Tonal languages without tone: downstep in Drubea and Numèè (Oceanic, New Caledonia)

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September 5, 2024

Abstract

In this paper, I analyze the lexical prosodic system of Drubea and Numèè, two of the rare tonal Oceanic languages. Building on Rivierre's (1973) seminal work, I show that the lexical prosodic system of these two languages can be analyzed as involving only register features: an underlying downstep, and a postlexical epenthetic upstep. Drubea and Numèè are thus tonal languages without tones *stricto sensu*. This new type of lexical prosodic system has both theoretical and typological implications: (i) register features, defined as in Snider's (1999; 2020) Register Tier Theory, need not be subordinate to or associated with tones, and may exist in the absence of tone, including in underlying representation; (ii) tonal systems come in two types: tone-based systems in which the tonal contrasts are defined paradigmatically, as in most tone languages, and register-based systems where tonal contrasts are defined syntagmatically, as in Drubea and Numèè.

Contents

1 Introduction

This paper is a contribution to our understanding of the crosslinguistic properties of register-affecting phenomena such as downstep and upstep, looking specifically at the rare and intriguing characteristics of downstep in Drubea and Numèè, two Oceanic languages of New Caledonia.

Downstep is a well-attested prosodic phenomenon affecting register, i.e. the pitch range within which tonal contrasts are to be realized, defined by a "floor" (lowest pitch within the range) and a "ceiling" (highest pitch within the range). Specifically, downstep is a contrastive pitch drop that sets a new, lower register ceiling for the remainder of its domain, most of the time the utterance.[1] In most documented cases, downstep is caused by a low (L) tone and targets a following high (H) tone. It is customary to distinguish between "automatic" downstep, caused by an overt L tone, e.g., /HLH/ = [HL$^{\downarrow}$H] = [˥ ˩ ꜔], and "non-automatic" downstep when the L tone trigger is not heard, e.g., when it is deleted or set afloat, as in /HLH/ = [H$^{\downarrow}$H] = [˥ ꜔] (Stewart, 1965). One of the main characteristics of languages with non-automatic downstep is the "terracing effect" (Winston, 1960; Connell, 2011) created by multiple successive downsteps in an utterance, with each downstep bringing the pitch range (or registrer) ceiling down by one notch, e.g., /HL̲HHHL̲HHH/ = [H$^{\downarrow}$HHH$^{\downarrow}$HHH] [˥ ꜖ ꜖ ꜖ ꜔ ꜔ ꜔]. Since automatic downstep is not at stake here, I will use 'downstep' to refer to the non-automatic kind only.

Downstep has been found to be triggered mostly by L tones, and to affect mostly H tones. Downstepped $^{\downarrow}$L and $^{\downarrow}$M tones are indeed very rare: I know of only fifteen cases of the former in the literature[2] and only eight languages are described as having a downstepped $^{\downarrow}$M tone

[1] Cf. Winston, 1960; Stewart, 1965, 1983, 1993; Hyman, 1979; Rialland, 1997; Connell, 2011; Hyman, 2017; Leben, 2018; and references therein.

[2] Bamileke Dschang (Bird and Stegen, 1993, 1995; Hyman, 1985b; Tadadjeu, 1974), Bamileke Ghomala (Nissim, 1981), Kikuyu (Clements and Ford, 1977, 1979, 1981), Nawdm (Nicole, 1980), Podoko (Anderson and Swackhamer, 1981), Nandi (Creider, 1982; Hyman, 1984), Ghotuo (Elugbe, 1986), Päri (Andersen, 1988),

to my knowledge.[3] Cases of downsteps not caused by L tones are rare, but attested. The downstepped L tone in Bamileke Dschang, for instance, has been analyzed as being caused by a floating H (Hyman, 1985b; Snider, 1999, 2020). Cases where downstep is not caused by a floating tone are also attested, e.g., dissimilatory downstep between two H tones (/HH/ = [H$^{↓}$H]) in Shambala (Odden, 1982) or Supyire (Carlson, 1983). However, cases of downstep not triggered by a L tone and affecting other tones than H are still considered exceptional, and are consequently still understudied (cf. Leben, 2018).

One additional point of interest is that downstep has until now been analyzed only as a derived phenomenon emerging from tonal interaction, either in postlexical phonology or in phonetic implementation (cf. Connell, 2011 for an overview). Until very recently, it had never been proposed that downstep could also be an underlying phonological primitive. Lionnet (2022b) showed that in Paicî, another Oceanic language of New Caledonia, downstep is best viewed as a phonological object of its own, present in underlying representation. A similar claim was made by Rochant (2023) about Baga Pukur, an Atlantic language of Guinea. In both cases, downstep is underlying in a system that also has underlying tones, e.g., the three underlying prosodic primitives of Paicî are the two tones H and L, and a downstep register feature. Underlying downstep is thus another attested, but non-canonical form of downstep.

The present paper aims to contribute to a better understanding of non-canonical forms of downstep by offering a description and analysis of Drubea and Numèè, two very closely related Oceanic languages of New Caledonia whose lexical prosodic system is typologically unique. Indeed, I show that the "tonal" system of Drubea and Numèè, first expertly described by Rivierre (1973), can be analyzed as consisting only of register features – specifically an underlying downstep and a postlexical epenthetic upstep –, and no tone at all. The main underlying lexical prosodic contrast is between downstepped register-bearing units (RBU, defined as the mora, although the syllable also plays a role, cf. §4.2) and registerless RBUs, i.e. a /$^{↓}$/ vs. /Ø/ contrast. Upstep is optionally inserted on registerless RBUs immediately before a downstep in order to increase the downward contrast marked by the downstep, which gives rise to alternations of higher and lower pitch heights giving the illusion of a tonal H vs. L contrast.

This system is particularly interesting from a cross-linguistic and typological perspective, as it is the only lexical prosodic system known to date that rests entirely on register features, without any need for tones. This enriches our understanding of word-prosodic typology, in particular the range and variety of "non-canonical" tone systems in Hyman's (2006) word-prosodic typology. This also questions the definition of "tone" and of what is required for a language to be considered "tonal". Specifically two types of tone systems must be recognized: in addition to the well-known TONE-based systems, in which tonal contrasts are defined paradigmatically (e.g., H is realized with higher pitch than L in the same context), REGISTER-based systems like in Drubea and Numèè must also be recognized, in which tonal contrasts are defined syntagmatically (e.g., a downstepped unit is realized with lower pitch than the preceding unit). From a theoretical perspective, this register-only system is

Edopi (Kim, 1996), Saxwe (Beavon-Ham, 2012), Igala (Adeniyi, 2016), Yala (Adeniyi, 2016), Sinyar (Boyeldieu, 2019), Kugama (Litvinova, 2023), Paicî (Lionnet, 2022b).

[3] Peñoles Mixtec (Daly and M., 2007), Bagiro (Boyeldieu, 2000), Ghotuo (Elugbe, 1986), Gokana (Hyman, 1985a), Klao (Lightfoot, 1974), Yoruba (Pulleyblank, 1986), and Ngamambo (Hyman, 1986) (Larry Hyman, p.c., 15 February 2021), as well as Kugama (Litvinova, 2023).

highly relevant for debates regarding the representation of tone and register, in particular the existence of dedicated register features, proposed by Snider (1990, 1999, 2020), and the relation between register and tone.

I address all these questions in the paper. I first give in §2 some relevant background information about Drubea & Numèè and the data that serve as the empirical basis of the main claim of the paper. I then describe the lexical prosodic system of the two languages in §3, and propose a register-based analysis in §4, couched in a modified version of Snider's (1999; 2020) Register Tier Theory. This analysis is then shown to be superior to a purely tonal alternative in §5. The typological and theoretical implications of the recognition of register-based tonal languages such as Drubea and Numèè are then discussed in §6.

2 The data

2.1 Drubea and Numèè

Drubea [ŋaa ˈⁿɖuᵐbea] (glottocode: dumb1241) and Numèè [ŋaa ˈŋumɛɛ] (nucl1484) are the two southernmost languages of Grande Terre, New Caledonia's main island.[4] Together with Kwényï, spoken on the Isle of Pines, about 50 kilometers southeast of Grande Terre, they constitute the Far South subgroup (Haudricourt, 1971) within the New Caledonian linkage of Southern Oceanic (Lynch et al., 2002), and count among the five tonal languages of New Caledonia, with Paicî and Cèmuhî, spoken in the central/northern region of Grande Terre.

Numèè and Kwényï are sometimes described as dialects of one language. I have excluded Kwényï from the present paper because it differs markedly with respect to its prosodic system (Rivierre, 1973, p. 154).[5] Drubea and Numèè, on the other hand, share the same tone system (with only minor differences), which is the focus of this paper.

Drubea is spoken by ca. 1,000 people.[6] There are three dialectal variants: [ŋaa vũũnya]

[4] /ŋaa/ means 'language'. The two language names are historically one and the same: proto-Drubea-Numee *ˈŋumea changed into [ˈŋumɛɛ] in Numèè through vowel coalescence, and into [ˈⁿɖuᵐbea] in Drubea through partial denasalization of the nasal consonant followed by an oral vowel (cf. Rivierre, 1973, pp. 52–61, 98–104). Language names follow the orthography proposed by the Académie des Langues Kanak (ALK, 2011, 2015, 2018). Note that Numèè speakers usually prefer to name their language variety after the place where it is spoken (e.g. /ŋaa xeɽe/ 'language of Goro', /ŋaa ˈɽuauɽu/ 'language of Touaourou', etc.). 'Numèè' is kept here as a convenient cover term, following ALK (2015), Rivierre (1973), and Wacalie (2013). The ISO 639-3 code for Drubea is 'duf', the one for Numèè (including Kwényï) is 'kdk'. I use glottocodes to clearly distinguish Numèè from Kwényï.

[5] Rivierre (1973, p. 154) states that "Numèè and Kwényï have 90% of their vocabulary in common, *modulo* regular vowel changes; but their sentence melody is astonishingly opposite. The first question that comes to mind is about the very existence of tone [in Kwényï]." He then concludes that Kwényï is indeed tonal and sketches the main properties of the system: morphemes have the same underlying tonal specification than in Numèè, but their realization is markedly different, highly context-dependent, and varies according to several criteria. His conclusion is that "the tonology [of Kwényï] appears as a structured and complex edifice, but threatened, undermined in many places, a possible illustration of a process whereby a two-tone system ceases to be functional" (Rivierre, 1973, p. 154). In her study of the phonology of Kwényï, Soon (2023) concludes that "[a]lthough pitch contrast is observed in some minimal pairs, impressionistically tone has a low functional load and plays a marginal role in signifying lexical contrast... This could indicate that tone is being lost as a contrastive feature in the language." The reader interested in the Kwényï prosodic system is referred to these two references for more detail.

[6] 1,022 speakers according to the 2019 census INSEE-ISEE, 2019.

in Unya, on the east coast, as well as two dialects in Paita on the west coast – [ŋaa pwɛco] (lit. 'language of the coast people') on the coast, and [ŋaa ᵑgakure] (lit. 'language of the mountain people') in the mountains.

Numèè is spoken by less than 1,000 speakers in three villages in the Far South of Grande Terre: Waho, Touaourou, and Goro.[7] Dialectal variation in Numèè is minimal (ALK, 2015; Wacalie, 2013).[8]

2.2 Previous work and data sources

Significant work on the Far South languages started with Rivierre's (1973) description of the phonological systems of the Unya dialect of Drubea (/ŋaa vũũnya/), the variety of Numèè spoken in Goro (/ŋaa xeɽe/), and Kwényï.[9]

Additional work on Drubea includes Shintani and Païta's grammar (1990a) and dictionary (1990b), based mostly on the mountain dialect of Paita, as well as a phonetic description of aspects of the consonant and vowel systems by Gordon and Maddieson (1999). Shintani also collected texts which he published in two separate volumes: Genet et al. (1992) and Shintani (2019). The latter is meant to serve as a language textbook, and was adapted to an online language tutorial in 2023 by the Académie des Langues Kanak (ALK), together with sound files of the original recordings (ALK, 2023).[10]

Additional work on Numèè includes a morphosyntactic description by Wacalie (2013), an unpublished lexicon by Rivierre and Vandégou (n.d.), as well as an M.A. thesis by Rendina (2009) which I was not able to consult. Texts recorded by A.-G. Haudricourt and J.-C. Rivierre in the 1960's are available in the online Pangloss collection, transcribed, glossed, and translated into French (Haudricourt and Rivierre, n.d.).

I have not collected any data on either Drubea or Numèè. The present paper is thus entirely based on secondary data – mainly Rivierre's (1973) phonological description and analysis of both languages, the Drubea grammar and Drubea-French dictionary published by Shintani and Païta (1990b, 1990a), texts collected by Shintani and published in Shintani (2019) and ALK (2023) as well as Haudricourt and Rivierre's (n.d.) recordings of Numèè texts. For Shintani's Drubea recordings and transcriptions, two citations are given: Shintani's (2019) book, and the corresponding lesson number in both the book and the online tutorial (ALK, 2023) preceded by "L", e.g. "Shintani, 2019, p. 254, L35" refers to lesson 35, the text of which is found on p. 254 of Shintani (2019), and the recording under the "Leçon 35" link in the online tutorial.[11] Speakers in Shintani's recordings were all women

[7] Numèè and Kwényï are not distinguished in census data. The 2019 census gives a global figure of 1,618 for both languages (INSEE-ISEE, 2019), the majority of which are likely to be speakers of Kwényï.

[8] If one excludes Kwényï, or considers it to be a separate language.

[9] Previous work of more limited scope includes a 1,200-word list and a very brief morphosyntactic sketch of Drubea and Numèè in Leenhardt (1946), as well as short word lists collected by a dozen travellers who visited New Caledonia at various points in time (detailed in Rivierre, 1973, pp. 19–20). A.-G. Haudricourt also collected extensive lexical data and many texts in both languages in 1963 (Rivierre, 1973, p. 20), some of which are available in the Pangloss collection (Haudricourt and Rivierre, n.d.).

[10] André-Georges Haudricourt and Jean-Claude Rivierre both collected texts in Drubea in the 1960's, but neither the recordings nor the transcriptions and translations of these texts are currently available, either in print or in accessible archival collections.

[11] The transcriptions in Shintani (2019) and in the online tutorial do not always correspond exactly to the accompanying recordings. The transcriptions proposed in this paper are my own re-transcriptions of the record-

in their 60's and 70's at the time of recording in the 1990's: Augustine "Titine" Betto, *née* Païta, Philomène "Philo" Poarareu, and Françoise Gaïa, *née* Païta.

Rivierre's (1973) description is not accompanied by recordings (if the recordings exist, they are not available in any known online or physical repository) which would allow to check Rivierre's phonetic transcription of pitch heights. The analysis I present in this paper thus partly rests on Rivierre's transcriptions. Rivierre is said by linguists who knew him to have had an excellent ear, which I was able to verify myself when working on Paicî, another New Caledonian language whose tone system he described and analyzed (in Rivierre 1974). My findings concur with his almost perfectly, which gives me full confidence in his transcriptions. I was also able to find confirming evidence in Shintani's Drubea recordings and Rivierre's own recorded Numèè texts, both mentioned above.

Glosses for grammatical words follow Shintani and Païta's (1990a) grammatical analysis and terminology, including in examples borrowed from Rivierre (1973), whose glosses of function words lacks precision. Translations to English are my own.

Throughout the paper, detailed information on the phonetic realization of pitch contrasts of each example is systematically provided –either the original narrow transcription of pitch heights for examples found in Rivierre (1973) and Shintani and Païta (1990a), or pitch tracings for examples taken from recorded texts (ALK, 2018; Haudricourt and Rivierre, n.d. Shintani, 2019), for which only a broad, phonological transcription is given in the original source. All transcriptions borrowed from original sources are converted to standard IPA notation (*modulo* a few simplifications, cf. §2.3). This includes the notation of pitch realizations: I converted Shintani and Paita's schematic notation and Rivierre's numerical notation to the more standard numerical system, i.e. using numbers from 1 (lowest pitch) to 5 (highest pitch). In order to be fully faithful to the original transcription, I keep Rivierre's use of .5 steps (e.g. 1.5, 3.5, etc.) despite their absence from standard IPA. The correspondences between Rivierre's original transcription and my retranscription are given in Table 1.

Table 1: Adaptation of Rivierre's (1973) scale for pitch notation

	Rivierre 1973	Retranscription
Highest	1	5
	1.5	4.5
	2	4
	2.5	3.5
	3	3
	3.5	2.5
	4	2
	4.5	1.5
Lowest	5	1

ings.

2.3 Phonological sketch

Drubea and Numèè (as well as Kwenyï) have virtually the same consonant inventory, presented in (1), where the phonological transcription used in this paper (in both underlying and surface transcriptions) is accompanied by a phonetic transcription. The only difference is the presence of /g^{w}/ in Drubea, which is absent in Numèè where it systematically corresponds to /ŋ^{w}/, unattested in Drubea. The plosive series is structured along a two-way contrast between voiceless and prenasalized voiced plosives, like in all the languages of Grande Terre. To alleviate the transcription, prenasalized plosives will be systematically transcribed as plain voiced plosives in this paper (e.g. /b/ = /^{m}b/), as is usual in New Caledonian linguistics.

(1) Drubea and Numèè consonant inventory (Rivierre, 1973, pp. 45–46; Shintani and Païta, 1990a, p. 1; * only in Drubea; ** not in Drubea)

Voiceless	p	pw	t	ʈ	c	k	kw
Prenasalized	b [^{m}b]	bw [^{m}b^{w}]	d [^{n}d]	ɖ [^{n}ɖ]	j [^{ɲ}ɟ]	g [^{ŋ}g]	gw [^{ŋ}g^{w}]*
Nasal	m	mw	n	ɳ	ɲ	ŋ	ŋw**
Fricative	v					x [ɣ]	
Flap				ɽ			
Glides					y [j]		w

The vowel inventories of the two languages are also very close, the only difference being the presence in Numèè of the three long front rounded vowels /üü øø õõ/, absent from Drubea, as shown in (2).

(2) Drubea and Numèè vowel inventory (Rivierre, 1973, pp. 82, 89; Shintani and Païta, 1990a, p. 9; *only in Numèè)

	Short		*Long*		
Oral	i	u	ii	üü [yy]*	uu
	e	ʊ	ɪɪ		ʊʊ
	ɛ	o	ee	øø*	oo
	a			aa	
Nasal	ĩ	ũ	ĩĩ		ũũ
	ẽ	õ	ẽẽ	øø̃*	õõ
	ã			ãã	

Rivierre (1973) only gives a partial account of syllable and word structure in Drubea and Numèè. He shows that coda consonants are not allowed: only open syllables are attested, with or without an onset consonant. Vowel length is said to be contrastive. Permissible syllable structures can thus be summarized in the formula (C)V(V), with VV representing a long vowel. According to Rivierre (1973), sequences of unlike vowels are heterosyllabic, never diphthongs, and there are no heterosyllabic sequences of identical vowels –that is, /kie/ [ki.e] 'axe' is disyllabic (not *[ki͡e]), whereas /kee/ [ke:] 'husband' is monosyllabic (and [ke.e] is not attested). Shintani and Païta (1990a, p. 1) propose the same analysis for Drubea. I will follow this analysis here.

Most monomorphemic stems[12] are mono- or disyllabic, as illustrated in (3) below, where σ and σː stand for (C)V and (C)VV respectively.

(3)	a.	σ	/be/	'death, die'
			/ĩ/	'end, extremity'
	b.	σː	/boo/	'blind'
			/ʊʊ/	'net'
	c.	σ.σ	/ku.ɽe/	'forest, bush'
			/i.ˈya/	'to fish'
			/kwi.e/	'wind'
			/i.a/	'declare war'
	d.	σː.σ	/pwẽẽ.ɖi/	'youngest son'
			/ũũ.ɽe/	'moon'
	e.	σ.σː	/wã.ɽee/	'liana'
			/u.tii/	'go home'
			/be.ii/	'be jealous'
	f.	σː.σː	/vẽẽ.too/	'fish *sp.*'

Stems of more than two syllables are also attested, although many appear to be morphologically complex –in particular, compounding (both in nouns and in verbs) is frequent. For lack of time and data, Rivierre does not provide a full analysis on the internal structure of words of more than two syllables. He mostly ignores these words in his analysis of the tone system, which I will also do, for the same reasons (cf. §3.8).

3 The lexical prosodic system of Drubea and Numèè

As shown by Rivierre (1973, pp. 124–153), the lexical prosodic systems of Drubea and Numèè are virtually identical. The only significant difference lies in utterance-final prosodic phenomena, discussed in §3.4. Rivierre describes the two systems as one, illustrating his generalizations and analyses with examples taken from both. I do the same here, although I give more Drubea than Numèè examples, mainly because of the relative abundance of available Drubea data. The source language is always explicitly given in all examples.

In this section, I give a description of the surface prosodic patterns attested in both languages, using analytical categories (in particular 'downstep' and 'upstep') that are fully developed in the analysis I propose in §4. I first describe the tonal behavior of monosyllabic stems (henceforth "monosyllables") (§§ 3.1 to 3.5), then that of dissylables (§3.6), before discussing the special case of CVˈV syllables (§3.7). The issue of stems of more than two syllables is briefly addressed in §3.6, and morphophonological tonal effects in §3.9.

3.1 Downstepped vs. registerless monosyllabic stems

Monosyllables mostly fall into two prosodic types in Drubea and Numèè: those that are systematically realized lower than the preceding morpheme, and those that are not.[13] The

[12]The stem is, for the purpose of this paper, defined as a free-standing monomorphemic lexical item.

[13]There is in fact a third, minor type, as we will see in §3.7.

latter tend to be realized at the same pitch as the preceding morpheme, all else being equal, but are also very frequently realized with higher pitch, as we will see in §3.2. I will, for now, call these two types SAME-PITCH and LOWER-PITCH syllables respectively, and will transcribe the latter with a preceding downstep mark –a transcription which reflects the analysis I propose in §4. Note that I use the term 'syllable' in this section for ease of exposition. I will show in §§ 3.7 and 4.2 that the tone- (or rather register-) bearing unit is actually the mora (although the syllable also has a role to play).

Numerous minimal pairs are attested in both languages, as illustrated with Drubea examples in (4) (Rivierre, 1973, pp. 123–124; Shintani and Païta, 1990a, p. 17).

(4)	/ī/	'extremity, tip'	/ꜜī/	'piece, bit'
	/ɪɪ/	'indigenous bamboo'	/ꜜɪɪ/	'*Elaeocarpus angustifolius*, tree *sp.*'
	/be/	'death; to die'	/ꜜbe/	'*Melaleuca quiquenervia*, niaouli'
	/ɖoo/	'bag, envelope'	/ꜜɖoo/	'*Cordyline spp.*, plant *sp.*'
	/cu/	'to wipe'	/ꜜcu/	'to knock down with a pole'
	/ɲi/	'coconut tree'	/ꜜɲi/	'breast'
	/kee/	'husband'	/ꜜkee/	'*Broussonetia papyrifera*, mulberry tree'

The contrast between same-pitch /be/ 'die' and lower-pitch /ꜜbe/ 'niaouli tree' is illustrated in (5) and (6) (the morpheme under consideration is underlined in the examples). As can be seen in Figures 1 and 2, /be/ 'die' is realized at the same pitch as the preceding syllable, while /ꜜbe/ 'niaouli tree' is realized at a lower pitch.[14]

(5) /... ꜜmwa <u>be</u> to ꜜŋe co + ↑%/
[... ꜜmwã be to ꜜŋe ↑%co]
PFV die LOC in water
'[his son] died in the water.' (Drubea; Shintani, 2019, p. 178, L24)

(6) /dɪɪ <u>ꜜbe</u>/
[↑dɪɪ ꜜbe]
small niaouli
'small niaouli tree.' (Drubea; Shintani, 2019, p. 353, L49)

This same- vs. lower-pitch realization is seen irrespective of the prosodic type of the preceding syllable. Examples (7) and (8) illustrate the descriptive marker /te/ following the same-pitch noun /aboʈu/ 'person' in (7), and following the lower-pitch perfective marker /ꜜmwa/ in (8).[15] Figures 3 and 4 show that /te/ is realized at the same pitch as the immediately preceding syllable in both cases, irrespective of whether it is a same-pitch or lower-pitch syllable. Note that the speaker repeats the marker /te/ in (7), and both instances are realized at the same pitch as the last two syllables of the noun /aboʈu/. The pitch rise seen

[14]The upstep seen in [↑dɪɪ] in (6) is discussed in §3.2. The utterance-final boundary upstep ↑% in (5) is explained in §3.3. Notice, also, the pitch lowering effect of utterance-initial nasal stops, in both [ꜜmwa] in Figure 1 and the prenasalized portion of [↑ⁿdɪɪ] in Figure 2. This lowering effect is frequent in Drubea and Numèè, and will be seen recurrently on pitch tracings in the remainder of the paper.

[15]Shintani and Païta (1990a, p. 25) define the 'descriptive' tense-aspect category as 'expressing an action or notion that is specific and conceived of as taking place in the present'.

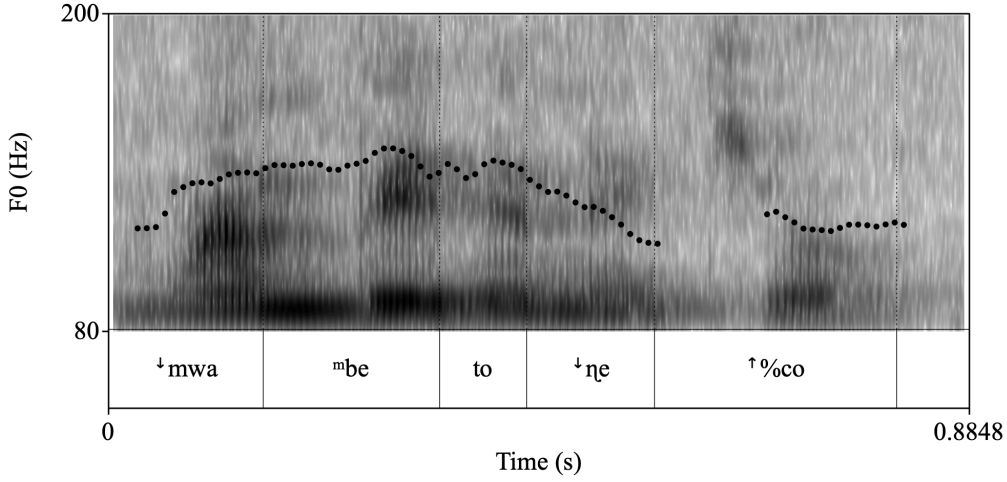


Figure 1: /... ˈmwa be to ˈŋe co + ˆ%/ '[his son] died in the water.' (Drubea; Shintani, 2019, p. 178, L24)

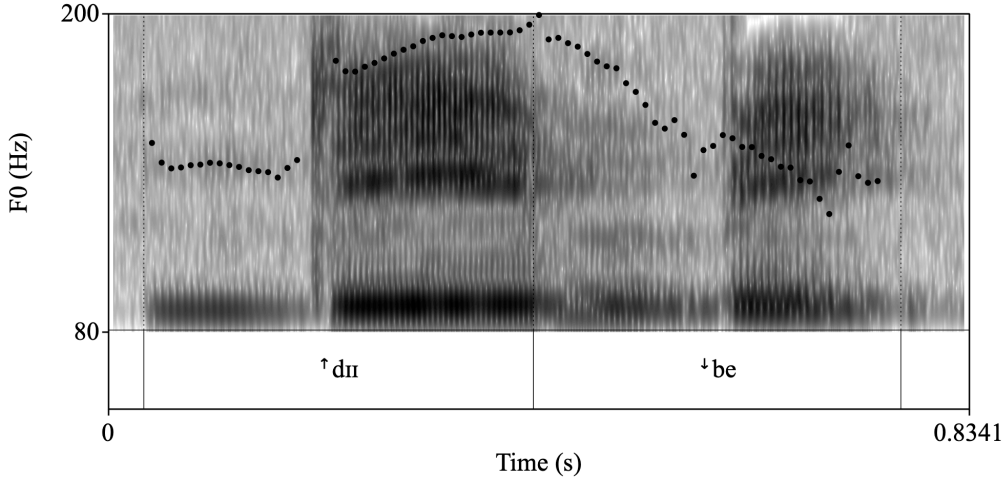


Figure 2: /dɪɪ ˈbe/ 'small niaouli.' (Drubea; Shintani, 2019, p. 353, L49)

in [aˈtboɽu] need not concern us here, and will be dealt with in §3.2. The important point is that there is no pitch drop in the transition from the last syllable of /aboɽu/ to the following same-pitch syllable /te/.[16]

(7) /˩taa aboɽu te || te wii-ɽe ɲi/
[(˩)taa aˈtboɽu te || te wii-ɽe ɲi]
one person DESCR DESCR squeeze-ACT coconut
'someone is... is squeezing coconut pulp.' (Drubea; Shintani, 2019, p. 172, L23)

(8) /ko ˩mwa te ŋa-ɽe... /
[ko ˩mwã te ŋa-ɽe...]
I.SBJ PFV DESCR do-ACT
'I work [my field].' (Drubea; Shintani, 2019, p. 234, L32 [AT])

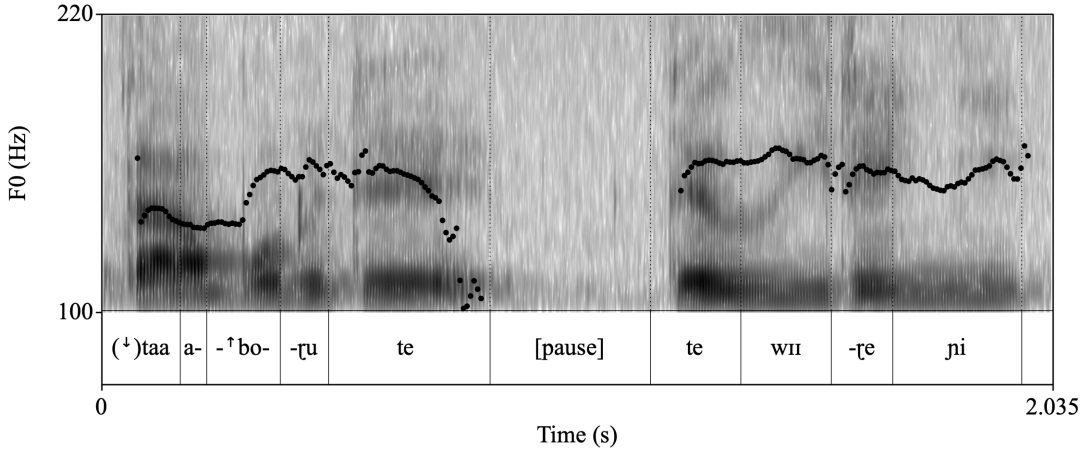


Figure 3: /˩taa aboɽu te || te wii-ɽe ɲi/ 'someone is squeezing coconut pulp.' (Drubea; Shintani, 2019, p. 172, L23)

Examples (9) and (10) illustrate the lower-pitch word /˩ʈã/ 'fire(wood)' after same-pitch /kaa/ 'smoke' (9) and lower-pitch /˩vi/ 'take' (10). As can be seen in Figures 5 and 6 , /˩ʈã/ is realized lower than the preceding syllable in both cases.[17]

(9) /... kaa ˩ʈã/
[... ˈkaa ˩ʈã]
smoke fire
'... (fire) smoke' (Drubea; Shintani, 2019, p. 173, L23)

[16]The utterance-initial realization of lower-pitch syllables, such as /˩taa/ in (7) will be discussed in §§ 3.5 and 4.5.

[17]The slightly falling melody on [kaa] in (9)/Figure 5 is unexplained. It does not appear to be the realization of any category or meaning, and is barely audible in the recording.

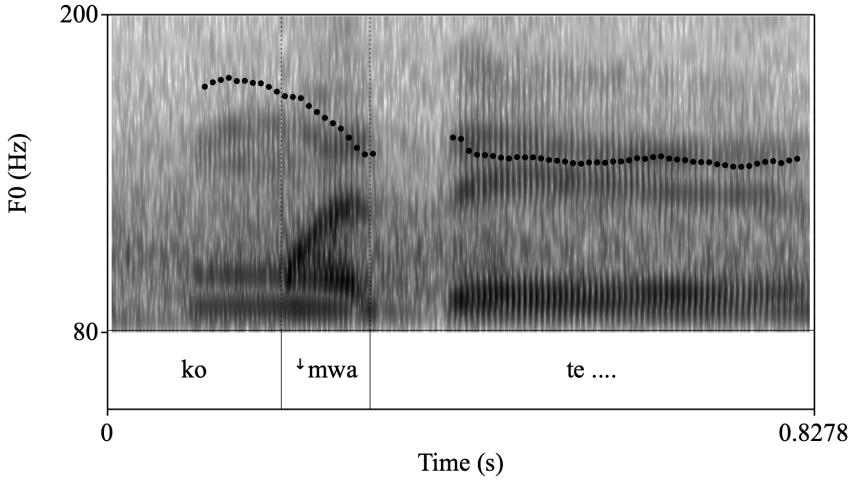


Figure 4: /ko ˈmwa te … / ‘I [work my field].’ (Drubea; Shintani, 2019, p. 234, L32)

(10) /kãˈã ˈvi ˈt̪ã/
[kãˈã ˈvi ˈt̪ã]
PROS take firewood
‘[then we] take firewood’ (Drubea; Shintani, 2019, p. 172, L23)

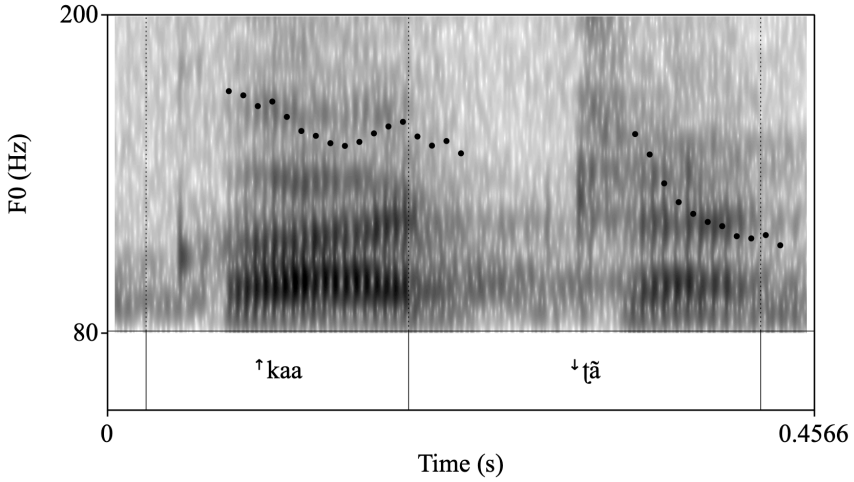


Figure 5: /kaa ˈt̪ã/ ‘(fire) smoke’ (Drubea; Shintani, 2019, p. 173, L23)

A sequence of same-pitch syllables is realized, unsurprisingly, with the same pitch throughout, as in the sequence [...boɽu te || te wɪɪ-ɽe ɲi] in (7)/Figure 3 above. A sequence of lower-pitch syllables, on the other hand, is realized as a series of pitch drops (Rivierre, 1973, p. 145; Shintani and Païta, 1990a, p. 19). This is already illustrated in (10)/Figure 6

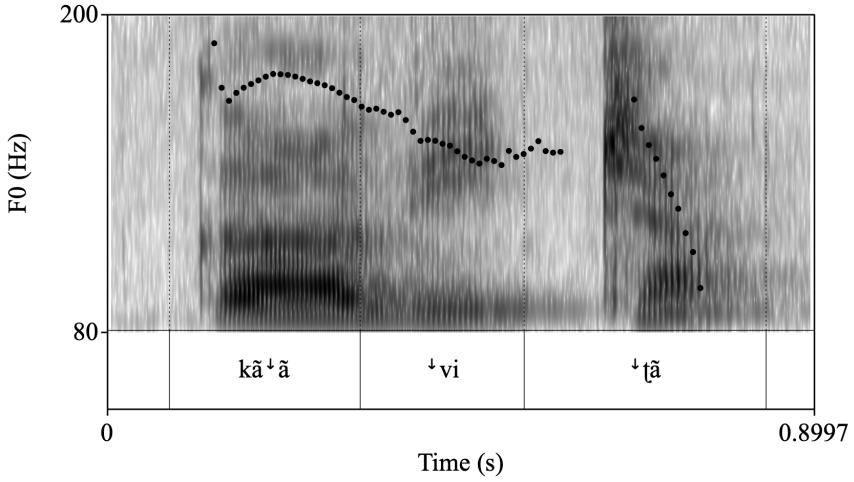


Figure 6: /kã˩˧ã ˩˧vi ˩˧t̪ã/ '[then we] take firewood' (Drubea; Shintani, 2019, p. 172, L23)

above. Two additional examples are given in (11) and (12).[18]

(11) /˩˧ɳi ˩˧mwa ˩˧ɳii ˩˧me/
[(˩˧)ɳi ˩˧mwa ˩˧ɳii ˩˧me]
[ɳi^{4} mwa^{3} ɳii^{2} me^{1}]
3PL.SBJ PFV say that
'They said that...' (Drubea; Shintani and Païta, 1990a, p. 19)

Example (12) below shows a succession of four lower-pitch syllables: /... ˩˧mwa ˩˧ɳii ˩˧yoo ˩˧ɳe.../, followed by the same-pitch word /xee/, itself followed by two lower-pitch syllables /... ˩˧yɛ ˩˧me/.

(12) /ko ˩˧mwa ˩˧ɳii ˩˧yo-V ˩˧ɳe-xee-˩˧yɛ ˩˧me .../
[ko ˩˧mwa ˩˧ɳii ˩˧yoo ˩˧ɳe-˥˧xee-˩˧yɛ ˩˧me ...]
I.SBJ PFV say to-2SG now that
'I said just now that...' (Drubea; Shintani, 2019, p. 306, L43 [AT])

Figure 7 shows that the first four consecutive lower-pitch syllables [˩˧mwa ˩˧ɳii ˩˧yoo ˩˧ɳe] in example (12) are realized with four consecutive drops in pitch. The successive pitch drops do not all have the same magnitude: the first drop [ko ˩˧mwa] is sharp, while the following ones are less and less noticeable, because the intervals are successively smaller as the speaker reaches the lower end of her pitch range. The slight pitch rise seen on [˥˧xee] will be explained in §3.2.

The behavior of these two types of syllables suggests a contrast in terms of register rather than tone height: the lower-pitch syllables are realized within a lower register than

[18]In examples taken from Rivierre (1973) and Shintani and Païta (1990a), the original transcription is transposed into numerical notation on the third line (cf. Table 1 in §2.2 above), and reinterpreted within the analysis proposed in this paper on the first two lines.

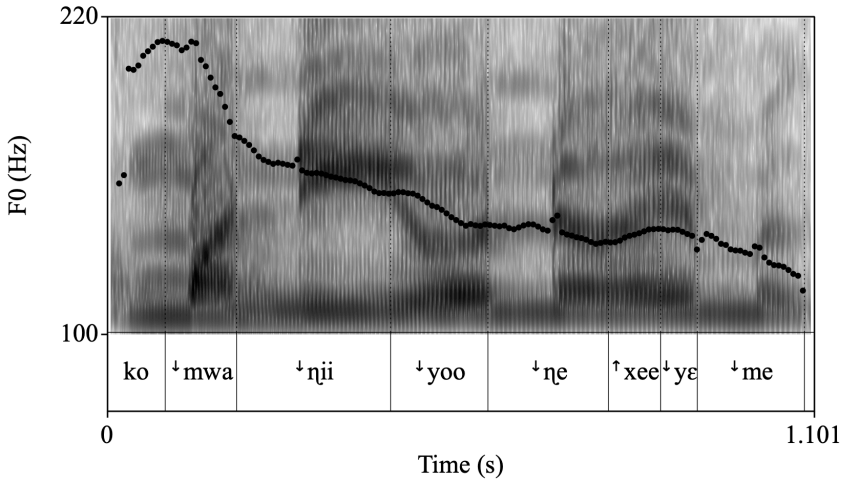


Figure 7: /ko ˈmwa ˈŋii ˈyoo ˈne-xee-ˈyɛ ˈme .../ 'I said just now that...' (Drubea; Shintani, 2019, p. 306, L43 [AT])

the immediately preceding one.[19] This lower register is maintained for the remainder of the utterance, unless another lower-pitch syllable imposes a new register lowering. Furthermore, lower-pitch syllables are not associated with any particular pitch range: they are often realized toward the higher end of a speaker's pitch range at the beginning of an utterance–especially utterances including many lower-pitch syllables. Jean-Claude Rivierre, who analyzes lower-pitch syllables as low-toned and same-pitch ones as high-toned, as we will see in §5, says it explicitly: '[t]his contrastive nature [i.e. paradigmatic register contrast with the preceding syllable] of the low tone [= lower-pitch syllable] is more essential to its definition than its pitch height' (Rivierre, 1973, p. 153; ; here and in further quotes, the translation and added comments are mine). In other words, lower-pitch syllables behave like downstepped syllables. Same-pitched syllables, on the other hand, are inert from the point of view of register: (i) they do not impose any register change, and (ii) their realization is subject to contextual variation, as we will see in the next section. This suggests that they carry no underlying indication of tone or register. 'Lower-pitch' syllables will henceforth be referred to as 'downstepped', and 'same-pitch' ones as 'registerless', in accordance with the phonological transcription used so far, and the analysis fully developed in §4.

With only registerless and downstepped syllables, one should expect the pitch of an utterance to only ever go down –abstracting away from possible effects of intonation. This is mostly the case– and is, indeed, one salient characteristic of both Drubea and Numèè, which makes them noticeably different from very closely related Kwényï (which, as noted by Rivierre (1973, p. 154), is characterized by an overall rising melody profile). One major exception to this principle is the raising frequently undergone by registerless syllables in two contexts: before a downstepped syllable, and utterance-finally (in Drubea), as discussed in the following two sections.

[19] 'Register' is taken here as referring to pitch range, characterized by a floor and ceiling; it does not refer to phonation type, as is frequent in the literature on Southeast Asian languages, or any other attested use of the term.

3.2 Pre-downstep raising of registerless syllables

As noted by Rivierre (1973, p. 132), before a downtepped syllable, speakers oscillate between two realizations of what I analyze as registerless syllables: either at the same pitch as the preceding syllable, as with the descriptive marker /te/ in (13)a below, or higher than the preceding syllable as in (13)b – the latter being more frequent according to Rivierre (1973), which is confirmed by Shintani's recorded texts.

(13) /ko te ˩beɽu-ɽe/

a. [ko te ˩beɽu-ɽe]
[ko^{4} te^{4} be^{3}ɽu$^{2.5}$-ɽe$^{2.5}$]

b. [ko ˥te ˩^{m}beɽu-ɽe]
[ko^{4} te^{5} be$^{2.5}$ɽu^{2}-ɽe^{2}]
I.SBJ DESCR swim-ACT
'I swim.' (Drubea; Rivierre, 1973, p. 132)

This pre-downstep raising, which I transcribe and analyze as upstep (cf. §4.4), very frequently affects registerless syllables. As clearly described by Rivierre (1973, p. 153), this raising 'reinforces and highlights the contrast marked by each low tone [= downstep] with the preceding syllable. [...] A high-toned [= registerless] syllable is itself best defined as a syllable that does not mark a contrast of this type than as a high-pitched syllable.' (Rivierre, 1973, p. 153). Note that pre-downstep raising rarely affects downstepped syllables, and when it does, it is realized differently, as we will see below (cf. (18) and adjacent prose). This is one of the key differences between the two types of syllables.

Rivierre further notes that 'the raised realization of the H tone [= registerless syllable] before a L tone [= downstep] is *common* but not obligatory; understandably, it is largely used in H-L-H-L [= registerless-downstepped-registerless-downstepped] sequences.' (Rivierre, 1973, p. 133; Rivierre's emphasis). Without this raising of registerless syllables, 'each new L tone [= downstep] brings the speaker down toward lower and lower registers, making the register drop characteristic of the downstep more and more difficult to produce and perceive. The [raising of] H tones [=registerless syllables] is thus used in this context to maintain the register of the utterance within a range conducive to an economic and perceptible realization of L tones [=downsteps]' (*ibid.*). Rivierre (1973, p. 134) finally notes that 'the raising of H-toned [= registerless] syllables rarely compensates for the lowering of the register caused by the preceding L tone [= downstep], which explains the overall descending trend in a downstepped-registerless-downstepped... sequence'. This is illustrated in the following two examples, the first one (14) from Rivierre (1973), the second one (15) from Shintani (2019)/ALK (2023). As seen in Figure 8, the successive valleys and peaks marked by the sequence of downsteps and upsteps in (15) are characterized by lower and lower pitch, and the overall pitch trajectory throughout the utterance follows a downward course.

(14) /ko ˩mwa cu˩kwa õ ˩keɽee-ɽe/
[˥ko ˩mwa ˥cu˩kwa ˥õ ˩keɽee-ɽe]
[ko^{5} mwa^{4} cu$^{4.5}$kwa^{3} o̰$^{3.5}$ ke^{2}ɽee^{2}-ɽe]
1.SG.SBJ PFV finish LOC eat-ACT
'I am done eating.' (Drubea; Rivierre, 1973, p. 133)

(15) /ˈŋe-ˈbʊʊ-V ˈya yaa ˈme a-ˈʈe/
[(ˈ)ŋe-ˈbʊʊ-ˈʊ ˈya ˈyaa ˈme ˈa-ˈʈe]
COLL-face-2.SG.POSS then NEG EPIST STAT-good
'Your face does not look good.' (Drubea; Shintani, 2019, p. 130, L17)

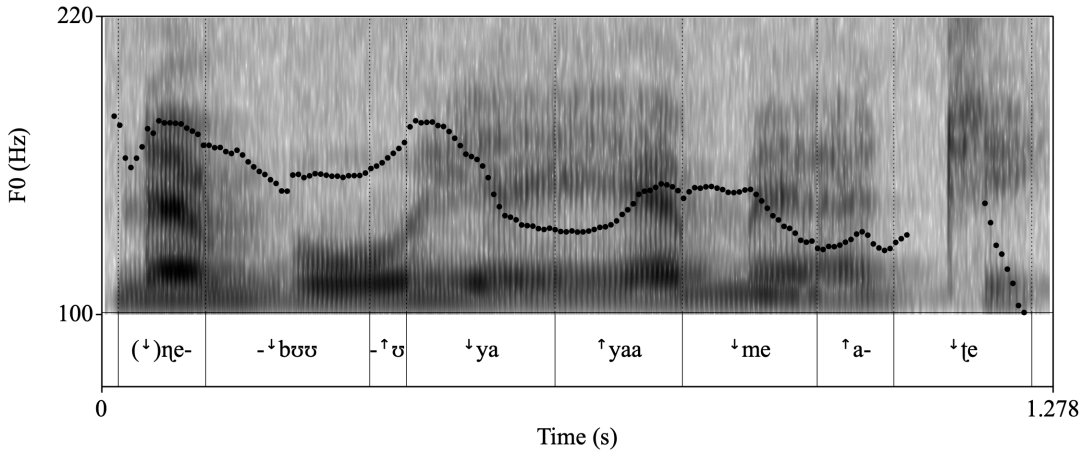


Figure 8: /ˈŋe-ˈbʊʊ-V ˈya yaa ˈme a-ˈʈe/ 'Your face does not look good.' (Drubea; Shintani, 2019, p. 130, L17)

Pre-downstep raising is not always limited to the syllable that immediately precedes the downstep: it sometimes extends through a sequence of registerless syllables. This pitch raising scoping over several successive registerless syllables may be abrupt, as in (16)/Figure 9, where one can see that the raising effect caused by the downstep on the second mora of the determiner /maˈa/ does not affect only the preceding registerless mora, but extends to the entire sequence of preceding registerless syllables, with the same raised pitch throughout.[20]

(16) /ˈʈã ˈmwa ŋe-ʈe maˈa vʊʊ ˈŋia/
[(ˈ)ʈã ˈmwa ˈŋe-ʈe maˈa vʊʊ ˈŋia]
fire PFV burn-ACT DET.PL stone DIST
'The fire burns these stones.' (Drubea; Shintani, 2019, p. 172, L23)

Alternatively, the raising effect may be gradual, in which case the pitch starts rising on the first registerless syllable of the affected sequence, and reaches its peak on the registerless syllable immediately before the downstep, as in example (17)/Figure 10, where the rise starts on the registerless syllable [pwe] immediately after the downstepped syllable [ˈŋo], and rises gradually until it reaches its peak on the assertive marker [pa], immediately before the downstepped syllable [ˈtũã] 'see'. This gradual rise can be seen as a form of interpolation, i.e. a gradual transition from the lower pitch of a downstepped syllable to the higher pitch of the next raised pre-downstep syllable. I transcribe this interpolation phenomenon with a northeast-pointing arrow [↗].

[20]Syllable-internal downsteps such as in /maˈa/ will be discussed in §3.7.

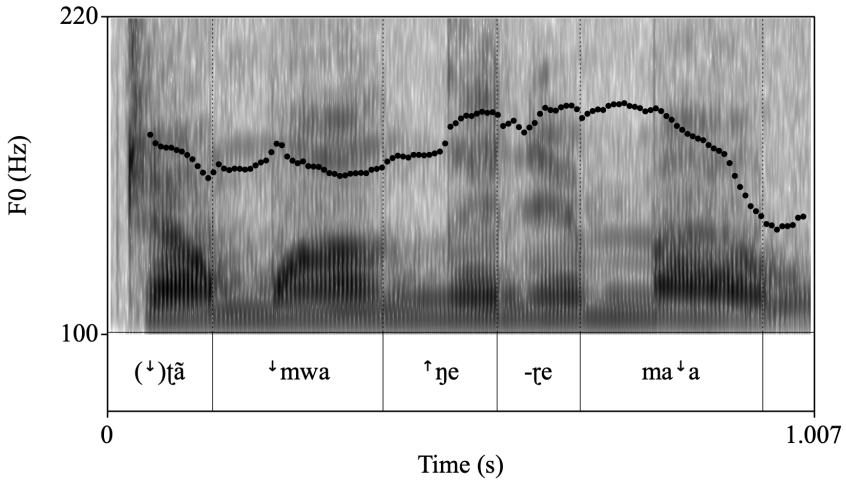


Figure 9: /↓ʈã ↓mwa ŋe-ʈe ma↓a... / 'The fire burns these [stones].' (Drubea; Shintani, 2019, p. 172, L23)

(17) /↓ɳopwe ki pa ↓tũã-ʈe pa a-↓ʈre/
[(↓)ɳo↗pwe ↗ki ↑pa ↓tũã-ʈe pa a-↓ʈre]
and 2SG.SBJ ASSERT see-ACT ASSERT STAT-good
'And you think it is a good thing?' (lit. and you see [that] it is good?) (Drubea; Shintani, 2019, p. 41, L04)

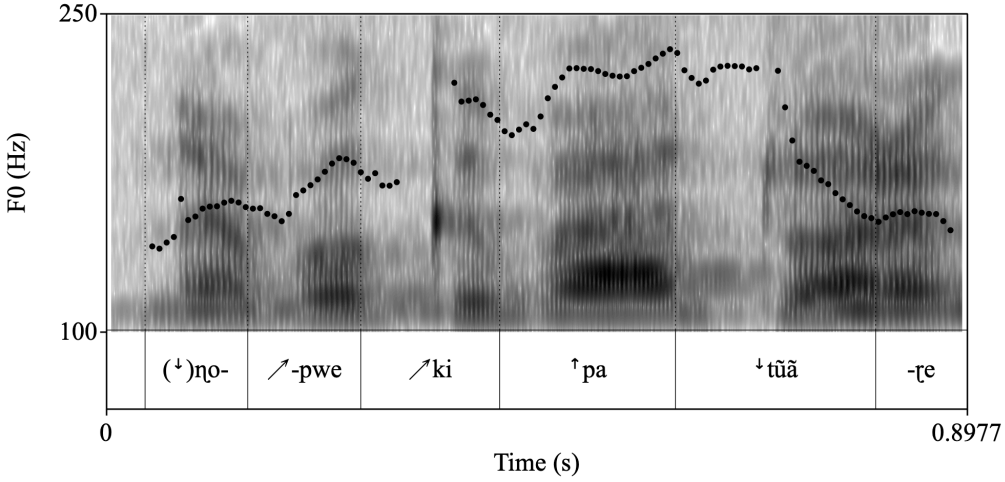


Figure 10: /↓ɳopwe ki pa ↓tũã-ʈe.../ 'And you see [that it is good]...' (Drubea; Shintani, 2019, p. 41, L04)

Finally, as mentioned above, pre-downstep raising is also sometimes seen to affect downstepped syllables. In such cases, the downstep is never undone by the raising effect. Instead, the rise in pitch is heard on the end of the syllable, after the register lowering triggered by the downstep, in what can be described as a rising contour. This is attested even on monomoraic

CV syllables, as seen in (18) ([V$\widehat{\text{ꜛV}}$] represents a monomoraic vowel affected by upstep on its second half).

(18) /ˡŋ̰e ˡmwą̰ ˡvẹ̰/
[(ˡ)ŋ̰e ˡmwą̰$\widehat{\text{ꜛą̰}}$ ˡvẹ̰]
[ŋ̰e^{4} mwą̰$^{3.5–4}$ vẹ̰^{3}]
3PL.SBJ PFV go
'They go.' (Numèè; Rivierre, 1973, p. 147)

The realization of registerless syllables is also sensitive to utterance-final phenomena, as seen in the next two sections: final raising in Drubea (§3.3), and final downstepping of light syllables in Numèè (§3.4).

3.3 Utterance-final raising in Drubea

A tendency toward raising of registerless syllables is also seen in utterance-final position in Drubea (Numèè differs from Drubea on this point, as discussed in the next section). This is particularly marked when the final syllables are preceded by one or more pitch drops caused by downstepped syllables. This effect is not explicitly described by either Rivierre (1973) or Shintani and Païta (1990a), but it can be seen in some of their transcriptions. Optional final raising is illustrated with the two examples below, from Rivierre (1973). In both cases, the utterance ends with a sequence of two registerless syllables. In (19), there is no final raising, while in (20), the final registerless syllable is realized at a higher pitch than the immediately preceding one. I transcribe this final pitch rise with an upstep symbol followed by a percentage sign (ꜛ%) placed at the end of the utterance in phonological transcription, right before the final syllable in surface transcription. This transcription corresponds to the analysis of this rise as a final boundary upstep I propose in §4.8.

(19) /ˡtaa dɪɪ bee/
[(ˡ)taa dɪɪ bee]
[taa^{4} ⁿdɪɪ^{4} ᵐbee^{4}]
one small fish
'one small fish' (Drubea; Rivierre, 1973, p. 126)

(20) /ˡtaa bee pwi + ꜛ%/
[(ˡ)taa bee ꜛ%pwi]
[taa^{4} ᵐbee^{4} pwi^{5}]
one fish cooked
'one cooked fish' (Drubea; Rivierre, 1973, p. 128)

In the Unya dialect described by Rivierre (1973), this effect seems to be rare – at least the reader is enclined to assume so, given the fact that utterance-final registerless syllables are realized with the same pitch as the preceding syllable in all but two examples, one of them being example (20) above. Final raising is much more frequent in the Païta dialect. This is not explicitly said in Shintani and Païta's (1990a, pp. 17–22) description, but it can be seen in the few phonetic transcriptions they give. A cursory survey of the fifty texts recorded by Shintani and available in the online Drubea tutorial (ALK, 2023) suggests that

the vast majority of utterance-final registerless syllables undergo this final raising in the Païta dialect. The example in (21) below is taken from one of these texts. As can be seen in Figure 11, the final two syllables [pwɛ wẽ] are clearly realized with a higher pitch than the preceding registerless-prefix a-, which is pronounced at the same lowered pitch as the downstepped final syllable of the verb [uˈi] which immediately precedes it (see also example (7) above).[21]

(21) /keˈe kãˈã uˈi a-pwɛ wẽ + ↑%/
[keˈe ↑kãˈã uˈi a-↗pwɛ ↑%wẽ]
1PL.SBJ PROS do STAT-all LOC
'We will do everything that way.' (Drubea; Shintani and Païta, 1990a, p. 172, L23)

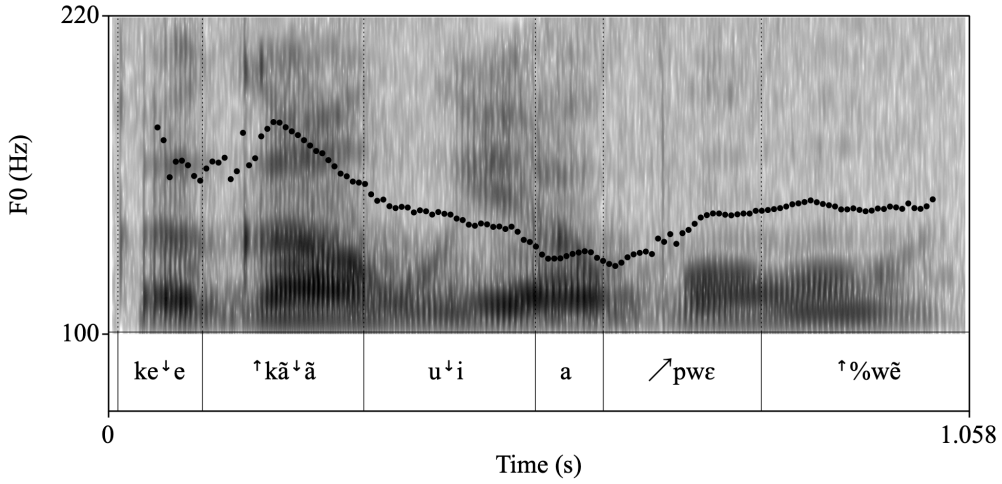


Figure 11: /keˈe kãˈã uˈi-a -wɛ wẽ + ↑%/ 'We will do everything that way.' (Drubea; Shintani, 2019, p. 172, L23)

3.4 Utterance-final downstepping in Numèè

In Numèè –at least in the Goro dialect described by Rivierre (1973)–, utterance-final light CV syllables are systematically downstepped if they are preceded by a registerless syllable –i.e. CV → ˈCV / σ_# (where "σ" stands for a registerless syllable). That this is indeed downstep is revealed by the fact that the preceding registerless syllable often undergoes pre-downstep raising, as is the case in examples (22) and (23), where the downstepping of final /ŋa/ → [ˈŋa] and /wẽ/ → [ˈwẽ] triggers raising of the preceding /a/ → [↑a] and /gii/ → [↑gii] respectively. I analyze this final downstepping process as the realization of a final boundary downstep, transcribed /↓%/ (cf. §4.8).[22]

[21]The downstep in the CVˈV monosyllables /keˈe/ and /kãˈã/ will be discussed in §3.7).

[22]The non-initial downstep in /yaˈa/ and /geˈe/, as well as the double downstep on [ˈˈmẽ] in (23) will be explained in §3.7.

(22) /dɛɳu a ŋa + ↓%/
[dɛɳu ↑a ↓%ŋa]
[dɛ^{4}ɳu^{4} a$^{4.5}$ ŋa^{3}]
jaw REL up
'upper jaw' (Numèè; Rivierre, 1973, p. 132)

(23) /... ya↓a ge↓e ↓mẽ ↓tõŋẽɽẽ xɪɪ-↓a ɲĩ püɽüco gɪɪ wẽ + ↓%/
[... ya↓a ↑gee ↓↓mẽ ↓tõŋẽɽẽ ↑xɪɪ-↓a ɲĩ püɽüco ↑gɪɪ ↓wẽ]
NEG we NEG know place-there (s)he come.out from LOC
'[this child], we don't know where he's coming from!' (Numèè; Ati and Rivierre, 1966, S54/04'03")

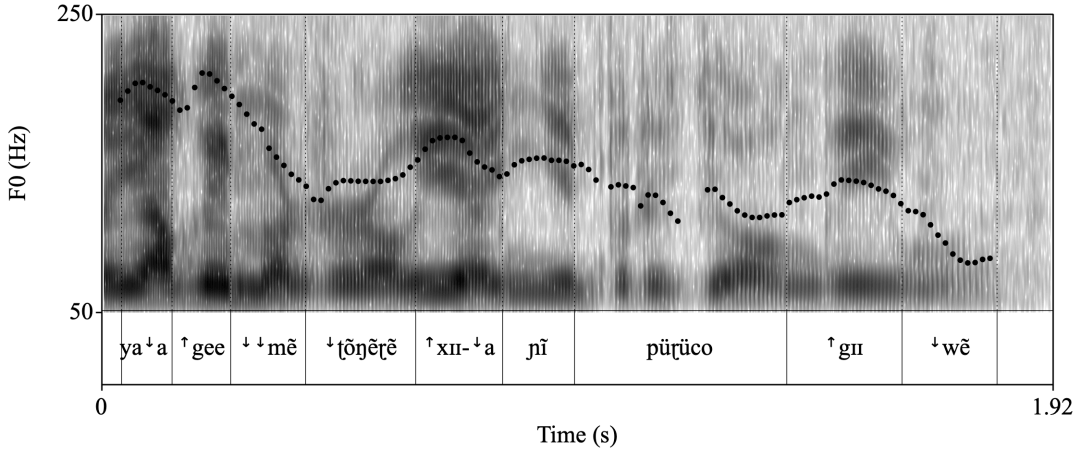


Figure 12: /... ya↓a ge↓e ↓mẽ ↓tõŋẽɽẽ xɪɪ-↓a ɲĩ püɽüco gɪɪ wẽ/ '[this child], we don't know where he's coming from!' (Numèè; Ati and Rivierre, 1966, S54/04'03")

Additional evidence in favor of viewing final downstepping as the assignment of a boundary downstep is that it affects underlyingly downstepped syllables as well, as shown by the fact that the contrast between the two types of syllables is maintained in utterance-final position. An utterance-final registerless light syllable is indeed not realized as low as a downstepped syllable in the same position, as noted by Rivierre (1973, p. 127) and illustrated in (24) and (25). This shows that downstepping is the realization of an inserted extra downstep, not just the result of a change of the final syllable from registerless to downstepped. When realized on an already downstepped syllable, the boundary downstep results in a double downstep, which explains the lower realization of underlying downstepped /↓ɲĩ/ → [↓↓ɲĩ] in (25) compared to registerless /ɲĩ/ → [↓ɲĩ] in (24).

(24) /jaa ɲĩ + ↓%/
[↑ⁿɟaa ↓%ɲĩ]
[ⁿɟaa^{5} ɲĩ^{4}]
juice coconut
'coconut juice' (Numèè; Rivierre, 1973, p. 127)

(25) /jaa ˩ɲĩ + ˩%/
[ᵗʱɟaa ˩˩%ɲĩ]
[ʱɟaa^{5} ɲĩ$^{3.5}$]
juice breast
'breast milk' (Numèè; Rivierre, 1973, p. 127)

Final downstepping affects only light syllables: CVV syllables remain registerless utterance-finally, as in (26) (compare with (22) above) and (27).[23]

(26) /dɛɳʊ a miːi + ˩%/
[dɛɳʊ a miːi]
[dɛ^{4}ɳʊ^{4} a^{4} miːi^{4}]
jaw REL low
'lower jaw' (Numèè; Rivierre, 1973, p. 132)

(27) /a-˩ɽoo ˩wɛcaaxɪɪ + ˩%/
[a-ᵗɽo˩o ˩wɛcaaxɪɪ]
LOC-down near.the.channel
'... down near the channel.' (Numèè; Ati and Rivierre, 1966, S31/01'58")

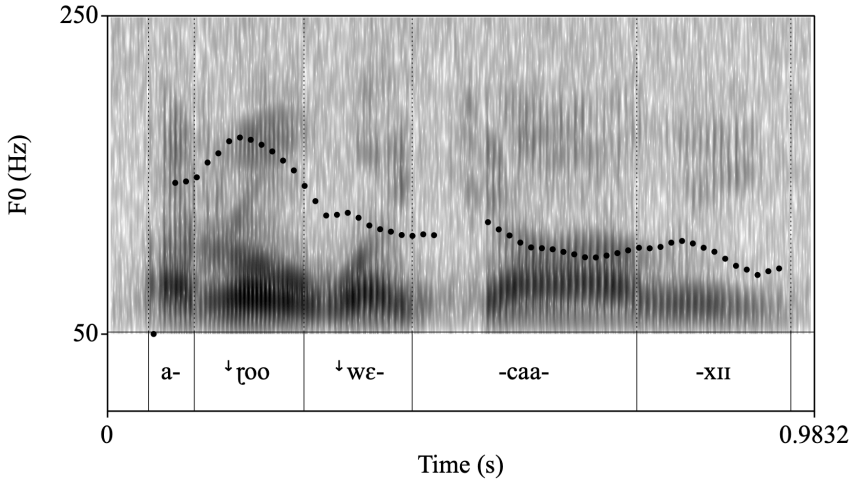


Figure 13: /a-˩ɽoo ˩wɛcaaxɪɪ/ '... down near the channel.' (Numèè; Ati and Rivierre, 1966, S31/01'58")

Finally, downstepping does not apply after a downstepped syllable, as shown in (28) and (29).

[23]Note that the realization of the downstep (and preceding upstep) in (27)/Figure 13 is delayed by one mora in /a-˩ɽoo/ → [a-ᵗɽo˩o] (instead of exepcted [ᵗa-˩ɽoo]). It is not clear why this is the case. This might be an example of pitch target delay, or carryover effect, very frequent in tone languages (cf. Han and Kim, 1974; Hyman and Schuh, 1974; Xu, 1997; *inter alia*).

(28) /ˡtẽẽ-ˡẽ nõ bɛˡtĩĩ ku + ˡ%/
[(ˡ)tẽẽ-ˡẽ nõ ᵗbɛˡtĩĩ ku]
[tẽẽ^{5}-ẽ^{4} nõ^{4} bɛ^{5}ˡtĩĩ^{3} ku^{3}]
girl-PROX grill three yam
'This girl is grilling three yams.' (Numèè; Rivierre, 1973, p. 135)

(29) /... ɲĩ yʊʊ a-ˡpaa kwẽ + ˡ%/
[... ɲĩ ↗yʊʊ ᵗa-ˡpaa kwẽ]
3SG berth LOC-up sand
'... he berths on the sand.' (Numèè; Ati and Rivierre, 1966, S64/04'57")

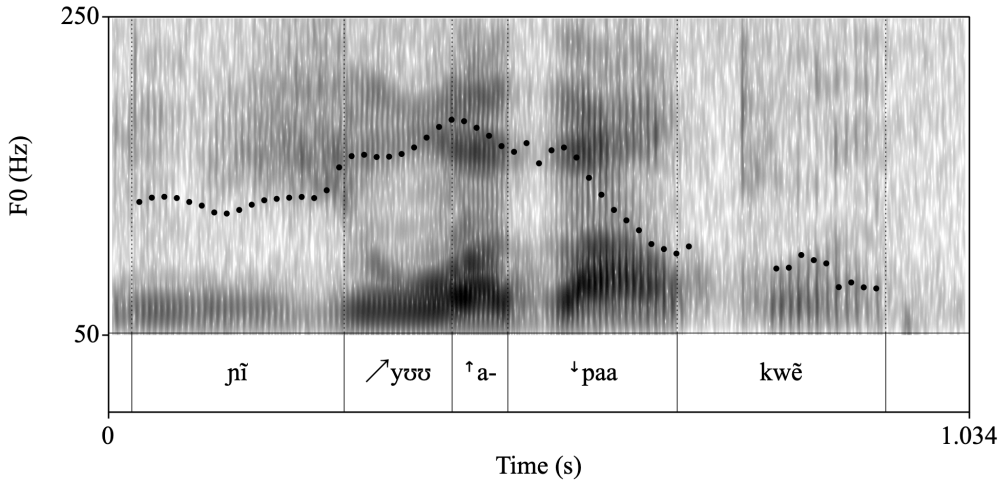


Figure 14: /... ɲĩ yʊʊ a-ˡpaa kwẽ/ '... he berths on the sand.' (Numèè; Ati and Rivierre, 1966, S64/04'57")

The latter examples suggest that the final boundary downstep /ˡ%/ is realized only on final light syllables following a registerless syllable, and left unrealized in all other contexts. From now on, the boundary downstep will be included in underlying form only when it is realized.

3.5 Utterance-initial downstep

Downstep is not realized utterance-initially, where downstepped and registerless syllables are not phonetically distinct (unless they are followed by a downstepped syllable, as we will see below). This can be seen by comparing (30), which contains only registerless syllables, and (19) above, repeated as (31) below, in which the initial syllable is downstepped. Both utterances start at the same pitch height. Non-realization of the underlying downtep is indicated by parentheses.

(30) /ko te tɪɪ-ʈe kuʈe/
[ko te tɪɪ-ʈe kuʈe]
[ko^{4} te^{4} tɪɪ^{4}-ʈe^{4} kuʈe^{4}]
I DESCR look.at-ACT bush
'I look at the bush.' (Drubea; Rivierre, 1973, p. 127)

(31) /ˈtaa dɪɪ bee/
[(ˈ)taa dɪɪ bee]
[taa^{4} ^{n}dɪɪ^{4} ^{m}bee^{4}]
one small fish
'one small fish' (Drubea; Rivierre, 1973, p. 126)

This is easily explained if downstep is viewed as the realization of an instruction to contrast downward with the immediately preceding syllable. In the absence of any preceding syllable, there is nothing to contrast with, and the utterance starts at what can be considered to be the pitch baseline. According to Rivierre and Shintani's transcriptions as well as the selection of recordings from Shintani's (2019) text collection that I was able to process, the baseline in Drubea and Numèè can be schematically represented as mid-high 4 out of 5 on the pitch-height scale. This fairly high pitch level corresponds to the ceiling of the default initial register of an unmarked utterance. The fact that the utterance starts by default at a rather high pitch is most likely due to the necessity to allow for a pitch decline in the course of the utterance, either because of the presence of following downstepped syllables (and the overall downward realization of most utterances, noted by Rivierre, 1973, p. 153), or simply because of declination, a universal tendency for pitch to gradually lower over the course of an utterance, which is attested in Drubea and Numèè, where an utterance containing only registerless syllables 'follows a straight-falling melodic line' (Rivierre, 1973, p. 131).

As shown by Rivierre (1973, p. 125), the contrast between utterance-inital downstepped and registerless syllables is maintained in the presence of a following downstepped syllable: in this context, an initial registerless syllable undergoes pre-downstep raising and is realized higher than the baseline, while an initial downstepped syllable does not, and is realized at the baseline. This is illustrated by the contrast between utterance-initial registerless /goo/ in (32) and downstepped /ˈgoo/ in (33).

(32) /goo ˈmie/
[ˈgoo ˈmie]
[^{ŋ}goo^{5} mie^{3}]
plant.sp wet
'wet *Hibbertia pancheri*' (Drubea; Rivierre, 1973, p. 125)

(33) /ˈgoo ˈmie/
[(ˈ)goo ˈmie]
[^{ŋ}goo^{4} mie^{3}]
tree wet
'wet tree' (Drubea; Rivierre, 1973, p. 125)

This partly explains why the default ceiling of the utterance-initial register is not at the highest point of the speaker's range (i.e. at level 5): it must remain possible to raise the default register when pre-downstep raising affects the utterance-initial syllable.

3.6 Disyllables

Disyllabic stems can be classified into three register classes (Rivierre, 1973, pp. 124, 126–127; Shintani and Païta, 1990a, pp. 17–18).[24] These three classes are illustrated in (34) with a minimal triplet.

(34) a. Type 1: registerless / σ σ / e.g. /kuɽe/ 'forest'
b. Type 2: downstepped initial syllable /ˈσ σ / e.g. /ˈkuɽe/ 'end'
c. Type 3: downstepped second syllable / σˈσ / e.g. /kuˈɽe/ 'crayfish'

The registerless disyllables (type 1) behave exactly like a succession of two registerless monosyllables: they are realized at the same pitch as the preceding syllable, as with /veto/ 'put' in example (35)/Figure 15; they may be affected by pre-downstep raising, as with /tea/ 'to go up' and /mweɽe/ 'again' in (36), or by either of the two utterance-final phenomena described in §§ 3.3 and 3.4 above: utterance-final raising in Drubea, e.g. /kapwa/ 'corrugated iron' in (37)/Figure 16, and utterance-final dowstepping in Numèè, e.g. /mwoɽo/ 'alive' in (38), where downstepping of the final syllable causes pre-downstep raising of the initial.

(35) /... ˈmwa veto ˈtaa.../
[... ˈmwa veto ˈtaa...]
PFV put one
'[I] put a [blanket on the table]. (Drubea; Shintani, 2019, p. 97, L12)

(36) /ɲi ˈmwa tea mweɽe ˈmee/
[ˈ↑ɲi ˈmwa te↗a ↗mweˈ↑ɽe ˈmee]
[ɲi^{5} mwa^{4} te^{4}a$^{4.5}$ mwe^{5}ɽe^{5} mee^{4}]
3SG.SBJ PFV go.up again come
'He comes back up.' (Drubea; Rivierre, 1973, p. 134)

(37) /ko te ˈɽo-mwaɽi ˈmwa... ˈŋi kapwa + ˈ↑%/
[ko te ˈɽo-ˈ↑mwaɽi ˈmwa... ˈŋi ↗kaˈ↑%pwa]
1SG.SBJ DESCR stay-close house with corrugated.iron
'I covered the house with corrugated iron. (Drubea; Shintani, 2019, p. 147, L19)

(38) /ˈcĩĩbu ˈmwã ˈku mwoɽo + ˈ↓%/
[(ˈ)cĩĩˈ↑bu ˈmwã ˈku ˈ↑mwoˈ↓%ɽo]
[cĩĩ^{4}bu^{5} mwã^{4} ku^{3} mwo^{4}ɽo^{3}]
rat PFV flee alive
'The rat escaped safe and sound.' (Numèè; Rivierre, 1973, p. 146)

The initial syllable of a type 2 disyllable behaves like a downstepped monosyllable: it is realized lower than the preceding syllable, irrespective of whether that syllable is downstepped or registerless. In example (39), the initial downstepped syllable of the verb /ˈɽobe/ 'wake up' is realized lower than the immediately preceding downstepped syllable /ˈmwa/, as seen in Figure 17. Like with dowstepped monosyllables, the first syllable of type 2 disyllables frequently causes raising of the preceding registerless syllable(s), as illustrated in

[24] A fourth class, CVˈV.CV, is also attested in recent loanwords, as discussed in §3.7.

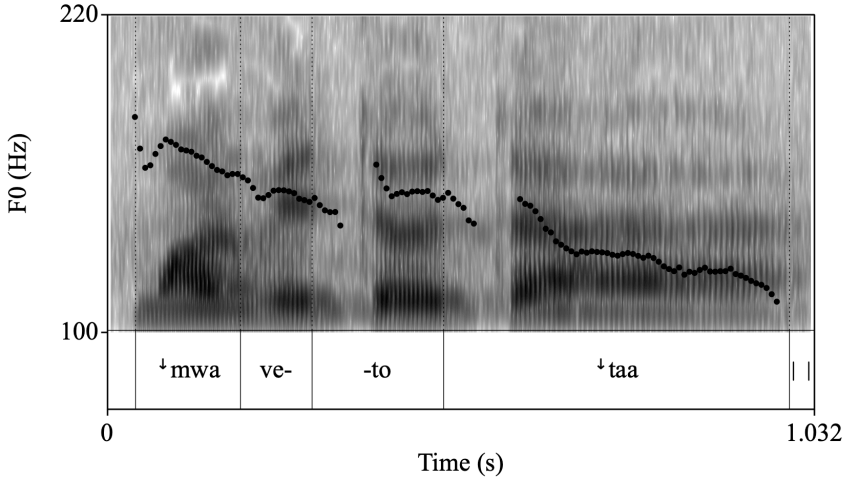


Figure 15: /... ˡmwa veto ˡtaa.../ ‘[I] put a [blanket on the table]. (Drubea; Shintani, 2019, p. 97, L12)

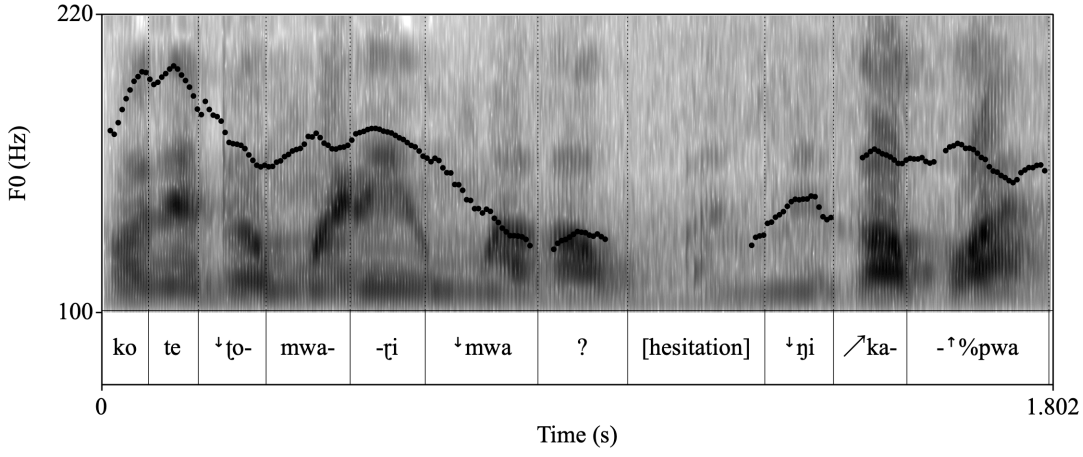


Figure 16: /ko te ˡʈo-mwaʈi ˡmwa... ˡŋi kapwa + ˆ%/ ‘I covered the house with corrugated iron. (Drubea; Shintani, 2019, p. 147, L19)

example (40), where the registerless descriptive marker /te/ is clearly raised before the verb /ˈŋɛʈɛ/ ‘think’, as shown in Figure 18 (see also /ˈbeʈu/ ‘swim’ in (13)b and /ˈkeʈee/ ‘eat’ in (14) above).

(39) /ko ˈmwa ˈʈobe/
[ko ˈmwa ˈʈobe]
1SG.SBJ PFV wake.up
‘I woke up.’ (Drubea; Shintani, 2019, p. 193, L26)

(40) /ko te ˈŋɛʈɛ-ʈe ˈme.../
[ko ˈte ˈŋɛʈɛ-ʈe ˈme...]
1SG.SBJ DESCR think-ACT that
‘I think that...’ (Drubea; Shintani, 2019, p. 214, L29)

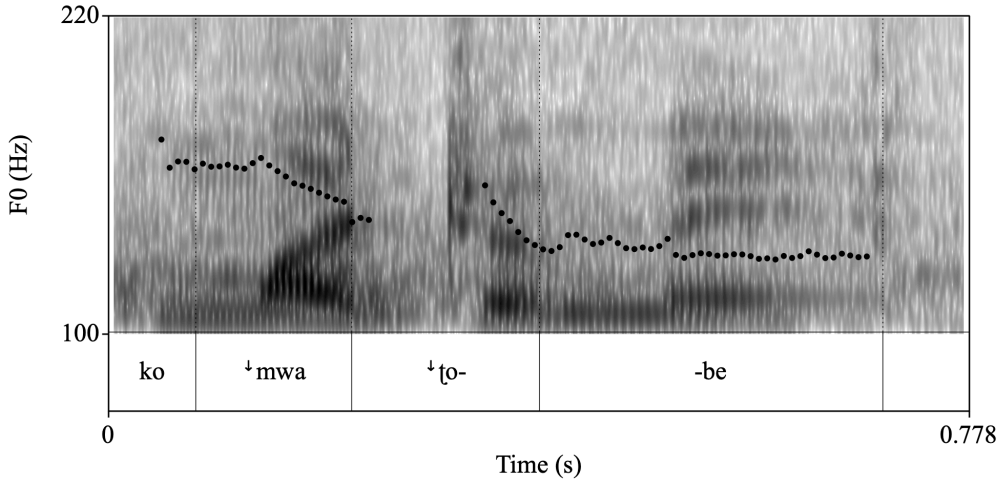


Figure 17: /ko ˈmwa ˈʈobe/ ‘I woke up.’ (Drubea; Shintani, 2019, p. 193, L26)

The second syllable of type 2 disyllables behaves like a registerless syllable. It is realized by default at the same pitch as the initial syllable, as in (40)/Figure 18 above. It is also subject to pre-downstep raising, as well as utterance-final raising in Drubea – although this is rarely the case for light syllables, and is seen mostly with long second syllables.[25] This is illustrated with the verb /ˈmwaʈii/ ‘plant’ in Drubea, affected by pre-downstep raising in (41)/Figure 19 and by utterance-final raising in (42)/Figure 20.[26]

[25]Both Rivierre (1973, pp. 124, 127) and Shintani and Païta (1990a, p. 18) note a strong tendency to realize the long vowel in the second syllable of a type-2 disyllable (ˈCV.CV:) with raised pitch when pronounced in isolation.

[26]The syllable-internal downstep in /kãˈã/ and its realization as a double downstep on the following syllable is discussed in §3.7. In both examples, the final syllable in Shintani’s transcription seems to be followed by a faint, nasal-sounding element. It is not clear whether this is an actual morpheme not reported in the transcription, or meaningless nasalized lengthening of the final vowel typical of utterance-final laxing, or something else. This is represented as “(?)” on Figures 19 and 20.

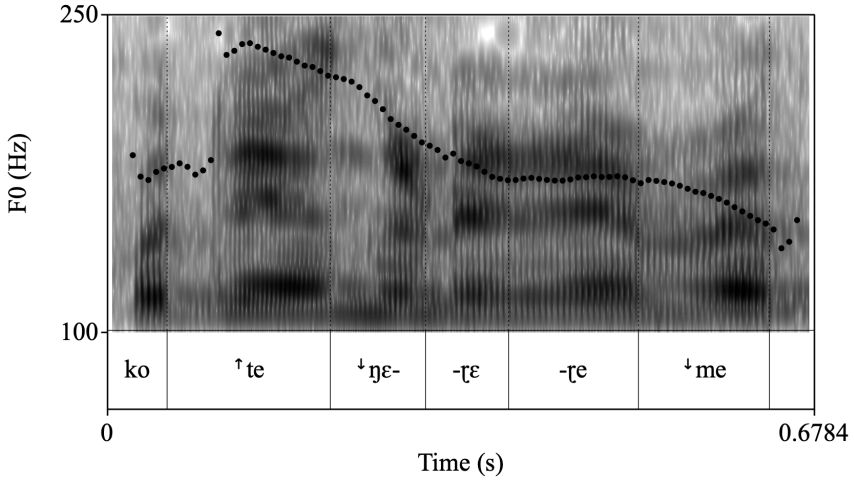


Figure 18: /ko te ˩ŋɛɽɛ-ɽe ˩me…/ ‘I think that…’ (Drubea; Shintani, 2019, p. 214, L29)

(41) /kã˩ã ˩mwaɽii bu˩ki/
[kãã ˇˇmwa↗ɽii ˆbu˩ki]
PROS plant flower
‘[I] planted flowers.’ (Drubea; Shintani, 2019, p. 147, L19)

(42) /te ˩mwaɽii-ɽe ku +ˆ%/
[te ˩mwa↗ɽii-↗ɽe ˆ%ku]
DESCR plant-ACT yam
‘[I] plant yams.’ (Drubea; Shintani, 2019, p. 234, L32)

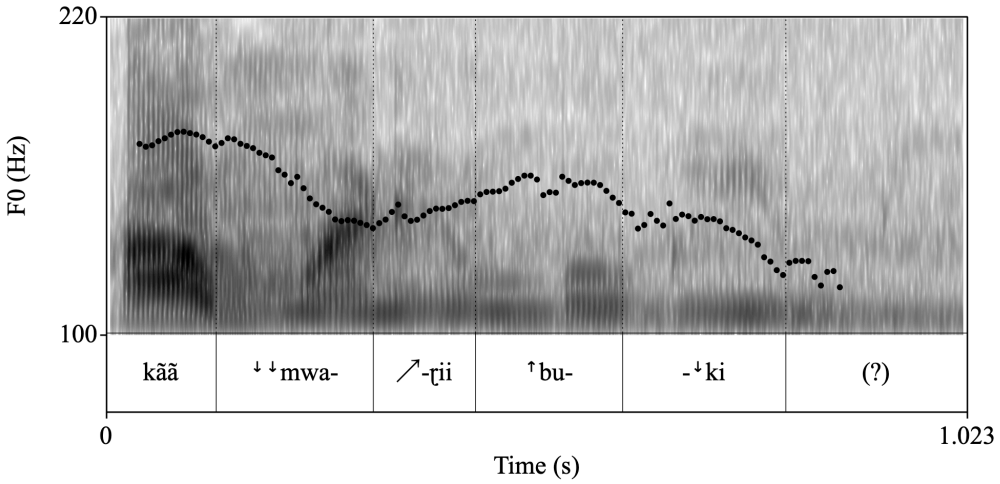


Figure 19: /kã˩ã ˩mwaɽii bu˩ki/ ‘[I] planted flowers.’ (Drubea; Shintani, 2019, p. 147, L19)

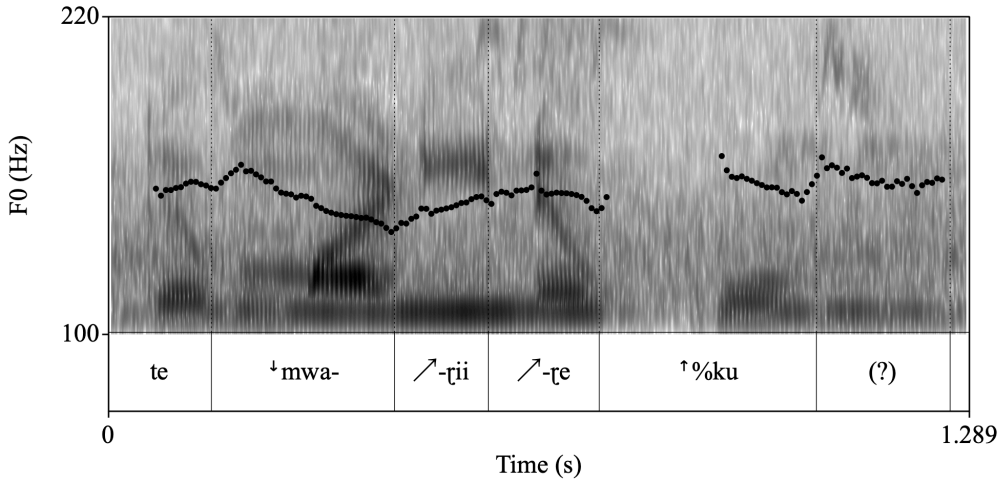


Figure 20: /te ˡmwaɽii-ɽe ku +ᵗ%/ '[I] plant yams.' (Drubea; Shintani, 2019, p. 234, L32)

Finally, in type 3 disyllables, the second syllable is always realized at a lower pitch than the first one, just like a downstepped monosyllable would. This is illustrated with the disyllable /veˡyuu/ 'to be sick, to die' in (43) and (44) below. The pitch drop affecting the second syllable is clearly visible in Figure 21 and Figure 22. As for the initial syllable, it behaves exactly like a registerless monosyllable: it is either realized at the same pitch as the preceding syllable, as in (43)/Figure 21, or undergoes pre-downstep raising, as in (44)/Figure 22.

(43) /kaˡgwee te ki te veˡyuu-ɽe +ᵗ%/
[kaˡgwee te ki te veˡyuu-ᵗ%ɽe]
like DET 2SG.SBJ DESCR be.sick-ACT
'You look sick.' (lit. it is like you are sick) (Drubea; Shintani, 2019, p. 130, L17)

(44) /... ˡŋi ˡmwa veˡyuu-ɽe wẽ teˡe ˡŋi ˡmwa ɲimie-ˡkãã/
[... ˡŋi ˡmwa ᵗveˡyuu-ɽe ↗wẽ ᵗteˡe ˡŋi ˡmwa ↗ɲimiᵗe-ˡkãã]
3PL.SBJ PFV die-ACT because 3PL.SBJ PFV get.old
'[Some others,] they died of old age.' (lit. they died because they grew old) (Drubea; Shintani, 2019, p. 235, L32)

3.7 CVˡV syllables

In addition to registerless CV(V) and downstepped ˡCV(V) syllables, there is a third prosodic type which deserves attention: syllables with a long vocalic nucleus whose second mora is downstepped, i.e. (C)VˡV. The threeway contrast is firmly established in both languages, where minimal triplets are frequent. A few examples from Drubea are listed in (45).

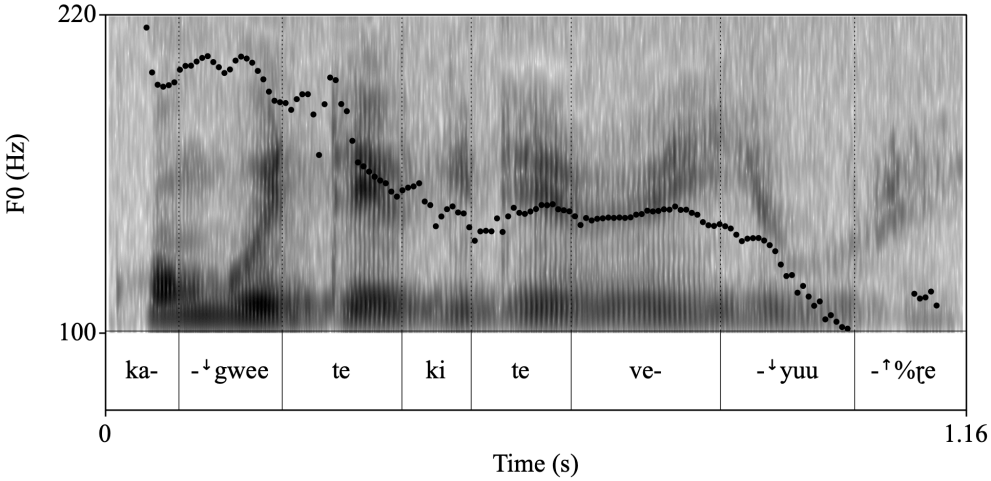


Figure 21: /… kaˈgwee te ki te veˈyuu-ɽe/ ‘You look sick.’ (lit. it is like you are sick) (Drubea; Shintani, 2019, p. 130, L17)

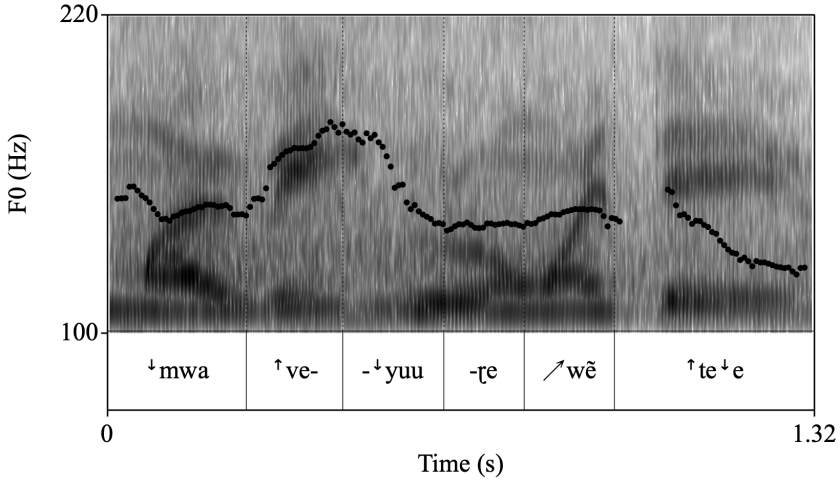


Figure 22: /… ˈmwa veˈyuu wẽ teˈe…/ ‘… [they] died because…’ (Drubea; Shintani, 2019, p. 235, L32)

(45) Drubea (Shintani and Païta, 1990a, p. 19)

a.	/beˡe/	NEGATION
	/bee/	‘fish’
	/ˡbee	‘descendance’
b.	/pwaˡa/	‘group of men’
	/pwaa/	‘white’
	/ˡpwaa/	‘packet’
c.	/koˡo/	‘place, field’
	/koo/	‘fish *sp.*’
	/ˡkoo/	‘egg’
d.	/keˡe/	‘we (PL)’
	/kee/	‘husband’
	/ˡkee/	‘*Broussonetia papyrifera*, paper mulberry’
e.	/kãˡã/	PROPSECTIVE
	/kãã/	‘parent, friend’
	/ˡkãã/	‘big’

The prosodic nature and behavior of CVˡV syllables is illustrated in (46) with the negative marker / beˡe/. As can be seen in Figure 23, the second mora is downstepped, i.e., it is realized within a lower register than the preceding mora and imposes this lower register to the following registerless syllable. In most cases, the initial mora of CVˡV syllables is realized with predownstep raising, which is seen in the realization [ᵗbeˡe] of the negative marker /beˡe/ in (46)/Figure 23, and, more clearly so, in (47)/Figure 24.[27] However, this is not always the case, as shown in example (48) and Figure 25, where the initial mora of [beˡe] is clearly realized at the same pitch as the preceding subject pornoun [(ˡ)ŋi].[28]

(46) /ɲi beˡe ŋa-ɽe + ᵗ%/
[ɲi ᵗbeˡe ŋa-ᵗ%ɽe]
3SG.SBJ NEG work-ACT
‘[He said that] he doesn’t work.’ (Drubea; Shintani, 2019, p. 67, L8)

(47) /ˡŋi ˡmwa beˡe || ... /
[(ˡ)ŋi ˡmwa ᵗbeˡe || ...]
3PL.SBJ PFV NEG
‘They don’t [think about working].’ (Drubea; Shintani, 2019, p. 306, L43)

(48) /ˡŋi beˡe ˡkwe-ɽe/
[(ˡ)ŋi beˡe ˡkwe-ɽe]
3PL.SBJ NEG eat-ACT
‘They don’t eat [it].’ (Drubea; Shintani, 2019, p. 187, L25)

[27] In Figure 24, the pitch starts rather low and gradually reaches the expected utterance-initial baseline late, at the very end of the first syllable, possibly due to the initial nasal in [(ˡ)ŋi] (nasal stops have a tendency to lower the pitch in Drubea). The downstep of the second syllable /ˡmwa/, is, in turn, delayed to the end of the syllable.

[28] The final syllable [ɽe] in Figure 25 is almost whispered, and its pitch is not detected by Praat, but it sounds the same as that of the preceding syllable [kwe].

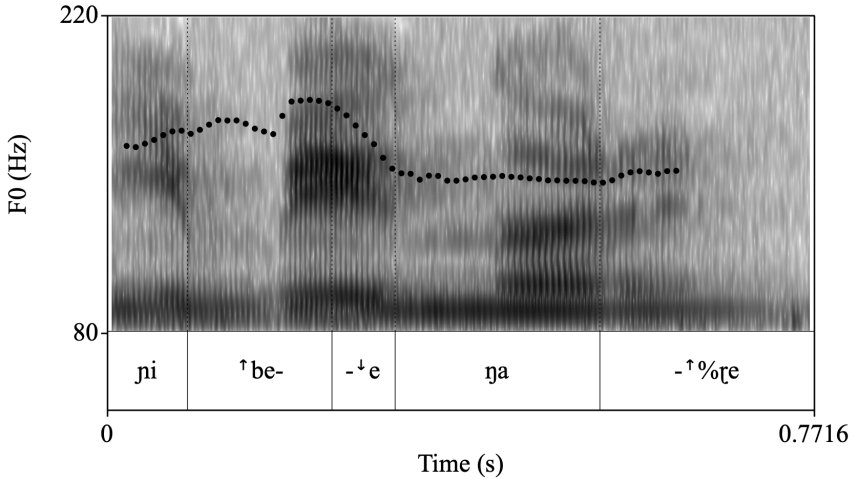


Figure 23: /ɲi beˈe ŋa-ɽe/ ‘[He said that] he doesn’t work. (Drubea; Shintani, 2019, p. 67, L8)

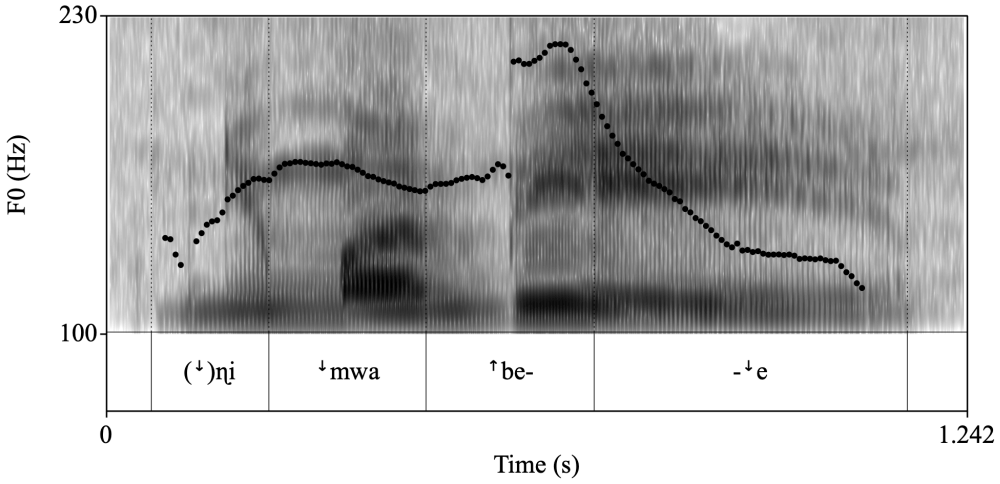


Figure 24: /ˈɳi ˈmwa beˈe || .../ ‘They don’t [think about working].’ (Drubea; Shintani, 2019, p. 306, L43)

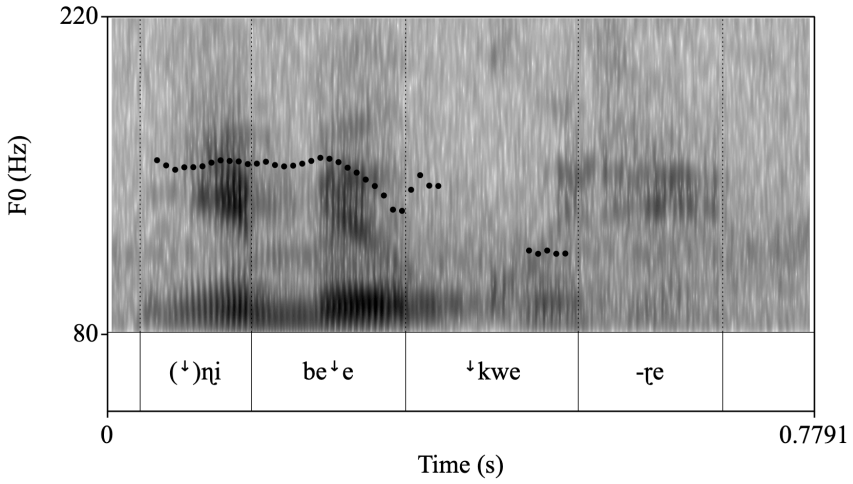


Figure 25: /ˈŋi beˈe kwe-ɽe/ 'They don't eat [it].' (Drubea; Shintani, 2019, p. 187, L25)

The downstep affecting the second mora is frequently displaced and realized on the following syllable. If that syllable is underlyingly registerless, it is then realized with a downstep, i.e. /CVˈV CV.../ → [CVV ˈCV...]. This is shown in (49)/Figure 26 and (50), where the downstep in the negative marker /beˈe/ and the quantifier /pwaˈa/ respectively is displaced and realized on the initial syllable of the following word. Note that pre-downstep raising of /beˈe/ = [ˈbee ˈ...] and /pwaˈa/ [ˈpwaa ˈ...] also applies.

(49) /ko beˈe jaaŋi-ɽe ˈme tuˈmwa auɽe ˈŋe ˈmee .../
[ko ˈbee ˈjaa↗ŋi-ˈɽe ˈme ˈtuˈmwa auɽe ˈŋe ˈmee ...]
1SG NEG want-ACT that other people FUT come
'I do not want other people to come [help me plant yams].' (Drubea; Shintani, 2019, p. 48, L05)

(50) /kạ̲ạ̲ pwaˈa ʈe a ʈeˈẹ̲/
[kạ̲ạ̲ ˈpwaa ˈʈe a ˈʈeˈẹ̲]
[kạ̲ạ̲^{4} pwaa^{5} ʈe^{4} a^{4} ʈe^{5}ẹ̲^{3}]
one.of all ART REL Treẽ
'One man from the Treẽ clan' (Drubea; Rivierre, 1973, p. 143)

When the following syllable is underlyingly downstepped, downstep displacement creates a double downstep, i.e. /CVˈV ˈCV.../ → [CVV ˈˈCV...], as illustrated with /beˈe ˈʈõkõ/ [bee ˈˈʈõkõ] in (51)/Figure 27, and /yaˈa ˈmẹ̲/ [yaa ˈˈmẹ̲] and /geˈe ˈmẹ̲/ [gee ˈˈmẹ̲] in (52).

(51) /ko beˈe ˈʈõkõ ˈŋii-ɽe .../
[ko ˈbee ˈˈʈõkõ ˈŋii-ɽe ...]
1SG.SBJ NEG be.able say-ACT
'I cannot say..." (Drubea; Shintani, 2019, p. 67, L08)

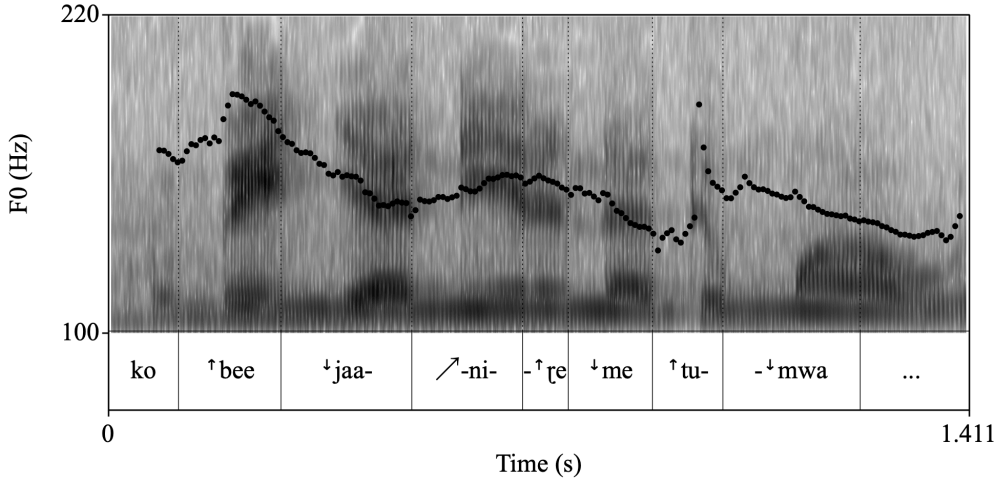


Figure 26: /ko beˈe jaaŋi-ɽe ˈme tuˈmwa .../'I do not want other [people to come help me plant yams].' (Drubea; Shintani, 2019, p. 48, L05)

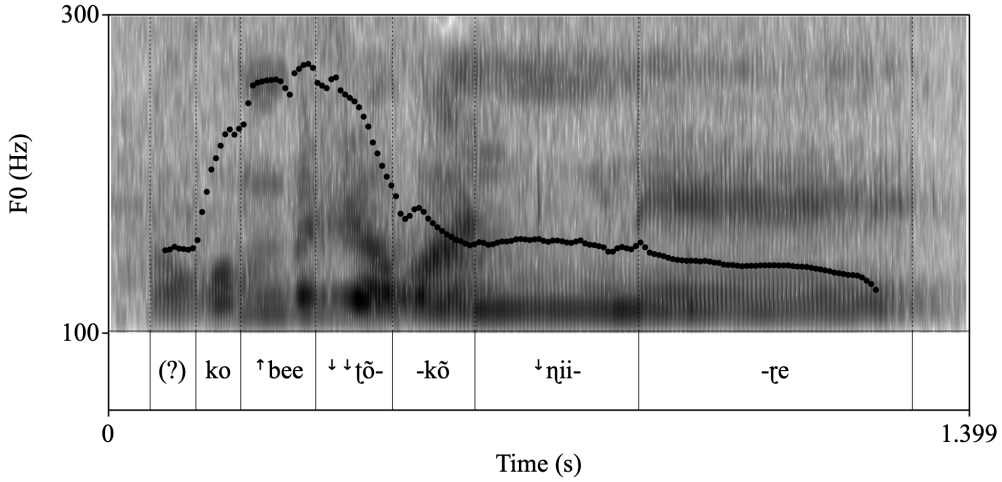


Figure 27: /ko beˈe ˈtõkõ ˈŋii-ɽe .../ 'I cannot say..." (Drubea; Shintani, 2019, p. 67, L08)

(52) /yaˈa ˈmẹ̃ geˈe ˈmẹ̃ ɲaˈi/
[ˆyaa ˇˇmẹ̃ ˆgee ˇˇmẹ̃ ˆɲaˈi]
[yaa^{5} mẹ̃^{3} gee^{5} mẹ̃^{3} ɲa^{4}i^{3}]
NEG that we FUT arrive
'We will not arrive.' (Numèè; Rivierre, 1973, p. 143)

That there is indeed a double downstep in such cases is confirmed by the fact that the contrast between registerless and downstepped syllables is maintained under downstep displacement, as illustrated with the near-minimal pair in (53): underlyingly downstepped /ˈkwe-ɽe/ 'eat' in (53b) is realized with a starker pitch drop under downstep displacement than registerless /kwɛ-ɽe/ 'dance' in (53a), which corresponds to the cumulative effect of its underlying downstep and the displaced downstep from preceding /koˈo/.

(53) Drubea (Rivierre, 1973, p. 144)

a. /koˈo kwɛ-ɽe/ 'place of dancing'
[ˆkoo ˈkwɛ-ɽe]
[koo^{5} kwɛ^{4}-ɽe]
place dance-ACT

b. /koˈo ˈkwe-ɽe/ 'place of eating
[ˆkoo ˇˇkwe-ɽe]
[koo^{5} kwe^{3}-ɽe]
place eat-ACT

CVˈV syllables are attested in both monosyllables and disyllables. The latter are exclusively recent loanwords from French and English, of CVˈV.CV(V) shape – i.e., the downstep is always in the initial syllable. A few Drubea examples are given in (54).

(54)

/oˈoci/	'horse'	< English
/piˈiki/	'pig'	< English
/poˈoci/	'pouch, pocket'	< French *poche*
/taˈaci/	'bowl'	< French *tasse*
/coˈoɽo/	'salt'	< English
/kaˈaɽɛ/	'car'	< English 'cart'

As seen above, CVˈV sequences behave differently from CV.ˈCV disyllables, with which there is no downstep displacement. It is not entirely clear whether CV.ˈV words (with two different vowels) behave similarly to or differently from CVˈV syllables. These are analyzed as involving two syllables by Rivierre, an analysis I do not question in this paper. There are only nine such words in Shintani and Païta's (1990b) Drubea dictionary, many of which low-frequency words (e.g., specific worm or shellfish species). The only two that are found with mid-to-high frequency in Shintani's recordings (ALK, 2018; Shintani, 2019) are the verbs /uˈi/ 'to do, to make' and /yaˈi/ 'to arrive'. I have not found one clear instance of downstep displacement involving these two words in the corpus. The speech rate of the speakers is too high in most cases to make it possible to clearly determine the exact realization, and in those rare cases of relatively careful speech, the downstep is not displaced, but clearly realized on the second vowel, i.e. [uˈi], [yaˈi]. The Numèè cognate of the verb 'to arrive' is /ɲaˈi/. This verb is used several times in every one of the eight Numèè texts collected by Haudricourt

& Rivierre and archived in the Pangloss collection (Haudricourt and Rivierre, n.d.). In all instances, the downstep is clearly heard between the two vowels, with no displacement. This is not a full and detailed investigation of this question, for which more carefully articluated data is necessary, but it seems to at least suggest that Rivierre was likely correct in isolating CVˈV syllables as having special status, different from CV.ˈV sequences (and more generally that his analysis of sequences of like vowels as long vowels and sequences of unlike vowels as heterosyllabic was likely correct).

Note that the existence of CVˈV syllables shows that the element carrying the indication of register is not the syllable, but the mora. I will come back to this in detail in §4.2.

3.8 Stems of more than two syllables

While most stems in Drubea and Numèè are either mono- or disyllabic, stems of more than two syllables (mostly three or four) are also attested. However, neither Rivierre (1973) nor Shintani and Païta (1990a) give a detailed description of their tonal behavior. Rivierre acknowledges the difficulty of establishing the morphological structure of words of more than two syllables. Compounding is indeed frequent, and many of the long words that he was not able to identify as compounds may turn out to be complex –something he was not able to systematically verify in the field for lack of time (Rivierre, 1973, pp. 129–130).

On the basis of the limited data he collected, Rivierre (1973, p. 130) hypothesizes that tri- and tetrasyllables, like mono- and disyllables (cf. §3.10 below), may not have more than one downstep ("L tone" in his analysis).[29] Rivierre further surmises that those with more than one downstep are actually compounds. This implies that each member of a compound constitutes an independent prosodic domain (which I call 'stem' here). The culminativity constraint of downstep is enforced within this domain, but not at the entire morphological word level. Indeed, it is quite common for compounds to include more than one downstep, when they combine several stems containing a downstepped element, as in the examples in (55) (compound elements are separated by a middle dot ⟨·⟩).

(55) a. /koˈo·ˈmwa/ 'mound (on which houses are built)'
field·house

b. /ˈʊʊ·ũ·pooˈka/ 'blanket'
mat·hair·animal

c. /ˈkǫ̱·ˈvuu-ɽe/ 'voice, language'
manner·speak-ACT

Rivierre's hypothesis is supported by the fact that, cross-linguistically, compounds have a tendency not to constitute a single tonal or prosodic domain. Examples include such different languages as the isolate Laal of Chad (Lionnet, 2022a), or the Ju|'hoan language of Namibia (Kx'a, formerly Northern Khoisan; Miller, 2010). Closer to Drubea and Numèè, this is also the case of Paicî, another tonal language of New Caledonia, in which each member of a compound constitutes an independent tonal domain–notably for the application of a similar culminativity constraint limiting the number of downsteps per tonal domain to exactly one (Lionnet, 2022b).

[29] Shintani and Païta (1990a, pp. 21–22) come to the same conclusion – although they note that tri- and tetrasyllables fall into several classes depending on what syllable carries the downstep.

I will leave tri- and tetrasyllabic words aside in this paper. A full investigation of their prosodic behavior requires additional data collection from native speakers, which I have not been able to conduct yet. I can only say that in transcribing a selection of Shintani's (2019) recorded texts, none of the (seemingly) monomorphemic tri- or tetrasyllabic words I have encountered contained more than one downstepped syllable, or jeopardized in any way the register analysis proposed in this paper.

3.9 Verbal classifier prefixes

Morpheme concatenation in Drubea and Numèè, be it through compounding or affixation, does not seem to interact in any significant way with the prosodic behavior of the morphemes involved. Affixes are all toneless,[30] except the verbal classifier prefixes, which are used to modify the meaning of their verb base in systematic ways, e.g. /xa-/ 'VERB with one's teeth', /gi-/ 'VERB with a knife', etc. These prefixes are always monosyllabic, and take on the prosodic specification of the initial syllable of the verb they are prefixed to (Rivierre, 1973, pp. 140–141; cf. also Shintani and Païta, 1990a, p. 46). This is illustrated with the Drubea prefix /ʈa-/ 'VERB with one's hand' in (56).

(56) a. /ʈa-uʈu/ ʈa-uʈu 'cut by hand'
b. /ʈa-ˈtie/ ˈʈa-ˈtie 'tear by hand'

The example in (57) shows that the prefix in /ʈa-ˈtie/ [ˈʈa-ˈtie] is indeed downstepped, as can be seen from the fact that it triggers pre-downstep raising of the preceding registerless syllable [ˈte]. The fact that the there is still a pitch drop between the prefix and the verb also shows that the downstep on the prefix is indeed a copy of the downstep of the initial syllable of the verb /ˈtie/ rather than a realignment of this downstep to the left edge of the morphological word.

(57) /ko te ʈa- ˈtie -ʈe/
ko te ˈʈa- ˈtie -ʈe (downstep copy)
[ko ˈte ˈʈa- ˈtie -ʈe]
[ko^{4} te$^{4.5}$ ʈa^{4} ti^{3}e^{3} -ʈe^{3}]
I.SBJ DESCR with.hand- tear -ACT
'I tear by hand.' (Drubea; Rivierre, 1973, p. 141)

3.10 Summary

The lexical prosodic system of Drubea and Numèè is entirely built on one underlying binary contrast: registerless (i.e. prosodically unspecified) vs. downstepped elements. These elements are either entire syllables as in CV(V) and ˈCV(V), or the second mora of a syllable, as

[30] Both Rivierre (1973, pp. 138–140) and Shintani and Païta (1990a) analyze all affixes except the verbal classifier prefixes as toneless. Rivierre's description of the contextual realizations of the possessive suffix /-ʈe/ ∼ /-V/ and the ACTIVE verbal suffix /-ʈe/ seems to indicate a difference in behavior between these suffixes and what he analyzes as H-toned syllables (= registerless in my analysis). It is not clear to me that this distinction is warranted, since most of the contextual realizations described by Rivierre are fully compatible with a registerless analysis of these morphemes under the register analysis proposed here, and the few remaining doubts about this compatibility cannot be cleared with the data presented by Rivierre. I will consider that suffixes are registerless, simply noting that more work is necessary to confirm this.

in the case of CVˈV syllables, which suggests that both the syllable and the mora have a role to play –a point I address more in detail in §4.2. Downstep is realized as a downward register contrast with what precedes. It is not realized utterance-initially, where the conditions for this contrast are not met. In that case, the downstep is simply left unrealized and downstepped elements are pronounced just like registerless ones at baseline pitch, a high-mid default pitch schematically represented as a level 4 on the typical 1-to-5 scale. Registerless elements are prosodically inert, i.e. their realization is entirely context-dependent. When utterance-initial, they are realized at baseline pitch. In non-initial position they are realized by default at the same pitch as the preceding (downstepped or registerless) element. When followed by a downstepped element (including when in utterance-initial position), they tend to undergo pitch raising, to emphasize the downward contrast that follows. Finally, registerless elements are sensitive to utterance-final prosodic phenomena: final raising in Drubea, final lowering in Numèè.

The distribution of downstep within mono- and disyllabic stems is summarized in Table 2. One interesting property that emerges is CULMINATIVITY: a stem may include at most one downstep – which was already noted by Rivierre (1973, p. 128).[31] This downstep may affect the first or second syllable of disyllables. It may also affect the second mora of a bimoraic CVV syllable. In the native vocabulary, this is found only with monosyllabic CVˈV stems. CVˈV.CV(V) stems are also attested, but all are recent loanwords, mostly from English and French. CV(V).CVˈV stems are strictly unattested. The optionality of the onset consonant is not indicated in the schematic syllable structures given in Table 2, i.e., CV, CVV, and CV(V) stand for (C)V, (C)VV, and (C)V(V) respectively.

Table 2: Downstep distribution in mono- and disyllabic stems

Registerless	σ1 downstepped	σ2 downstepped	Intra-syllabic downstep
CV	ˈCV	—	—
CVV	ˈCVV	—	CVˈV
CV.CV	ˈCV.CV	CV.ˈCV	—
CV.CVV	ˈCV.CVV	CV.ˈCVV	—
CVV.CV	ˈCVV.CV	CVV.ˈCV	CVˈV.CV (loans)
CVV.CVV	ˈCVV.CVV	CVV.ˈCVV	CVˈV.CVV (loans)

4 Register analysis

In the preceding section, I described the lexical prosodic system of Drubea and Numèè as consisting of a contrast between downstepped units and registerless units. In this section, I propose an analysis of this contrast and of the prosodic behavior of these units in terms of register features, demonstrating that no tone or tonal feature is necessary to account for the lexical prosodic system of Numèè and Drubea, which are thus not tonal languages *stricto sensu*, but languages that use register for lexical contrast.

[31] Shintani and Païta (1990a) do not explicitly make this claim, but their sketch of the prosodic system is compatible with it.

4.1 A brief history of the representation of tone and register

The representation of register phonemona like downstep and upstep results from a long history of attempting to extend featural representations to tone, i.e., to represent tone as a bundle of features, and explain tonal behavior with the properties of these features (e.g., Clements, 1983; Hyman, 1993a; Pulleyblank, 1986; Snider, 1999, 2020; Wang, 1967; Yip, 1980, 1989). The most widely used feature system is that proposed by Yip (1980) and refined by Pulleyblank (1986), which makes use of two features: one "register" feature [±upper], dividing the tone range into an upper and a lower register, and a secondary feature [±high] (Yip) or [±raised] (Pulleyblank) further subdividing each register into discrete tonal categories. In this system, a four-height tonal contrast would be analyzed as in (58) below.[32]

(58)

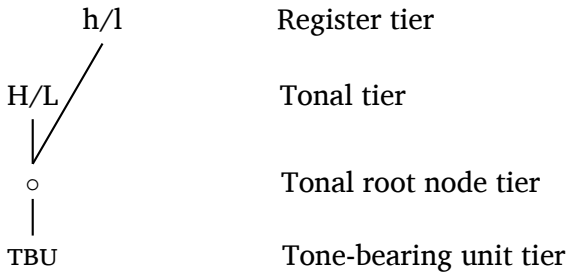
Tone height	Possible transcription	[upper]	[high]/[raised]
4	a̋	+	+
3	á	+	–
2	ā	–	+
1	à	–	–

Snider's (1999; 2020) Register Tier Theory is superficially very similar to the above approaches in proposing a four-way contrast using two types of features: two REGISTER FEATURES *h* (high) & *l* (low) and two TONE FEATURES H (High) & L (Low). Snider's system is, however, different from all others in one crucial point: the definition of the register features. Indeed, while his two tone features H and L can be considered to be the exact unary equivalent of Yip and Pulleyblank's binary [+raised]/[+high] and [–raised]/[–high] respectively, his two register features *h* and *l* are not equivalent to Yip and Pulleyblank's register feature [±upper]. The latter is defined on purely paradigmatic grounds: [+upper] tones are realized within a higher register than [–upper] tones in the same environment. In contrast, Snider's *h* and *l* register features are defined in syntagmatic terms: they "effect a register shift *h* = higher and *l* = lower *relative to the preceding register setting* (Snider, 2020, p. 25, emphasis mine; see also p.151-153). In other words, *h* and *l* are defined as overt representations of upstep (*h* = ˄) and downstep (*l* = ˅) respectively, which I show in this section are very well suited to account for the Drubea and Numèè facts described above.

Snider (1999, 2020) further refines the featural representation of tone by proposing a geometry in which register and tone features are linked to a Tonal Root Node (TRN), which is itself associated with a Tone Bearing Unit (TBU), as shown in (59).

[32] Other authors have proposed very similar systems with unary rather than binary features (e.g., Clements, 1983; Hyman, 1993b).

(59) Geometry of tone (Snider, 2020, p. 23)



The TRN is what unites register and tone features into a single bundle defining individual tones (e.g., low = L*l*, high = H*h*, mid = L*h* or H*l*, etc.), exactly as the C and V root nodes in feature geometry unite segmental features into bundles defining individual segments (Sagey, 1986,Clements and Hume, 1995). This representation allows to account for the fact that low tones have a very strong cross-linguistic tendency to downstep a following H tone. Indeed, a low tone is always specified as *l* on the register tier (and L on the tone tier), i.e. as a downstep-inducing element.[33]

In the rest of this section, I show that register features, in Snider's syntagmatic definition, are sufficient to account for the lexical prosodic system of Drubea and Numèè. In other words, register features need not be paired with tone features and may be active in a phonological system even in the absence of tone features.

4.2 Stem-level patterns and the Register-Bearing-Unit

I propose to analyze downtepped register-bearing units in Drubea and Numèè as being underlyingly associated with a *l* register feature. Note that in the absence of tone features, the tonal root node is unnecessary, and thus absent from representations. The distribution of this *l* feature in mono- and disyllabic stems, summarized in Table 2, has two characteristics: (i) there are only three stem-level register patterns: Ø, *l*, and Ø*l*; and (ii) the Register-Bearing Unit (RBU) is the mora, with a strong syllabic constraint: register features associate with the leftmost mora of a syllable. This accounts for all the native mono- and disyllabic stem shapes described in §3 and listed in Table 2, i.e. all register-less stems (Ø pattern), stems with an initial downstepped syllable (*l* pattern), and stems with a downstepped second syllable (Ø*l* pattern). It also accounts for monosyllabic CV$^{!}$V stems, as discussed below.

This analysis predicts that syllable-internal downstep (i.e. downstep affecting the second mora of a long vowel) should only be allowed in monosyllabic bimoraic stems, as a result of their combination with the Ø*l* pattern. The *l* feature in this case exceptionally associates with the second mora, for lack of a second syllable. In disyllabic stems, on the other hand there are always enough syllables for all patterns to align their *l* feature with the leftmost mora of a syllable. As can be seen in Table 3, The constraint that *l* be aligned with the left edge of the syllable means that only the mappings in (a) (for *l* associated with a CVV.CV(V) stem) and (c) (for Ø*l* associated with a CV(V).CVV stem) are possible. As we saw in §3.10, the mapping in (d) is strictly unattested, and that in (b) is found only in recent loanwords. I will ignore these loanwords in the remainder of this paper. Nothing in their behavior suggests any incompatibility with the register analysis proposed here. These could either be analyzed as

[33] See Snider (2020, pp. 21–65) for a detailed description of the theory and its explanatory potential.

Table 3: Attested and unattested register pattern mappings on disyllables

		CVV.CVV + *l*	CVV.CVV + *Øl*
a.	l | CVV . CV(V)	✓	*
b.	l | CVV . CV(V)	*	*
c.	l | CV(V) . CVV	*	✓
d.	l | CV(V) . CVV	*	*

involving an exceptional *ØlØ* pattern confined to loanwords, or be treated as compounds, i.e. two separate prosodic domains: *Øl* monosyllabic CVˈV + register-less monosyllabic CV(V).[34] Note that CVˈV syllables constitute the only argument in favor of considering that the mora plays any role in register feature association. Without these stems, the RBU would be defined as the syllable. All attested native mono- and disyllabic stem shapes are thus accounted for by the analysis, as shown in Table 4.

Table 4: Mapping of register patterns onto mono- and disyllabic native stems

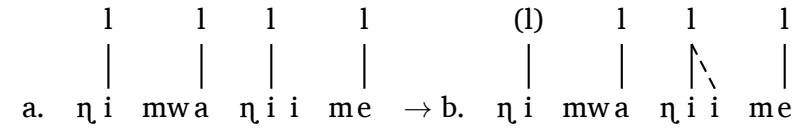
	Ø pattern	*l pattern*	*Øl pattern*
1σ-stem	CV(V)	l | CV(V)	l | CVV
2σ-stem	CV(V) . CV(V)	l | CV(V) . CV(V)	l | CV(V) . CV(V)

[34]Similar analyses of phonotactically odd loanwords as compounds have been proposed in other languages, e.g. Ju|'hoan (Miller, 2010).

4.3 Register analysis: the basics

An utterance containing a sequence of downstepped monosyllabic morphemes, such as in example (11) above, is represented as in (60) below.[35]

(60) /ˈŋi ˈmwa ˈŋii ˈme/ → [(ˈ)ŋi ˈmwa ˈŋii ˈme] (Drubea; cf. (11))

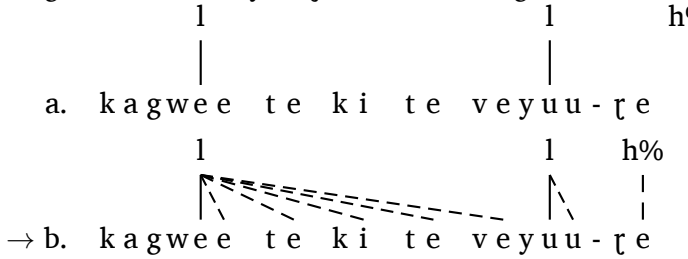


The utterance-initial downstep on /ˈŋi/ is not realized, as seen in §3.5. We will see in §4.5) that this unrealized downstep is actually still phonologically active, and not deleted, hence its presence in parentheses in the surface transcription. Each one of the following *l* features is realized as a register drop, taking the speaker step by step all the way down to the lower end of their pitch range.

An utterance involving only registerless morphemes remains devoid of any register indication, and is thus, by default, realized at the baseline. The same is true of utterances whose only *l*-bearing RBU is utterance-initial, as in example (31): the initial downstep is not realized, making such utterances prosodically identical to ones with no downstep at all (although see §4.5).

Registerless RBUs following a downstepped RBU are by default (and in the absence of any following downstep) realized at the same pitch as the downstepped RBU in question, as we saw in §§ 3.1 and 3.2. This could be interpreted as the result of spreading the *l* feature to all following registerless RBUs, as shown in (61) below, repeated from (43) above (cf. also (60)b above). (The final boundary h% feature will be discussed in §4.8.)

(61) /kaˈgwee te ki te veˈyuu-ɽe + ˈ%/ → [kaˈgwee te ki te veˈyuu-ˈ%ɽe] (Drubea; cf. (43))



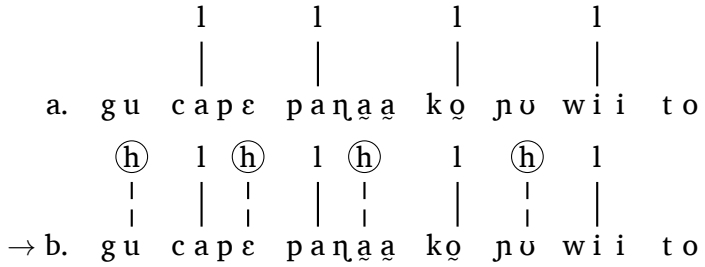
However, the realization of registerless RBUs is highly variable, as we saw. Additionally to utterance-initial default baseline realization, they are available for pre-downstep raising, final raising (Drubea) or lowering (Numèè), and extrapolation. Spreading of the preceding register feature to account for same-pitch realization is thus at best optional (if even necessary), and will henceforth not be represented. Registerless RBUs will be left unassociated, which is an apt representation of their availability to variable realizations.

[35] I assume that an utterance starts at a default register, which I call the 'baseline' (cf. §3.5 above), and which I do not transribe. Cf. Snider, 2020, p. 25 for a similar idea about the interpretation of utterance-initial register features.

4.4 Pre-downstep raising as *h*-epenthesis

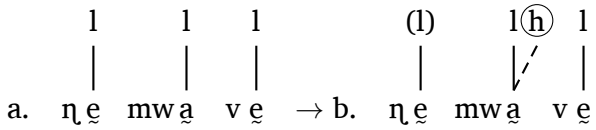
Pre-downstep raising can be analyzed as the optional postlexical assignment of a *h* register-raising (= upstep) feature, as illustrated in (62), where every registerless syllable followed by a downstep is affected.

(62) /gu ˈcapɛ ˈpaŋ̰aa ˈkǫ̰ ɲʊ ˈwii.to/
[ˆgu ˈcaˆpɛ ˈpaˆŋ̰aa̰ ˈkǫ̰ ˆɲʊ ˈwii.to]
[gu^{5} ca^{4}pɛ$^{4.5}$ pa^{3}ŋ̰aa̰$^{3.5}$ kǫ̰^{2} ɲʊ$^{2.5}$ wii$^{1.5}$.to$^{1.5}$]
2SG.SBJ raise mast on boat there
'Raise the mast on the boat!' (Numèè; Rivierre, 1973, p. 134)



This inserted *h* feature may not delete an underlying *l*. As we saw in §3.2, pre-downstep raising affects mostly registerless RBUs, and is rarely seen with downstepped RBUs. When it does affect a downstepped RBU, as in examples (18) in §3.2 above, the raising occurs after the pitch drop triggered by the downstep. That is, the postlexical insertion of the *h* feature creates a register contour $\widehat{lh}$ on a single mora, as illustrated in (63), repeated from (18) above.

(63) /ˈŋ̰ḛ ˈmwa̰ ˈvḛ/→ [(ˈ)ŋ̰ḛ ˈmwa̰$\widehat{\text{ˆa̰}}$ ˈvḛ] (Numèè; cf. (18))

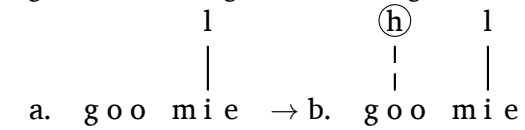


4.5 Utterance-initial downstep

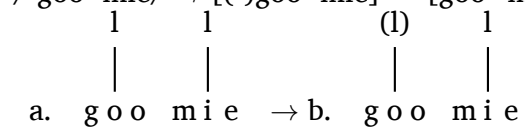
As we saw in §3.5, the downstep is not realized utterance-initially, where there is no distinction in pitch between a downstepped RBU and a registerless one – if the following RBU is registerless. The contrast between downstepped and registerless syllable is, however, maintained whenever the utterance-initial syllable is followed by a downstepped RBU. In this case, a registerless syllable undergoes pre-downstep raising, while a downstepped one does not. This can easily be accounted for by considering that the *l* feature on the utterance-initial RBU is not deleted, but only left unrealized, for lack of a preceding RBU to contrast with. That is, the lack of phonetic distinction between registerless and downstepped syllables in this position is the result of the identical phonetic implementation of two otherwise contrastive phonological objects.

The presence of this unrealized *l* feature is revealed by the fact that it prevents pre-downstep raising, i.e., *h*-epenthesis.[36] This can be seen by comparing (64) and (65) (repeated from (32) and (33) respectively). In (64), registerless /goo/ '*Hibbertia pancheri*' is targeted by *h*-epenthesis caused by the following downstepped adjective /ˈmie/. In (65), on the other hand, *l*-carrying /ˈgoo/ 'tree' fails to undergo *h*-epenthesis in the same context.

(64) /goo ˈmie/ → [ˈgoo ˈmie] = [goo^{5} mie^{3}] (Drubea; cf. (32))



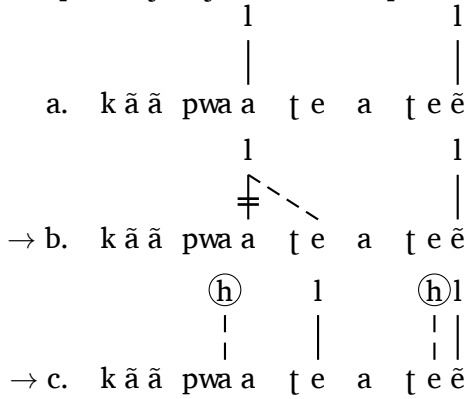
(65) /ˈgoo ˈmie/ → [(ˈ)goo ˈmie] = [goo^{4} mie^{3}] (Drubea; cf. (33))



4.6 CVˈV syllables: downstep displacement and double downstep

As we saw in §3.7 above, the downstep in CVˈV syllables has a tendency to be realized on the following syllable. As illustrated in (66) (repeated from (50) above), this downstep displacement is easily represented as spreading of the *l* feature onto the next syllable followed by delinking from its original host, as with /pwaˈa ʈe/ in (66)b. This is followed by postlexical *h*-epenthesis (pre-downstep raising) in (66)c.[37]

(66) /kãã pwaˈa ʈe a ʈeˈẽ/ → [kãã ˈpwaa ˈʈe a ˈʈeˈẽ] (Drubea; cf. (50))

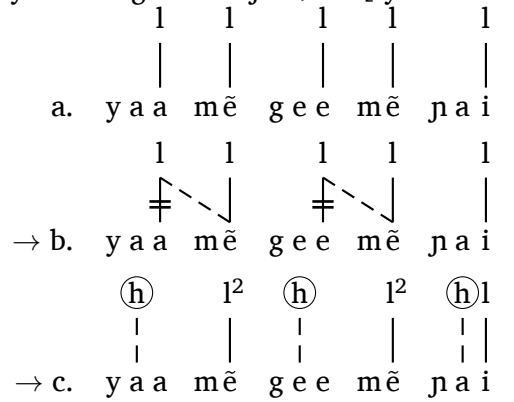


When the following syllable is already underlyingly downstepped, downstep displacement creates a double downstep, as seen in §3.7. This is illustrated in (67) (repeated from (52) above). The *l* feature on both /yaˈa/ and /geˈe/ is shifted to the next syllable in (67)b, with whose underlying *l* feature it combines in (67)d, yielding a double downstep (represented as l^2).

[36] I have not seen any case of pre-downstep raising affecting an utterance-initial downstepped RBU. If this were to occur, the *lh* contour created by *h*-epenthesis, as seen in (18) and (63), would preserve the phonetic distinction between registerless and downstepped RBUs in this position.

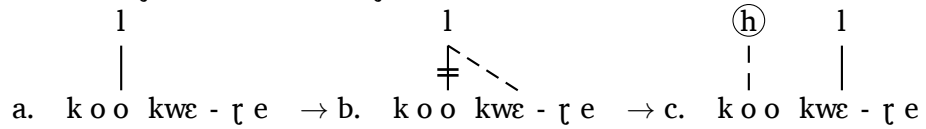
[37] Note that /ʈe.ˈẽ/ is a disyllabic stem.

(67) /yaˡa ˡmẽ geˡe ˡmẽ ɲaˡi/ → [ˆyaa ˡˡmẽ ˆgee ˡˡmẽ ˆɲaˡi] (Numèè; cf. (52))

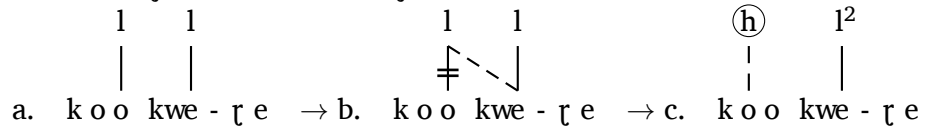


The contrast between registerless and downstepped syllables is thus maintained under downstep displacement, as seen in the near-minimal pair in (68) and (69), repeated from (53)a and b respectively. As seen, the downstep of the initial syllable /koˡo/ shifts to the following syllable in both cases (step b in both examples), and the underlying registerless vs. downstepped contrast on the following syllable (/kwɛ/ vs. /ˡkwe/) is maintained, only it is this time realized as a simple vs. double downstep contrast ([ˡkwɛ] vs. [ˡˡkwe], step c).[38]

(68) /koˡo kwɛ-ɽe/ → [ˆkoo ˡkwɛ-ɽe] (Drubea; cf. (53)a)



(69) /koˡo ˡkwe-ɽe/ → [ˆkoo ˡˡkwe-ɽe] (Drubea; cf. (53)b)



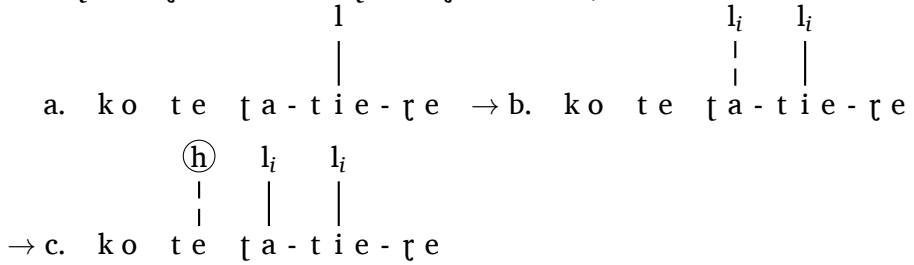
4.7 Morphological register copying

The only morphologically conditioned register operation in Drubea and Numèè is seen with verbal classifier prefixes, as discussed in §3.9. This can now be represented as copying of the

[38] Since downstep displacement appears to be by far the most frequent realization of CVˡV monosyllables, one may wonder whether they might be better analyzed as registerless syllables followed by an underlying floating *l* feature: /CVV^{①}/. The floating downstep would be preferably realized on the following syllable, but may exceptionally be realized on its host – a case of "self-docking" in Rolle's (2018: 80–81) terms – in which case it associates only with the very last mora of the syllable. This analysis is mostly equivalent to the one I propose, with one exception: it fails to account for the absence of monomorphemic monomoraic syllables followed by a floating *l*, i.e., *CV^{①}. This absence can easily be explained in the underlying /CVˡV/ analysis I propose, in at least two ways: either the combination of a CV syllable with the *Øl* pattern is impossible for lack of enough morae to realize the pattern, or this combination is neutralized with CVˡV by lengthening of the vowel to fit the pattern (/CV + *Øl*/ → CVˡV). Full neutralization is not expected in the floating *l* analysis, where one should still see a contrast between /CV^{①}/ and /CVV^{①}/ when the downstep is realized on the following syllable, e.g., /CV^{①} # CV.../ → [CV # ˡCV...] vs. /CVV^{①} # CV.../ → [CVV # ˡCV...]. Such a contrast is not attested, which militates in favor of the underlying /CVˡV/ analysis.

l feature carried by the initial syllable of the verb stem to which the prefix is attached. This is illustrated in (70) (repeated from (57)). Register feature copying onto the prefix is shown in (70)b, where the original feature and its copy are coindexed. Postlexical *h*-epenthesis then applies in (70)c.

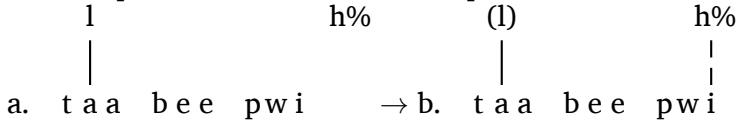
(70) /ko te ʈa-ˈtie-ɽe/ → [ko ˈte ˈʈa-ˈtie-ɽe] (Drubea; cf. (57))



4.8 Utterance-final prosody

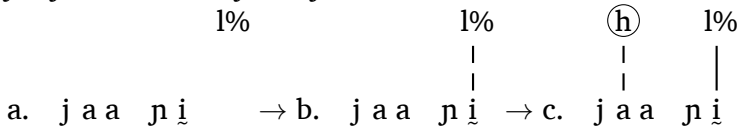
I analyze utterance-final raising in Drubea and lowering in Numèè, described in §§ 3.3 and 3.4, as the realization of boundary register features *h*% and *l*% respectively. The realization of these boundary register features operates under different conditions in both languages. In Drubea, the boundary *h*% (optionally) docks on any utterance-final registerless syllable, and may spread leftward onto any preceding registerless syllable. This is illustrated in (71) (repeated from (20)).

(71) /ˈtaa bee pwi + ˈ%/ →[(ˈ)taa bee ˈ%pwi] (Drubea; cf. (20))

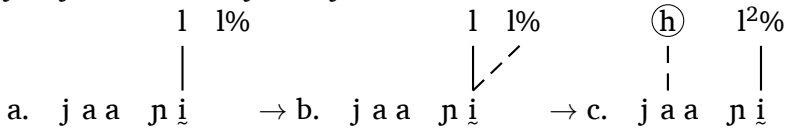


In Numèè, the boundary *l*% is realized only on utterance-final monomoraic syllables, both registerless and downstepped (creating a double downstep in the latter case), if they are preceded by a registerless syllable, i.e. one that can undergo pre-downstep raising, as seen in §3.4. This is illustrated in (72) and (73) below, repeated from (24) and (25) respectively.

(72) /jaa ɲĩ + ˌ%/ → [ˈjaa ˌ%ɲĩ] (Numèè; cf. (24))



(73) /jaa ˈɲĩ + ˌ%/ → [ˈjaa ˌˌ%ɲĩ] (Numèè; cf. (25))



5 Tonal alternative

In this section, I show that the register analysis proposed in §4 fares better than one in which downstep is analyzed as the result of tonal interaction alone. In laying out this alternative, I ignore utterance-final prosodic effects and CV$^{\downarrow}$V syllables, which would be straightforwardly accounted for and are not crucial for the comparison.

Rivierre's (1973) original analysis of the lexical prosodic system of Drubea and Numèè is couched in purely tonal terms: the main contrast is between marked L-toned syllables (my downstepped syllables) and unmarked H-toned syllables (my registerless syllables). However, as we saw at the end of §3.1, his description of the realization of L-toned and H-toned syllables corresponds exactly to the register analysis I propose in this paper. The L tone is indeed said to be realized as a downward register contrast with the preceding syllable, i.e. a downstep, while H-toned syllables are clearly described as unspecified for lexical prosody, and subject to contextual realization (Rivierre, 1973, p. 153). The register analysis I propose here thus builds on Rivierre's insightful description and understanding, and translates it into a more adequate framework (autosegmental phonology, downstep, register features) in order to better highlight the properties of this very unusual system and bring it to bear on contemporary phonological theory and representations.

What I would like to demonstrate here is that an analysis in purely tonal terms, i.e. Rivierre's L vs. Ø∼H analysis taken literally (and not in the way that Rivierre intended), would not be satisfactory.

Utterances consisting of an alternating sequence of what I analyze as registerless and downstepped syllables, such as in example (15) and Figure 8, are realized as a succession of peaks and valleys with a marked lowering of the pitch ceiling after every valley. This is suggestive of a much simpler analysis in terms of a succession of H and L tones, with automatic downstep of every H by the preceding L: HLHLHL $\rightarrow$ HL$^{\downarrow}$HL$^{\downarrow}$HL = [H^{5}L^{3}H^{4}L^{2}H^{3}L^1]. That is, downstepped RBUs could alternatively be analyzed as underlyingly L-toned tone-bearing units (TBU), and registerless syllables as toneless TBUs, i.e., Ø, with default H insertion on Ø syllables to implement the underlying L vs. Ø contrast.

This analysis does not, however, straightforwardly account for the behavior of these two types of RBUs/TBUs. First, it does not naturally explain why a L-toned TBU is systematically realized lower than a preceding L-toned TBU. This behavior is not expected of a L tone – unless one posits a postlexical Obligatory Contour Principle (OCP) constraint violated by any two successive L tones on the tonal tier at the utterance level, irrespective of morpheme and/or word boundaries, and solved by inserting a downstep between every pair of adjacent L tones: LLLL $\rightarrow$ L$^{\downarrow}$L$^{\downarrow}$L$^{\downarrow}$L. This is a rather unnatural and unexpected OCP constraint, which is absolutely unnecessary in the register analysis, where the downstep is not derived, but has underlying status. This OCP constraint also adds complexity to the representational apparatus, which now includes three units: underlying L, epenthetic H, and epenthetic downstep. This also complexifies the analysis by recognizing two types of pitch drops: the purely tonal transition from H to L (from an underlying /ØL/ sequence) and the register lowering created by downstep insertion in [L$^{\downarrow}$L] sequences (from underlying /LL/), with no independent evidence that these are indeed two different phenomena.

The tonal analysis also fails to adequately account for the behavior of Ø syllables. The default same-pitch realization of Ø syllables can easily be analyzed as the optional spreading

of the H or L tone of the preceding syllable. However, this adds complexity to the analysis as well, since an underlying /ØL/ sequence, which is always realized with a contrastive pitch drop from Ø to L, is now analyzed differently depending on the immediately preceding tone: as a [HL] sequence in /(Ø)ØL/ → [(H)HL] and as a [L$^{↓}$L] sequence in /LØL/ → [LL$^{↓}$L] (where underlining represents tone spreading).

Pre-downstep raising, in turn, would have to be analyzed as involving two separate phenomena with a similar motivation and effect: raising of H immediately before L (e.g. /ØØØL/ → [HH$^{↑}$HL]), and raising of L immediately before $^{↓}$L (e.g. /LØØL/ → [LL$^{↑}$L$^{↓}$L]), both postlexical. Raising of H immediately before L is typologically very frequent (cf. Hyman and Schuh, 1974; Connell, 2011, pp. 12–13, and references therein). Raising of L before $^{↓}$L is more unexpected, but its cross-linguistic rarity is mostly due to the overall rarity of languages with downstepped L tones.[39] Interestingly, it is attested in two other tonal languages of New Caledonia, both of which have a downstepped low tone: Paicî (Lionnet, 2022b, pp. 14–15) and Cèmuhî (Lionnet, In preparation; Rivierre, 1980, p. 57).

To summarize, the tonal analysis suffers from both a duplication and a conspiracy problem. Both the downward pitch contrast characterizing the so-called L-toned syllables and the optional pitch raising reinforcing this contrast are unnecessarily analyzed as having two different sources, one of which – the generalized OCP-L constraint– having a strong arbitrary flavor. The register analysis, on the other hand, straightforwardly accounts for both with only one source each: underlying downstep (*l* feature) and optional epenthetic upstep (*h* feature) respectively. Furthermore, the tonal analysis is not representationally economic, as it cannot eschew the need to refer to downstep (and possibly upstep, depending on how pre-H and pre-L raising are analyzed). The only difference with the register analysis is that downstep (and upstep) are seen as derived rather than primary/underlying. But in order to maintain that downstep (and upstep) can only be obtained through tonal interaction, the tonal analysis posits tones (underlying L and epenthetic H) for which there is actually no independent evidence. This tonal analysis –similar to Rivierre's original analysis only in that it uses the same representations, otherwise quite different as we saw– is thus unnecessarily convoluted, and seems to serve only one purpose: avoiding positing an underlying downstep and recognizing the possibility for register features to be independent of tone and have primary/underlying status. Economy and explanatory adequacy both favor the register analysis – an analysis which is all the more likely that underlying downsteps seem to be an areal feature of New Caledonia, where at least three other languages can arguably be analyzed as having an underlying downstep: Paicî (Lionnet, 2022b), Xârâcùù (Lionnet, 2022b, pp. 41–42; cf. Rivierre, 1978), and Cèmuhî (Lionnet, In preparation; cf. Rivierre, 1980, p. 57).

6 Discussion

6.1 Defining downstep

The lexical prosodic system of Drubea and Numèè, with its underlying downstep and no tones, is typologically very unusual. Not only is this not a canonical case of downstep triggered by a L tone and affecting a following H tone, it is even more exceptional in not

[39] Cf. footnote 2

being related to tone at all. Many of the typical properties of downstep are, however, related to the effect it has on (mostly H) tones. How can the contrastive pitch lowering pattern of Drubea and Numèè then be described and analyzed as a form of downstep? Looking at the typical properties of downstep listed by Leben (2018: 2; building on Hyman, 1979 and Rialland, 1997) and repeated in (74), (75), and (76) below, one can see that most are in fact found in Drubea and Numèè – provided some are slightly modified.

Two properties that are not found in the downstep pattern of Drubea and Numèè are the following:

(74) Leben (2018, p. 2):

a. 'Downstep preserves an affected tone's phonological identity', i.e., 'a downstepped High tone remains a High tone.'

b. Downstep is phonologically distinct from a lower underlying tone, i.e., a downstepped H tone is not a M tone.[40]

These clearly do not apply to the Drubea and Numèè prosodic system, for lack of tones. If one accepts that downstep may exist in otherwise non-tonal systems, which I hope to have demonstrated in this paper, then these properties cannot be seen as crucial definitional criteria of downstep. Instead, they are the consequences of the core properties of downstep, listed in (75) below, found in phonological systems that also have tonal primitives.

The following three core properties of downstep, by contrast, are found in Drubea and Numèè, provided they are slightly rephrased:

(75) Leben (2018, p. 2):

a. 'Downstep affects not a single tone but the entire tonal sequence in its domain.'

b. 'Downstep's effect is to change the register for what follows.'

c. 'The number of instances of downstep that can occur—in succession or in combination with other tones in an utterance—is in principle unlimited.'

Property (75a) can be said to be at work in Drubea and Numèè, if one considers that what is affected by downstep is not the '*tonal* sequence', but more generally the prosodic material within its domain. In the case of Drubea and Numèè, registerless RBUs are by default realized at the same pitch height as the preceding downstepped RBU, i.e. within a new, lowered register compared with the register of the RBU preceding the downstep. In any case, downstep in Drubea and Numèè does indeed 'change the register for what follows' (75b).

Property (75c), i.e., the utterance-level cumulativity of downstep, is clearly present in Drubea and Numèè, where an utterance may be composed of a string of individual morphemes each bearing one downstepped RBU. Such an utterance is realized with as many pitch drops as there are downsteps, as can be seen in the examples in (11) and (12)/Figure 7 above.

The last three properties mentioned by Leben, listed in (76), are of a different nature: they are typological tendencies rather than strict definitional criteria. These should thus not be given the same importance in the definition of downstep.

[40] Rephrased from 'downstep is phonologically distinct from a Mid tone', to accommodate for languages with downstepped M and/or L.

(76) Leben (2018, p. 2):

a. Utterance-initially, there is no phonetic contrast between downstep and its absence.[41]

b. 'Characteristically, only High tones are contrastively downstepped, though a few cases of downstepped Low and Mid are found.'

c. 'Downstep functions contrastively in a variety of ways – phonological, syntactic, morphosyntactic, and lexical.'

Property (76a) is known to have a few exceptions[42], although it holds for a majority of languages with downstep. We saw in §3.5 that Drubea and Numèè do conform to this typological expectation: there is indeed no phonetic difference between a downstepped and a registerless RBU in utterance-initial position (unless the following RBU is downstepped). This fact alone confirms the downstep analysis and disproves the tonal alternative entertained in the preceding section, since it is not expected for an underlying tonal contrast, e.g., H vs. L, not to be realized utterance-initially.

Property (76b) also has exceptions: 15 languages to date have been described as having a downstepped L tone, and eight languages a downstepped M tone (cf. footnotes 2 and 3). One of the goals of the present paper is to show that, additionally to downstepped M and downstepped L, non-canonical cases of downstep include underlying downstep, i.e. downstep independent of tone.

Finally, regarding the loosely defined property in (76c), one can only say that Drubea and Numèè are languages in which downstep is used exclusively for lexical contrast.

We can conclude from what precedes that the contrastive pitch drop that is the basis of the lexical prosodic system of Drubea and Numèè does indeed meet what I consider to be the core definitional criteria of downstep, i.e. the three properties in (75), and also conforms to at least some of the crosslinguistic expectations of downstep, such as its non-realization in utterance-initial position.

6.2 Tone, register, and the typology of lexical prosodic systems

Given that register is not tone *stricto sensu*, and given that the register feature *l* in Drubea and Numèè is culminative (no more than one per stem), which is a property frequently associated with "accent", one may hypothesize that Drubea and Numèè might be better described as accentual rather than tonal languages. I show in this section that this is not the case – although the typologically unusual lexical prosodic system of Drubea and Numèè requires a refinement of the definition of what counts as a 'tonal' language and an enrichment of the typology lexical prosodic systems.

Hyman (2006) places all 'word-prosodic' systems on a continuum between two prototypical systems: TONE vs. STRESS ACCENT (which I simplify to 'accent' here). 'Accent' is defined as having 'two inviolable properties: (i) OBLIGATORINESS (every word has at least

[41] Rephrased from: 'Utterance-initially, there is no phonetic contrast between High tone and downstepped High tone', to accommodate for languages with downstepped M and/or L.

[42] E.g., Bamileke Dschang (Hyman, 1979, p. 12; Pulleyblank, 1986, pp. 39–42), Ikaan (Salffner, 2009, pp. 93, 96–97, 289–296), Kipare, (Odden, 1986, pp. 263–264), Paicî (Lionnet, 2022b)

one stress accent); (ii) SYLLABLE-DEPENDENCY (the stress-bearing unit is necessarily the syllable).'[43] Two additional properties are characteristic of accent, although they do not suffice to define it, as they are also found in some *bona fide* tone systems (Hyman, 2006, 2010, cf.). These are CULMINATIVITY – there cannot be more than one main accent per word – and DEMARCATIVITY – accent occurs in a predictable position with reference to some morpheme edge (cf. van der Hulst, 1999, 2002, 2006; Hyman, 2006; van Zanten and Goedemans, 2007; Downing, 2010; a.o.).

Only one of these properties is found in the downstep pattern of Drubea and Numèè: culminativity.[44] Indeed, there cannot be more than one downstep per stem – although a morphological word may have more than one, as in verbs with a verbal classifier prefix (when the initial syllable of the verb is downstepped, cf. (56)b and (57)), or compounds consisting of more than one stem containing a downstepped RBU (e.g. /ˈʊʊ + ũ + poo ˈka/ 'blanket', lit. mat + hair + animal). However, this is not a sufficient definitional criterion of accent, as we saw. None of Hyman's (2006) two inviolable criteria is met: downstep is not obligatory in Drubea and Numèè, where many stems (and words) contain only registerless RBUs, i.e. have no indication of register. Downstep is also not syllable-dependent: the RBU is the mora (although the syllable plays an important role in determining which mora in a CVV syllable is the RBU). Finally, downstep in Drubea and Numèè is not demarcative, since it is found on both the first and second syllables of disyllabic stems, i.e., its position within a stem does not seem to be defined or constrained by a reference to either edge of the stem.

At the other end of the word-prosodic continuum are TONE systems, which Hyman (2006) defines as systems 'in which an indication of pitch enters into the lexical realization of at least some morphemes.' Crucial to this definition are the fact that the domain of tone is the morpheme, and that tones and tonal operations belong to lexical (as opposed to postlexical) phonology. Given this definition, Drubea and Numèè can be classified as *bona fide* tonal languages: their lexical prosodic system is entirely based on a lexical pitch-based contrast which has the morpheme as its domain– specifically the stem (and to a certain extent the verbal classifier prefixes, which get their register specification from a lexical tonal operation). The only difference with other tone languages is that the pitch contrast is entirely syntagmatically defined in Drubea and Numèè, contrary to all other tonal languages, where it is defined paradigmatically.

One must thus acknowledge that tone systems come in two types: TONE-based systems in which tonal contrasts are defined paradigmatically, e.g., H vs. L, with H having a higher pitch target than L in the same context,[45] and REGISTER-based systems in which the tonal contrast is syntagmatically defined.[46] The separate existence of these two types, as revealed by Drubea and Numèè, justifies that register features and tones be treated as independent

[43]It is likely that this criterion is too strict, and that languages where the accent-bearing unit is the mora are also attested, e.g. Xârâcùù (Rivierre, 1978; Lionnet, 2022b, pp. 41–42).

[44]Interestingly, culminativity of downstep is a property shared by two other Kanak languages with underlying downstep: Paicî (Lionnet, 2022b), a tonal language, and Xârâcùù, where downstep is accentual (Rivierre, 1978; Lionnet, 2022b, pp. 41–42). It is not the case of Baga Pukur (Rochant, 2023, p. 193), however, which seems to indicate that it might be a feature typical of New Caledonia rather than a property of underlying downsteps.

[45]It is crucial to take context into account given the relative character of the realization of tonal contrasts: a H tone can have lower pitch in some contexts, e.g. utterance-finally, than a L tone in another context, e.g. utterance-initially; but in each of these two contexts, the H tone is realized higher than the L tone.

[46]Languages with both tone and downstep and/or upstep – e.g. the canonical case of downstep emerging from the syntagmatic lowering effect of a L tone on a following H tone – have elements of both types.

phonological objects of different nature, as in the register analysis proposed in §4.

7 Conclusion

In this paper, I have proposed a register-based reanalysis of the lexical prosodic system of Drubea and Numèè, building on Rivierre's (1973) initial description and analysis. This reanalysis brings to light a typologically unique tonal system entirely based on register features, i.e., without tones. The major contrast is indeed between downstepped and prosodically unspecified units. The behavior of these units justifies an analysis of downstep as an underlying register feature, which is the only underlying phonological primitive needed to account for the entire lexical prosodic system. I have shown that the register analysis fares better than both an analysis where tone is primary and register features derived, and one in which register is primary and default tones are inserted for full tonal specification. The possibility for register features to exist in the absence of tone, including in underlying representations, is a strong argument in favor of dedicated representations for register, and a clear separation of register features and tone in tonal representations.

Abbreviations and glosses

Abbreviations in this paper follow the Leipzig Glossing Rules, with the following exceptions:

ACT	Active
ASSERT	Assertive
COLL	Collective
DESCR	Descriptive
EPIST	Epistemic
PROS	Prospective
RBU	Register bearing unit
STAT	Stative
TBU	Tone bearing unit
TRN	Tonal root note

Acknowledgments

I would like to thank the Theory of Tone Project (THoT) inaugural workshop audience, as well as three anonymous referees and the editors for constructive feedback and comments. Many thanks also to Princeton students Cian Healy, Aidan Iacobucci, and Sebastian Williams for helping me with the digitization of Shintani and Païta's (1990b) Drubea-French dictionary into a searchable database.

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