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

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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 prosodic lexical system has both theoretical and typological consequences: (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/ = [HLꜜH] = [˥ ˩ ˧], and “non-automatic” downstep when the L tone trigger is not heard, e.g., when it is deleted or set afloat, as in /HLH/ = [HꜜH] = [˥ ˧] (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/ = [HꜜHHHꜜHHH] [˥ ˦ ˦ ˦ ˧ ˧ ˧]. In this paper, 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 ꜜL and ꜜM tones are indeed very rare: I know of only fifteen cases of the former

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

in the literature[2] and only eight languages are described as having a downstepped ꜜM tone 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/ = [HꜜH]) in Shambala (Odden, 1982) or Supyire (Carlson, 1983). However, 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, represented as "ρ") and registerless RBUs, i.e. a /ꜜ/ 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, e.g. $/\rho{}^{ꜜ}\rho/ \rightarrow [\rho{}^{ꜜ}\rho] \sim [{}^{ꜛ}\rho{}^{ꜜ}\rho]$, which gives rise to alternations of higher and a 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 types of systems found on the continuum from canonical tone to canonical accent (Hyman, 2006). 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 con-

[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), 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).

text), 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 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 two potential alternatives 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 [ɳaa ꜜᶯɖuᵐbea] (glottocode: dumb1241) and Numèè [ɳaa ꜜɳumɛɛ] (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 Kwényî 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, have virtually the same tone system, which is the focus of this paper.

Drubea is spoken by ca. 1,000 people[6] in two separate regions: the village of Unya, on the west coast of the island, and several villages in the Paita region on the east coast. There are three dialectal variants: [ɳaa vũũnya] in Unya on the East Coast, as well as two dialects in Paita on the West Coast – [ɳaa pwɛco] (lit. 'language of the coast people') on the coast, and [ɳaa 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] It used to be spoken on Ouen Island, where the Tayo

[4] /ɳaa/ means 'language'. The two language names are historically one and the same: proto-Drubea-Numee *ɳumea changed into *ɳumɛɛ* in Numèè through vowel coalescence, and into *ᶯɖubea* 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. /ɳaa xeɽe/ 'language of Goro', /ɳaa ꜜʈuauɽu/ '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] The reader interested in the Kwényï prosodic system is referred to Soon (2023).

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

[7] Numèè and Kwényï are not distinguished in census data. The 2019 census gives a global figure of 1,618 for

Creole (and to a lesser extent Kwényï) has now replaced it. 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 (/ɳaa vũũnya/), the variety of Numèè spoken in Goro (/ɳaa xeɽe/), and Kwényï.[9]

Additional work on Drubea includes Shintani and Païta's grammar (1990) and dictionary (1990), 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 (1995). 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 (1990a) and Shintani and Païta (1990b), and texts collected by Shintani and published in Shintani (2019) and ALK (2023). 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 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.

Glosses for grammatical words follow Shintani and Païta's (1990) grammatical analysis and terminology, including in examples borrowed from Rivierre (1973), whose glosses of

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 in Drubea and Numèè and very brief morphosyntactic sketch 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 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 recordings.

function lacks precision. Translations to English are my own.

All transcriptions borrowed from original sources are converted to standard IPA notation. This includes the notation of pitch realizations: I converted Shintani and Paita's schematic notation of pitch 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 and my transcriptions are given in Table 1.

Table 1: Adaptation of Rivierre's (1973) scale for pitch notation to the standard IPA scale

	Rivierre 1973	My transcription
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

2.3 Phonological sketch

Drubea and Numèè (as well as Kwenyï) have virtually the same consonant inventory, presented in (1). The only difference is the presence of /gʷ/ in Drubea, which is absent in Numèè where it systematically corresponds to /ŋʷ/, unattested in Drubea. 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 /yy øø ø̃ø̃/, absent from Drubea, as shown in (2).

(1) Drubea-Numèè-Kwênyï consonants (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 [ᵐb]	bʷ [ᵐbʷ]	d [ⁿd]	ɖ [ⁿɖ]	j [ᶮɟ]	g [ᵑg]	gʷ [ᵑgʷ]*
Nasal	m	mʷ	n	ɳ	ɲ	ŋ	ŋʷ**
Fricative	v					x [ɣ]	
Flap				ɽ			
Glides					y [j]		w

(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	yy*	uu
	e		ʊ	ɪɪ		ʊʊ
	ɛ		o	ee	øø*	oo
		a			aa	
Nasal	ḭ		ṵ	ḭḭ		ṵṵ
	ḛ		o̰	ḛḛ	ø̰ø̰*	o̰o̰
		a̰			a̰a̰	

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) (I represent long vowels as VV sequences, for reasons that will become clear later; this is in contrast with heterosyllabic vocalic sequences, always represented as V.V). Rivierre (1973) systematically analyzes sequences of like vowels as long vowels, whereas sequences of unlike vowels are always analyzed as heterosyllabic, never as diphthongs –that is, /kee/ [keː] 'husband' is monosyllabic, whereas /kie/ [ki.e] 'axe' is disyllabic. 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.ꜜya/	'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).

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

3 The lexical prosodic system of Drubea and Numèè

As shown by Rivierre (1973, pp. 124–153), the tone systems of Drubea and Numèè are virtually identical. The only significant difference is the realization of utterance-final toneless syllables, 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 CVꜜV syllables (§3.7). The issue of stems of more than two syllables is briefly addressed in §3.6, and tonal effects in morphophonology in §3.9.

3.1 Downstepped vs. registerless syllables

Monosyllables 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 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 of syllables 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. 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)	/ĩ/	'extremity, tip'	/ꜜĩ/	'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 be to ꜜɳe co/
[... ꜜmwã ᵐbe to ꜜɳe ꜛco]
PFV die LOC in water
'[his son] died in the water.' (Drubea; Shintani, 2019, p. 178, L24)

[13] There is in fact a third, minor type, as we will see in §3.7.
[14] The pitch rise seen on the final syllable [ꜛco] in (5) will be discussed in §3.2.

(6) /dɪɪ ꜜbe/
[$^{\text{n}}$dɪɪ ꜜ$^{\text{m}}$be]
small niaouli
‘small niaouli tree.’ (Drubea; Shintani, 2019, p. 353, L49)

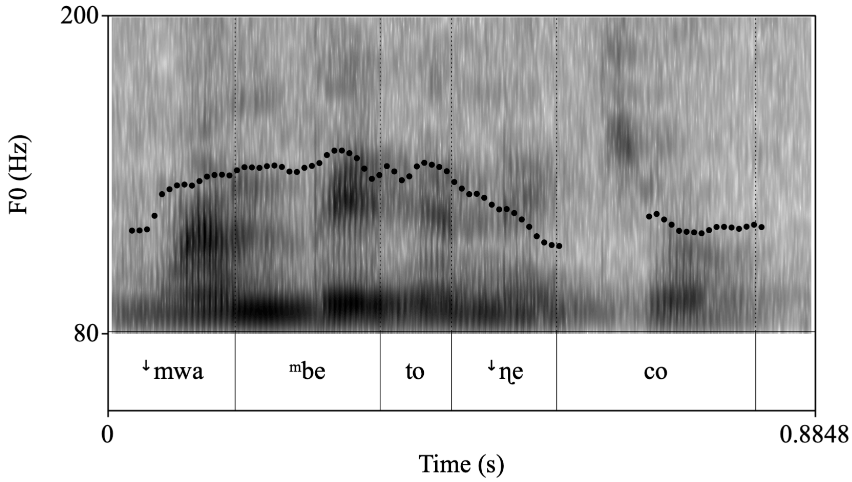


Figure 1: /... ꜜmwa be to ꜜɳe co/ ‘[his son] died in the water.’ (Drubea; Shintani, 2019, p. 178, L24)

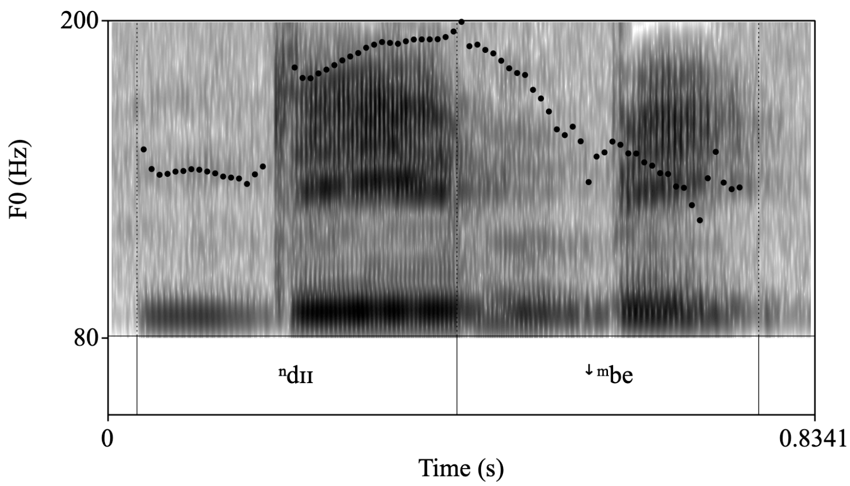


Figure 2: /dɪɪ ꜜbe/ ‘small niaouli.’ (Drubea; Shintani, 2019, p. 353, L49)

This same- vs. lower-pitch realization is seen irrespective of the prosodic type of the preceding stem. Examples (7) and (8) illustrate the descriptive marker /te/[15] following the

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

same-pitch noun /aboɽu/ ‘person’ in (7), and following the lower-pitch perfective marker /ꜜmwa/ in (8). Figures 3 and 4 show that /te/ is realized at the same pitch as the immediately preceding morpheme in both cases, irrespective of whether it is a same-pitch or lower-pitch morpheme. 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 /aboɽu/. The pitch rise seen in [a^{ꜛm}boɽu] 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 same-pitch /aboɽu/ to the following same-pitch item /te/.[16]

(7) /ꜜtaa aboɽu <u>te</u> || te wɪɪ-ɽe ɲi/
[(ꜜ)taa a^{ꜛm}boɽu te || te wɪɪ-ɽe ɲi]
one person DESCR DESCR squeeze-ACT coconut
‘someone is... is squeezing coconut pulp.’ (Drubea; Shintani, 2019, p. 172, L23)

(8) /ko ꜜmwa <u>te</u> ŋa-ɽe... /
[ko ꜜmwã te ŋa-ɽe...]
I.SBJ PFV DESCR do-ACT
‘I work [my field].’ (Drubea; Shintani, 2019, p. 234, L32 [AT])

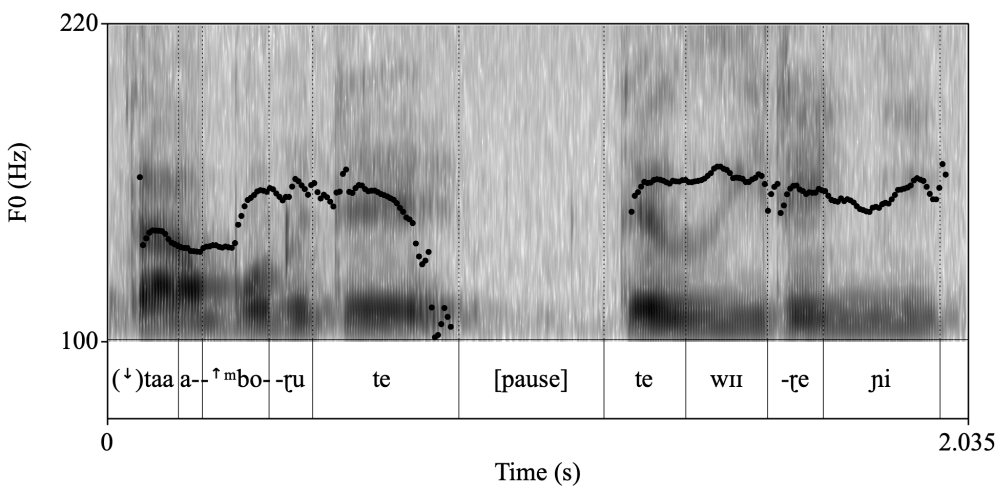


Figure 3: /ꜜtaa aboɽu te || te wɪɪ-ɽe ɲi/ ‘someone is squeezing coconut pulp.’ (Drubea; Shintani, 2019, p. 172, L23)

Examples (9) and (10) illustrate the lower-pitch word /ꜜɽã/ ‘fire(wood)’ after same-pitch /kaa/ ‘smoke (9) and lower-pitch /ꜜvi/ ‘take’. As can be seen in Figures 5 and 6 , /ꜜɽã/ is realized lower than the preceding morpheme in both cases.

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

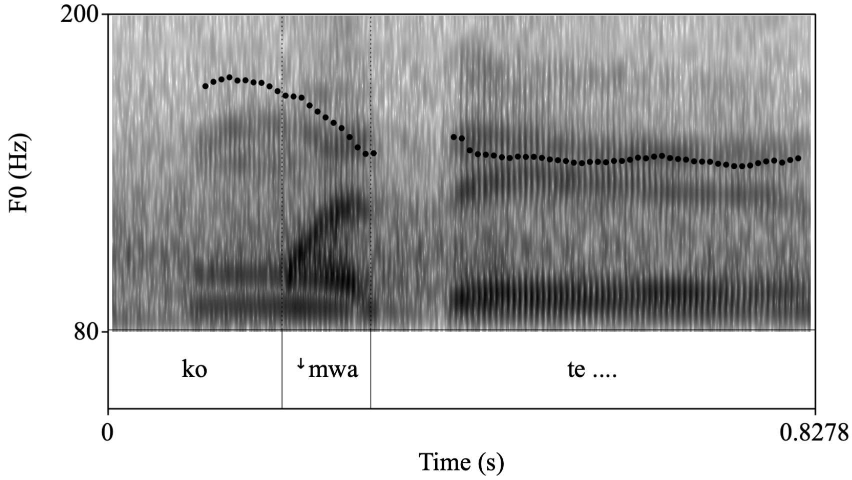


Figure 4: /ko ꜜmwa te ... / ‘I [work my field].’ (Drubea; Shintani, 2019, p. 234, L32)

(9) /kaa ꜜʈã/
[kaa ꜜʈã]
smoke fire
‘(fire) smoke’ (Drubea; Shintani, 2019, p. 173, L23)

(10) /kãꜜã ꜜvì ꜜʈã/
[kãꜜã ꜜvì ꜜʈã]
PROS take firewood
‘[then we] take firewood’ (Drubea; Shintani, 2019, p. 172, L23)

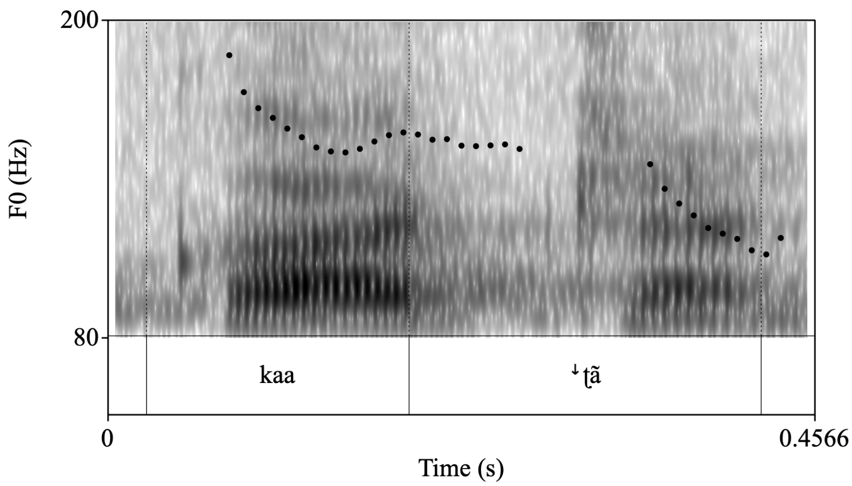


Figure 5: /kaa ꜜʈã/ ‘(fire) smoke’ (Drubea; Shintani, 2019, p. 173, L23)

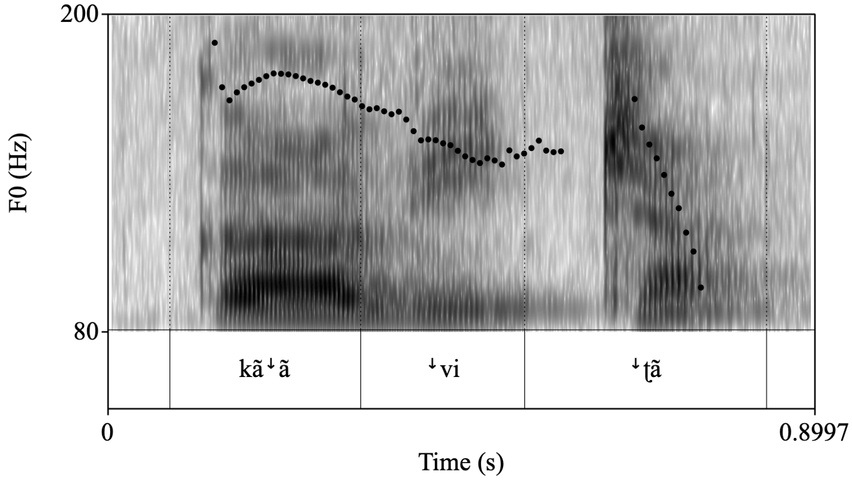


Figure 6: /kã꜌ã ꜌vì ꜌ʈã/ '[then we] take firewood' (Drubea; Shintani, 2019, p. 172, L23)

A sequence of same-pitch syllables is realized, unsurprisingly, with the same pitch throughout, as in the sequence [...ᵐboʈu te || te wɪɪ-ʈe ɲi] in (7)/Figure 5 above. A sequence of lower-pitch syllables 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 above. Two additional examples are given in (11) and (12).[17]

(11) /꜌ɳi ꜌mwa ꜌ɳii ꜌me/
[(꜌)ɳi ꜌mwa ꜌ɳii ꜌me]
[ɳi⁴ mwa³ ɳii² me¹]
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 monosyllables: /... ꜌mwa ꜌ɳii ꜌yoo ꜌ɳe.../, followed by the same-pitch syllable /xee/, itself followed by two lower-pitch syllables /... ꜌yɛ ꜌me/.

(12) /ko ꜌mwa ꜌ɳii ꜌yoo ꜌ɳe-xee-꜌yɛ ꜌me .../
[ko ꜌mwa ꜌ɳii ꜌yo-V ꜌ɳe-ꜛxee-꜌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. These are simply less difficult to produce, as the

[17] 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.

speaker reaches the lower end of her pitch range. The slight pitch rise seen on the same-pitch syllable [ꜛxee] will be explained in §3.2. Finally, the last two syllables, [ꜜyɛ ꜜme] are clearly realized with two successive pitch drops.

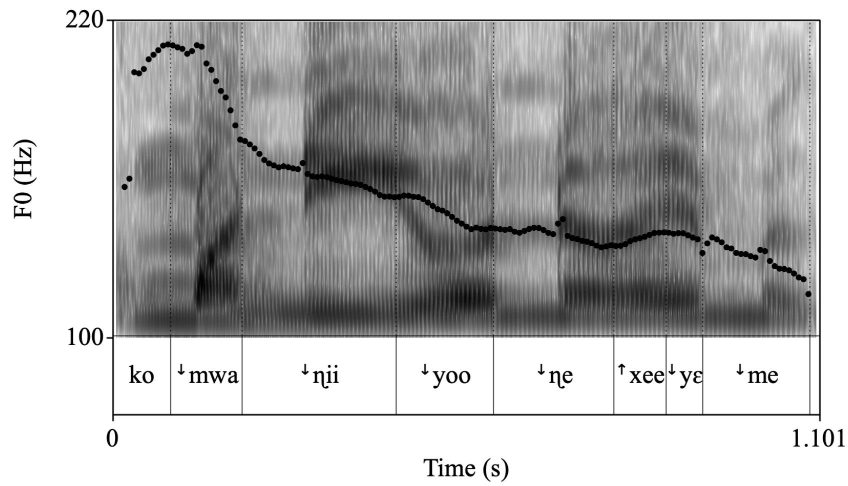


Figure 7: /ko ꜜmwa ꜜɳii ꜜyoo ꜜne-xee-ꜜyɛ ꜜme ...
/ 'I said just now that...' (Drubea; Shintani, 2019, p. 306, L43 [AT])

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 the immediately preceding syllable. 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 H-toned, as we will see in §5.1, 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).[18] In other words, the 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 indication of tone or register. 'Same-pitch' syllables will henceforth be referred to as 'registerless', and 'lower-pitch' syllables as 'downstepped', in accordance with the phonological transcription used so far, and the analysis fully developed in §4.

With only registerless an 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

[18]'Cet aspect contrastant du ton bas lui est plus essentiel que son registre.' (Rivierre, 1973, p. 153, my translation)

makes them noticeably different from very closely related Kwényï, as noted by Rivierre (1973, p. 154). One major exception to this principle is the raising frequently undergone by registerless syllables in two contexts: before a downstepped syllable, and utterance-finally, as discussed in the following two sections.

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	ꜜbeɽu-ɽe/
	a.	[ko	te	ꜜ^{m}beɽu-ɽe]
		[ko^{4}	te^{4}	^{m}be^{3}ɽu$^{2.5}$-ɽe$^{2.5}$]
	b.	[ko	ꜛte	ꜜ^{m}beɽu-ɽe]
		[ko^{4}	te^{5}	^{m}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, but only rarely downstepped syllables (cf. example (18) below and adjacent prose). 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; here and in further quotes, translation and added comments are mine).

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; author'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 trajectory of pitch throughout the utterance follows a downward course.

(14) /ko ꜜmwa cuꜜkwa õ ꜜkeɽee-ɽe/
[ꜛko ꜜmwa ꜛcuꜜkwa ꜛõ ꜜkeɽee-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) /ꜜɳe-ꜜbʊʊ-V ꜜya yaa ꜜme a-ꜜɽe/
[(ꜜ)ɳe-ꜜmbʊʊ-ꜛʊ ꜜya ꜛyaa ꜜme ꜛa-ꜜɽe]
COLL-face-2.SG.POSS then NEG EPIST STAT-good
'Your face does not look good.' (Drubea; Shintani, 2019, p. 130, L17)

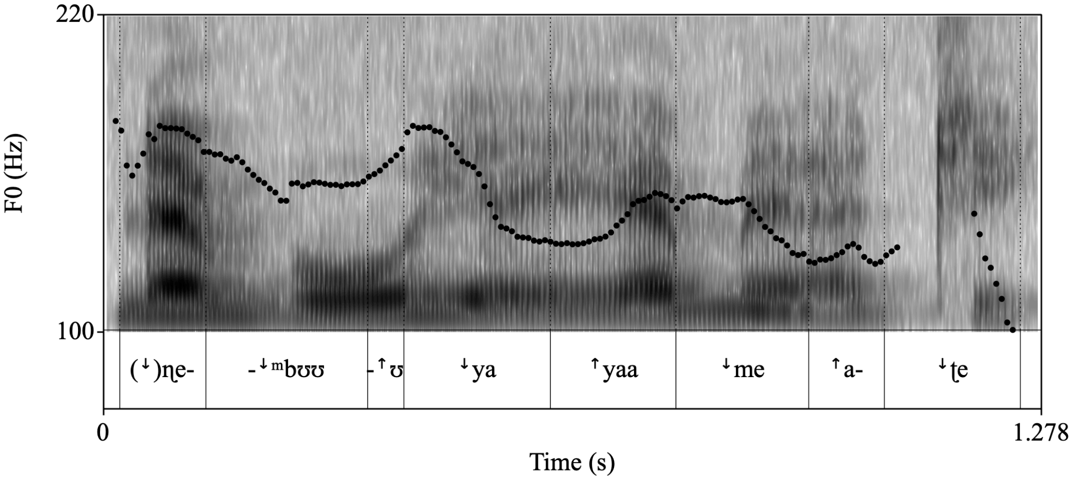


Figure 8: /ꜜɳe-ꜜbʊʊ-V ꜜya yaa ꜜme a-ꜜɽe/ 'Your face does not look good.' (Drubea; Shintani, 2019, p. 130, L17)

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 /maꜜa/[19] does not affect only the preceding registerless mora, but extends to the entire sequence of preceding registerless syllables, with the same raised pitch throughout.

(16) /ꜜɽã ꜜmwa ŋe-ɽe maꜜa vʊʊ ꜜɳia/
[(ꜜ)ɽã ꜜmwa ꜛŋe-ɽe maꜜa vʊʊ ꜜɳia]
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 [ꜜɳo],

[19] Such cases of syllable-internal downsteps will be discussed in §3.7.

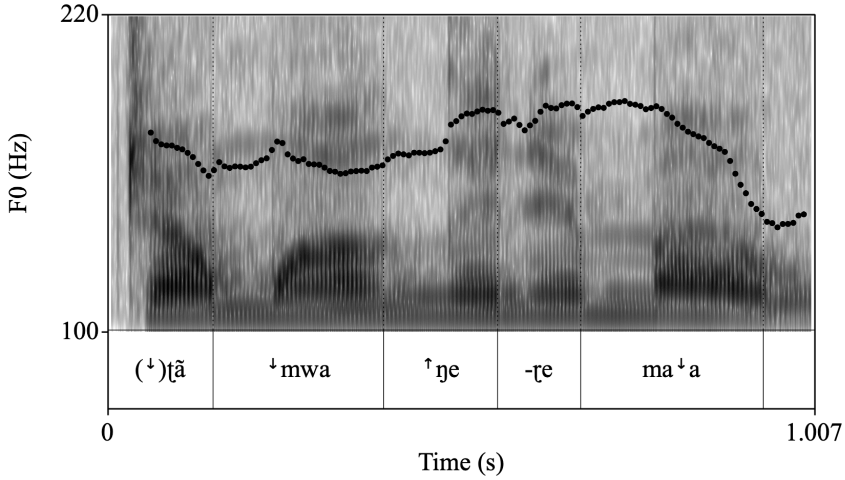


Figure 9: /ꜜʈã ꜜmwa ŋe-ʈe maꜜa... / ‘The fire burns these [stones].’ (Drubea; Shintani, 2019, p. 172, L23)

and rises gradually until it reaches its peak on the assertive marker [pa], immediately before the downstepped syllable ꜜtũã] ‘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 [↗].

(17) /ꜜɳopwe ki pa ꜜtũã-ʈe pa a-ꜜʈre/
[(ꜜ)ɳo↗pwe ↗ki ꜛpa ꜜtũã-ʈe pa a-ꜜʈre]
and 2.SG.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)

Finally, 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).

(18) /ꜜɳḛ ꜜmwa̰ ꜜvḛ/
[(ꜜ)ɳḛ ꜜmwa̰͡ꜛa̰ ꜜvḛ]
[ɳḛ^{4} mwa̰$^{3.5–4}$ vḛ^{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).

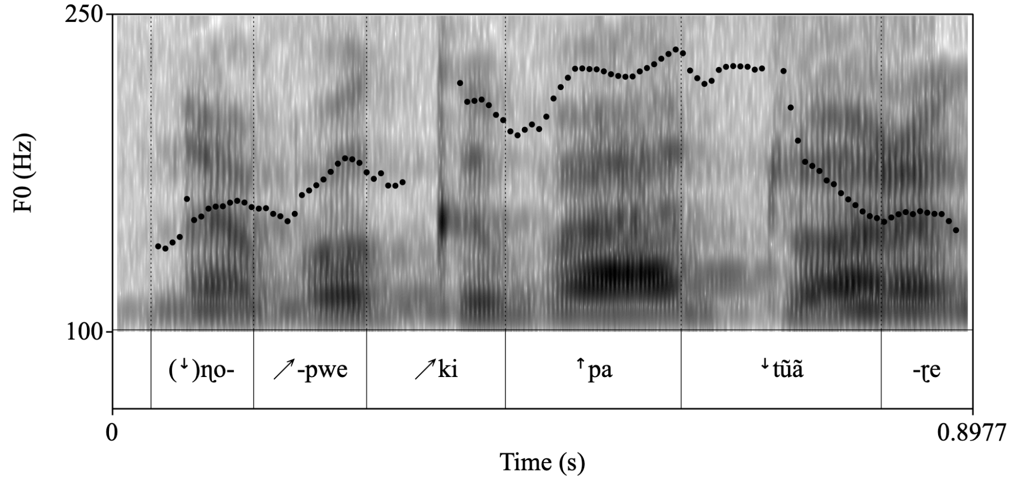


Figure 10: /ꜜɳopwe ki pa ꜜtũã-ɽe…/ ‘And you see [that it is good]…’ (Drubea; Shintani, 2019, p. 41, L04)

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 lower-pitch 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. Otptional 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)

/ꜜtaa	dɪɪ	bee/
[(ꜜ)taa	^{n}dɪɪ	^{m}bee]
[taa^{4}	^{n}dɪɪ^{4}	^{m}bee^{4}]
one	small	fish

‘one small fish’ (Drubea; Rivierre, 1973, p. 126)

(20)

/ꜜtaa	bee	pwi + $^{ꜛ\%}$/
[(ꜜ)taa	^{m}bee	$^{ꜛ\%}$pwi]
[taa^{4}	^{m}bee^{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 cases, 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 (1990, 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 [uꜜi] which immediately precedes it (see also example (7) above).[20]

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

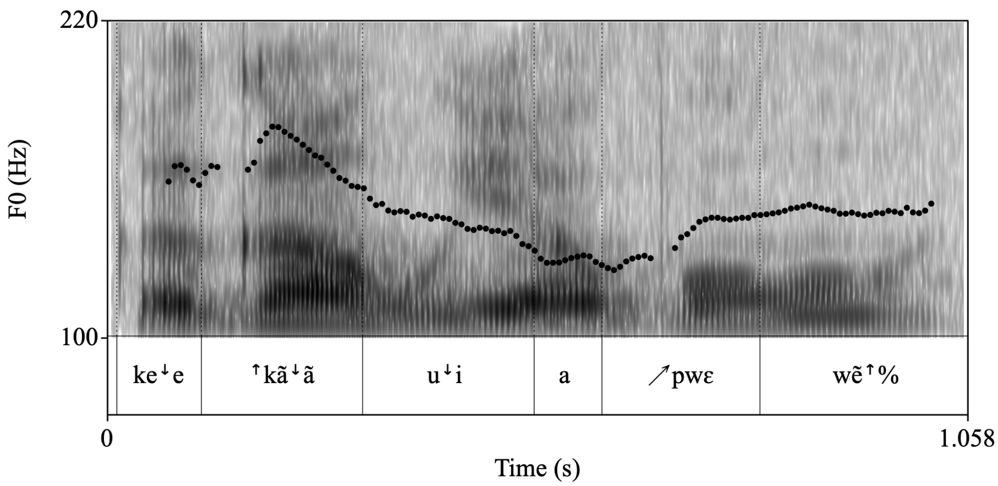


Figure 11: /keꜜe kãꜜã uꜜi-a -wɛ wẽ + ꜛ%/ 'We will do everything that way.' (Drubea; Shintani, 2019, p. 172, L23)

3.4 Utterance-final downstepping in Numèè

In Numèè – at least in the Goro dialect described by Rivierre (1973) –, utterance-final registerless light CV syllables are systematically downstepped if they are preceded by a registerless syllable – i.e. CV → ꜜCV / 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 example (22), where the downstepping of final /ɳa/ → [ꜜɳa] triggers raising of the preceding /a/ → [ꜛa]. I analyze this final downstepping process as the realization of a final boundary downstep, transcribed /ꜜ%/ (cf. §4.8).

[20]The downstep in the CVꜜV monosyllables /keꜜe/ and /kãꜜã/ will be discussed in §3.7).

(22)	/dɛɳu	a	ɳa + ꜜ%/	
	[dɛɳu	ꜛa	ꜜ%ɳa]	
	[dɛ^{4}ɳu^4	a$^{4.5}$	ɳa^3]	
	jaw	REL	up	
	‘upper jaw’ (Numèè; Rivierre, 1973, p. 132)			

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 (23) and (24). 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 /ꜜɲĩ/ → [ꜜꜜɲĩ] in (24) compared to registerless /ɲĩ/ → [ꜜɲĩ] in (23).

(23)	/jaa	ɲĩ + ꜜ%/	
	[ꜛᶮɟaa	ꜜ%ɲĩ]	
	[ᶮɟaa^5	ɲĩ^4]	
	juice	coconut	
	‘coconut juice’ (Numèè; Rivierre, 1973, p. 127)		

(24)	/jaa	ꜜɲĩ + ꜜ%/	
	[ꜛᶮɟaa	ꜜꜜ%ɲĩ]	
	[ᶮɟaa^5	ɲĩ$^{3.5}$]	
	juice	breast	
	‘breast milk’ (Numèè; Rivierre, 1973, p. 127)		

Final downstepping affects only light syllables: registerless CVV syllables remain registerless utterance-finally, as in (25) (compare with (22) above).

(25)	/dɛɳʋ	a	mḭḭ + ꜜ%/	
	[dɛɳʋ	a	mḭḭ]	
	[dɛ^{4}ɳʋ^4	a^4	mḭḭ^{4}]	
	jaw	REL	low	
	‘lower jaw’ (Numèè; Rivierre, 1973, p. 132)			

Finally, downstepping does not apply after a downstepped syllable, as shown in (26).

(26)	/ꜜtẽẽ-ꜜẽ	nõ	bɛꜜtĩĩ	ku + ꜜ%/	
	[(ꜜ)tẽẽ-ꜜẽ	nõ	ꜛbɛꜜtĩĩ	ku]	
	[tẽẽ^5-ẽ^4	nõ^4	bɛ^{5}ꜜtĩĩ^3	ku^3]	
	girl-PROX	grill	three	yam	
	‘This girl is grilling three yams.’ (Numèè; Rivierre, 1973, p. 135)				

The latter examples suggest that the final boundary downstep /ꜜ%/ 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 followd by a downstepped syllable, as we will see below). This can be seen by comparing (27), which contains only registerless syllables, and (19) above, repeated as (28) 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.

(27)

/ko	te	tɪɪ-ɽe	kuɽe/
[ko	te	tɪɪ-ɽe	kuɽe]
[ko^4	te^4	tɪɪ^4-ɽe^4	kuɽe^4]
I	DESCR	look.at-ACT	bush

‘I look at the bush.’ (Drubea; Rivierre, 1973, p. 127)

(28)

/ꜜtaa	dɪɪ	bee/
[(ꜜ)taa	^{n}dɪɪ	^{m}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 on registerless syllables ‘follows a straight-falling melodic line’ (Rivierre, 1973, p. 131).

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 (pre-downstep raising affects only registerless syllables), and is realized at the baseline. This is illustrated by the contrast between utterance-initial registerless /goo/ in (29) and downstepped /ꜜgoo/ in (30).

(29) /goo ꜜmie/
[ꜛᵑgoo ꜜmie]
[ᵑgoo^5 mie^3]
plant.sp wet
‘wet *Hibbertia pancheri*’ (Drubea; Rivierre, 1973, p. 125)

(30) /ꜜgoo ꜜmie/
[(ꜜ)ᵑgoo ꜜmie]
[ᵑgoo^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).[21] These three classes are illustrated in (31) with a minimal triplet.

(31)
a. Type 1: registerless / σ σ / e.g. /kuɽe/ ‘forest’
b. Type 2: downstepped initial syllable /ꜜσ σ / e.g. /ꜜkuɽe/ ‘end’
c. Type 3: downstepped second syllable / σꜜσ / e.g. /kuꜜɽe/ ‘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 (32)/Figure 12; they may be affected by pre-downstep raising, as with /tea/ ‘to go up’ and /mweɽe/ ‘again’ in (33), 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 (34)/Figure 13, and utterance-final dowstepping in Numèè, e.g. /mwoɽo/ ‘alive’ in (35), where downstepping of the final syllable causes pre-downstep raising of the initial.

(32) /... ꜜmwa veto ꜜtaa.../
[... ꜜmwa veto ꜜtaa...]
PFV put one
‘[I] put a [blanket on the table]. (Drubea; Shintani, 2019, p. 97, L12)

(33) /ɲi ꜜmwa tea mweɽe ꜜmee/
[ꜛɲi ꜜmwa te↗a ↗mweꜛɽe ꜜmee]
[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)

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

(34) /ko te ꜜʈo-mwaʈi ꜜmwa... ꜜŋi kapwa + ꜛ%/
[ko te ꜜʈo-ꜛmwaʈi ꜜmwa... ꜜŋi ↗kaꜛ%pwa]
1SG.SBJ DESCR stay-close house with corrugated.iron
‘I covered the house with corrugated iron. (Drubea; Shintani, 2019, p. 147, L19)

(35) /ꜜcĩĩbu ꜜmwã ꜜku mwoʈo + ꜜ%/
[(ꜜ)cĩĩꜛbu ꜜmwã ꜜku ꜛmwoꜜ%ʈo]
[cĩĩ^{4}bu^5 mwã^4 ku^3 mwo^{4}ʈo^3]
rat PFV flee alive
‘The rat escaped safe and sound.’ (Numèè; Rivierre, 1973, p. 146)

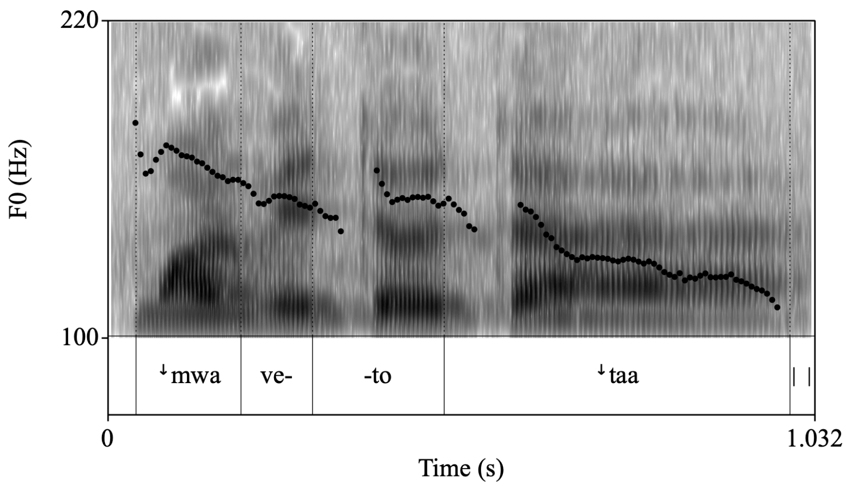


Figure 12: /... ꜜmwa veto ꜜtaa.../ ‘[I] put a [blanket on the table]. (Drubea; Shintani, 2019, p. 97, L12)

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 (36), the initial downstepped syllable of the verb /ꜜʈobe/ ‘wake up’ is realized lower than the immediately preceding downstepped syllable /ꜜmwa/, as seen in Figure 14. Like with dowstepped monosyllables, the first syllable of type 2 disyllables frequently causes raising of the preceding registerless syllable(s), as illustrated in example (37), where the registerless descriptive marker /te/ is clearly raised before the verb /ꜜŋɛʈɛ/ ‘think’, as shown in Figure 15 (see also /ꜜbeʈu/ ‘swim’ in (13)b and /ꜜkeʈee/ ‘eat’ in (14) above).

(36) /ko ꜜmwa ꜜʈobe/
[ko ꜜmwa ꜜʈo^{m}be]
1SG.SBJ PFV wake.up
‘I woke up.’ (Drubea; Shintani, 2019, p. 193, L26)

(37) /ko te ꜜŋɛʈɛ-ɽe ꜜme.../
[ko ꜛte ꜜŋɛʈɛ-ɽe ꜜme...]
1SG.SBJ DESCR think-ACT that

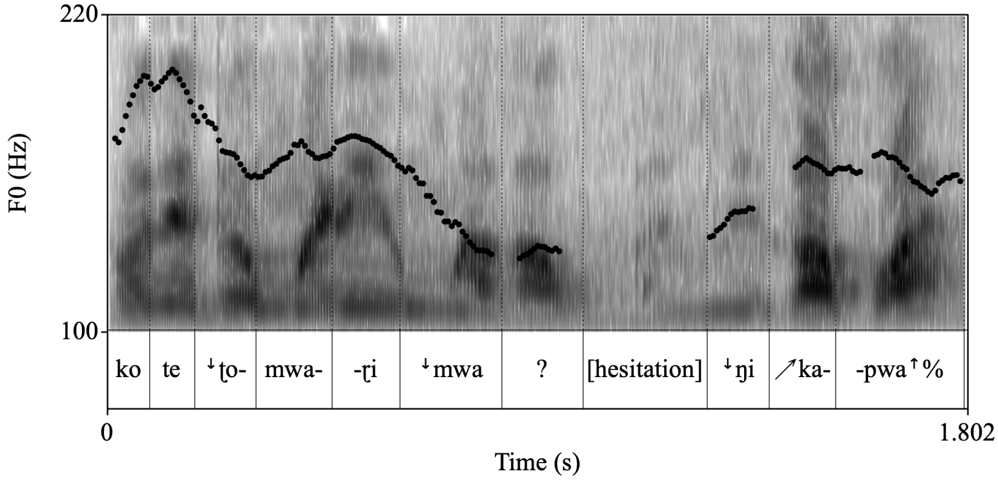


Figure 13: /ko te ꜜʈo-mwaɽi ꜜmwa... ꜜŋi kapwa + ꜛ%/ 'I covered the house with corrugated iron. (Drubea; Shintani, 2019, p. 147, L19)

'I think that...' (Drubea; Shintani, 2019, p. 214, L29)

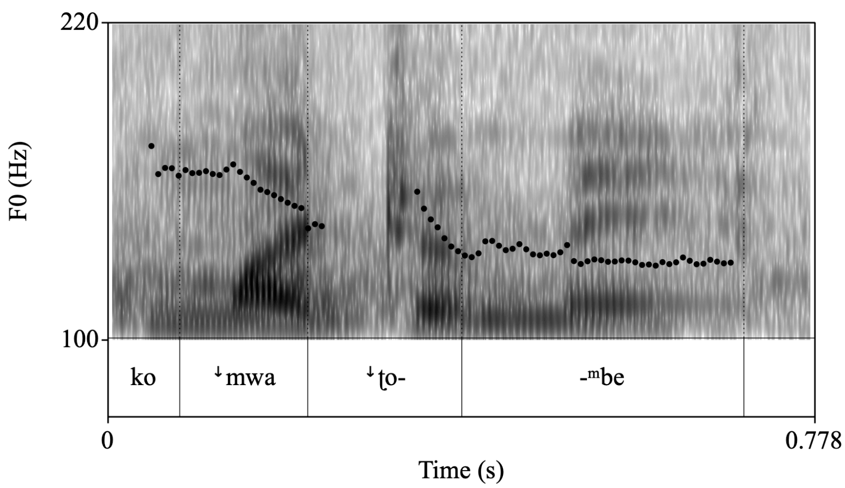


Figure 14: /ko ꜜmwa ꜜʈobe/ 'I woke up.' (Drubea; Shintani, 2019, p. 193, L26)

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 (37)/Figure 15 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.[22] This

[22]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 (ꜜCV.C<u>V:</u>) with raised pitch when pronounced in isolation.

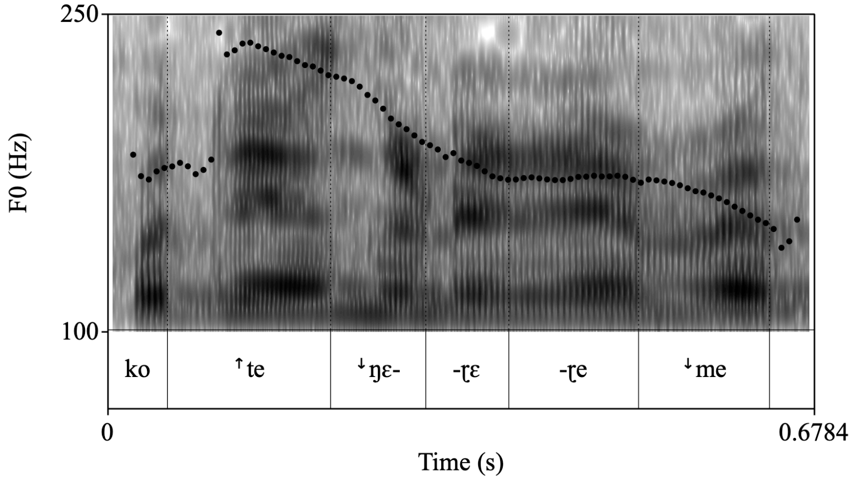


Figure 15: /ko te ꜜŋɛɽɛ-ɽe ꜜme…/ ‘I think that…’ (Drubea; Shintani, 2019, p. 214, L29)

is illustrated with the verb /ꜜmwaɽii/ ‘plant’ in Drubea, affected by pre-downstep raising in (38)/Figure 16 and by utterance-final raising in (39)/Figure 17.[23]

(38) /kãꜜã ꜜmwaɽii buꜜki/
[kãã ꜜꜜmwa↗ɽii ꜛmbuꜜki]
PROS plant flower
‘[I] planted flowers.’ (Drubea; Shintani, 2019, p. 147, L19)

(39) /te ꜜmwaɽii-ɽe ku +ꜛ%/
[te ꜜmwa↗ɽii-↗ɽe ꜛ%ku]
DESCR plant-ACT yam
‘[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 /veꜜyuu/ ‘to be sick, to die’ in (40) and (41) below. The pitch drop affecting the second syllable is clearly visible in Figure 18 and Figure 19. 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 (40)/Figure 18, or undergoes pre-downstep raising, as in (41)/Figure 19 (see also /bɛꜜto/ ‘turn around’ in (**??**) above).

(40) /kaꜜgwee te ki te veꜜyuu-ɽe +ꜛ%/
[kaꜜgwee te ki te veꜜyuu-ꜛ%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)

[23] The syllable-internal downstep in /kãꜜã/ and its realization as a double downstep on the following syllable is discussed in §3.7.

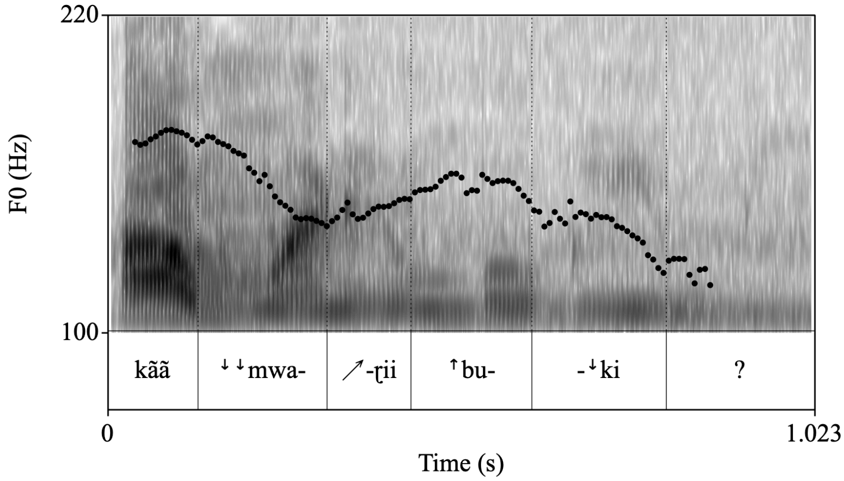


Figure 16: /kãꜜã ꜜmwaɽii buꜜki/ ‘[I] planted flowers.’ (Drubea; Shintani, 2019, p. 147, L19)

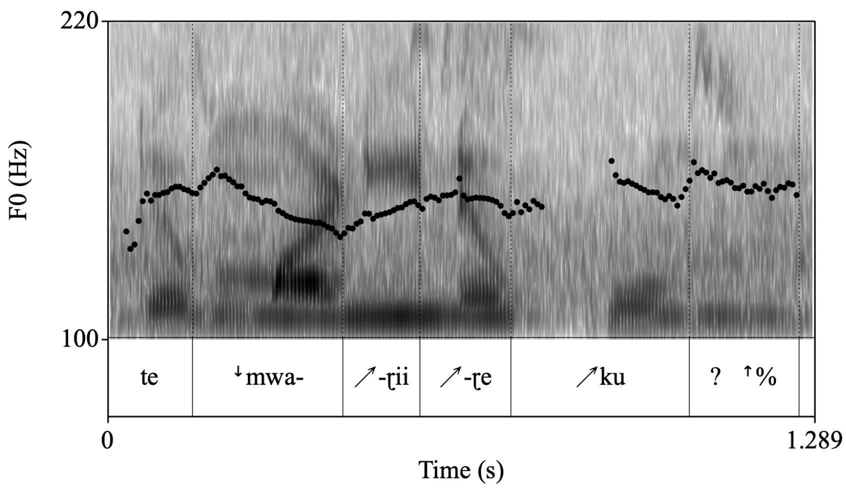


Figure 17: /te ꜜmwaɽii-ɽe ku +ꜛ%/ ‘[I] plant yams.’ (Drubea; Shintani, 2019, p. 234, L32)

(41) /… ꜜɳi ꜜmwa veꜜyuu-ɽe wẽ.teꜜe ꜜɳi ꜜmwa ɲimie-ꜜkãã/
[… ꜜɳi ꜜmwa ꜛveꜜyuu-ɽe ↗wẽ.ꜛteꜜe ꜜɳi ꜜmwa ↗ɲimiꜛe-ꜜkãã]
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)

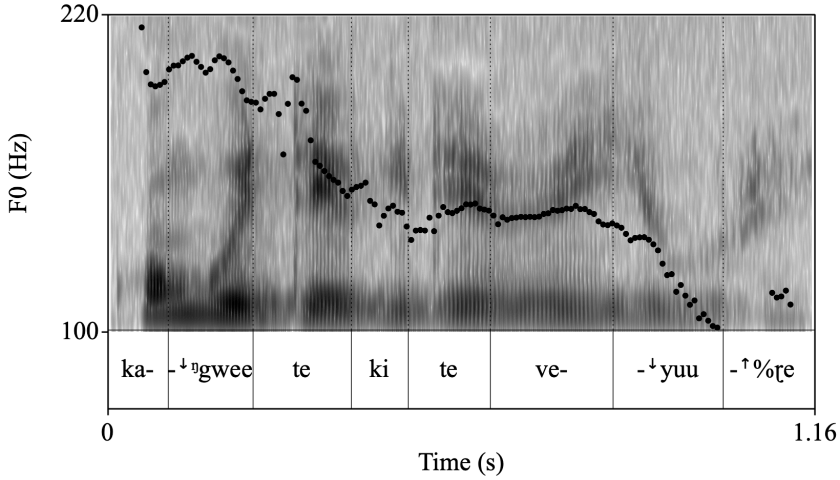


Figure 18: /… kaꜜgwee te ki te veꜜyuu-ɽe/ 'You look sick.' (lit. it is like you are sick) (Drubea; Shintani, 2019, p. 130, L17)

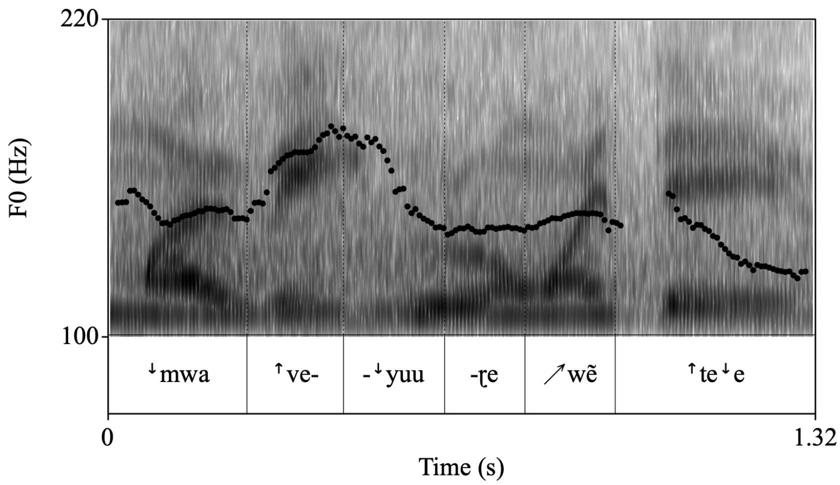


Figure 19: /… ꜜmwa veꜜyuu wẽ teꜜe…/ '… [they] died because…' (Drubea; Shintani, 2019, p. 235, L32)

3.7 CVꜜV syllables

In addition to registerless CV(V) and downstepped ꜜCV(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)VꜜV. The threeway contrast is firmly established in both languages, where minimal triplets are frequent. A few examples from Drubea are listed in (42).

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

a. /beꜜe/ NEGATION
/bee/ 'fish'
/ꜜbee 'descendance'

b. /pwaꜜa/ 'group of men'
/pwaa/ 'white'
/ꜜpwaa/ 'packet'

c. /koꜜo/ 'place, field'
/koo/ 'fish *sp.*'
/ꜜkoo/ 'egg'

d. /keꜜe/ 'we (PL)'
/kee/ 'husband'
/ꜜkee/ '*Broussonetia papyrifera*, paper mulberry'

e. /kãꜜã/ PROPSECTIVE
/kãã/ 'parent, friend'
/ꜜkãã/ 'big'

The prosodic nature and behavior of CVꜜV syllables is illustrated in (43) with the negative marker / beꜜe/. As can be seen in Figure 20, the initial mora is realized at the same pitch as the preceding syllable [ɲi], and the second mora is downstepped, i.e. realized at a lower register, this lower register being maintained for the realization of the following registerless syllables: [beꜜe ŋa-ɽe].

(43)
/ɲi	beꜜe	ŋa-ɽe/
[ɲi	ᵐbeꜜe	ŋa-ɽe]
3SG.SBJ	NEG	work-ACT

'[He said that] he does'nt work.' (Drubea; Shintani, 2019, p. 67, L8)

The initial registerless mora of a CVꜜV syllable frequently undergoes pre-downstep raising, as seen with /beꜜe/ [ꜛᵐbeꜜe] in (44)/Figure 21 and /wĩꜜĩ/ [ꜛwĩꜜĩ] in (45).

(44)
/ꜜɳi	ꜜmwa	beꜜe	|| ... /
[(ꜜ)ɳi	ꜜmwa	ꜛᵐbeꜜe	|| ...]
3PL.SBJ	PFV	NEG	

'They don't [think bout working].' (Drubea; Shintani, 2019, p. 306, L43)

(45)
/ꜜtaa	wĩꜜĩ-ɳũũ	ꜜŋøø/
[(ꜜ)taa	ꜛwĩꜜĩ-ꜛɳũũ	ꜜŋøø]
[taa^{4}	wĩ^{5}ĩ^{4}-ɳũũ^{5}	ŋøø^{4}]
one	middle	tree

'middle of a tree' (Numèè; Rivierre, 1973, p. 144)

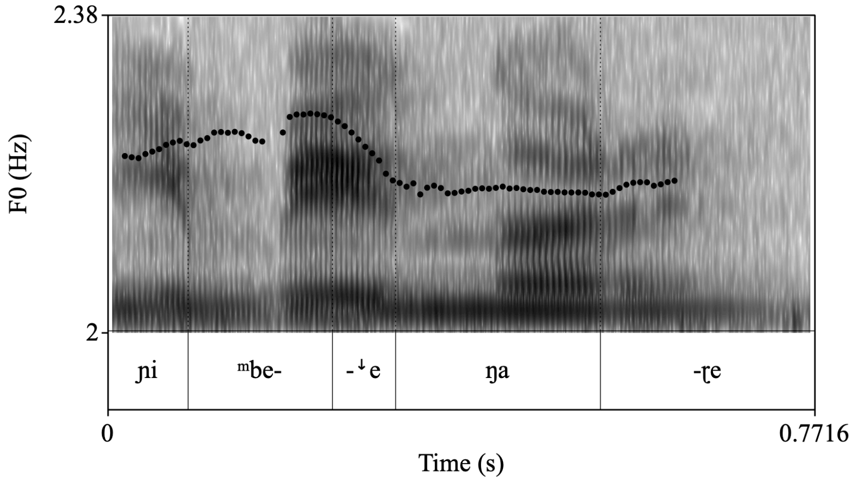


Figure 20: /ɲi beꜜe ŋa-ɽe/ '[He said that] he doesn't work. (Drubea; Shintani, 2019, p. 67, L8)

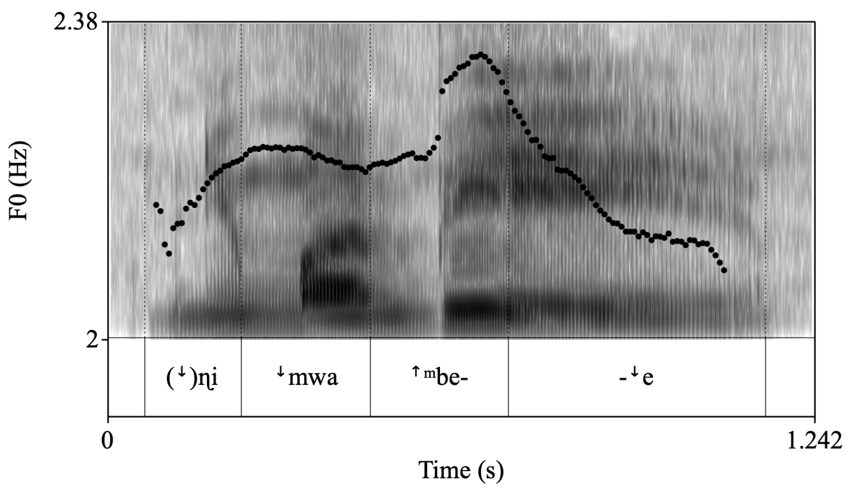


Figure 21: /ꜜɳi ꜜmwa beꜜe || …/ 'They don't [think about working].' (Drubea; Shintani, 2019, p. 306, L43)

The downstep affecting the second mora is frequently displaced and realized on the following syllable. If that syllable is undelryingly registerless, it is then realized with a downstep, i.e. /CVꜜV CV.../ → [CVV ꜜCV...], as in (46)/Figure 22 and (47), where pre-downstep raising also applies.

(46) /ɲi beꜜe tʊʊ-ʈe/
[ɲi ꜛmbee ꜜtʊʊ-ʈe]
3SG.SBJ NEG grow-ACT
'It does not grow.' (Drubea; Shintani, 2019, p. 353, L49)

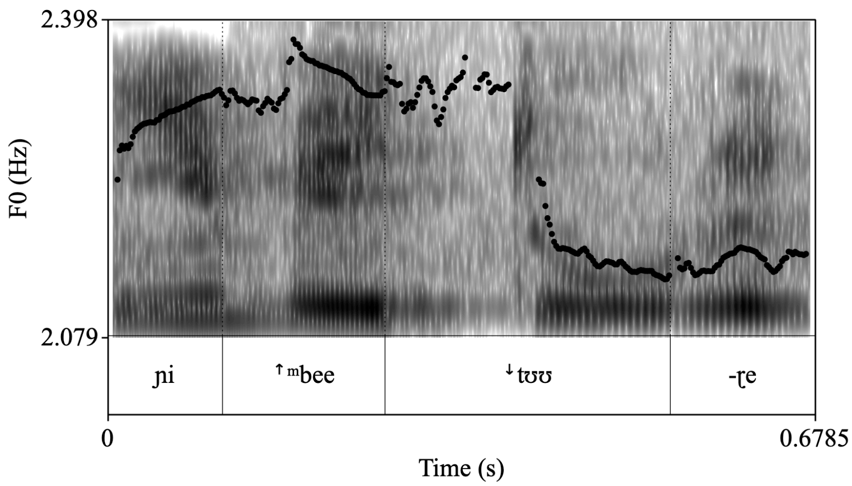


Figure 22: /ɲi beꜜe tʊʊ-ʈe/ 'It doesn't grow.' (Drubea; Shintani, 2019, p. 353, L49)

(47) /ka̰a̰ pwaꜜa ʈe a ʈeꜜḛ/
[ka̰a̰ ꜛpwaa ꜜʈe a ꜛʈeꜜḛ]
[ka̰a̰^{4} pwaa^5 ʈe^4 a^4 ʈe^{5}ḛ^{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. /CVꜜV ꜜCV.../ → [CVV ꜜꜜCV...], as illustrated with /beꜜe ꜜʈõŋɛʈɛ-ʈe/ [bee ꜜꜜʈõŋɛʈɛ-ʈe] in (48)/Figure 23, and /yaꜜa ꜜmḛ/ [yaa ꜜꜜmḛ] and /geꜜe ꜜmḛ/ [gee ꜜꜜmḛ] in (49).

(48) /ko beꜜe ꜜʈõŋɛʈɛ-ʈe .../
[ko ꜛbee ꜜꜜʈõŋɛʈɛ-ʈe ...]
1SG.SBJ NEG know-ACT
'I don't know [where he sleeps]." (Drubea; Shintani, 2019, p. 67, L08)

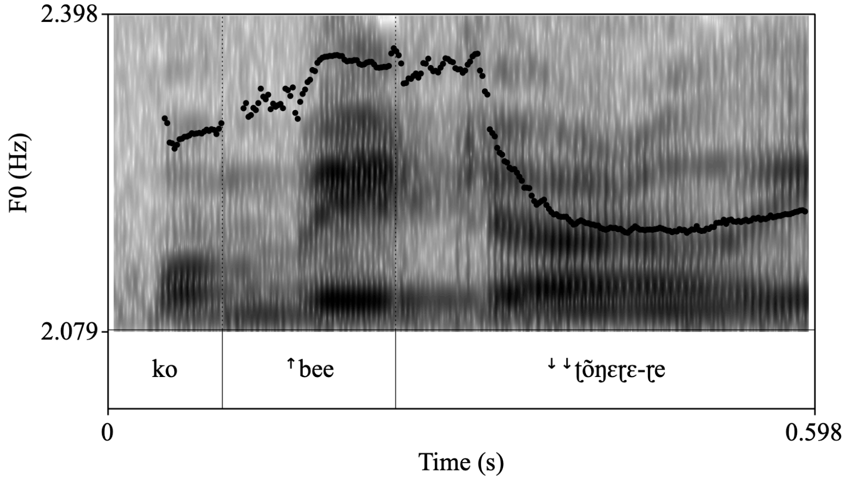


Figure 23: /ko beꜜe ꜜʈõŋɛʈɛ-ʈe .../ 'I don't know [where he sleeps].' (Drubea; Shintani, 2019, p. 67, L08)

(49) /yaꜜa ꜜmḛ geꜜe ꜜmḛ ɲaꜜi/
[ꜛyaa ꜜꜜmḛ ꜛgee ꜜꜜmḛ ꜛɲaꜜi]
[yaa⁵ mḛ³ gee⁵ mḛ³ ɲa⁴i³]
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 (50): underlyingly downstepped /ꜜkwe-ʈe/ 'eat' in (50a) is realized with a starker pitch drop under downstep displacement than registerless /kwɛ-ʈe/ in (50b), which corresponds to the cumulative effect of its underlying downstep and the displaced downstep from preceding /koꜜo/.

(50) a. /koꜜo kwɛ-ʈe/ 'place of dancing' (Drubea; (Rivierre, 1973, p. 144))
[ꜛkoo ꜜkwɛ-ʈe]
[koo⁵ kwɛ⁴-ʈe]
place dance-ACT

b. /koꜜo ꜜkwe-ʈe/ 'place of eating (Drubea; Rivierre, 1973, p. 144)
[ꜛkoo ꜜꜜkwe-ʈe]
[koo⁵ kwe³-ʈe]
place eat-ACT

CVꜜV syllables are attested in both monosyllables and disyllables. The latter are exclusively recent loanwords from French and English, of CVꜜV.CV(V) shape – i.e., the downstep is always in the initial syllable. A few Drubea examples are given in (51).[24]

[24]The prosodic pattern in these words is likely an adapation of the prosodic pattern found in the original language, e.g. CVC words in French, realized with falling pitch in isolation /ˈCVC + L%/ = [ˈCV̂C], are borrowed as CVꜜV.CV disyllables, e.g. /poꜜoci/ [ꜛpoꜜoci] from *poche* /pɔʃ/ 'pocket'; English disyllabic words with initial stress receive the same treatment, e.g. *pussy* borrowed as /puꜜuci/ [ꜛpuꜜuci] 'female cat'.

(51)	/oꜜoci/	'horse'	< English
	/piꜜiki/	'pig'	< English
	/poꜜoci/	'pouch, pocket'	< French *poche*
	/taꜜaci/	'bowl'	< French *tasse*
	/coꜜoɽo/	'salt'	< English
	/kaꜜaɽɛ/	'car'	< English 'cart'

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), and surmises that those with more than one downstep are actually compounds. 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,[25] 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,

[25] 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 /-ɽe/ ∼ /-V/ and the ACTIVE verbal suffix /-ɽe/ 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 are 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 these prefixes are registerless, simply noting that more work is necessary to confirm this. In any case, the prosodic behavior of these two suffixes does not question the well-foundedness of the register analysis presented here.

1973, pp. 140–141; cf. also Shintani and Païta, 1990a, p. 46). This is illustrated with the Drubea prefix /ɽa-/ ‘VERB with one’s hand’ in (52).

(52) a. /ɽa-uɽu/ ɽa-uɽu ‘cut by hand’
b. /ɽa-ꜜtie/ ꜜɽa-ꜜtie ‘tear by hand’

The example in (53) shows that the prefix in /ɽa-ꜜtie/ [ꜜɽa-ꜜtie] is indeed downstepped, as can be seen from the fact that it triggers pre-downstep raising of the preceding registerless syllable [ꜛte]. 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 /ꜜtie/ rather than a realignment of this downstep to the left edge of the morphological word.

(53)

/ko	te	ɽa-	ꜜtie	-ɽe/	
ko	te	ꜜɽa-	ꜜtie	-ɽe	(downstep copy)
[ko	ꜛte	ꜜɽa-	ꜜtie	-ɽe]	
[ko^4	te$^{4.5}$	ɽa^4	ti^{3}e^3	-ɽe^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 is entirely built on one binary contrast: registerless (i.e. prosodically unspecified) vs. downstepped syllables (or moras in the case of CVꜜV syllables, cf. **??**). 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 not realized and downstepped syllables are realized just like registerless syllables at baseline pitch, a high-mid default pitch schematically represented as a level 4 on the typical 1-to-5 scale. Registerless syllables 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) register-bearing unit. When followed by a downstepped syllable (including when in utterance-initial position), they tend to undergo pitch raising, to emphasize the downward contrast that follows. Finally, registerless syllables 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).[26] This downstep may affect the first or the second syllable of disyllables. It may also affect the second mora of a bimoraic CVV syllable, but only in monosyllables and in the initial syllable of disyllables (i.e. CVꜜV.CV(V), CV(V).CVꜜV stems being unattested). Note that all disyllabic CVꜜV.CV(V) stems are recent loanwords. Note that the optionality of the onset consonant is not indicated in the in 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, in all positions within the stem.

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

Table 2: Downstep distribution in mono- and disyllabic stems

Registerless	σ1 downstepped	σ2 downstepped	Intra-syllabic downstep
CV	ꜜCV	—	—
CVV	ꜜCVV	—	CVꜜV
CV.CV	ꜜCV.CV	CV.ꜜCV	—
CV.CVV	ꜜCV.CVV	CV.ꜜCVV	—
CVV.CV	ꜜCVV.CV	CVV.ꜜCV	CVꜜV.CV (loans)
CVV.CVV	ꜜCVV.CVV	CVV.ꜜCVV	CVꜜV.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.

After a brief overview of the theory and representation of tone and register features, I propose a modified version of Snider's (1999; 2020) Register Tier Theory where register features are strictly separated from tone features (§4.1. I then propose an analysis of the prosodic system of these two languages within this register-separate-from-tone model, by first establishing the stem-level register patterns of Drubea and Numèè as well as the Register-Bearing Unit (§4.2), before accounting for the interactions between downstepped and registerless units in the following subsections.

4.1 Tone and register

There have been various proposals 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).[27] 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 (54) below.

[27] Authors such as Hyman (2010) or Clements, Michaud, et al. (2010) have argued that there is no evidence in favor of subtonal features of any sort, in particular in African tone systems, which they say are better represented with tonal primitives (e.g. H, M, L) than with features. I will not address their arguments here. See McPherson (2016) and Lionnet (2022a) for recent overviews and counterarguments.

(54)

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

Other authors have proposed very similar systems with unary rather than binary features (e.g., Clements, 1983; Hyman, 1993b). One such system is Snider's (1999; 2020) Register Tier Theory, which distinguishes two REGISTER FEATURES *h* (high) & *l* (low) and two TONE FEATURES H (High) & L (Low). These two kinds of systems are mostly equivalent in the number of distinct categories and natural classes they allow to define. 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 equivalent of Yip and Pulleyblank's [+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 representations of upstep (*h* = ꜛ) and downstep (*l* = ꜜ) respectively. This is what allows Snider to use register features to account for upstep and downstep, and is one of the major differences with the other subtonal feature systems.

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 (55).

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

h/l	Register tier
H/L	Tonal tier
○	Tonal root node tier
TBU	Tone-bearing unit tier

The TRN is what unites register and tone features into a single bunde 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.[28]

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

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

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$^{\downarrow}$V stems, as discussed below.

Table 3: Attested and unattested register pattern mappings on disyllables

		CVV.CVV + *l*	CVV.CVV + Ø*l*
a.	$\text{C}\overset{\text{l}}{\underset{|}{\text{V}}}\text{V.CV(V)}$	✓	*
b.	$\text{CV}\overset{\text{l}}{\underset{|}{\text{V}}}\text{.CV(V)}$	*	*
c.	$\text{CV(V).C}\overset{\text{l}}{\underset{|}{\text{V}}}\text{V}$	*	✓
d.	$\text{CV(V).CV}\overset{\text{l}}{\underset{|}{\text{V}}}$	*	*

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. Indeed, as shown 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 mappings in (b) and (d) are indeed unattested in the native vocabulary – more precisely, CV(V).CV$^{\downarrow}$V stems are strictly unattested, while CV$^{\downarrow}$V.CV(V) are attested only in recent loans from English and French. 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 involving an exceptional *ØlØ* pattern confined to loanwords, or be treated as compounds, i.e. two separate prosodic domains: *Øl* monosyllabic CVꜜV + register-less monosyllabic CV(V).[29] Note that CVꜜV 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)

4.3 Register analysis: the basics

I assume that an utterance starts at a default register, which I call the 'baseline' (cf. §3.5 above).[30] This default baseline is not transcribed.

An utterance containing a sequence of downstepped monosyllabic morphemes, such as in example (11) above, is represented as in (56) below.

(56) /ꜜɳi ꜜmwa ꜜɳii ꜜme/ → [(ꜜ)ɳi ꜜmwa ꜜɳii ꜜme] (Drubea; cf. (11))

```
        l     l    l     l          (l)    l    l     l
        |     |    |     |           |     |    |\    |
   a.  ɳ i  mw a  ɳ i i  m e   → b.  ɳ i  mw a  ɳ i i  m e
```

The utterance-initial downstep on /ꜜɳi/ 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 realized at the baseline. The same is true of utterances whose only *l*-bearing RBU is utterance-initial, as in example (28): the initial downstep is not realized, making such utterances prosodically identical to ones with no downstep at all (although see §4.5).

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

[30]Cf. Snider, 2020, p. 25 for a similar idea about the interpretation of utterance-initial register features.

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 (57) below, repeated from (40) above (cf. also (56)b above). (The final boundary h% feature will be discussed in §4.8.)

(57) /kaꜜgwee te ki te veꜜyuu-ɽe + ꜛ%/ → [kaꜜgwee te ki te veꜜyuu-ꜛ%ɽe] (Drubea; cf. (40))

l l h%

a. k a g w e e t e k i t e v e y u u - ɽ e

l l h%

→ b. k a g w e e t e k i t e v e y u u - ɽ e

However, the realization of registerless morae is highly variable, as we saw: registerless syllables are available for pre-downstep raising, final raising (Drubea) or final lowering (Numèè), extrapolation, and utterance-initial default baseline realization. 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 syllables will be left unassociated, which is an apt representation of their availability to variable realizations.

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 (58), where every registerless syllable followed by a downstep is affected.

(58) /gu ꜜcapɛ ꜜpaɳaa ꜜko̰ ɲʊ ꜜwii.to/
[ꜛgu ꜜcaꜛpɛ ꜜpaꜛɳa̰a̰ ꜜko̰ ꜛɲʊ ꜜwii.to]
[gu^{5} ca^{4}pɛ$^{4.5}$ pa^{3}ɳa̰a̰$^{3.5}$ ko̰^{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)

l l l l

a. g u c a p ɛ p a ɳ a̰ a̰ k o̰ ɲ ʊ w i i t o

h l h l h l h l

→ b. g u c a p ɛ p a ɳ a̰ a̰ k o̰ ɲ ʊ w i i t o

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 (59), repeated from (18) above.

(59) /ꜜɳḛ ꜜmwa̰ ꜜvḛ/→ [(ꜜ)ɳḛ ꜜmwa̰͡ꜛa̰ ꜜvḛ] (Numèè; cf. (18))

```
        l      l    l          (l)     l(h)  l
        |      |    |           |      |/    |
a.  ɳ ḛ   mw a̰   v ḛ   → b.  ɳ ḛ   mw a̰    v ḛ
```

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 underlying representations.

The presence of this unrealizd *l* feature is revealed by the fact that it prevents pre-downstep raising, i.e., *h*-epenthesis.[31] This can be seen by comparing (60) and (61) (repeated from (29) and (30) respectively). In (60), registerless /goo/ '*Hibbertia pancheri*' is targeted by *h*-epenthesis caused by the following downstepped adjective /ꜜmie/. In (61), on the other hand, *l*-carrying /ꜜgoo/ 'tree' fails to undergo *h*-epenthesis in the same context.

(60) /goo ꜜmie/ → [ꜛᵑgoo ꜜmie] = [ᵑgoo⁵ mie³] (Drubea; cf. (29))

```
               l               (h)    l
               |                :     |
a.  g o o   m i e   → b.   g o o   m i e
```

(61) /ꜜgoo ꜜmie/ → [(ꜜ)goo ꜜmie] = [ᵑgoo⁵ mie³] (Drubea; cf. (30))

```
      l        l               (l)    l
      |        |                |     |
a.  g o o   m i e   → b.   g o o   m i e
```

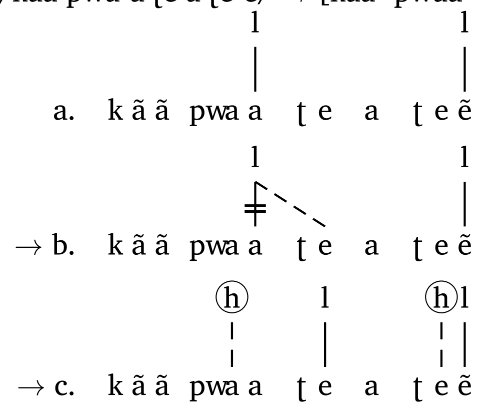
4.6 CVꜜV syllables: downstep displacement and double downstep

As we saw in §3.7 above, the downstep in CVꜜV syllables has a tendency to be realized on the following syllable. As illustrated in (62) (repeated from (47) above), this downstep displacement is easily represented as spreading of the *l* feature onto the next syllable, as

[31] 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 (59), would preserve the phonetic distinction between registerless and downstepped RBUs in this position.

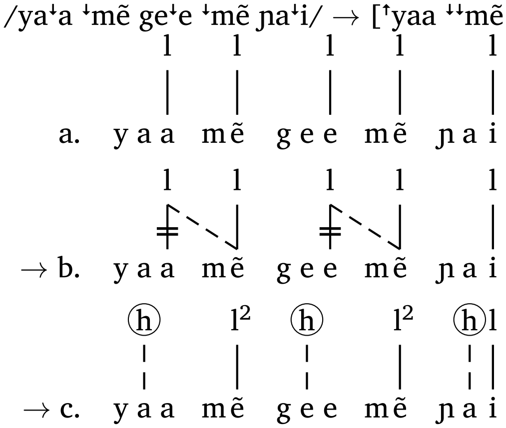
with /pwaꜜa ʈe/ in (62)b, followed by delinking from its original host, as in (62)c. This is followed by postlexical *h*-epenthesis (pre-downstep raising) in (62)c.[32]

(62) /kãã pwaꜜa ʈe a ʈeꜜẽ/ → [kãã ꜛpwaa ꜜʈe a ꜛʈeꜜẽ] (Drubea; cf. (47))



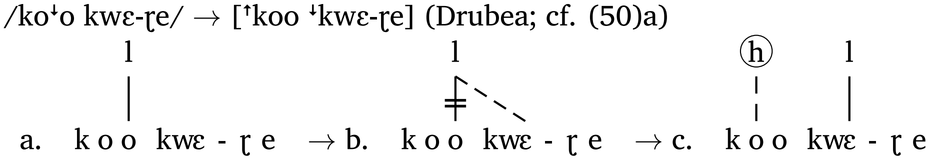
When the following syllable is already underlyingly downstepped, downstep displacement creates a double downstep, as seen in §3.7. This is illustrated in (63) (repeated from (49) above). The *l* feature on both /yaꜜa/ and /geꜜe/ is shifted to the next syllable in (63)b, with whose underlying *l* feature it combines in (63)d, yielding a double downstep (represented as l^2).

(63) /yaꜜa ꜜmẽ geꜜe ꜜmẽ ɲaꜜi/ → [ꜛyaa ꜜꜜmẽ ꜛgee ꜜꜜmẽ ꜛɲaꜜi] (Numèè; cf. (49))



The contrast between registerless and downstepped syllables is thus maintained under downstep displacement, as seen in the near-minimal pair in (64) and (65), repeated from (50)a and b respectively. As seen, the downstep of the initial syllable /koꜜo/ 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. /ꜜkwe/) is maintained, only it is this time realized as a simple vs. double downstep contrast ([ꜜkwɛ] vs. [ꜜꜜkwe], step c).

(64) /koꜜo kwɛ-ʈe/ → [ꜛkoo ꜜkwɛ-ʈe] (Drubea; cf. (50)a)



[32]Note that /ʈeẽ/ is not a CVꜜV monosyllable, but a disyllabic stem: /ʈe.ꜜẽ/.

(65) /koꜜo ꜜkwe-ɽe/ → [ꜛkoo ꜜꜜkwe-ɽe] (Drubea; cf. (50)b)

l l | l l | ⓗ l^2
a. k o o kwe - ɽ e → b. k o o kwe - ɽ e → c. k o o kwe - ɽ e

Since downstep displacement appears to be by far the most frequent realization of CVꜜV monosyllables, one may wonder whether they might be better analyzed as registerless syllables followed by an underlying floating *l* feature: /CVV①/. 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., *CV①. This absence can easily be explained in the underlying /CVꜜV/ analysis I propose, in at least two ways: either the combination of a CV syllable with the Ø*l* pattern is impossible for lack of enough morae to realize the pattern, or this combination is neutralized with CVꜜV by lengthening of the vowel to fit the pattern (/CV + Ø*l*/ → CVꜜV). Full neutralization is not expected in the floating *l* analysis, where one should still see a contrast between /CV①/ and /CVV①/ when the downstep is realized on the following syllable, e.g., /CV① # CV... → [CV # ꜜCV...] vs. /CVV① # CV... → [CVV # ꜜCV...]. Such a contrast is not attested, which militates in favor of the underlying /CVꜜV/ analysis.

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 *l* feature carried by the initial syllable of the verb stem to which the prefix is attached. This is illustrated in (66) (repeated from (53)). Register feature copying onto the prefix is shown in (66)b, where the original feature and its copy are coindexed. Postlexical *h*-epenthesis then applies in (66)c.

(66) /ko te ʈa-ꜜtie-ɽe/ → [ko ꜛte ꜜʈa-ꜜtie-ɽe] (Drubea; cf. (53))

l | l_i l_i
a. k o t e ʈ a - t i e - ɽ e → b. k o t e ʈ a - t i e - ɽ e

ⓗ l_i l_i
→ c. k o t e ʈ a - t i e - ɽ e

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.[33] The

[33] The boundary register features could be given a more classic analysis as boundary tones H% and L% respectively, with the understanding that postlexical boundary tones are different in nature than lexical register

realization of theze boundary register features operates under different conditions in both languages. In Drubea, the boundary *h*% docks on any utterance-final registerless syllable (and may spread leftward onto any preceding registerless syllable). This is illustrated in (67) (repeated from (20)).[34]

(67) /$^{\downarrow}$taa bee pwi + $^{\uparrow\%}$/ →[($^{\downarrow}$)taa $^{\mathrm{m}}$bee $^{\uparrow\%}$pwi] (Drubea; cf. (20))

```
        l                    h%         (l)                h%
        |                                |                /
a.   t a a   b e e   p w i      → b.  t a a   b e e   p w i
```

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. a syllable that can undergo pre-downstep raising, as seen in §3.4. This is illustrated in (68) and (69) below, repeated from (23) and (24) respectively.

(68) /jaa ɲĩ + $^{\downarrow\%}$/ → [$^{\uparrow\text{ɲ}}$ɟaa $^{\downarrow\%}$ɲĩ] (Numèè; cf. (23))

```
                l%                 l%          (h)     l%
                                  /             |       |
a.   j a a   ɲ ḭ      → b.   j a a   ɲ ḭ    → c.   j a a   ɲ ḭ
```

(69) /jaa $^{\downarrow}$ɲĩ + $^{\downarrow\%}$/ → [$^{\uparrow\text{ɲ}}$ɟaa $^{\downarrow\downarrow\%}$ɲĩ] (Numèè; cf. (24))

```
             l  l%              l  l%          (h)     l²%
             |                  | /             |       |
a.   j a a   ɲ ḭ      → b.   j a a   ɲ ḭ    → c.   j a a   ɲ ḭ
```

5 Alternative analyses

In this section, I show that the register analysis proposed in §4 fares better than two alternatives making use of tonal categories H and L: one in which downstep is analyzed either as the result of tonal interaction alone (§5.1), and one in which register features are primary but require the additional support of tonal features (§5.2). Note that I ignore utterance-final raising and lowering in this section, as well as CV$^{\downarrow}$V syllables, which would be straightforwardly accounted for in both alternatives and are not crucial for the comparison.

features. However, analyzing them as register features is as descriptively adequate, and representationally more economic: the only two prosodic objects that are needed to account for the prosodic system of Drubea and Numèè are the two features *l* (underlying lexical *l* and boundary *l*%) and *h* (postlexical, both epenthetic *h* and boundary *h*%).

[34] The conditioned and non-systematic realization of these boundary register features is not typical of *bona fide* boundary tones, and sheds doubt on whether they should really be analyzed as boundary features. The question of the nature of these utterance-final prosodic phenomena in Drubea and Numèè is still open, and can only be investigated with more data – in particular, a general investigation of non-lexical prosody and the prosody of different clause types, which is still lacking. Since this is mostly orthogonal to the main point of this paper, I leave it aside for now. I use the term "boundary" here out of mere convenience to refer to postlexical prosodic phenomena targeting the utterance-final position.

5.1 Tonal alternative

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 th 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 analysis taken literally, 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 $\rightarrow$ HLꜜHLꜜHL $=$ $[\mathrm{H^5L^3H^4L^2H^3L^1}]$. That is, downstepped RBUs could alternatively be analyzed as underlyingly L-toned TBUs, 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 OCP-L 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 $\rightarrow$ LꜜLꜜLꜜL. 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 [LꜜL] 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/ $\rightarrow$ $[\underline{\mathrm{(H)H}}\mathrm{L}]$ and as a [LꜜL] sequence in /LØL/ $\rightarrow$ $[\underline{\mathrm{LL}}{}^{\downarrow}\mathrm{L}]$ (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/ → [HHꜛHL]), and raising of L immediately before ꜜL (e.g. /LØØL/ → [LLꜛLꜜL]), both postlexical. Raising of H immediately before L is typologically very frequent (cf. Connell, 2011, pp. 12–13, and references therein). Raising of L before ꜜL is more unexpected, but its cross-linguistic rarity is mostly due to the overall rarity of languages with downstepped L tones.[35] Interestingly, it is also attested in Paicî (Lionnet, 2022b, pp. 14–15), another tonal language of New Caledonia.

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: 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. The tonal analysis 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 two other languages can arguably be analyzed as having an underlying downstep: Paicî (Lionnet, 2022b) and Xârâcùù (Lionnet, 2022b, pp. 41–42; cf. Rivierre, 1978).

5.2 RTT-compliant alternative: primary register and underspecified tone

Another alternative, in the spirit of the register analysis proposed here, but closer to Snider's (1999; 2020) Register Tier Theory, is one in which register features are primary, and tone features inserted postlexically for a full specification of tonal root nodes. This analysis makes crucial use of feature underspecification, a powerful representational tool that is an integral part of Snider's theory (cf. Snider, 2020, pp. 28–32).

This analysis would, just like the register analysis, posit an underlying contrast between syllables specified as *l* and underspecified for tone, and syllables fully unspecified for both tone and register, i.e. *l* vs. Ø. Just like in the register analysis, Ø syllables are optionally targeted by spreading of a preceding *l* (same-pitch realization), or specified by postlexical *h* insertion (pre-downstep raising), or left unspecified (interpolation). After all register-feature phonology has applied (*l* spreading and/or postlexical *h* insertion), tone features are inserted postlexically to fully specify *l* TRNs as *l*L (= "low" tone) and *h* TRNs as *h*H (= "high" tone). Syllables that are unspecified for register at this stage do not receive any tone features either, and are left fully unspecified and realized with interpolation. This analysis is

[35]Cf. footnote 2

schematized in Table 5 (b.i–ii). The register analysis is also repeated in a.i–ii in the table for comparison. The representational material posited by the RTT-compliant alternative that is not necessary in the register analysis is shown in boxes: the two tone features H and L, as well as the TRN. Note that only the *h*-epenthesis treatment of registerless/toneless syllables is shown in the table; the other two options of spreading a preceding *l* or leaving the syllable unspecified are ignored since they do not illustrate any notable difference between the two alternatives.

Table 5: RTT-compliant vs. register analysis compared (illustrated with the syllable as RBU/TBU)

		Underlying	Postlexical register	Postlexical tone
a. Register analysis:	i. /ꜜσ/ = [ꜜσ]	l σ	*n/a*	*n/a*
	ii. /σ/ = [ꜛσ]	σ	h σ	*n/a*
b. RTT-compliant:	i. /σ̀/ = [σ̀]	l $\boxed{\circ}$ σ	*n/a*	$\boxed{L}$ l $\boxed{\circ}$ σ
	ii. /σ/ = [σ́]	$\boxed{\circ}$ σ	h $\boxed{\circ}$ σ	$\boxed{H}$ h $\boxed{\circ}$ σ

This analysis can be considered a notational variant of the register analysis. The tone features it posits are fully redundant. There is no evidence in favor of these tone features and the postlexical rules by which they are inserted, hence no empirically driven reason to posit them in the analysis. There is, consequently, no evidence for the TRN either, whose only function is to unite register and tone features into single bundles corresponding to fully specified tones. The only argument that could be invoked in support of the TRN and tone features is the universality of tonal representations, that is, the idea that tones are universally represented as a TRN linked to one register and one tone feature. I do not subscribe to this universalist view. I adopt a bottom-up, emergent view of features (Boersma, 1998; Mielke, 2008), whereby the features posited by the analyst and the categories and natural classes they define must be empirically motivated, i.e. evidenced by phonological properties and behavior. If there is no evidence for H and L (hence for the TRN as well) in the lexical prosodic system of Drubea and Numèè, then I contend that there is no reason to posit these representations in the analysis of that system.

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 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 (70), (71), and (72) 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:

(70) 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.[36]

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 (71) 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:

(71) 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 (71a) 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

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

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' (71b).

Property (71c), 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 (72), 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.

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

a. Utterance-initially, there is no phonetic contrast between downstep and its absence.[37]

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 (72a) is known to have a few exceptions[38], 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, since it is not expected for an underlying tonal contrast, e.g., H vs. L, not to be realized utterance-initially.

Property (72b) 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 (72c), 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 (71), and also conforms to at least some of the crosslinguistic expectations of downstep, such as its non-realization in utterance-initial position.

[37] 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.

[38] 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)

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 one stress accent); (ii) SYLLABLE-DEPENDENCY (the stress-bearing unit is necessarily the syllable).'[39] 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.[40] 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. (52)b and (53)), or compounds consisting of more than one stem containing a downstepped RBU (e.g. /ꜜʊʊ + ũ + pooꜜka/ '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

[39] 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).

[40] 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.

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,[41] and REGISTER-based systems in which the tonal contrast is syntagmatically defined.[42] The separate existence of these two types, as revealed by Drubea and Numèè, justifies that register features and tones be treated as independent 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 (Shintani and Païta's (1990) *assertif*)
COLL	Collective (Shintani and Païta's (1990) *collectif*)
DESCR	Descriptive
EPIST	Epistemic (Shintani and Païta's (1990) *éventuel*)
PROS	Prospective (Shintani and Païta's (1990) *proximité temporelle*)
RBU	Register bearing unit
STAT	Stative (Shintani and Païta's (1990) *préfixe verbal d'état*)
TBU	Tone bearing unit
TRN	Tonal root note

[41] 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.

[42] 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.

Acknowledgments

Acknowledgments to be added

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