuna in stressed syllables, a second direction is to hypothesize that certain tones are the mere surface realization of what is underlyingly a combination of tonemes. This has been done by L. Anderson (1959: 118), who claims that the Cushillococha Tikuna reflexes of SMA Tikuna tones $/^{52}/$, $/^{43}/$, and $/^{31}/$ are the realization of sequences of two level tonemes linked to a single syllable (respectively tonemes $/^{5+1}/$, $/^{4+3}/$, and $/^{3+1}/$).²⁶ Again, there is no language-internal evidence whatsoever—synchronically at least—that any tone in SMA Tikuna might really be the realization of a sequence of tonemes. “Evidence for this type of decompositional analysis comes primarily from morphotonological alternations”, as noted by Brunelle *et al.* (2020: 349) in a discussion of the relevance of similar reductionist hypotheses applied to the tone systems of certain mainland Southeast Asian languages (*e.g.* Standard Thai as analyzed by Morén & Zsiga 2006). But the complex patterns of morphotonological alternations referred to in the second half of Section 4.2. do not support a “decompositional analysis” for any of the tones of SMA Tikuna. I therefore see it as more faithful to the data to posit ten tonemes corresponding to the ten tones and phonational patterns attested in SMA Tikuna stressed syllables, instead of arbitrarily considering certain tones to be phonologically complex exclusively on the grounds of their relative degree of phonetic complexity.

5. Toneme inventory in unstressed syllables

Unstressed syllables, in contrast to stressed syllables’ ten possible tonemic values, exhibit only six possible tonemic values, as shown in Table 8. Note again that the major phonetic exponent of five of these tonemic values is pitch, while that of the last one is phonation.

²⁶ Note that in his study, L. Anderson uses the Central Americanist tone height scale (Yip 2002: 21), in which $\langle^1\rangle$ stands for the highest relative tone height and $\langle^5\rangle$ for the lowest relative tone height—*i.e.* the opposite of Chao’s (1930) tone height scale, the one used in the present paper. For clarity, L. Anderson’s transcriptions are here converted into their Chao scale equivalents.

Toneme	Typical realization
<i>Pitch-related distinctive properties</i>	
/ ⁵ /	[⁵] level tone
/ ⁴ /	[⁴] level tone
/ ³ /	[³] level tone
/ ¹ /	[¹] level tone
/ ^{1/4} /	[¹] or [⁴] level tone
<i>Phonation-related distinctive properties</i>	
/ˀ/	creaky-voiced level phonation

Table 8: SMA Tikuna toneme inventory in unstressed syllables

The phonological status of tonemes /⁵/, /⁴/, /³/, /¹/, and /^ˀ/ will be discussed first (Section 5.1.). That of toneme /^{1/4}/ will be discussed more at length in a separate section (Section 5.2.).

5.1. Five tones, five tonemes

The distinctiveness of five tonetic realizations, and therefore the existence of at least five tonemic values, in unstressed syllables rather clearly follows from such sets of near-minimal pairs as the following:

- (13) a. [ˈkɔ̃.³ri⁵] ‘white person’
 b. [ˈbuɾ.²buɾ.⁴ri⁴] ‘tree sp. (*Manilkara* sp.)’
 c. [ˈpɔ̃.²¹ri³] ‘edible tuberous plant sp.’
 d. [ˈpɔ̃.³ri¹] ‘tobacco’
 e. [ˈʔɔ̃.²ri] ²⁷ ‘fruit’
- (14) a. [ˈmã.³mã⁵] ‘mother’
 b. [ˈʔɔ̃.⁴³mɕ⁴] ‘monkey sp. (*Lagothrix lagothrica*)’
 c. [ˈɲã.²mã³] ‘his path’
 d. [ˈɖɔ̃.²¹mã¹] ‘fish sp.’
 e. [ˈɲã.²mã̃] ‘its root’
- (15) a. [ˈʔɔ̃.³ʔa⁵] ‘chicken’
 b. [ˈɲã.²ʔa⁴] ‘its trunk’
 c. [ˈteuɾ.³⁴ʔa³] ‘to fall (the night)’
 d. [ˈpɕ.⁴³ʔa¹] ‘party’
 e. [ˈɲã.²ʔu] ‘his rope’

²⁷ Some SMA Tikuna speakers realize this word as [ˈʔɔ̃.²riʔi³] (from an underlying form /ʔoʔ²diʔ^ˀ/ that is slightly different from the one—/ʔoʔ²di^ˀ/—whose realization is displayed in (15e.)).

- (16) a. [ḡũ⁵=] ‘3M/N/NS.BEN’
 b. [ḡã⁴=] ‘3M/N/NS.SBJ’
 c. [ḡã³=] ‘3M/N/NS.OBJ’²⁸
 d. [ḡã¹=] ‘2SG.IMP’²⁸

Again, sets of strictly minimal pairs illustrating all five contrasts would be extremely hard to collect. However, nothing in my data suggests that any two tones among [⁵], [⁴], [³], [¹], and [^C] could stand in a complementary distribution relationship according to any criterion. All five tones can contrast in essentially the same segmental and suprasegmental context, so that all five have to be the realization of five separate tonemes. In particular, note that the toneme of a given unstressed syllable is by no means conditioned by the toneme of the syllable that immediately precedes it.

What was said of tonemes /^{MC}/ and /^{CM}/ in Section 4.3. to substantiate their inclusion, despite the nature of their main phonetic exponents, to the inventory of *tonemes* in stressed syllables also applies, *mutatis mutandis*, to /^C/ in unstressed syllables. Toneme /^C/, while having a phonational feature as its main phonetic exponent, clearly patterns phonologically into a single contrastive paradigm with the other five tonemes found in unstressed syllables. I therefore treat it here as a toneme itself.

5.2. A sixth toneme

Interestingly, although SMA Tikuna only exhibits five tonal and phonational realizations on the surface in unstressed syllables, these five realizations can be shown to be underlied by *six*—not *five*—tonemic values.

Some SMA Tikuna morphemes consist in (or include) an unstressed syllable that may surface with either tone [¹] or tone [⁴]. Although in some cases the two alternative tonal realizations of these syllables appear to follow a complementary distribution rule, as in examples (17a.-d.), in other cases they stand in free variation—to varying degrees—in the exact same phonological context, as in examples (17e.) and (18):

²⁸ The exact function of the morphemes in (16c.–d.) is actually more complex (see Bertet 2020:428–446), but this is irrelevant here.

(17) [-gu¹]~[-gu⁴] ‘LOC2’:

- | | | | |
|----|---|---|----------------|
| a. | [¹ tea ²¹ gu ¹] | *[¹ tea ²¹ gu ⁴] | ‘on me’ |
| b. | [¹ ṅã ⁴³ gu ¹] | *[¹ ṅã ⁴³ gu ⁴] | ‘on it’ |
| c. | *[¹ ṅã ² gu ¹] | [¹ ṅã ² gu ⁴] | ‘on him’ |
| d. | ?[¹ tu ³¹ mã ¹ gu ¹] | [¹ tu ³¹ mã ¹ gu ⁴] | ‘on him/her’ |
| e. | ([¹ mẽ ³ tea ¹ gu ¹]) | ~ [¹ mẽ ³ tea ¹ gu ⁴] | ‘on the table’ |

(18) [-buu¹]~[-buu⁴] ‘(raw) food’:

- | | | | |
|----|---|--|------------|
| a. | [¹ tea ²¹ buu ¹] | ~ [¹ tea ²¹ buu ⁴] | ‘my food’ |
| b. | [¹ tɔ ³ buu ¹] | ~ [¹ tɔ ³ buu ⁴] | ‘our food’ |
| c. | [¹ ṅã ⁴³ buu ¹] | ~ ([¹ ṅã ⁴³ buu ⁴]) | ‘its food’ |
| d. | ([¹ ṅã ² buu ¹]) | ~ [¹ ṅã ² buu ⁴] | ‘his food’ |

By exhibiting this ability to surface with two alternative tones, these syllables differ from both syllables with a lexical toneme /¹/—as in (19)—and syllables with a lexical toneme /⁴/—as in (20)—which lack this ability:

(19) [-ga¹]~[-ga⁴] ‘rib’ vs [-ga¹] (*[-ga⁴]) ‘voice’:

- | | | | |
|----|--|--|------------|
| a. | [¹ tea ²¹ ga ¹] | ~ [¹ tea ²¹ ga ⁴] | ‘my rib’ |
| b. | [¹ tea ²¹ ga ¹] | *[¹ tea ²¹ ga ⁴] | ‘my voice’ |

(20) [-tã¹]~[-tã⁴] ‘uncle (mother’s brother)’ vs [-tã⁴] (*[-tã¹]) ‘trunk’:

- | | | | |
|----|---|--|------------|
| a. | [¹ tea ²¹ tã ¹] | ~ [¹ tea ²¹ tã ⁴] | ‘my uncle’ |
| b. | *[¹ tea ²¹ tã ¹] | [¹ tea ²¹ tã ⁴] | ‘my trunk’ |

Such minimal pairs suggest that these syllables could be analyzed as featuring a toneme of their own that is neither /¹/ nor /⁴/. I transcribe as /^{1/4}/ this sixth toneme found in unstressed syllables.

The specific behavior of toneme /^{1/4}/ in relation to SMA Tikuna’s system of tonological alternations provides evidence for its status as a separate underlying unit. In relativizations in the non-salientive nominal agreement class, for instance, predicative heads undergo a specific tonological alternation pattern and take a suffix /-~ʔu⁴/ ‘REL.NS’. In this tonological alternation context, toneme /¹/ turns into /³/, as in (21a.), and toneme /⁴/ turns into /⁵/, as in (21b.). By contrast, toneme /^{1/4}/, in contexts where it is realized as [⁴], usually turns into /⁴/, as in (21d.). Note that in contexts where it is realized as [¹], however, toneme /^{1/4}/ usually turns into /³/, as in (21c.), and thus behaves like toneme /¹/:

- (21) Tonological alternation context 1 (non-salientive relativization in /~ʔu⁴/):
- | | | | | | |
|----|--|---|---|-------------|---|
| a. | /~ʔi ³ ~du ³ ka ¹ / ‘to play’ | → | /~ʔi ³ ~du ³ ka ³ ~ʔu ⁴ / ‘who plays’ | <i>i.e.</i> | / ¹ /→/ ³ / |
| b. | /dau ³⁴ gu ⁴ / ‘be red (pl.)’ | → | /dau ³⁴ gu ⁵ ~ʔu ⁴ / ‘who are red’ | | / ⁴ /→/ ⁵ / |
| c. | /~e ³ ~ba ^{1/4} / ‘to exist’ | → | /~e ³ ~ba ³ ~ʔu ⁴ / ‘who exists’ | | / ^{1/4} / [1]→/ ³ / |
| | [ʔɛ̃ ³ mã ¹] | | [ʔɛ̃ ³ mã ³ ʔũ ⁴] | | |
| d. | /~eʔ ² ~ba ^{1/4} / ‘be there’ | → | /~eʔ ² ~ba ⁴ ~ʔu ⁴ / ‘who is there’ | | / ^{1/4} / [4]→/ ⁴ / |
| | [ʔɛ̃ʔ ² mã ⁴] | | [ʔɛ̃ʔ ² mã ⁴ ʔũ ⁴] | | |

In relativizations in the feminine nominal agreement class, now, predicative heads undergo a different tonological alternation pattern and take a suffix /-ku³/ ‘REL.F’. In this tonological alternation context, the behavior of toneme /^{1/4}/, which regularly turns into /^C/ as in (22c.-d.), systematically differs from that of tonemes /¹/ and /⁴/, which remain unchanged as in (22a.-b.):

- (22) Tonological alternation context 2 (feminine relativization in /-ku³/):
- | | | | | | |
|----|--|---|---|-------------|---|
| a. | /~ʔi ³ ~du ³ ka ¹ / ‘to play’ | → | /~ʔi ³ ~du ³ ka ¹ -ku ³ / ‘who plays’ | <i>i.e.</i> | / ¹ /→/ ¹ / |
| b. | /dau ³⁴ gu ⁴ / ‘be red (pl.)’ | → | /dau ³⁴ gu ⁴ -ku ³ / ‘who are red’ | | / ⁴ /→/ ⁴ / |
| c. | /ʔu ⁴³ ku ^{1/4} / ‘to enter’ | → | /i ³ =ʔu ⁴³ ku ^C -ku ³ / ‘who enters’ | | / ^{1/4} / [1]→/ ^C / |
| | [ʔu ⁴³ ku ¹] | | [i ³ ʔu ⁴³ ku ³] | | |
| d. | /~du ³⁴ ku ^{1/4} / ‘to put in’ | → | /~du ³⁴ ku ^C -ku ³ / ‘who puts in’ | | / ^{1/4} / [4]→/ ^C / |
| | [ɲũ ³⁴ ku ⁴] | | [ɲũ ³⁴ ku ³] | | |

Note that in spontaneous speech, however, especially in younger speakers and in morphemes of infrequent use, toneme /^{1/4}/ is often treated as if it were toneme /¹/ or toneme /⁴/ when submitted to tonological alternation processes.

Toneme /^{1/4}/ is the only one to exhibit a (partial) sandhi behavior in SMA Tikuna. In fact, the allotonic complementary distribution rule alluded to at the beginning of this section and illustrated in (17a.-c.) is likely to have been obligatory at an earlier stage of the language. Lexicalized items containing toneme /^{1/4}/ with a fixed realization, like those displayed in (23), indicate a regular sandhi rule by which /^{1/4}/ must have been regularly realized as [1] immediately after stressed tonemes /³⁶/, /⁵²/, /⁴³/, /³¹/, /³/, and /²¹/, while it was regularly realized as [4] immediately after stressed tonemes /³⁴/, /²/, and /^{MC}/.²⁹

²⁹ My data do not allow me to tell with certainty how toneme /^{1/4}/ would have been realized immediately after toneme /^{CM}/ or any of the unstressed tonemes according to the sandhi rule described here.

(23)			/ ^{1/4} / → [1]	vs	/ ^{1/4} / → [4]
	/ˈ~dai ³⁶ ~ba ^{1/4} /	‘other.N-ANAPH’	[ˈp̄āi ³⁶ mã ¹]		
	/ˈ~e ⁴³ ~ba ^{1/4} /	‘MED.F-ANAPH’	[ˈɲẽ ⁴³ mã ¹]		
	/ˈdʒi ³¹ ~ba ^{1/4} /	‘MED.N-ANAPH’	[ˈdʒi ³¹ mã ¹]		
	/ˈ~e ³ ~ba ^{1/4} /	‘MED.NS-ANAPH’	[ˈɲẽ ³ mã ¹]		
	/ˈteo ²¹ ~ba ^{1/4} /	‘1SG-ANAPH’	[ˈteo ²¹ mã ¹]		
	/ˈdʒe ³⁴ ~ba ^{1/4} /	‘DIST.NS-ANAPH’			[ˈdʒe ³⁴ mã ⁴]
	/ˈdʒi ² ~ba ^{1/4} /	‘MED.M-ANAPH’			[ˈdʒi ² mã ⁴]

However, what must have once been a regular rule has now come to be a mere tendency outside of lexicalized morphologically complex forms. This explains the cases of free variation illustrated in (17e.) and (18).

Toneme /^{1/4}/ is probably the most unstable unit in today’s SMA Tikuna tonological system, in part as a consequence of its relatively opaque identity. Interestingly, though, this instability is likely not to be a recent phenomenon. This toneme and its reflexes in other Tikuna varieties are indeed among the few elements of the Tikuna tonological system to apparently display significant dialectal variation, both phonetically and phonologically. Thus, in Cushillococha Tikuna (D. Anderson 1962; D. Anderson & L. Anderson 2017; Amalia Skilton pers. com.), part of the reflexes of SMA Tikuna’s toneme /^{1/4}/ have merged into the stable toneme /⁴/, while the rest of them have evolved into a stable and transparent toneme /²/—with its own realization [2]—absent from SMA Tikuna’s inventory in unstressed syllables.³⁰ One may hypothesize that the lower surface realization of SMA Tikuna’s toneme /^{1/4}/ may also have been formerly a tone [2] instead of [1]—which, by partially linking it to an exclusive tonal realization, would have allowed it to be less opaque—but in any case such a tone [2] is not found as a regularly contrastive realization of /^{1/4}/ in today’s SMA Tikuna.

6. Phonetic realization of the tonemes: a few concrete samples

The graphs, waveforms and spectrograms displayed in this section are meant to visually illustrate with concrete cases the typical realizations of SMA Tikuna tonemes as listed above in Table 1.

³⁰ This implies that Cushillococha Tikuna, which features tonemes /¹/, /²/, /³/, /⁴/, and /⁵/ in unstressed syllables (straightforwardly realized as [1], [2], [3], [4], and [5]), is a typologically extremely rare case of a language with five level tonemes contrasting in the exact same environment (see Edmondson & Gregerson 1992: 560–568).

Graphs 1a. through 2b. show pitch-related tonemes found in stressed syllables. Graphs 1a. and 1b. provide graphic representations, split in two groups for clarity, of tones from a single audio sample (Audio sample 1) and are meant to be read together. So do Graphs 2a. and 2b., which represent tones from another audio sample (Audio sample 2).

(24) Audio sample 1 (see Graphs 1a. and 1b.):

[¹ pa ³⁶ ka ¹]	/pa ³⁶ -ka ^{1/31}	‘to cling to someone’s liver’
[¹ tu ⁵² ta ⁴]	/tu ⁵² =ta ⁴ /	‘to drag (in future)’
[¹ pa ⁴³ ta ⁴]	/pa ⁴³ =ta ⁴ /	‘to be dry (in f.)’
[¹ pa ³⁴ ta ⁴]	/pa ³⁴ =ta ⁴ /	‘to be full (in f.)’
[¹ ʔu ³ ta ⁴]	/ʔu ³ =ta ⁴ /	‘to say (in f.)’
[¹ ʔa ³¹ ta ⁴]	/ʔa ³¹ =ta ⁴ /	‘to burn (in f.)’
[¹ ka ² ta ⁴]	/ka ² =ta ⁴ /	‘to stab (in f.)’
[¹ pa ²¹ ta ⁴]	/pa ²¹ =ta ⁴ /	‘to be tired (in f.)’
([¹ pa ^{MC} ta ⁴])	/pa ^{MC} =ta ⁴ /	‘to cling (in f.)’ ³²
([¹ pa ³⁴ ta ⁴])	/pa ³⁴ =ta ⁴ /	‘to be full (in f.)’ ³²

(25) Audio sample 2 (see Graphs 2a. and 2b.):

[tea ³ ṅã ³ ɲõ ³⁶ ka ¹]	/tea ³ =~da ³ =~o ³⁶ -ka ^{1/33}	‘I bite its liver’
[tea ³ ṅã ³ tu ⁵² ta ⁴ ʔ ¹]	/tea ³ =~da ³ =tu ⁵² =ta ^{1/34}	‘I drag it too’
([tea ³ ṅã ³ m̃ ³⁴ ta ⁴ ʔ ¹])	/tea ³ =~da ³ =~be ³⁴ =ta ¹ /	‘I splash water on him too’ ³⁵
[tea ³ ṅã ³ mũ ³⁴ ta ⁴ ʔ ¹]	/tea ³ =~da ³ =~bu ³⁴ =ta ¹ /	‘I harass him too’
[tea ³ ṅã ³ mũ ³ ta ⁴ ʔ ¹]	/tea ³ =~da ³ =~bu ³ =ta ¹ /	‘I weave it too’
[tea ³ ṅã ³ mũ ³¹ ta ⁴ ʔ ¹]	/tea ³ =~da ³ =~bu ³¹ =ta ¹ /	‘I harpoon it too’
[tea ³ ṅã ³ mũ ² ta ⁴ ʔ ¹]	/tea ³ =~da ³ =~bu ² =ta ¹ /	‘I send it too’
[tea ³ ṅã ³ ɲa ²¹ ta ⁴ ʔ ¹]	/tea ³ =~da ³ =a ²¹ =ta ¹ /	‘I scold him too’
([tea ³ ṅã ³ mũ ^{MC} ta ⁴ ʔ ¹])	/tea ³ =~da ³ =~bu ^{MC} =ta ¹ /	‘I eat it too’ ³⁵
[tea ³ ṅã ³ ʔu ⁴³ ta ⁴ ʔ ¹]	/tea ³ =~da ³ =ʔu ⁴³ =ta ¹ /	‘I cook it too’

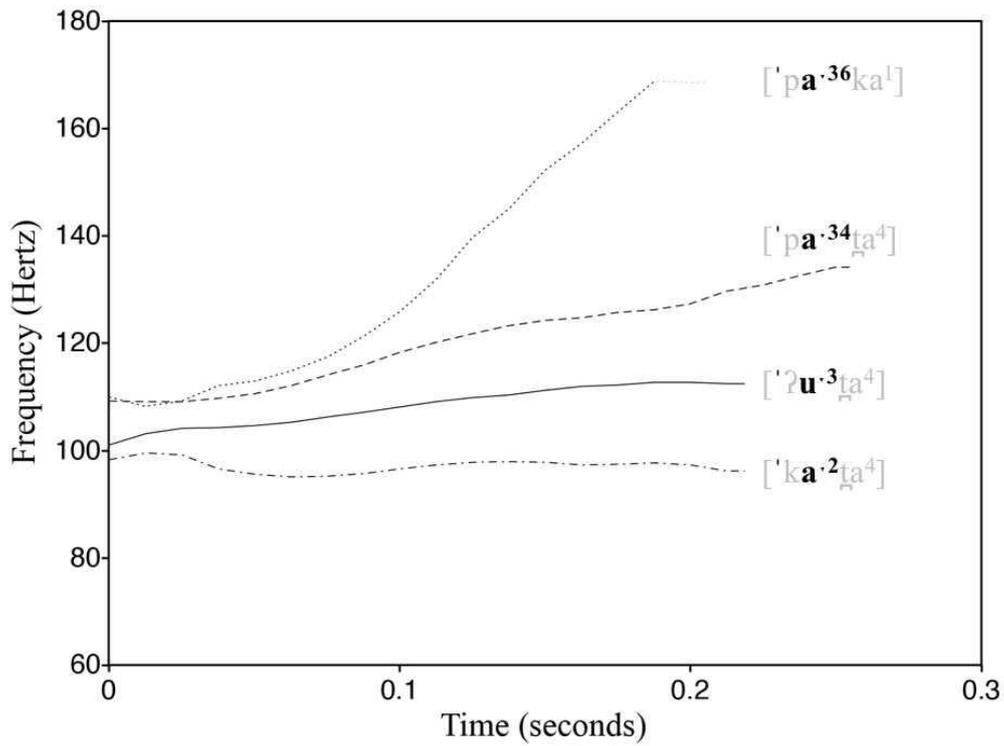
³¹ The deep phonological representation of [¹pa³⁶ka¹] would be /pa^{MC}-ka¹/ where /-ka¹/ ‘liver’ has the lexical property of triggering the alternation of /^{MC}/ with /³⁶/ in an immediately preceding syllable.

³² Items not included in Graphs 1a. and 1b.

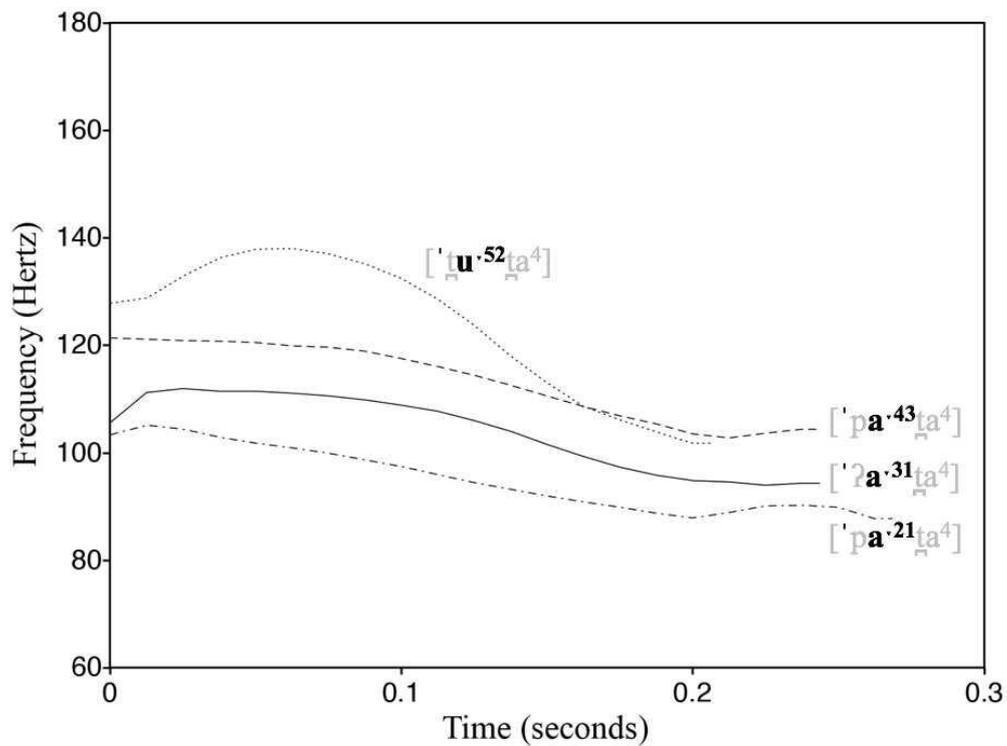
³³ The deep phonological representation of [tea³ṅã³ ɲõ³⁶ka¹] would be /tea³=~da³=~o³⁶-ka¹/ where /-ka¹/ ‘liver’ has the lexical property of triggering the alternation of /^{MC}/ with /³⁶/ in an immediately preceding syllable.

³⁴ The phonological status of the final glottal stop in [=ta⁴(ʔ)¹] ‘too’ is unclear and is treated as non-lexical here, hence its phonological transcription /=ta¹/. Contrary to regular phonological glottal stops in most unstressed syllables, it only surfaces before pause, and disappears altogether elsewhere. Furthermore, it cannot trigger an epenthetic copy vowel (yielding *[=ta¹ʔa³]), which regular phonological glottal stops usually do. A few other morphemes in my data display such glottal stops occurring before pause only, such as [-mã(ʔ)^{1/4}] /~ba^{1/4}/ ‘ANAPH’ and the four relativizer suffixes ([-kuw(ʔ)³] /-kuw³/ ‘REL.F/M’, [-(ʔũ⁴)ṅç(ʔ)¹] /-(~ʔu⁴)~de¹/ ‘REL.N’, [-ʔe(ʔ)¹] /-ʔe¹/ ‘REL.S’, and [-ʔũ(ʔ)⁴] /~ʔu⁴/ ‘REL.NS’).

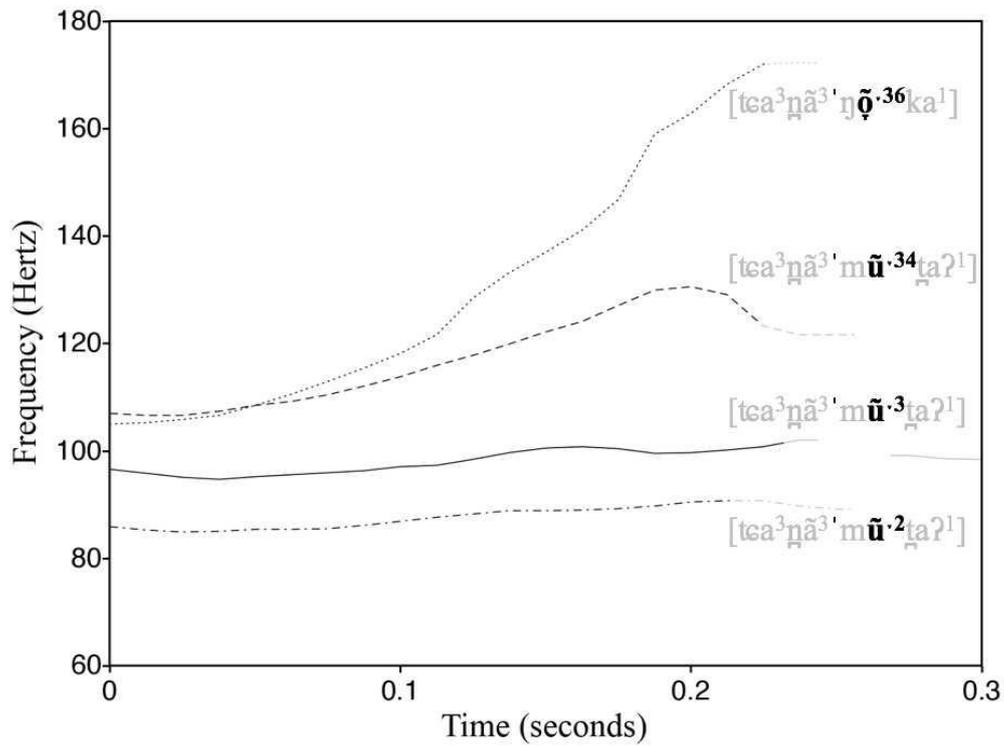
³⁵ Items not included in Graphs 2a. and 2b.



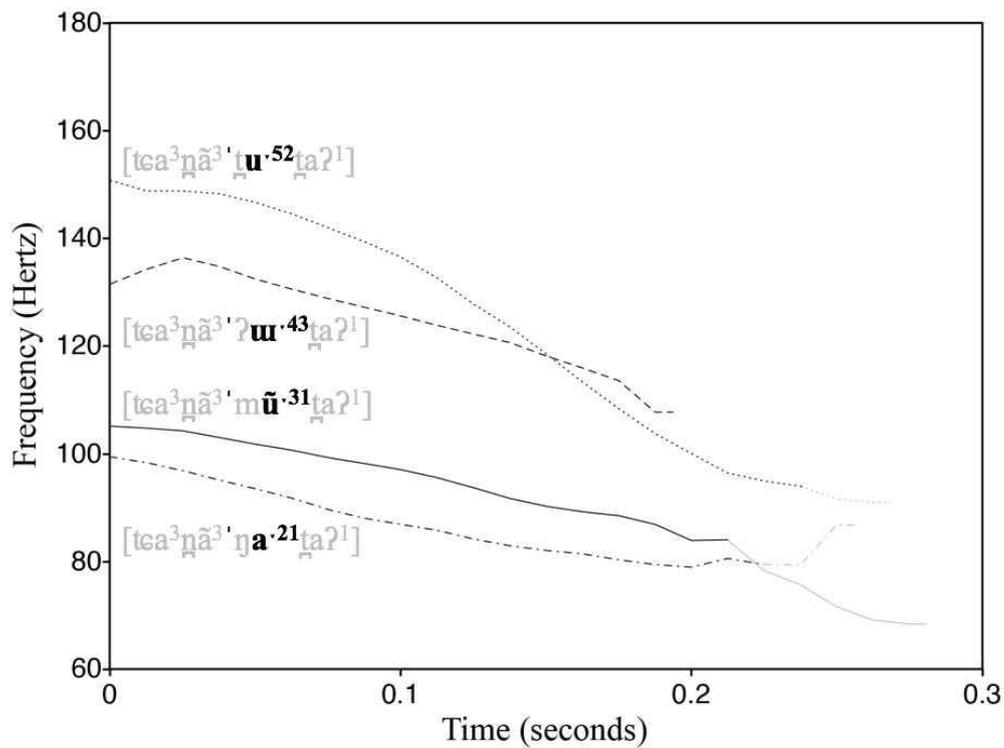
Graph 1a.: Graphic representation of level and rising tones from Audio sample 1



Graph 1b.: Graphic representation of falling tones from Audio sample 1



Graph 2a.: Graphic representation of level and rising tones from Audio sample 2



Graph 2b.: Graphic representation of falling tones from Audio sample 2

Each of the two audio samples on which Graphs 1a. through 2b. are based contains nearly-minimally contrasting items pronounced in a row by JSG, with a short pause after each item. Within each sample, all items (with the exception of the first, for morphophonological reasons) are identical except in one of their syllables which, while always displaying comparable segments, differs in tone from all other varying syllables in the other items. Each of the two samples thus provides a set of immediately comparable realizations of all pitch-related tonemes. Note that in Graphs 1a. through 2b., only the portion of the F0 signal corresponding to the portion of the items in bold dark type is represented, *i.e.* only vocalic portions from a consonant release to a consonant closure.³⁶

Graph 3 shows pitch-related tonemes found in unstressed syllables. It is based on a third audio sample (Audio sample 3) that also contains segmentally-comparable contrasting items pronounced in a row by JSG, with a short pause after each item.

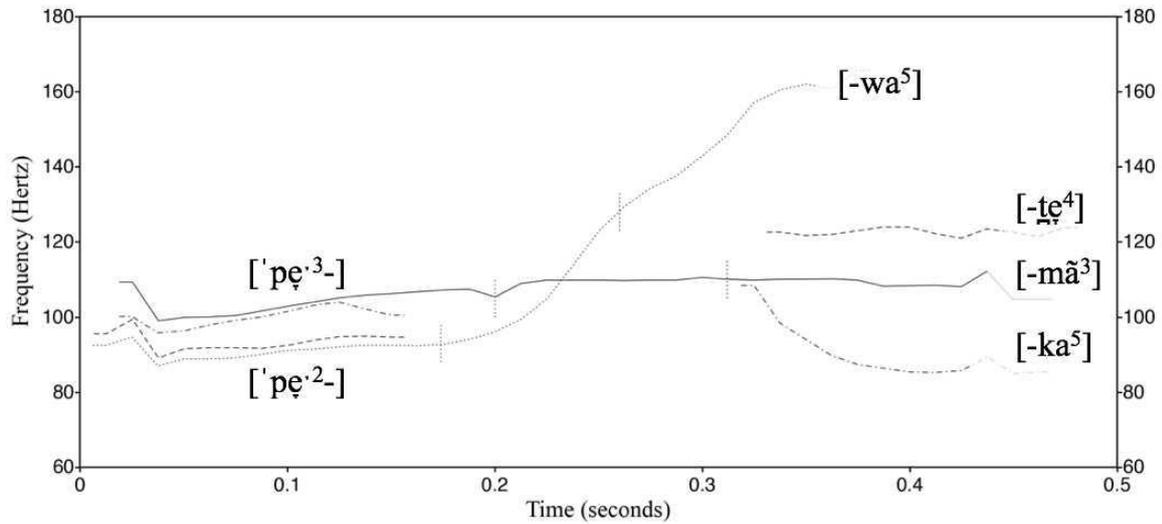
(26) Audio sample 3 (see Graph 3):

['pɛ̆· ³ mã ³]	/'pe ³ -~ba ³ /	'your (pl.) path'
(['pɛ̆· ³ nẽ ³]	/'pe ³ -~de ³ /	'your (pl.) son') ³⁷
['pɛ̆· ² tɛ ⁴]	/'pe ² -te ⁴ / ³⁸	'your (pl.) husbands'
['pɛ̆· ² wa ⁵]	/'pe ² -wa ⁵ / ³⁸	'at you (pl.)'
['pɛ̆· ³ ka ¹]	/'pe ³ -ka ¹ /	'your (pl.) livers'

³⁶ Strictly speaking, values of F0 are shown up to the moment when there is no longer voicing, which indeed roughly corresponds to the closure of the (voiceless) stops that immediately follow the vowel nuclei under study. Note that Graphs 1a. through 3 were made in Praat. In medium-quality recordings such as those used here, Praat sometimes detects pitch where there is *perceptually* none; portions of the curves I identify as such artifacts are in light gray.

³⁷ Item not included in Graph 3.

³⁸ The personal possessive prefix /'pe³-/ '2PL' may take an optional allomorph /'pe²-/ when immediately preceding a syllable with toneme /⁵/ or /⁴/.



Graph 3: Graphic representation of tones from Audio sample 3

Note that contrary to Graphs 1a. through 2b., Graph 3 displays entire items, *i.e.* not only single vowel nuclei. Vertical dotted bars in Graph 3 roughly indicate where consonants [w] and [m] start and end in items ['pe̞²-wa⁵] and ['pe̞³-mã³] respectively.

Finally, Figures 1 and 2 are meant to illustrate the interesting contrast that obtains between tonemes /^{MC}/ and /^{CM}/ in stressed syllables, *i.e.* a contrast in right- vs left-alignment of creaky voice phonation within the syllable. It is based on a last audio sample (Audio sample 4) that contains two minimally-contrasting items pronounced in a row by LAR, with a short pause after the first item:

(27) Audio sample 4 (see Figures 1 and 2):

['tɕo̞ ^{MC}]	/tɕo ^{MC} /	'to be white'
['tɕo̞ ^{CM}]	/tɕo ^{CM} /	'to open (a canoe)'

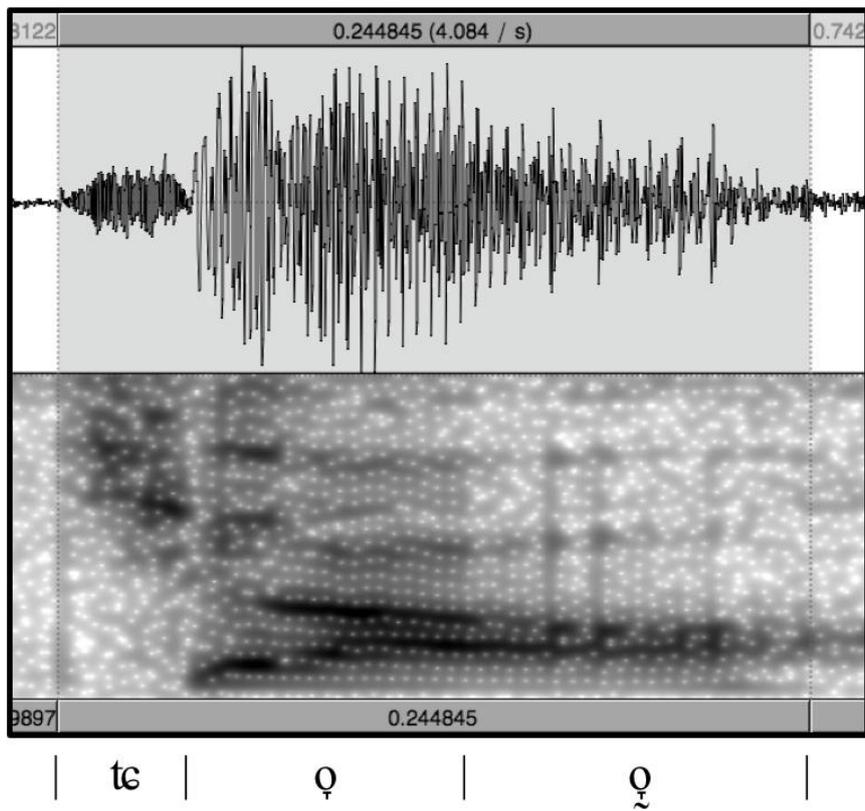


Figure 1: Waveform and spectrogram of the word /'tɛo^{MC}/ 'to be white' from Audio sample 4

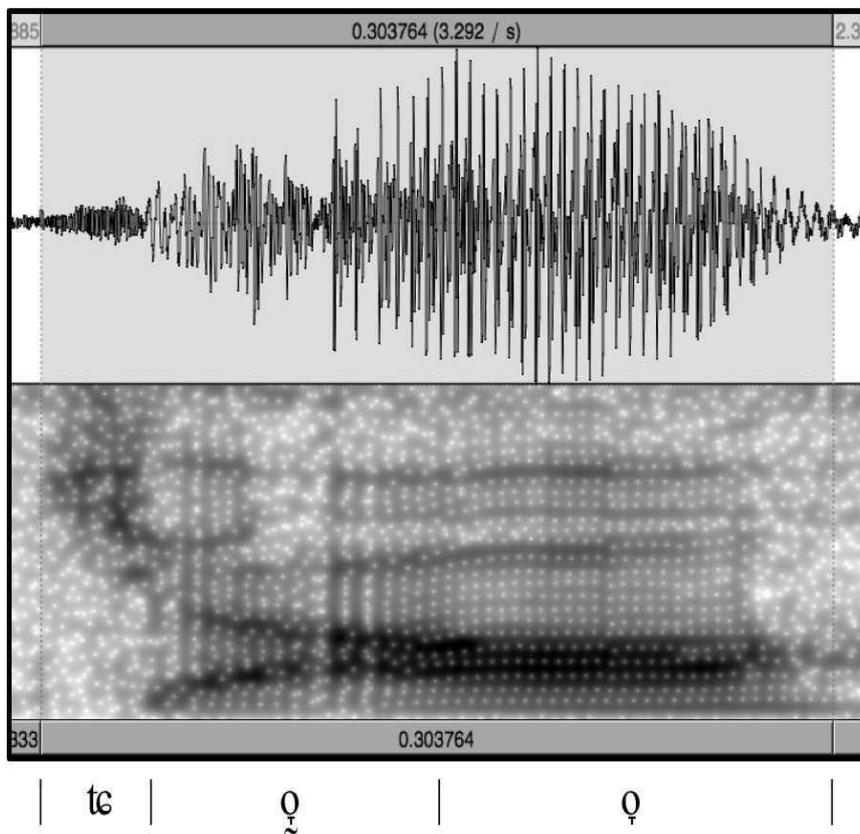


Figure 2: Waveform and spectrogram of the word /'tɛo^{CM}/ 'to open (a canoe)' from Audio sample 4

7. Discussion

7.1. Distributional asymmetries of the tonemes

As is to be expected, SMA Tikuna's rich toneme inventory is subject to several distributional asymmetries. Although the systemic significance of several of these asymmetries for a synchronic and diachronic description of SMA Tikuna's tonological system remains unclear to me, I shall list here for reference the major ones I have noticed.

First, while most tonemes occur both as lexical specifications and as a result of (productive) morphosyntactically-conditioned tonological alternations (*i.e.* as grammatical tonemes), other tonemes are only found as lexical specifications. The latter are tonemes /⁵²/, /³⁴/, /⁴³/, /^{MC}/,³⁹ and /^{1/4}/. Note that the converse does not obtain: all tonemes are found in unanalyzable lexical items, *i.e.* none occurs as a grammatical toneme only.

Second, some tonemes are noticeably rarer than others within the lexicon.⁴⁰ Toneme /⁵²/ is one of them. Because, as a whole, lexical items with /⁵²/ are not particularly semantically-basic and frequent, and because /⁵²/ does not occur as a grammatical toneme, it might be the rarest of all tonemes in terms of average token-frequency. Also lexically rare are tonemes /³⁶/, /⁵/, and /^{CM}/. These tonemes do occur as grammatical tonemes

³⁹ At least two etymologically-related bound nouns (/~(a)^Ce⁴/ 'mother-in-law' and /~(a)^Ctu³/ 'father-in-law') trigger what at first sight can be mistaken for a tonological alternation whereby a toneme /^{MC}/ would arise. Indeed, these two nouns regularly cause the lexical toneme of an immediately preceding possessive personal prefix to be replaced by /^{MC}/, as in *e.g.* /'təu²¹-/ '1SG' + /~(a)^Ctu³/ > /'təu^{MC}tu³/ 'my father-in-law' or /'tə²-/ '1PL.INCL' + /~(a)^Ctu³/ > /'tə^{MC}tu³/ 'our (incl.) father-in-law'. When attached to an unstressed syllable, however, these two bound nouns surface with disyllabic allomorphs (/~a^Ce⁴/ and /~a^Ctu³/ respectively) and creaky-voiced phonation is then realized on the first syllable of these allomorphs instead of associating to a preceding syllable (as in *e.g.* /'təu²¹-/ '1SG' + /~bu¹ku³/ 'friend' + /~(a)^Ctu³/ > /'tə²¹~bu¹ku³~a^Ctu³/ 'my friend's father-in-law'). Therefore, rather than claiming that these two bound nouns trigger their own tonological alternations, it is greatly preferable to say that their monosyllabic allomorphs exhibit a pre-morphemic *floating creaky-voiced toneme* (occurring as a non-floating toneme in their disyllabic allomorphs) which under certain conditions replaces an immediately preceding toneme. Interestingly, this analysis, if correct, implies a functional correspondance between /^C/ in unstressed syllables (as found in these bound nouns' disyllabic allomorphs) and /^{MC}/—*i.e.* not /^{CM}/—in stressed syllables (as found as a floating toneme in these bound nouns' monosyllabic allomorphs).

⁴⁰ I have not carried out systematic statistical type- and token-frequency counts of each toneme in my corpus; this paragraph is only based on obvious observations.

though, so that their average token-frequencies are certainly higher than that of /⁵²/. All other tonemes are roughly equally frequent in the lexicon.

A third distributional asymmetry involves unstressed syllables whose underlying representation ends with a glottal stop /ʔ/. Only tonemes /⁴/, /³/, and /^C/ are regularly found in such syllables. Tonemes /¹/ and /^{1/4}/ are completely absent from them. As for toneme /⁵/, it only occurs in one such syllable (in the bound noun /-tɛuʔ⁵/ [-tɛu⁵ʔu³] ‘liquid’), which is moreover likely to be the recent product of a reanalysis (from its still-existing alternative disyllabic form /-tɛi⁵ʔu³/ [-tɛi⁵ʔu³]).

Lastly, tonemes /^C/ and /^{1/4}/ do not occur pre-tonically, *i.e.* in proclitics. This strengthens the case for a distinction, within unstressed syllables, between pre-tonic and post-tonic syllables (see Section 3.2.1.).

7.2. Typological assessment

SMA Tikuna’s inventory of ten tonemes in stressed syllables, *i.e.* the language’s maximum number of phonological contrasts between primarily pitch- or phonation-related suprasegmental realizations in the same segmental and morphosyntactic context, is rather exceptional cross-linguistically. It is especially hard, however, to assess exactly how exceptional it is. Because a cross-linguistic operational definition of what should be counted as a toneme is not straightforward, toneme inventories are not established in the same way across different languages and therefore not directly comparable. Even the analysis of a single tonal language may yield widely divergent inventories from the perspective of different authors. This is especially true of languages with large toneme inventories.

That being said, and duly taken into account, one may nevertheless make an attempt at a statistical study of toneme inventory size across languages. Maddieson (1978: 364-365), in such a study based on a genetically balanced sample of 207 tone languages, observed an exponential decay in number of languages as one increases the number of units in their toneme inventory. Thus, languages with a two-toneme inventory account for slightly more than 50% of his sample, those with a three-toneme inventory for about 30%, and those with four-, five-, and six-

toneme inventories for only 6 to 7% each. Maddieson notes “a further sharp reduction [...] in the frequency of systems with more than 6 [contrastive] tones”, and adds that his 207-language sample, which happens not to contain languages with more than eight tonemes, allows to conclude that “probably less than 1 in 200 tone languages contrasts 8 or more tones”. These results were roughly replicated in another, more recent study by Maddieson (2012) based on an independent, slightly wider but less genetically balanced sample of tone languages. A quick survey by Gordon (2016: 221-222) based on the 29 tone languages featured in the 100-language WALS sample (Dryer & Haspelmath 2013) also yields comparable results, implying that statistically extremely few languages display an inventory of more than six tonemes.

Although one may legitimately question the details of the three aforementioned studies, the overall picture that emerges from them is clear and consistent. Whether one counts the two phonation-related tonemes of SMA Tikuna, /^{MC}/ and /^{CM}/, as tonemes or not, it can reasonably be assumed that the language stands among the probably less than 0.5% (*i.e.* 1/200) of the languages of the world to display an inventory of eight or more tonemes. Other such languages include a dozen of mostly Hmong-Mien, but also Sino-Tibetan and Tai-Kadai languages spoken in the south of China, a handful of Oto-Manguean languages from the southern Mexican states of Oaxaca and Guerrero, and a few outliers.⁴¹

In addition to featuring a typologically highly remarkable paradigmatic density, SMA Tikuna’s tonological system also lies at a typological extreme in terms of syntagmatic density. SMA Tikuna’s syntagmatic toneme density, which I define here as the average rate of underlying Toneme Bearing Units (TBUs) that are lexically specified for toneme in the language

⁴¹ Here is an (incomplete) list of these languages based on my interpretation of the corresponding sources. At least one variety of the following languages is claimed to be able to make a contrastive use of eight or more distinct clusters of pitch- and phonation-related phonetic properties in the exact same segmental environment. *Hmong-Mien*: A-Hmao (Mortensen 2002: 16–18), Hmong (Mortensen 2006a: 73, Mouton 2018), Hmu (Sands 2003), Kim Mun (Strecker 1990), Mashan (Mortensen 2006b), Pa-Hng (Edmondson 1992: 163–164). *Sino-Tibetan*: Bai (Wiersma 2003: 655, 658), Khatso (Donlay 2015: 102). *Tai-Kadai*: Kam (Tang 2008: 87). *Oto-Manguean (Eastern branch)*: Amuzgo (Kim 2011), Chatino (Cruz 2011, Rasch 2002: 38), Triqui (DiCanio 2008, Matsukawa 2012: 29). *Lakes Plain (New Guinea)*: Iau (Bateman 1990). *Nilotic (South Sudan)*: Shilluk (Remijsen & Ayoker 2014).

(as opposed to those that are tonologically underspecified),⁴² is 100%. In other words, every single underlying syllable in SMA Tikuna is specified for toneme. While “omniprosodicity” (Hyman 2012: 13), *i.e.* a 100% syntagmatic toneme density, by definition situates SMA Tikuna at the very upper extreme of a typological scale based on this parameter (Hyman 2009: 214), this property cannot be satisfactorily evaluated yet in terms of cross-linguistic usual- or unusualness. Gussenhoven (2004: 35) tentatively states that full syntagmatic toneme density “appears to be rare” among the languages of the world, but it seems that no extensive statistical cross-linguistic study of this typological parameter has been attempted to date that may support this statement, as was already observed by Hyman (2012: 16) a few years ago.

7.3. Areal assessment

Yet it is from an areal perspective, *i.e.* within the context of Amazonia, that the paradigmatic density of SMA Tikuna’s tonological system, and to some extent its syntagmatic density, stand out the most. At the time L. Anderson wrote that Cushillococha Tikuna’s “system of five phonemic levels of pitch [made] up the first such intricate system of tone to be found in South America” (1959: 76-77), very little was known about South American tone languages, a state of affairs still noted by Yip (2002: 246) at the beginning of the 2000s. Due to the publication of good-quality descriptions of a number of Amazonian tone systems over the last two decades, the situation has now improved significantly, opening the way to a more satisfactory overall understanding of Amazonian tonology (although this field of research is still without a doubt in its early stages, as observed by Gómez-Imbert (2012)).

Hyman’s (2010) is to date the most extensive survey of South American tone languages. From Hyman’s (2010: 391) perspective, of the 49 South American tone languages taken into account in his study, “only Ticuna contrasts more than two tone heights”. Aikhenvald, in a less detailed survey, notes that “[j]ust a few [Amazonian] languages have three contrastive tones” and mentions Andoque, Southern Nambikuára, Tikuna,

⁴² This definition is based on Gussenhoven’s (2004: 35) use of his concept of “tonal density”.

and possibly Pirahã as instances of such languages (2012: 122, 417). She adds that “Puinave [...] is unusual for Amazonia” in apparently featuring four contrastive tones (2012: 121). A few more Amazonian languages, such as Kakua (Maddieson *et al.* 2014-2018, Bolaños Quiñónez 2016: 70-90) and Yuhup (Ospina Bozzi 2002: 121-124, Maddieson *et al.* 2014-2018), have been reported to possibly have toneme inventories of more than two values. Although the analytic perspectives of these authors differ to some extent, and the details of the tonological systems of many Amazonian languages are still poorly understood, it is clear from Hyman’s and Aikhenvald’s surveys that the vast majority of the many tone languages of Amazonia have minimal toneme inventories that only exceptionally reach three, or possibly up to four values. This makes SMA Tikuna’s ten-toneme inventory—or eight-toneme inventory, if one does not want to count SMA Tikuna’s phonation-related tonemes, /^{MC}/ and /^{CM}/, as tonemes proper—not only apparently unique in Amazonia (and, in fact, in all of South America), but also remarkably distinct from any other toneme inventory in the region.

Interestingly, SMA Tikuna is spoken in western Amazonia, in the heart of a large region noted by Hyman (2010: 377-378) and Aikhenvald (2012: 123-125) for comprising most South American tone languages. The relevance of this observation remains unclear, however, as SMA Tikuna’s tonological system does not seem to be significantly closer to those of its neighboring tone languages than to those of any other South American tone languages.

SMA Tikuna’s syntagmatic toneme density is even harder to assess from an areal perspective. I shall simply observe that many Amazonian tone languages have been described as featuring “pitch-accent” systems. As noted by Hyman, “[m]any of these so-called [“pitch-accent”] systems have a relatively low ‘tonal density’ [*i.e.* syntagmatic toneme density]” (2012: 15). One may thus reasonably assume that the average syntagmatic toneme density among the Amazonian tone languages is rather low, and in any case far from SMA Tikuna’s 100%-density. Nevertheless, SMA Tikuna’s areal unusualness is likely much less striking in this regard than in regard to the size of its toneme inventory.

8. Concluding remarks

In this paper, I have shown that the Tikuna variety of the Colombian community of San Martín de Amacayacu is to be analyzed as featuring an inventory of ten tonemes in stressed syllables and six tonemes in unstressed syllables. Such a large toneme inventory is cross-linguistically extremely rare, and unique in all of South America. Beyond the size of its toneme inventory, a few other features of particular typological interest of SMA Tikuna's tonological system have been mentioned, such as its full syntagmatic toneme density and the fact that it involves (in the speech of many speakers) a phonological contrast between two syllabic alignments of creaky-voice phonation (modal-to-creaky or $/^{MC}/$ vs creaky-to-modal or $/^{CM}/$). One of SMA Tikuna's unstressed tonemes ($/^{1/4}/$) is also typologically and theoretically remarkable in that it is not linked to a tonal realization of its own, but instead alternatively surfaces as the stable realizations of two other tonemes ($/^1/$ and $/^4/$) from which it differs by displaying a characteristic alternation behavior in its surface realization and by exhibiting a behavior of its own when submitted to the language's morphotonological alternations.

The analysis I have developed in this study is focused on San Martín de Amacayacu Tikuna. From what I know of other varieties of the language,⁴³ it seems that the Tikuna phonological system, while it does exhibit noticeable—although relatively superficial—dialectal divergence at the segmental level, is remarkably homogeneous across the language's territory at the suprasegmental level. It is likely that the only significant dialectal variation in this regard involves the phonetic realizations and phonological statuses of toneme $/^{1/4}/$ and those of the phonation-related tonemes $/^{CM}/$, $/^{MC}/$, and $/^C/$. It is especially striking to note that

⁴³ I have mainly had access to the spoken form—live or recorded—of the Tikuna varieties of the following areas: Arara (Colombia), *via* conversations with Abel Antonio Santos Angarita; Buenos Aires (Colombia), *via* conversations with anonymous speakers; Cushillococha (Peru), *via* conversations with anonymous speakers and recordings by Amalia Skilton available on the California Language Archive; Nazareth (Colombia), *via* conversations with an anonymous speaker; Ourique (Brazil), *via* recordings available on the Acervo de Línguas Indígenas do Museu Paraense Emílio Goeldi; Paranapará II (Brazil), *via* recordings available on the Acervo de Línguas Indígenas do Museu Paraense Emílio Goeldi; Primera Maloca on the Pupuña river (Colombia), *via* recordings from Abel Santos' private archive; and Santa Rosa de Lima (Peru), *via* recordings from Jean-Pierre Goulard's private archive.

L. Anderson's (1959) tonological analysis, which is based on Tikuna data from the Peruvian community of Cushillococha, largely coincides with my analysis of SMA Tikuna (although the two analyses are framed differently). A recent analysis—independent from mine—of Cushillococha Tikuna's tonological system by Skilton (2017 and pers. com.) also reaches highly similar results.

A fascinating question raised by Tikuna's tonological richness is that of its origins and evolution: how can such a complex system have emerged and reached apparent stability alone among the Amazonian languages? Unfortunately, Tikuna's likely lack of dialectal variation from the point of view of its tonological system, and the fact that it is possibly an isolate, essentially prevent the use of the comparative method as a tool to dig back into the language's history. Only typological comparison and internal reconstruction would be in a position to attempt speculative answers to this question, unless previously unknown, comparably complex tonological systems should one day be discovered in western Amazonia.

Glosses and abbreviations

1	first person	N	neuter
2	second person	NS	non-salientive
ANAPH	anaphoric	OBJ	object
BEN	benefactive	PL	plural
/C/	underlying consonant position	PRF	perfect
DIST	distal	REL	relativizer
F	feminine	S	salientive
F0	fundamental frequency	SBJ	subject
IMP	imperative	SBJV	Subjunctive Inflectional Type
INCL	inclusive	SG	singular
IND	Indicative Inflectional Type	SMA	San Martín de Amacayacu
M	masculine	/V/	underlying vowel position
MED	medial		

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