Downstep in Paicî (Oceanic, New Caledonia)

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Abstract

In this paper, I propose an updated analysis of the tone system of Paicî, one of the rare tonal Oceanic languages. Building on Jean-Claude Rivierre's (1974) work, I show that the tonal system of Paicî is best described with three underlying primitives: a High tone, a Low tone, and a downstep /ˡ/. Paicî is particularly interesting for the empirical documentation as well as the typological and theoretical understanding of downstep, because it combines many rare properties: (i) only downstepped ˡL is attested; (ii) downstep is its own phonological object; (iii) downstep is realized utterance-initially; and (iv) downstep is not caused by a floating tone, but has its roots in a former accentual system. The paper also provides an acoustic description of tone and downstep in Paicî –based on my own fieldwork as well as some of Rivierre's recordings– a first step toward filling an important gap in the documentation of downstepped ˡL tones and their properties.

1 Introduction

The notion of downstep –"the phenomenon by which a contrastive drop [in pitch] resets the register of the following tones" (Hyman 2017: 235)– has a long history in phonological theory, and has drawn much attention since its emergence in the mid-20th century (cf. Hyman 1979; Rialland 1997; Leben 2018 and references therein). It was initially thought that downstep was only possible between two High tones (HˡH), until cases of downstepped Mid (e.g. Yoruba, Bamgbose 1966; Gwari Hyman and Magaji 1970: 16) and Low tones (e.g. Bamileke Dschang, Tadadjeu 1974; Hyman 1985) were described. It was also believed at first that downstep was systematically caused by a floating Low tone. This was also later shown to be incorrect, with languages such as Shambala (Odden 1982) or Supyire (Carlson 1983), where the downstep in (some) HˡH sequences results from dissimilation effects unrelated to the presence of a L tone.

It is still the case, however, that languages with downstepped non-high tones and/or downstep not caused by a L tone are the exception rather than the rule. Only thirteen languages have been reported to have a ˡL tone, to my knowledge.[1] Leben (2018) notes that "the search for criteria [for the definition of downstep] that take downstepped Mid and

[1] Bamileke Dschang (Tadadjeu 1974; Hyman 1985), 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), and Sinyar (Boyeldieu 2019).

Low tones into account is hindered by the relative lack of information on their phonology and especially their phonetics."

This paper seeks to address this lacuna, by offering a description and analysis of tone in Paicî, an Oceanic language of New Caledonia.[2] The Paicî tone system was first described and analyzed by Rivierre (1974). The present paper, which owes much to Rivierre's work and intuitions, mostly confirms his description, and proposes a reanalysis of both the tonal inventory and the varied behaviors of tonal enclitics. I show that the tonal system of Paicî is best described with three underlying primitives: a High tone, a Low tone, and a downstep /ˈ/. Paicî is particularly interesting for the empirical documentation as well as the typological and theoretical understanding of downstep, because it combines many rare properties, among which the following: (i) only downstepped ˈL is attested; (ii) downstep is its own phonological object; (iii) downstep is realized utterance-initially, i.e. the L vs. ˈL contrast is maintained in the absence of an immediately preceding tone; and (iv) downstep is not caused by a floating L (or any other) tone, either in synchrony or in diachrony, but has its roots in a former accentual system. The paper also provides an acoustic description of tone and downstep in Paicî –based on my own fieldwork as well as some of Rivierre's recordings– a first step toward filling the unfortunate gap in documentation mentioned by Leben in the above quote.

There is a strong relation between tone and prosodic structure in Paicî. This relation is not the focus of this paper, and will only be mentioned when relevant for establishing the underlying tonal contrasts and characterizing downstep. The reader is referred to Lionnet (2019) for more detailed information on tone and prosodic structure.

After giving background information in §2 about Paicî and the source of the data that is the empirical basis of this paper, I show in §3 that Paicî lexical items contrast only two level tones: H vs. L, and give a phonetic description of the relative realization of these two tones. I then describe in §4 a process whereby L-toned words of four morae and above undergo systematic downstep after their second mora. This predictable phonological downstep is contrasted in §5 with underlying downstep present in the underlying representation of functional items –including a complex set of tonal enclitics– which constitutes evidence that downstep is its own phonological object /ˈ/, rather than a separate contrastive /ˈL/ tone. Further typologically rare properties of downstep are described in §6. The Low tone is then shown in §7 to have default status. §8 considers alternative analyses, namely Rivierre's (1974) initial three-tone analysis, a privative H vs. ∅ analysis, a strength-based analysis positing several L tones of differing strengths to explain the complex behavior of tonal enclitics, and an analysis of the downstep as being triggered by a floating L tone. I show that these analyses fail on either economy or descriptive adequacy. Finally, in §9, I compare the Paicî tone system to the accentual system of closely-related Xârâcùù, and, building on Rivierre (1978), I show that many properties of tone in Paicî are very likely to derive from a similar accent system.

[2]Throughout the paper, language names follow the official spelling proposed by the Académie des Langues Kanak (ALK, `https://www.alk.nc/`).

2 Paicî

2.1 Segmental inventory and phonotactics

Paicî [pàìcḭ̀] is one of the 28 Kanak languages of New Caledonia, all Oceanic, and one of the five tonal languages within this group. This makes it one of the rare Austronesian tonal languages, and one of the even rarer Austronesian languages whose tone system arose through endogenous tonogenesis, and not through contact with non-Austronesian tonal languages (Haudricourt 1968; Rivierre 1972, 1993, 2001). Despite being the third Kanak language by number of speakers (6,866 in 2014; INSEE-ISEE 2014), and the most spoken on Grande-Terre, the main island, it is still under-documented. The only three substantial descriptive works that have been published so far are Jean-Claude Rivierre's (1974) description of the tone system, his (1983) Paicî-French dictionary, and Gordon and Maddieson's (2004) phonetic description of the vowels.[3]

Paicî has ten oral and seven nasal vowels, listed in (1) (Rivierre 1983: 21, confirmed by my data). This inventory is typical of languages of central and southern New Caledonia. In the southeastern part of the Paicî-speaking area, /ʌ̰/ and /a̰/ tend to be neutralized (Rivierre 1983: 18; Gordon and Maddieson 2004).[4]

(1) Vowels (V̰ = nasalized vowel)

i	ɨ	u	ḭ	ɨ̰	ṵ
e	ə	o			
ɛ	ʌ	ɔ	ḛ	ʌ̰	o̰
	a			a̰	

The consonant system of Paicî is summarized in (2) (Rivierre 1983: 21). The binary contrast among stops is between voiceless and prenasalized. Like in most languages of Grande-Terre, there are no non-prenasalized voiced stops in Paicî.[5]

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[3] Rivierre and anthropologist Alban Bensa have also created a very rich archive of recorded and transcribed texts of various genres, many of which have been published (Bensa and Rivierre 1976, 1983, 1994; Bensa, Muckle, et al. 2015). Previous preliminary work on the phonology of Paicî includes Leenhardt (1946: 76-77), Grace (1955), and Haudricourt (1963, 1971).

[4] All transcriptions use IPA symbols, except for vowel nasalization, indicated with a subscript tilde [a̰] in order to leave room for tone marks above the vowel. Rivierre (1974) transcribes the interior vowels of Paicî as back unrounded ⟨ɯ ɤ ʌ⟩. I have taken the liberty to change the transcription of the first two to ⟨ɨ ə⟩, in accordance with their phonetic status as central vowels (cf. Gordon and Maddieson 2004). I keep the back unrounded symbol ⟨ʌ⟩ for the mid-low vowel in order to avoid any confusion between front ⟨ɛ⟩ and central ⟨ɜ⟩.

[5] The consonant inventory can in fact be analyzed as consisting of 12 rather than 18 underlying consonants. Ozanne-Rivierre and Rivierre (1989) note that the oral vs. nasal vowel contrast is neutralized after prenasalized and nasal stops, with only nasal vowels attested after nasal consonants (NṼ, *NV) and only oral vowels after prenasalized stops (ᴺDV, *ᴺDṼ). A simpler and more economic interpretation of these facts is that nasal consonants are allophones of prenasalized stops before nasal vowels: /ᴺDV/ = [ᴺDV], /ᴺDṼ/ = [NṼ]. This analysis is similar to the one proposed by Steriade (1993) for the Gbeya variety described by Samarin (1966). The choice of the prenasalized stop as the underlying representation rests on the assumption, argued for by Steriade, that the feature [nasal] is privative. In this paper, I will keep prenasalized and nasal stops distinct and adopt the New Caledonian tradition of not indicating prenasalization in phonological transcription (i.e. /b/ = [ᵐb]). Vowel nasalization will always be indicated, including after nasal consonants.

(2) Consonants

p	pw	t	c	k
b [ᵐb]	bw [ᵐbw]	d [ⁿd]	j [ᶮɟ]	g [ᵑg]
m	mw	n	ny [ɲ]	ng [ŋ]
	w	r, l		

Coda consonants are not allowed in Paicî, where the only permitted syllable types are V and CV. Whether vowel length is contrastive, as claimed by Rivierre (1974), is unclear, as there are no arguments so far in favor of viewing two subsequent identical vowels as a long vowel rather than a sequence of two short vowels. Overall, it seems like the syllable plays only a minimal role in the phonology of Paicî –and no role in the tone system, which, as we will see, refers to every prosodic category from the mora up to the prosodic word except the syllable.

2.2 The data

The tone system of Paicî was first described by Rivierre (1974).[6] The data presented in this paper partly come from this article and Rivierre's (1983) dictionary, as well as from texts he collected, to be found in the Pangloss online archive.[7]

I was able to both confirm Rivierre's description of the tone system and collect additional data during two field trips to New Caledonia in December 2017 and October-November 2019, with the help of two native Paicî speakers: Hélène Nimbaye (HN), in her fifties, from Câba (Tchamba), and Anna Gonari (AG), in her thirties, from Göièta (Goyeta). Both are bilingual in French. The elicitation sessions were recorded to a Marantz PMD 661 MKII (for HN) or Zoom H4n (for AG) digital recorder at a sampling rate of 44.1 kHz and 16 bit sample size, with a Røde NTG2 shotgun microphone. The recordings and their transcriptions are all archived in the XXX collection in the California Language Archive (URL: XXX). Speaker participation and informed consent were obtained in accordance with XXX University Linguistic Fieldwork IRB protocol #10346.

The phonetic data presented in this paper are both from my elicitation work and from Rivierre's recording of two texts: (i) *Le Maître de Göbwinyara* (Rivierre 1967b), as read by Novis Dui Pöömô (NDP), a male speaker from Pwaamâ (Paama), and (ii) *L'Enfant sorti de l'arbre* (Rivierre 1967a), told by Irénée Kowi (IK, male) –both in the online Pangloss collection. Pitch and spectrograms were extracted from Rivierre's and my recordings with Praat (Boersma and Weenink 2019), using standard settings. Speakers are indicated with their initials in square brackets in figure captions.

Elicitation sessions were entirely transcribed in ELAN. Examples are referenced with the ELAN filename followed by the corresponding annotation number within that file (format: YYMMDD-NbOfRecording-ConsultantCode:AnnotationNumber, e.g. 171228-02-HN1:67). Examples taken from Rivierre's texts are referenced with the letters G for *Le Maître de Gobwinyara* (Rivierre 1967b) and E for *L'Enfant sorti de l'arbre* (Rivierre 1967a), followed by the corresponding time code in Rivierre's recording: G/E:mm'ss".

[6] Aspects of Rivierre's description are also summarized in two subsequent articles (Rivierre 1978: 427–431, 1993: 161).

[7] Pangloss online archive, Paicî collection: `https://lacito.vjf.cnrs.fr/pangloss/corpus/list_rsc.php?lg=Paicî`, consulted on 04 Apr 2020. The data in the Pangloss archive are subject to the Creative Commons CC BY-NC-ND 2.5 license, which can be found at `https://creativecommons.org/licenses/by-nc-nd/2.5/`.

3 Tonal inventory: High vs. Low

Looking at Paicî lexical items, one can establish a contrast between two underlying tones: H vs. L.[8] Lexical items are in their vast majority isotonic, i.e. either all H (ca. 30%) or all L (ca. 60%). the remaining 10% consist of non-isotonic lexical items (7%) and a few toneless bound verb roots (3%). Isotonic lexical items are illustrated in (3) with a list of tonal minimal pairs taken from Rivierre's (1983) dictionary.

(3)	1μ	/í/	'to cry'	/ì/	'louse'
		/mṵ́/	'smoke'	/mṳ̀/	'flower'
	2μ	/kóó/	'humidity, cold'	/kòò/	'tree sp.'
		/pá̰dí/	'to hit, to thrash'	/pà̰dì/	'to divide'
	3μ	/pwáái/	'to fill, to load'	/pwàài/	'tree sp.'
		/údʌ́rɨ́/	'to catch on fire'	/ùdʌ̀rɨ̀/	'to disjoin'
	4μ	/tɔ́ɔ́wá̰rá̰/	'to accompany (music) in rhythm'	/tɔ̀ɔ̀wà̰rà̰/	'to reimburse'

In isolation or at the end of an utterance, the H tone tends to be realized on the initial mora only, with the pitch dropping significantly thereafter, as with the utterance final noun /wáápwíí/ 'araucaria (tree sp.)' in (4) and Figure 1 (Rivierre 2001: 32; the same is true of neighboring Cèmuhî, cf. Rivierre 1980: 53). This realization is suggestive of interpolation from the initial H-toned mora to a final boundary L% tone, characteristic of declarative/unmarked utterances. Note that the determiner /=ˡì/ in (4) and (5), and the coordination /=ˡbåù/ 'and, with' in (5) are predownstepped tonal enclitics (absence of an underlying tone is represented with a superscript circle). Tonal enclisis will be discussed in §5.2.

(4) /...=ˡì wáápwíí L%/
[...=ì wáāpwìì]
DEF araucaria
'[The coconut tree and] the araucaria' (191121-05-AG1:9)

Utterance-medially, on the other hand, H-toned words are realized with the same high pitch throughout, as shown with the noun /úpwá̰rá̰/ 'tree' in (5) and Figure 2. This confirms both Rivierre's (2001: 32) and Gordon and Maddieson's (2004: 300–301) description. Note that, as expected, the effect of the utterance-final L% is less perceptible after a L tone, as seen in example (5) and Figure 2. This final L% will henceforth be indicated only when relevant or necessary for the correct interpretation of pitch tracks.

[8] Paicî morphosyntax is mostly unstudied (apart from a brief sketch in Bensa and Rivierre 1976, and the few points in Rivierre 1974 touching on morphosyntactic aspects of tone). It is unclear what word categories exist in the language, and parts of speech are not indicated in Rivierre's (1983) dictionary. I have tentatively defined a preliminary split, mostly based on Rivierre's translations, between lexical and functional items. Lexical items (ca. 85% of monomorphemic items in the lexicon) are words which translate as and seem to behave like nouns, verbs, and adjectives –although it is unclear what the status of those adjectives is, and many roots seem to ignore the noun-verb distinction (see Moyse-Faurie (2004: 15–61) and references therein for a detailed discussion of the problem of defining categories such as nouns, verbs, and adjectives in Kanak and other Oceanic languages). I tentatively group every other word in the loosely defined category of "functional items," (ca. 15% of monomorphemic items), which I will come back to in §5.

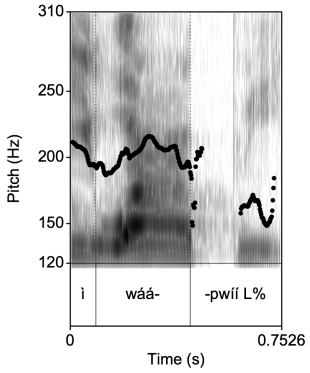

Figure 1: [...=ì wáápwíí L%] [AG] (191121-05-AG1:5)

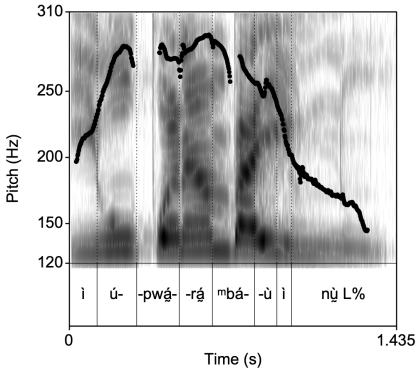

Figure 2: ì úpwa̱ra̱ =báù =ì nu̱ (L%)] 'the tree and the coconut tree' [AG] (201121-05-AG1:6)

(5) /=ˈì úpwa̱ra̱ =ˈbåù =ˈì nu̱/
[ì úpwa̱ra̱ =báù =ì nu̱]
DEF tree and DEF coconut.tree
'the tree and the coconut tree' (191121-05-AG1:6)

As clearly shown by Rivierre (1974), the tone-bearing unit is the mora.[9] The main argument comes from the process of phonological downstep described in §4 below. Only vowels are moraic in Paicî, where coda consonants are not allowed.

Syntagmatically, H and L tones are clearly distinct, as expected in a tone language. The upper pane of Figure 3 shows the F0 of the two tones in the first LH (38 tokens) and HL (53 tokens) sequences in all utterances in the text *Le Maître de Gobwinyara* (Rivierre 1967b; speaker NDP) where such sequences are not preceded by a downstep. Measurements are taken at the point where the pitch target is reached, i.e. the highest pitch on (or near) the H-toned mora and lowest pitch on or near the L-toned mora (the target is sometimes reached a little later than the mora bearing the tone, most often on the immediately following sonorant or nasal part of a prenasalized consonant). The bottom pane of Figure 3 shows the average difference between the two tones in both sequences. As can be seen, L and H are clearly distinct in both LH and HL sequences: the average F0 difference between L and H in LH is 15 Hz, while the difference in HL is 19 Hz (note that speaker NDP has a very low voice). This smaller difference suggests a downdrift effect, i.e. a slight lowering of H following L. The fact that the L in LH is higher than that in HL is due to the fact that tones tend to be realized higher utterance-initially.

Paradigmatically, on the other hand, H and L are close to indistinguishable, as seen in Figure 4, which shows the F0 of utterance-initial #H and #L tones (72 tokens each) in *Le Maître de Gobwinyara* (Rivierre 1967b).[10] Measurements are taken at the point of highest F0 within the utterance-initial vowel, which amounts to measuring how high the utterance

[9] 'Paicî is the only New Caledonian tonal language that "counts morae", and it does so with extreme precision' (Rivierre 1978: 431, my translation).

[10] There is a total of 349 utterances (complete intonation units) in the text. 269 start with a H tone (/a̱/ 'and' is the most frequently used word utterance-initially), 72 with a L tone, and eight with a downstepped ˈL tone. Figure 4 compares the 72 utterance-initial L tones with 72 utterance-initial H tones randomly selected.

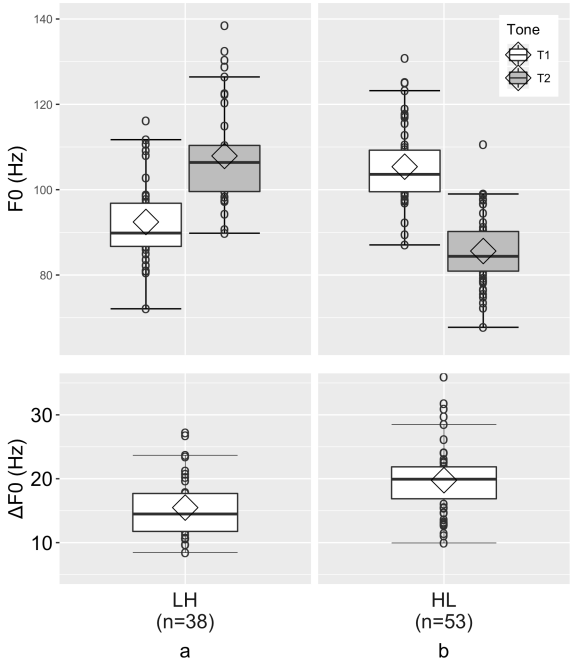

Figure 3: F0 of first and second tone in LH (a) and HL (b) sequences in Rivierre (1967b) [NDP]

starts. As can be seen, the average F0 is 103 Hz for #H and 98 Hz for #L, i.e. H and L differ only on average by 5 Hz utterance-initially. Furthermore, Figure 4 also shows that the pitch-range of #H is mostly included within the pitch range of #L, that is, at the beginning of an utterance, any realization of a H tone corresponds to a possible realization of a L tone. The only difference is that the pitch range of #L goes lower than that of #H. Consequently, although the average 5 Hz difference between #H and #L is significant ($t(133.7) = 3.4$, $p = 0.0007$***),[11] the overlap is such that it is safe to conclude that #H and #L are close to indistinguishable, i.e. it is most of the time impossible to determine the underlying tone of an utterance-initial word based on pitch only. This is reminiscent of Kiowa-Apache, where Bittle (1963: 85) says that 'the difference between high and low tone is discernible only when an utterance contains both.'

H and L are thus phonologically defined on the basis of syntagmatic contrast only, i.e. relative to each other, as per Pike's (1948: 4) definition. Note that H- and L-toned words do contrast in isolation. This contrast is, however, not predicated on a pitch height difference, but rather on a pitch movement difference, H-toned words being realized with a falling pattern, as mentioned above, while all morae of a L-toned words tend to be realized on the same pitch, with only a slight declination effect.

Non-isotonic words account for about about 7% of Paicî lexical items, and 5% of the total lexicon. These are illustrated in (6) below with words taken from Rivierre (1983). Many of these are fossilized compounds consisting of two (or more) isotonic components (6a), grammatical words (6b), exclamations (6c), or loanwords (6d) –categories which are known to have a cross-linguistic tendency to depart from regular phonotactics or prosody.

[11] Statistical significance is assessed using a Welch two-sample two-sided *t*-test at the 5% significance level ($p < 0.05$).

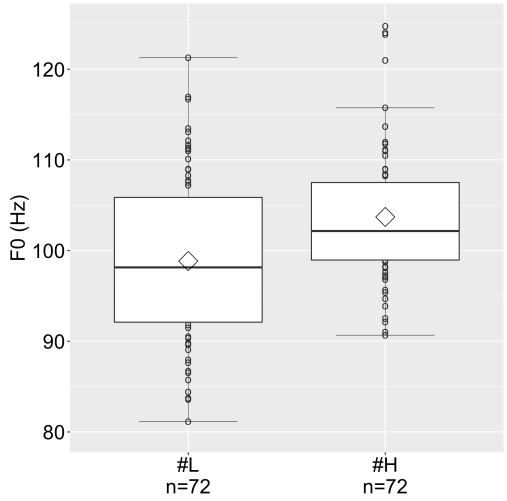

Figure 4: F0 of utterance-initial L and H in (Rivierre 1967b) [NDP]

(6) a. Fossilized compounds:
/e̋ré̋wèà/ ‘fish’ (/e̋ré̋/ ‘contents’ + /wèà/ (?))
/bwààwʌ́rɛ́/ ‘bird sp.’ (/bwàà/ (?) + /wʌ́rɛ́/ (?), cf. /bwààmà̰tà/ ‘bird sp.’)

b. grammatical words:
/cɛ́càà/ NEGATION
/àí/ ‘or’

c. Exclamations:
/ákàè/ ‘yes, ok’
/àípàà/ ‘bravo!’

d. Loanwords:
/lààcí/ ‘rice’ (< English)
/mwà̰gàcá̰/ ‘store, shop’ (< French *magasin*)

Finally, Paicî also has about 30 toneless verb roots. These are tonal enclitics, i.e. they get their tonal specification from the immediately preceding verb. We will come back to tonal enclisis in §5.2.

H tones are stable, i.e. they are not affected by any tonal processes, and in general never change: a H-toned mora always surfaces as H, and a H-toned word as all-H (*modulo* the effect of the utterance-final L% mentioned above). L tones, on the other hand, are targeted by several tonal processes, two of which will be the object of the following sections: downstep –both phonological (§4) and underlying (§5)– and floating H-tone realization and spread (cf. (11)).

4 Phonological downstep

Phonological downstep, described in Rivierre (1974), is illustrated in (7) with words taken from Rivierre (1983). While L-toned words of one to three morae are realized with a level

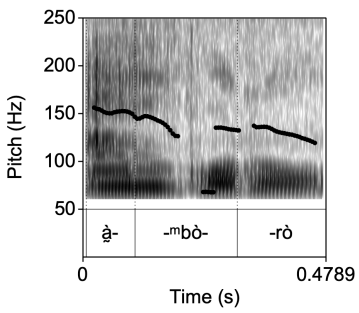

Figure 5: [ə̰ᵐbòrò] ‘person’ [HN] (171228-02-HN1:21)

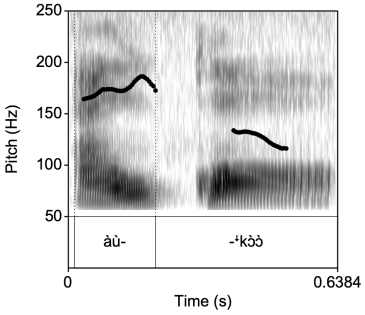

Figure 6: [àùˡkɔ̀ɔ̀] ‘kagu (brid sp.)’ [HN] (171228-02-HN1:14)

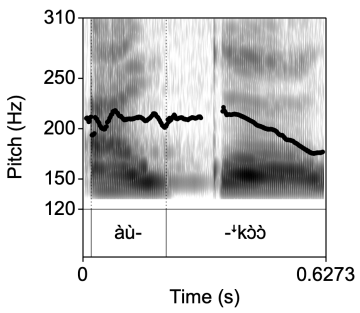

Figure 7: [àùˡkɔ̀ɔ̀] ‘kagu (bird sp.)’ [AG] (191121-07-AG1:69)

L tone throughout (7a), words of four morae and above undergo a register drop after the second mora (7b).

(7)	a.	$\grave{\mu}$:	/ì/	[ì]	‘louse’
			/mu̱/	[mu̱]	‘flower’
		$\grave{\mu}\grave{\mu}$:	/kòò/	[kòò]	‘tree sp.’
			/pa̱dì/	[pa̱ⁿdì]	‘to divide’
		$\grave{\mu}\grave{\mu}\grave{\mu}$:	/pwàài/	[pwàài]	‘tree sp.’
			/ùdʌrɨ/	[ùⁿdʌrɨ]	‘to disjoin’
	b.	$\grave{\mu}\grave{\mu}$ˡ$\grave{\mu}\grave{\mu}$:	/àùkɔ̀ɔ̀/	[àùˡkɔ̀ɔ̀]	‘kagu (bird sp.)’
			/pʌɟàɟìì/	[pʌⁿɟàˡⁿɟìì]	‘molar teeth’
		$\grave{\mu}\grave{\mu}$ˡ$\grave{\mu}\grave{\mu}\grave{\mu}$:	/ɛ̀àràbwà/	[ɛ̀àˡàràᵐbwà]	‘crab sp.’
			/pwèrètɔ̀ɔ̀tɨ̀/	[pwèrèˡtɔ̀ɔ̀tɨ̀]	‘wind’

As can be seen, in $4+\mu$ L-toned words, the third (and following) mora is systematically downstepped, irrespective of the skeletal structure (CV or V, between two different vowels, between two identical vowels, etc.). This shows that syllable structure plays no role here. The key constituent is the mora, which is both the TBU and the category counted by the phonological downstep process. Pitch tracks for the words /ə̰bòrò/ [ə̰ᵐbòrò] ‘person’ and /àùkɔ̀ɔ̀/ [àùˡkɔ̀ɔ̀] ‘kagu’ are given in Figures 5 and 6. Downstep is often realized as a fall on the downstepped mora, rather than an abrupt pitch drop before it, as shown by AG’s realization of [àùˡkɔ̀ɔ̀] in Figure 7.

Evidence for the downstep analysis of this phenomenon comes from the fact that all the morae following the pitch drop in the utterance (within the same word and in following words) are realized within a lower register: no following L is realized higher than the lowered L. This can be seen in example (8) and the corresponding pitch track in Figure 8, which shows that the register lowering affects all L-toned words following the downstepped mora in [tèàˡpàà].[12]

[12]The preposition /=nə̰ə̰/ ‘to(ward), at’ is a toneless enclitic: it gets its tonal specification from the preceding toned word. We will come back to tonal enclitics in §5.2.

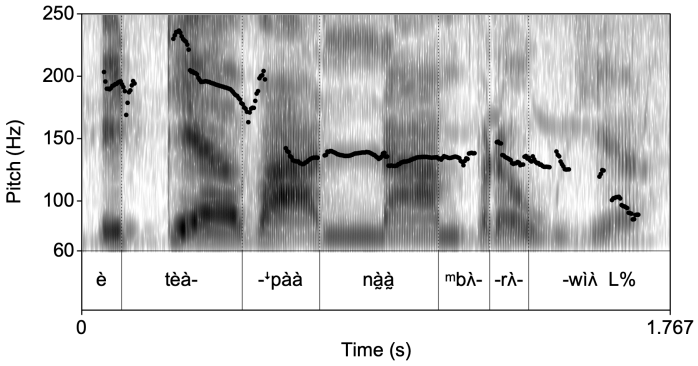

Figure 8: [è tèàˡpàà =nn̰à̰à̰ ᵐbʌ̀rʌ̀-wìʌ̀] ‘He arrived/was born on the seashore’ [HN] (171228-02-HN1:103)

(8) /è tèàpàà =nn̰å̰å̰ bʌ̀rʌ̀-wìʌ̀/
[è tèàˡpàà =nn̰à̰à̰ ᵐbʌ̀rʌ̀-wìʌ̀]
(s)he arrive =DIR edge-wave
‘(S)he arrived/was born on the seashore.’ (171228-02-HN1:103)

The example in (9) and Figure 9 further shows that a H tone following a downstep ˡL tone is realized not only lower than a preceding H, but at about the same height as a L tone preceding the downstep. Paicî is thus a language with “total downstep,” defined by Meeussen (1970: 270) as a kind of register lowering in which downstepped tones are ‘not lowered just a little, but all the way to the next lower register.’ Since only L tones are downstepped in Paicî, the lowering effect cannot directly be said to take the affected tone ‘all the way to the next lower register.’ However, the indirect effect of the downstep on following H tones clearly shows that the register drops by one tone-step.

(9) /è tèàpàà pn̰á̰ =nn̰å̰å̰ bʌ̀rʌ̀-wìʌ̀/
[è tèàˡpàà pn̰á̰ =nn̰á̰á̰ ᵐbʌ̀rʌ̀-wìʌ̀]
(s)he arrive =toward =DIR edge-wave
‘(S)he arrived on the seashore.’ (171228-02-HN1:106)

Rivierre (1974) describes phonological downstep as conditioned by metrical structure, although without a full analysis of the prosodic categories involved. Lionnet (2019) analyzes it as a form of OCP constraint applying between two successive L-toned bimoraic feet licensed by a dipodic colon, within the same prosodic word. This analysis is illustrated in (10) below, where feet are between parentheses (...) and cola between braces {...}. (I will come back to the definition and role of the prosodic word in §5.2).

(10) a. $1 \sim 3\grave{\mu}$ words:

$\grave{\mu}$:	/ì/	ì	‘louse’
$\grave{\mu}\grave{\mu}$:	/pn̰dì/	pn̰dì	‘to divide’
$\grave{\mu}\grave{\mu}\grave{\mu}$:	/ùdʌ̀rɨ̀/	ùdʌ̀rɨ̀	‘to disjoin’

b. $4\grave{\mu}+$ words:

$\grave{\mu}\grave{\mu}$ˡ$\grave{\mu}\grave{\mu}$:	/àùkɔ̀ɔ̀/	{(àù)ˡ(kɔ̀ɔ̀)}	‘kagu (bird sp.)’
$\grave{\mu}\grave{\mu}$ˡ$\grave{\mu}\grave{\mu}\grave{\mu}$:	/pwèrètɔ̀ɔ̀tɨ̀/	{(pwèrè)ˡ(tɔ̀ɔ̀)tɨ̀}	‘wind’

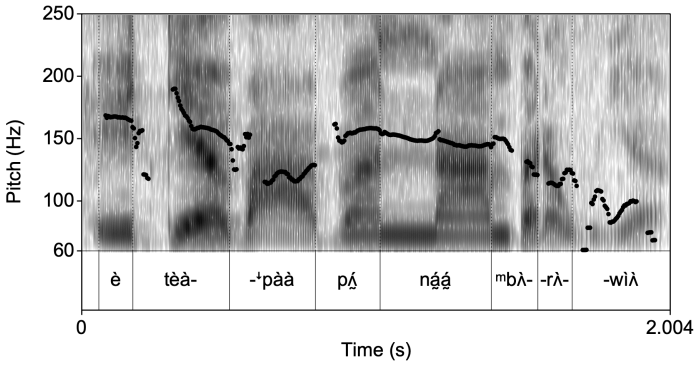

Figure 9: [è tèàˡpàà pá̱ =ná̱á̱ ᵐbʌ̀rʌ̀-wìʌ̀] 'He arrived on the seashore' [HN] (171228-02-HN1:106)

As seen, there are not enough morae in $1\sim3\mu$ words to parse two bimoraic feet, which explains the four-mora requirement for the application of phonological downstep.

Evidence that the colon is necessary, and that no foot is parsed unless it is licensed by a colon is given by the realization of the juncture H-tone, a floating tone marking the head-complement relation between two elements in certain head-initial morphosyntactic structures, e.g. transitive verbs followed by their incorporated objects, derivational prefixes and their base of affixation, etc. This is illustrated in (11), with the MIDDLE derivational prefix /pì-^{H}/.[13]

(11)	a.	1μ	/pì-^{H} cɔ̀/	pì-cɔ́	'move forward'
		2μ	/pì-^{H} wà̱dò/	pì-wá̱dò, *pì-(wá̱dó)	'get drunk'
		3μ	/pì-^{H} tʌ̀mà̱rì̱/	pì-tʌ́má̱rì̱, *pì-(tʌ́má̱)rì̱	'give birth'
	b.	4μ	/pì-^{H} nà̱ɟàìrì/	pì-{(ná̱ɟá)(ìrì)}	'curse'
			/pì-^{H} tɔ̰̀ɔ̰̀wà̱rì̱/	pì-{(tɔ́ɔ́)(wà̱rì̱)}	'reimburse'

As seen, this floating H tone is realized on the initial mora of the complement in $1\mu\sim3\mu$ words (11a), and on the initial foot if the word is at least four morae long (11b). The fact that the H tone is realized on the initial mora and not the initial foot in bi- an trimoraic words (11a) is evidence that the initial two morae in such words are not parsed into a foot. The reason is that they are not licensed by a colon. Note that there is no effect of the foot or colon on the realization of H tones in an all H word. See Lionnet (2019) for more detail on this analysis.

To summarize, phonological downstep targets only L tones, and is only attested between two L tones: LˡL. It is also entirely predictable, and need not be posited in underlying representation. Consequently, only two tonemes –H and L– are necessary to account for the tonology of lexical items in Paicî.

[13]This is described, although not in the same terms, by Rivierre (1974: 332–333, 337–339). Rivierre analyzes juncture-H-assigning morphemes as "proclitics." I depart from his analysis, because there is no evidence that these are clitics in any sense. Rivierre also fails to clearly identify the morphosyntactic head-dependent relation that characterizes all cases of juncture H assignment.

5 Underlying downstep

The tonology of functional items (pronouns, prepositions, adverbials, TAM markers, various "particles") gives evidence that not all downstepped ꜜL tones are predictable. There are clear cases of underlying downstep, i.e. morphemes for which downstep has to be specified in the underlying representation. Some of these functional words also constitute evidence that downstep in Paicî is best analyzed as its own phonological object /ꜜ/, as opposed to a contrastive /ꜜL/. I will first focus on non-enclitic functional items in §5.1, and discuss enclitics in §5.2.

5.1 Underlying downstep in non-enclitic functional items

About 60% of non-enclitic functional items are L-toned (e.g. /mə̀ə̀/ '(say) that'), 20% are H-toned (e.g. /cə́/ NEGATION), and 17% are non-isotonic (e.g. /cíbwàà/ PROHIBITIVE). The remaining 3% consist of four words –the three pre-verbal TAM markers listed in (12a-c) and the vocative marker /ꜜcò/ in (12d)– which are systematically realized lower than a preceding L-tone, and impose this register lowering to the rest of the utterance. These words are thus best analyzed as carrying an underlying downstepped ꜜL.

(12) a. /ꜜò/ FUTURE
b. /ꜜbwàà/ IMPERFECTIVE
c. /ꜜmwàà^{H}/∼/ꜜmə̀ə̀^{H}/ PUNCTUAL/SUCCESSIVE, 'then'[14]
d. /ꜜcò/ VOCATIVE

The tonal behavior of FUTURE /ꜜò/ and IMPERFECTIVE /ꜜbwàà/ is illustrated in (13); corresponding pitch tracks are given in Figures 10 and 11.[15]

(13) a. /rə̀ ꜜò wə̀dò.../
[rə̀ ꜜò wə̀^{n}dò...]
they FUT drink
'They will drink [something].' (171228-02-HN1:74)

b. /rə̀ ꜜbwàà wə̀dò kàpé/
[rə̀ ꜜ^{m}bwàà wə̀^{n}dò kàpé]
they IPFV drink coffee
'They are still drinking coffee.' (171228-02-HN1:87)

As seen in Figures 10 and 11, not only are /ꜜò/ and /ꜜbwàà/ realized lower than a preceding L-toned morpheme (here the subject marker /rə̀/), –but the following L tones on [wə̀^{n}dò] are realized with the same pitch as this lower tone. Additionally, following H tones are realized at about the same pitch as the L tones preceding the pitch drop caused by these morphemes, as clearly illustrated by the second syllable of [kàpé] in (13b) and Figure 11. That is, these functional words lower the entire register of the remainder of the utterance, justifying the downstep analysis. This also confirms that Paicî is a language with total downstep, irrespective of whether downstep is predictable or underlying.

[14] This morpheme assigns a juncture H tone to the following morpheme (cf. (11) above ad surrounding prose).
[15] Some of these examples consist of re-recordings of examples given by Rivierre (1974: 328).

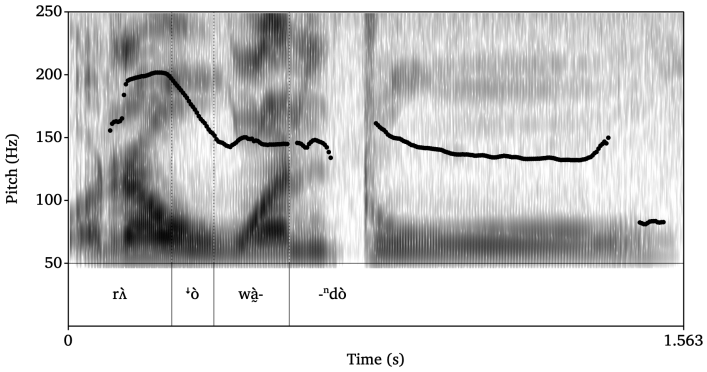

Figure 10: [rʌ̀ ˈò wa̰ⁿdò] ‘they will drink [something]’ [HN] (171228-02-HN1:74)

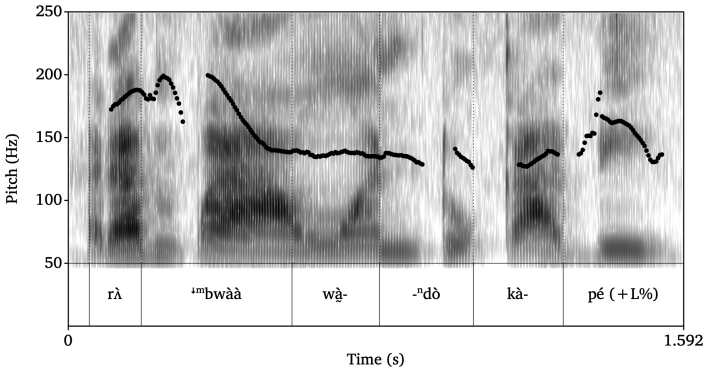

Figure 11: [rʌ̀ ˌᵐbwàà wa̰ⁿdò kàpé] ‘they are still drinking coffee’ [HN] (171228-02-HN1:87)

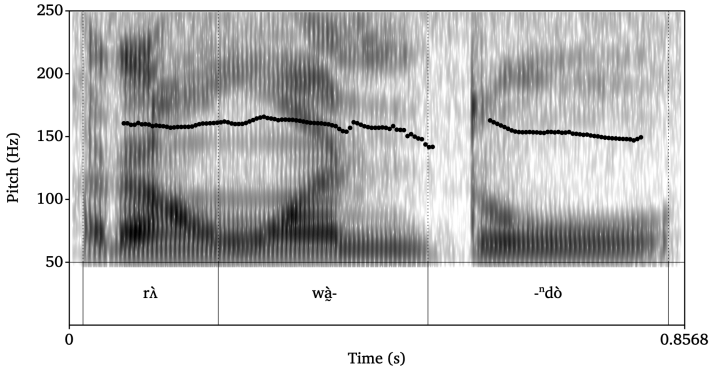

Figure 12: [rʌ wa̰ⁿdò] 'they drink [something]' [HN] (171228-02-HN1:52)

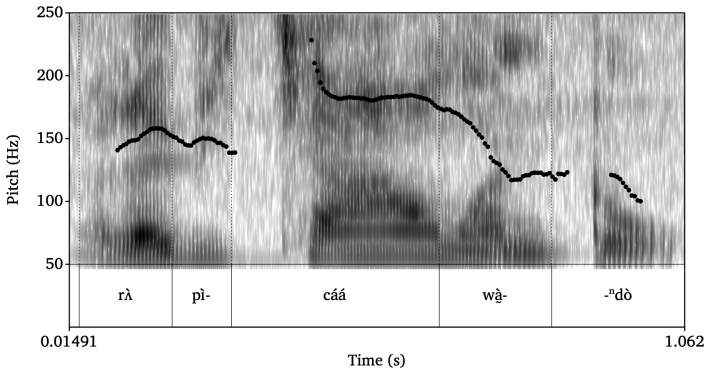

Figure 13: [rʌ pì-cáá-wa̰ⁿdò] 'they drink together' [HN] (171228-02-HN1:41)

For comparison, the realization of H and L tones in non-downstep contexts is illustrated in (14), with corresponding pitch tracks shown in Figures 12 and 13

(14) a. /rʌ wa̰dò.../
[rʌ wa̰ⁿdò...]
they drink
'They drink [something].' (171228-02-HN1:52)

b. /rʌ pì-^{H} cáá- wa̰dò/
[rʌ pì- cáá- wa̰ⁿdò]
they MID together drink
'They drink together.' (171228-02-HN1:41)

The all-L sequence in (14a) is realized with the same pitch throughout, as clearly shown in Figure 12. Figure 13 shows that the H-toned prefix [cáá-] in (14b) is realized higher than both the preceding L-toned elements [rʌ pì-] and the following L-toned verb [wa̰ⁿdò], as expected (with a slightly lower tone on [wa̰ⁿdò] than on [rʌ pì-] likely due to utterance final position).

The existence of these functional items whose downstepped ˡL cannot be predicted justify the underlying status of downstep in Paicî. The exact status of downstep is still unclear

however: is ˡL contrastive with H and L, or is downstep its own phonological object? I show the latter to be the correct analysis in the next section, based on the behavior of tonal enclitics.

5.2 Tonal enclisis

About 40% of functional items are tonal enclitics, i.e. morphemes whose tonal properties partly or completely depend on the closest preceding non-enclitic toned word, which I call "tonal nucleus", after Rivierre's *centre tonal*. Three types of tonal enclitics exist, differentiated by their tonal behavior, described by Rivierre (1974). I propose to account for these differences in terms of different underlying representations: toneless enclitics /=x̊/ (§5.2.1) contrast with predownstepped toneless enclitics /=ˡx̊/ (§5.2.2) and predownstepped L-toned enclitics /=ˡx̀/ (§5.2.3) (tonelessness is indicated with a superscript circle). The sign "=" is used here to represent the purely phonological relation of tonal enclisis, and has no morphological value. As will be clear in many examples given in this and following sections, prosodic structure and morpho-sytnactic structure are often at odds in Paicî (see Lionnet (2019) for more detail).[16]

5.2.1 Toneless enclitics

Approximately 80% of tonal enclitics are toneless, i.e. they have no underlying tone of their own, and get their tonal specification through spreading from the tonal nucleus (see §7.3 for cases involving non-isotonic nuclei). This is illustrated with the directional preposition /=nå̰å̰/ 'to, at' in (15a-b), repeated from (8)-(9) above. Many suffixes (e.g. object/possessive/oblique pronominal suffixes, transitivizing suffix /-rǐ/) are toneless, and analyzed on a par with toneless enclitics, since they have exactly the same behavior.[17]

(15) a. /è tèàpàà =nå̰å̰ bʌ̀rʌ̀-wìʌ̀/
[è tèàˡpàà =nà̰à̰ ᵐbʌ̀rʌ̀-wìʌ̀]
(s)he arrive =DIR edge-wave
'(S)he arrived/was born on the seashore.' (171228-02-HN1:103)

b. /è tèàpàà pá̰ =nå̰å̰ bʌ̀rʌ̀-wìʌ̀/
[è tèàˡpàà pá̰ =ná̰á̰ ᵐbʌ̀rʌ̀-wìʌ̀]
(s)he arrive toward =DIR edge-wave
'(S)he arrived on the seashore.' (171228-02-HN1:106)

The corresponding pitch tracks in Figures 8 and 9 above clearly show that /=nå̰å̰/ is realized at the same pitch as the preceding tonal nucleus: L-toned /tèàpàà/ [tèàˡpàà] in (15a) and Figure 8, H-toned /pá̰/ [pá̰] (15b) and Figure 9.

[16]Toneless enclitics correspond to Rivierre's (1974) *enclitiques intégrés (i)*, predownstepped toneless enclitics to his *enclitiques (j)*, and predownstepped L-toned enclitics to his *enclitiques (d)*. Rivierre mentions a fourth type of enclitics *–enclitiques contrastifs (c)–* which are actually not tonal enclitics in the analysis I propose here, since they do not form a prosodic word with the preceding tonal nucleus. This class consists of five L-toned functional items whose initial mora has polar tone, i.e. always contrasts with the preceding tone, e.g. [bwètì]~[bwétì] 'well' in [è púú bwètì] 'he sleeps well' vs. [è cə̀bù bwétì] 'he dances well' (Rivierre 1974: 329). The analysis of these items falls outside the scope of this paper.

[17]Their status as suffixes rather than separate words is justified by assimilation processes applying to suffixes, not to other enclitics.

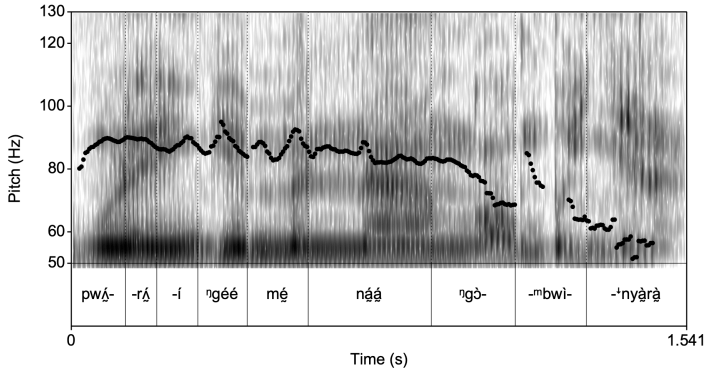

Figure 14: [pwǽ-rǽ-í =ᵑgéé =mḛ́ =nǽǽ ᵑgɔ̀ᵐbwìˈɲàràˌ] '[Then they heard the] crying noises coming from Göbwinyara' [NDP] (G:14'37")

Sequences of tonal enclitics are frequent.[18] In such cases, the tone of the nucleus spreads to the entire sequence of enclitics, as shown in (16), illustrating a H-toned nucleus followed by three toneless enclitics, and in (17), where the L-toned nucleus /tɛ̀ɛ̀pàà/ (realized [tɛ́ɛ́pàà] after the docking of the juncture H tone assigned by the SUCCESSIVE marker /ˈmwàˌàˌ^{H}/, cf. (11) above) is also followed by three toneless enclitics.[19]

(16) /...pwǽ-rǽ-í =gɛ̰ɛ̰ =mḛ =nɑ̰ɑ̰ gɔ̀bwìnyàràˌ/
[...pwǽ-rǽ-í =ᵑgéé =mḛ́ =nǽǽ ᵑgɔ̀ᵐbwìˈɲàràˌ]
noise-of-cry =horizontally =toward.here =DIR (place name)
'[Then he heard the] crying noises coming from Gobwinyara.' (G:14'37")

(17) /...ˈmwàˌà^{H} tɛ̀ɛ̀pàà =dɔ̰ =mḛ =nɑ̰ɑ̰ gɔ̀bwìnyàrà/
[...ˈmwàˌà tɛ́ɛ́pàà =ⁿdɔ̀ =mḛ̀ =nàˌà ᵑgɔ̀ᵐbwìˈɲàràˌ]
SUCC arrive =upward =toward.here =DIR (place name)
'[And then they] arrived in Göbwinyara' (G:07'09")

As clearly seen in Figures 14 and 15, the toneless enclitics are all realized at the same pitch as the immediately preceding tonal nucleus.

Not all toneless enclitics are functional items. There exist about 30 toneless second-position bound verb roots (V2), usually referring to an action, always used after a classificatory prefix expressing the manner in which the action referred to by V2 is performed (Ozanne-Rivierre and Rivierre 2004). This is illustrated below with the V2 /-dɅ̊rʊ̊/ 'to split' (18), combined with the two classificatory prefixes /cǽ-/ 'exert pressure on' and /cɔ̀-/ 'do X with the foot'/ (examples from Ozanne-Rivierre and Rivierre 2004: 363).

(18) /cí-dɅ̊rʊ̊/ [cí-ⁿdɅ́rʊ́] 'to split with the tip of an object'
/cɔ̀-dɅ̊rʊ̊/ [cɔ̀-ⁿdɅ̀rʊ̀] 'to split by stepping on'

The tonal nucleus and all immediately following tonal enclitics form a prosodic word, which is the domain of application of the phonological downstep described in §4 (cf. Lionnet

[18]There does not seem to be any upper limit on the number of enclitics following a tonal nucleus. The maximum I have found after a cursory search through Bensa and Rivierre's (1994) text collection is six.

[19]Two forms of the verb 'to arrive' are attested: /tɛ̀ɛ̀pàà/ (NDP, Rivierre 1983) and /tèàpàà/ (HN).

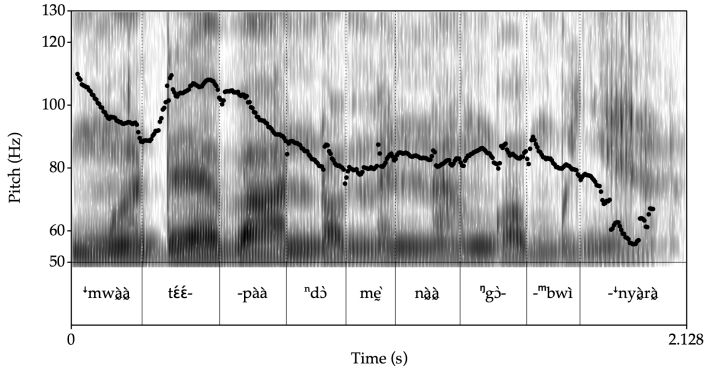

Figure 15: [...ˡmwà̠à̠ tɛ́ɛ́pàà =ⁿdɔ̀ =mɛ̰̀ =nà̠à̠ ᵑgɔ̀ᵐbwìˡɲà̠rà̠] '[And then they] arrived in Göbwinyara' [NDP] (G:07'09")

2019). This is seen in (19) and corresponding pitch tracks in Figures 16 to 18, where phonological downstep applies whenever the prosodic word contains at least four morae, irrespective of whether these morae are part of the tonal nucleus or one or several enclitics (feet are shown in parentheses, prosodic words between angle brackets; cola are ignored for the sake of legibility).

(19) a. /pwɛ̰̀ɛ̰̀dì = kɛ̰̊ɛ̰̊/
[⟨(pwɛ̰̀ɛ̰̀)ˡ(ⁿdì = kɛ̰̀)ɛ̰̀⟩]
youngest.brother =POSS:3SG
'his youngest brother' (G:07'31")

b. /á̠ nà̠ rʌ̀ nḭ̀à̠ =bɔ̊ɔ̊/
[á̠ nà̠ rʌ̀ ⟨(nḭ̀à̠) ˡ(=ᵐbɔ̀ɔ̀)⟩]
and when they look =down
'And when they look down...' (G:12'51")

c. /è tɔ̰̀ =mɛ̰̊ =nà̠à̠ bʌ̀rʌ̀-wìʌ̀/
[è ⟨(tɔ̰̀ =mɛ̰̀) ˡ(=nà̠à̠)⟩ ᵐbʌ̀rʌ̀-wìʌ̀]
(s)he enter =toward.here =DIR edge-wave
'(S)he came back (from the sea) to the shore.' (171228-02-HN1:95)

Phonological downstep applies within the phonological word only, and not just to any sufficiently long sequence of L tones. It is possible to have a long string of L tones with no downstep, if each individual prosodic word has a maximum of 3 morae. This is shown in (20), an utterance made of a succession of eight independent prosodic words, all but the last one L-toned. None of these is long enough to trigger phonological downstep, and as seen on Figure 19, the sequence of eleven L-toned morae they constitute is realized with approximately the same pitch throughout, with a slight declination effect.

(20) /gʌ̀ù nà̠bwè bàà gò jɛ̀ nḭ̀ḭ̀ pòᴴ mɔ̰̀ɔ̰̀/
[ᵑgʌ̀ù nà̠ᵐbwè ᵐbàà ᵑgò ᶨjɛ̀ nḭ̀ḭ̀ pò mɔ̰́ɔ̰̀]
you.two end because I PFV alas very cold
'Stop, for I am freezing.' (G:18'02")

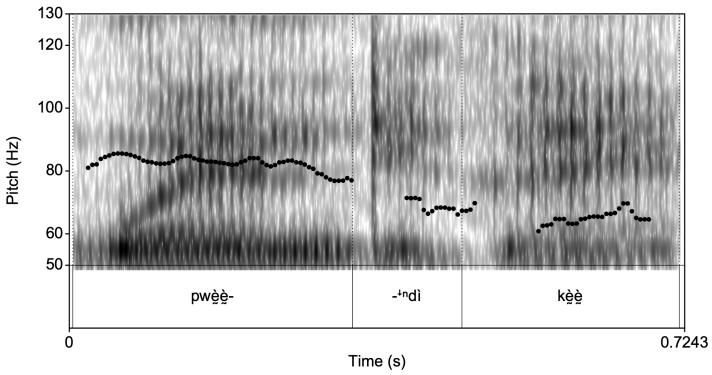

Figure 16: [pwe̱e̱ˈⁿdì =ke̱e̱] 'his youngest brother' [NDP] (G:07'31")

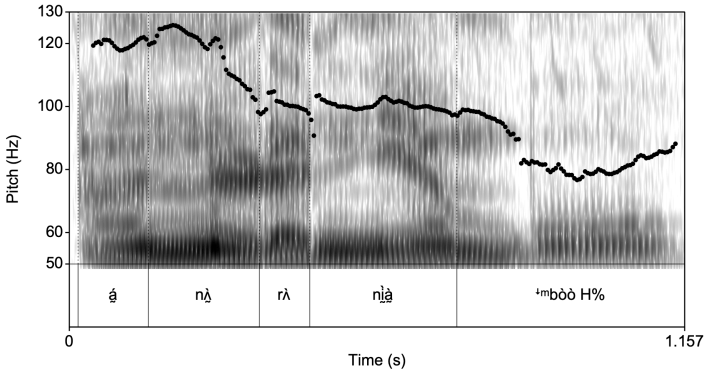

Figure 17: [a̱ na̱ ra ni̱a̱ =ˈᵐbòò] 'And when they looked down…' [NDP] (G:12'51")

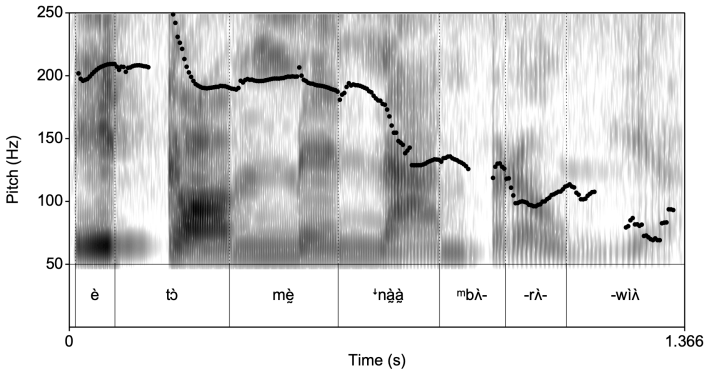

Figure 18: [è tɔ̀ =me̱ =ˈna̱a̱ ᵐbàrà-wìà] '(S)he came back (from the sea) to the shore.' [HN] (171228-02-HN1:95)

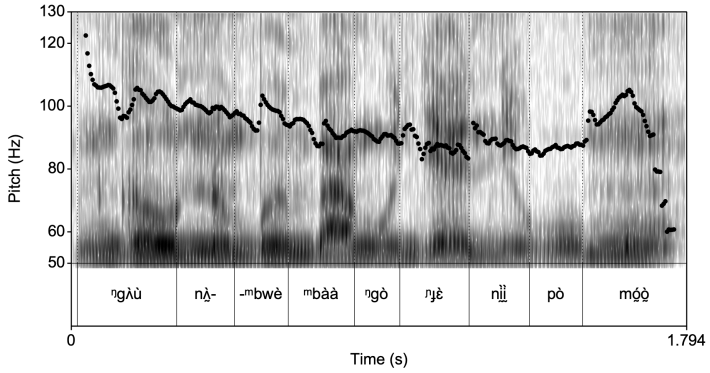

Figure 19: [ⁿgʌ̀ù nʌ̰ᵐbwè ᵐbàà ⁿgò ᶮjɛ̀ nḭ̀ḭ̀ pò mǫ́ǫ̰̀] 'Stop, for I am freezing.' [NDP] (G:18'02")

Phonological downstep can thus be used as a diagnostic for identifying tonal enclitics: any word that is grouped with the preceding tonal nucleus for the application of phonological downstep is a tonal enclitic.

5.2.2 Predownstepped toneless enclitics

There is a set of twelve enclitics (about 16% of all enclitics) that are realized H after a H-toned nucleus, just like toneless enclitics, but ꜜL after a L-toned nucleus.[20] Analyzing these enclitics as toneless and preceded by an underlying underlying downstep straightforwardly accounts for their behavior. This is shown with the animate subject marker /=ꜜwʌ̊/ in (21).

(21) a. /á̰ è ꜜmwà̰à̰^{H} ínʌ̰́ =ꜜwʌ̊ pwìrìdùà.../
[á̰ è ꜜmwà̰à̰ ⟨ínʌ̰́ =wʌ́⟩ pwìrìꜜⁿdùà...]
and (s)he SUCC say =SBJ (name)
'And Pwiridua then said...' (G:16'19")

b. /è tɔ̀ =ꜜwʌ̰̊ dùì/
[è ⟨tɔ̀ =ꜜwʌ̰̀⟩ ⁿdùì]
(s)he enter =SBJ (name)
'Dui comes/goes in.' (201121-04-AG1:5)

The tone of both H- and L-toned nuclei spreads onto the toneless mora of the subject marker /=ꜜwʌ̰̊/ in (21a) and (21b) respectively. After a L-toned nucleus, the L tone that has spread is affected by the enclitic's underlying downstep (21b)/Figure 21. Because H tones are immune to downstep, the underlying downstep of the enclitic is not realized after a H-toned nucleus (21a)/Figure 20. This underlying downstep, contrary to the phonological downstep seen in §4 above, is not subject to the four-mora minimum condition, as clearly seen in (21b), where it occurs after the first mora of the bimoraic prosodic word ⟨tɔ̀ =ꜜwʌ̀⟩.[21]

Evidence that predownstepped toneless enclitics are indeed tonal enclitics, i.e. form a prosodic word with the preceding tonal nucleus, is given in (22) and Figure 22. As can

[20]The two relative markers /=ꜜnʌ̰̊/ and /=ꜜíå/ and their derived forms /=ꜜcɛ̰̃nʌ̰̊/ (indefinite) and /=ꜜnʌ̰̊-íå/ (definite), the subject marker /=ꜜwʌ́~=ꜜṼ/ introducing animate subjects, the two prepositions /=ꜜwą̰̊~=ꜜǫ̰̃~=ꜜṼ/ (locative) and /=ꜜbáną̰̊ą̰~=ꜜbánʌ̰̊/ 'until', the two adverbials /=ꜜɛ̰̃rí/ 'later, in a moment' and /=ꜜnʌ̰̊bʌ́/ 'today', the interrogative /=ꜜpʌ́/ 'where', the complementizer /=ꜜnʌ̰̊ù/~/=ꜜnʌ̰̊ʌ̀/ 'for, in

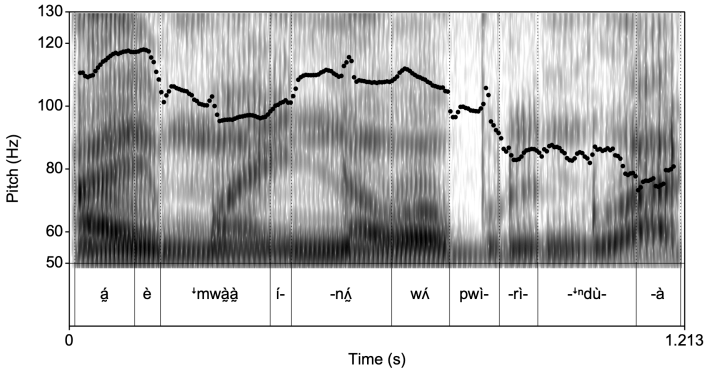

Figure 20: [á̠ è ˡmwà̠à̠ ínǹ̠ =wʌ́ pwìrìˡⁿdùà]‘And Pwiridua then said…’ [NDP] (G:16’19”)

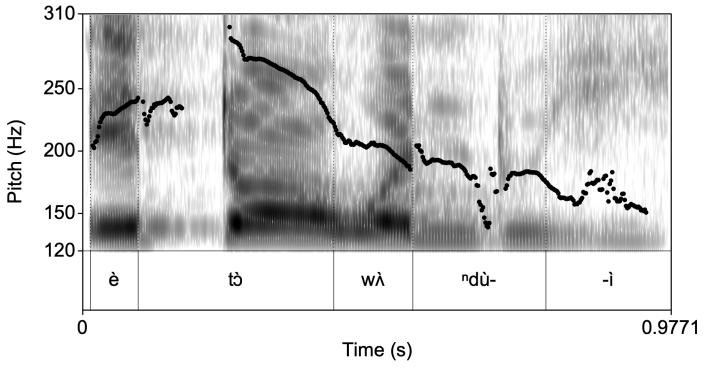

Figure 21: [è tɔ̀ =ˡwʌ̀ ⁿdùì] ‘Dui enters.’ [AG] (201121-04-AG1:5)

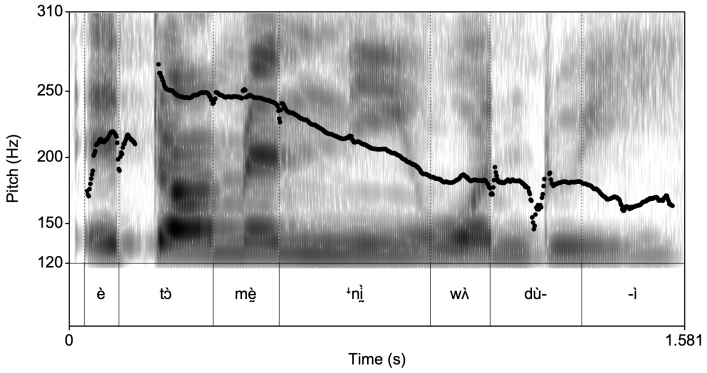

Figure 22: [è tɔ̀ =mɛ̀ =ˈnì=wʌ́ ⁿdùì] ‘Dui comes in here.’ [AG] (191121-04-AG1:7)

be seen, the presence of a phonological downstep after [mɛ̀] can only be explained if the prosodic word headed by /tɔ̀/ is made up of at least four morae, i.e. if it includes the subject marker /=ˈwʌ̊/ (the reason why the underlying downstep of /=ˈwʌ̊/ is not realized in this case is explained in §6.3.1). Predownstepped toneless enclitics are thus parsed with the preceding tonal nucleus (and any intervening enclitics) and counted for the application of phonological downstep.

(22)	/è	tɔ̀	=mɛ̊̀	=nì̊	=ˈwʌ̊ dùì/
	[è	⟨(tɔ̀	=mɛ̀)	ꜜ(=nì	=wʌ́)⟩ ⁿdùì]
	(s)he	enter	toward.here	=here	=SBJ (name)/
	‘Dui comes in here.’ (191121-04-AG1:7)				

The category of predownstepped toneless enclitics includes two “mixed” enclitics, whose first mora is toneless, but whose second mora is L-toned: the coordination /=bǎù/ ‘and, with’, and the purposive complementizer /=ˈnɑ̰̀ù/∼/=ˈnɑ̰̀ɑ̰̀/ ‘for, in order to (after motion verbs).’ The latter is illustrated after a H and a L tonal nucleus in (23a) and (23b) below.[22]

order to’, and the coordination /=ˈbǎù/ ‘and, with’.

[21]The pitch rises from the L-toned subject [è] or [rʌ́] to the following L-toned verb [tɔ̀] in (21b)/Figure 21, (22)/Figure 22, and (23b)/Figure 24, in preparation for the pitch drop that follows. This phenomenon, described by Rivierre (1980: 57) for neighboring Cèmuhî, is relatively frequent in AG’s speech, but rarer with HN and NDP.

[22]Whether these two items are monomorphemic or not is unclear. The /ˈnɑ̰̀-/ part in =ˈnɑ̰̀ù/∼/=ˈnɑ̰̀ɑ̰̀/ ‘for, in order to’ is likely related to a family of similar grammatical words: relative /=ˈnɑ̰̀/, complementizer /nɑ̰̀/ ‘that’, /nɑ̰̀∼nɑ́/ ‘when’, (bà)-nɑ̰̀ ‘in order to’. Determining a possible origin of /=ˈbǎù/ ‘with’ is less easy. Given its semantics, it might historically be related to the noun /bà/ ‘group, society,’ but this must remain a tentative hypothesis. In any case, the origin of the second, L-toned mora in both items (/ù/ in both words, /à/ in the /=ˈnɑ̰̀ɑ̰̀/ variant of /=ˈnɑ̰̀ù) is unclear. If these two morphemes are indeed monomorphemic in contemporary Paicî, one expects them to be entirely included in the prosodic word headed by the preceding tonal nucleus. However, it is impossible to prove that this is the case on a phonological basis. Indeed, the only way to determine whether the final L-toned mora in both items is part of the preceding prosodic word is to check whether phonological downstep is triggered when this mora is the fourth one in a supposed prosodic word. In such a context, there is indeed a downstep after the second mora: /ùù=ˈbǎù/ = [ùù=ˈbǎù], but it is impossible to determine whether this is phonological downstep (which would indicate that /ù/ is part of the prosodic word), or simply the underlying downstep of /=ˈbǎù/, which would be realized even in a prosodic word shorter than four morae, i.e. even if the final L-toned mora were excluded from the prosodic word.

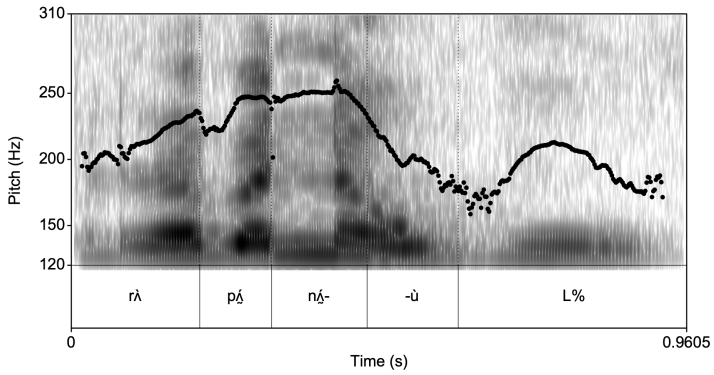

Figure 23: rʌ̀ pʌ̰́ =nʌ̰́ù púú] ‘They go to sleep.’ [AG] (191121-06-AG1:12)

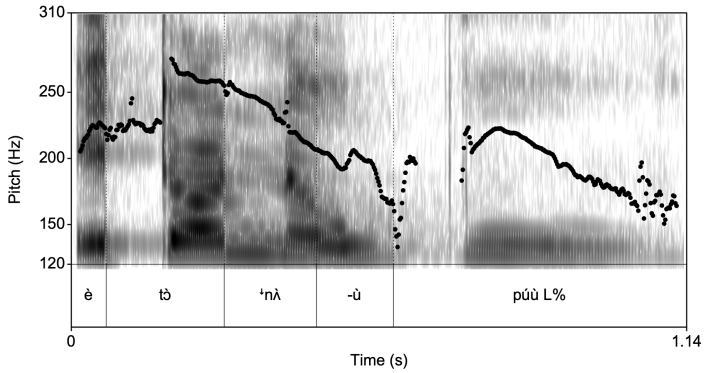

Figure 24: è tɔ̀ =ˡnʌ̰̀ù púú] ‘(S)he comes/goes in to sleep.’ [AG] (191121-06-AG1:2)

(23) a. /rʌ̀ pʌ̰́ =ˡnʌ̰̊ù púú/
[rʌ̀ ⟨pʌ̰́ =nʌ̰́ù⟩ púú]
they go =PURP sleep]
‘They go to sleep.’ (191121-06-AG1:12)

b. /è tɔ̀ =ˡnʌ̰̊ù púú/
[è ⟨tɔ̀ =ˡnʌ̰̀ù⟩ púú]
(s)he enter =PURP sleep]
‘(S)he comes/goes in to sleep.’ (191121-06-AG1:2)

A very similar case of a L tone spreading past an underlying downstep and triggering its realization is found in Sinyar (Sara-Bongo Bagirmi), as seen in (24) (Boyeldieu 2019).

(24) /kártí-n̊/ [kártín̊] ‘elephant-NOM.SG
/sùrù-n̊/ [sùrùǹ] ‘giraffe-NOM.SG
/ɓìsìˡ-n̊/ [ɓìsì-ˡǹ] ‘dog-NOM.SG

A related phenomenon is also attested In Saxwe (Kwa), where a L spreading onto a following H-toned TBU past a depressor consonant delinks the H tone of that TBU, and is

realized as a downstepped ˈL under the effect of the depressor consonant, as shown in (25) (Beavon-Ham 2012).

(25) /ògbó lá/ [òˈgbò lá] 'eggplant in question'
eggplant in.question

5.2.3 Predownstepped L-toned enclitics

The remaining three tonal enclitics are systematically realized lower than the preceding tone, both H and L. This is easily explained if these are analyzed as both underlyingly L and predownstepped. The three predownstepped L-toned enclitics are the two definite determiners /=ˈè̩/~/=ˈà̩/ and /=ˈì/, and the interrogative word /=ˈdʌ̀/ 'what' (which assigns a juncture H tone to its complement when used as a modifier: /=ˈdʌ̀^{H}/ 'what/which X'). The latter is illustrated in (26a) and (26b)after a monomoraic H-toned and L-toned nucleus respectively.

(26) a. /gʌ̀ tʊ́ʊ́ =ˈdʌ̀/
[ᵑgʌ̀ ⟨tʊ́ʊ́ =ⁿdʌ̀⟩]
you.SG throw =what
'What are you throwing?' (191121-07-AG1:60)

b. / pè =ˈdʌ̀/
[⟨pè =ˈⁿdʌ̀⟩]
it.is =what
What is it?'
(191121-07-AG1:2)

c. /pè bwə̀/
[pè ᵐbwə̀]
it.is banyan
It is a banyan tree.'
(191121-07-AG1:3)

As shown in Figure 25, the underlying downstep is realized when /=ˈdʌ̀/ follows a L tone, as in (26b), as expected. Compare the LˈL sequence in [pè =ˈⁿdʌ̀] (26b)/Figure 25 with the LL sequence in [pè ᵐbwə̀] (26c)/Figure 26. When following a H tone on the other hand, as in (26b), the downstep is left unrealized, because HˈL merges with HL in Paicî, i.e. downstep is never realized after H (we will come back to this more in detail in §6.1).

Evidence for the enclitic status of predownstepped L-toned enclitics is shown in (27) and Figure 28, where the downstep between [wà̩ⁿdò] and [-ˈᵑgʌ̀] can only be phonological in nature, indicating that [wà̩ⁿdò] heads a prosodic word which has at least four morae, i.e. which must include [=ⁿdʌ̀]: ⟨wà̩ⁿdò-ˈᵑgʌ̀ =ⁿdʌ̀⟩ (the reason why the underlying downstep of /=ˈè̩/ is not realized here is explained in §6.3.1). Note that the juncture H tone is not realized on non-isotonic words: /=ˈdʌ̀^{H} kàpé/ = [ⁿdʌ̀ kàpé].

(27) /gʌ̀ wà̩dò̩ -gʌ̊ =ˈdʌ̀^{H} kàpé
[ᵑgʌ̀ ⟨(wà̩ⁿdò̩) (-ˈᵑgʌ̀ =ⁿdʌ̀)⟩ kàpé]
you.SG drink -you.SG =what coffee
'What coffee do you drink?' (201125-AG1:57)

Finally, downstepped L-toned enclitics are always realized L, even when occurring late in long H-toned prosodic words, as shown in (28). This confirms that they are best analyzed as underlyingly L-toned.

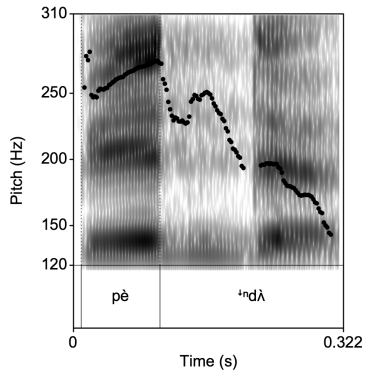

Figure 25: [pè =ˡⁿdʌ̀]] ‘What is it?” [AG] (191121-07-AG1:2)

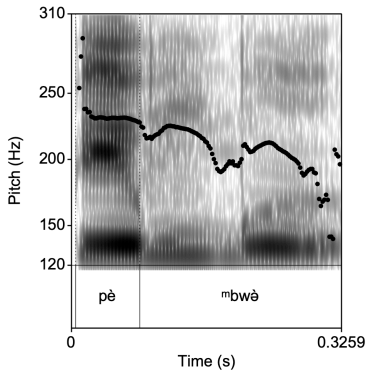

Figure 26: [pè ᵐbwə̀]] ‘It is a banyan tree.” [AG] (191121-07-AG1:3)

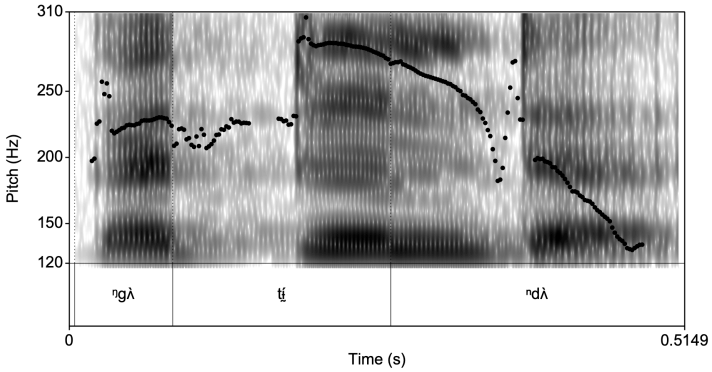

Figure 27: [ᵑgʌ̀ tʃ̰́ =ⁿdʌ̀] ‘What are you throwing?’ [AG] (191121-07-AG1:60)

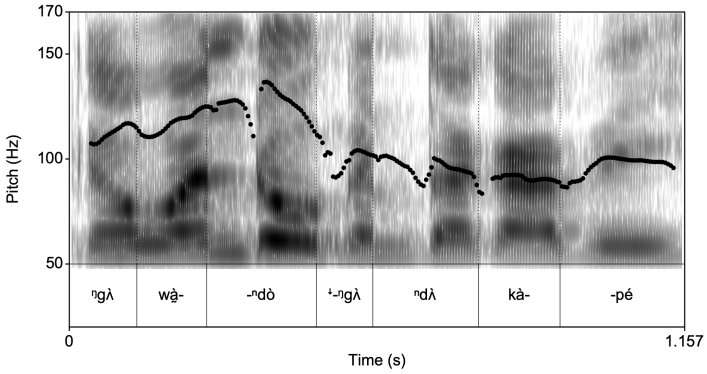

Figure 28: [g̰ʌ̀ wə̰̀dò-ˡgʌ̀ =dʌ̀ kàpé]. ‘What coffee do you drink?’ [AG] (201125-AG1:57)

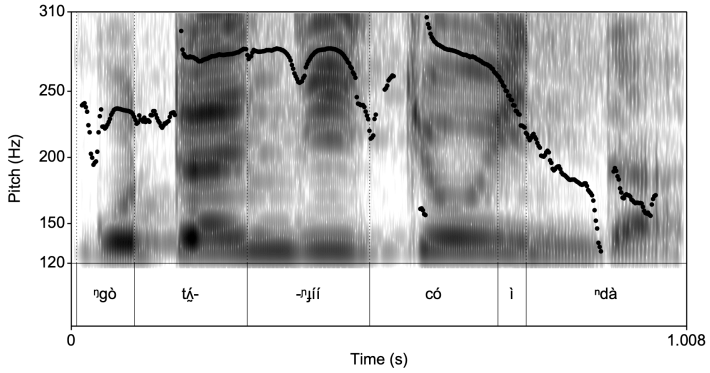

Figure 29: [ⁿgò tɤ̂ⁿɟíí =có =ì ⁿdà] 'I throw away the spare on my own.' [AG] (191125-AG:172)

(28) /gò tɤ̂jíí =cǒ =ˈì dà/
[ⁿgò ⟨tɤ̂ⁿɟíí =có =ì⟩ ⁿdà/
I throw.away =alone =DEF spear
'I throw away the spare on my own.' (191125-AG:172)

Predownstepped tonal enclitics thus have the interesting property of having an underlying tone while still being included in the tonal domain of the preceding tonal nucleus. Tonal enclisis is thus not defined by tonelessness in Paicî, despite the fact that the vast majority of tonal enclitics are toneless.

Finally, the contrast between the predownstepped toneless and predownstepped L-toned enclitics shows that downstep has to be analyzed as its own phonological object, present in the underlying representation of certain morphemes independently of the presence of an underlying L tone. The Paicî tone system is thus minimally accounted for with three phonological primitives: H, L, and /ˈ/.

6 Further properties of downstep

Downstep is intrinsically tied to L tones in Paicî. We have seen that it affects only L tones (*ˈH). In this section, we will further show that downstep is never realized after a H tone (*HˈL; §6.1), and that, unlike most languages with downstep, it is realized at the beginning of utterances (§6.1). Finally, we will see that downstep is culminative within two phonological domains (§6.3), a property rarely associated with downstep.

6.1 No downstep after H

Downstep, whether it be phonological or underlying, is never realized after a H tone. The HˈL sequence is unattested in Paicî, where it is merged with HL (Rivierre 1974: 328). The upper pane in Figure 30a-b shows the F0 of the two tones in the first HL (53 tokens, Figure 30a, repeated from Figure 3b) and HˈL (15 tokens, Figure 30b) sequences in all utterances in *Le Maître de Gobwinyara* (Rivierre 1967b) where such sequences are not preceded by a downstep. The lower pane displays the F0 difference between the first and second tone of each

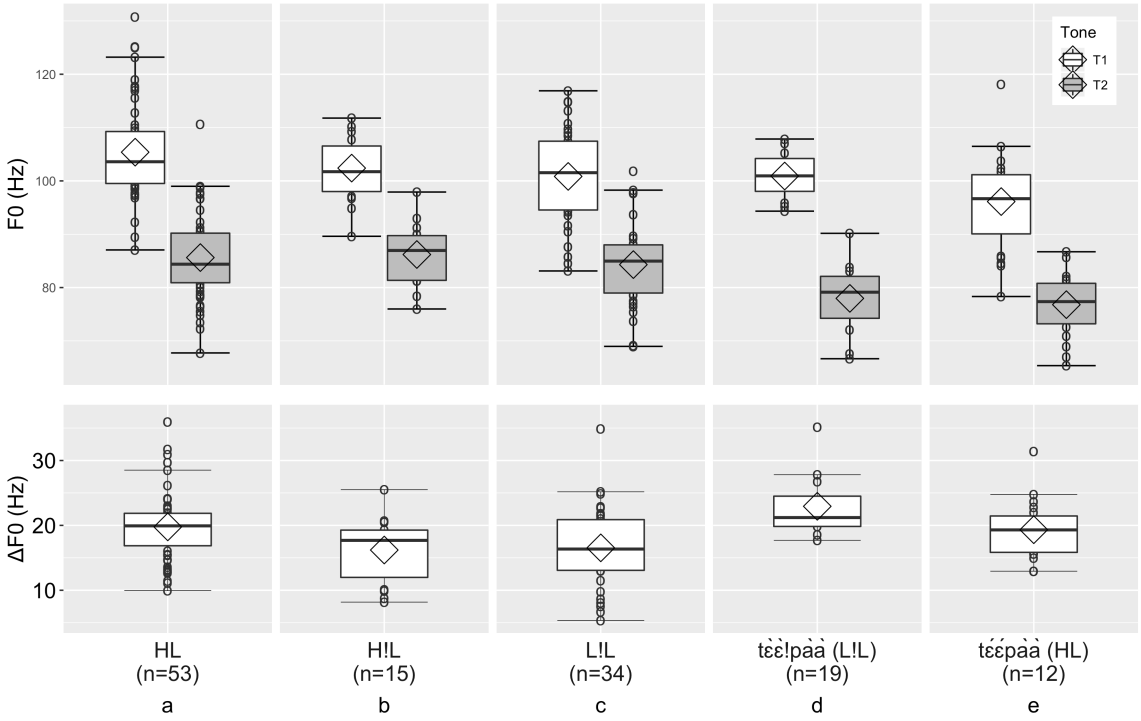

Figure 30: F0 (upper panel) and ΔF0 (lower panel) of HL (a), H$^{\downarrow}$L (b), L$^{\downarrow}$L (c), L$^{\downarrow}$L in [tɛ̀ɛ̀$^{\downarrow}$pàà] (d), and HL in [tɛ́ɛ́pàà] (d), [NDP]

sequence. As can be seen, the realizations of underlying HL and H$^{\downarrow}$L sequences start on average with an equally high-pitched H (105 Hz and 102 Hz respectively), and the following L and $^{\downarrow}$L have nearly exactly the same pitch: (85 Hz and 86 Hz respectively). The average pitch drop in HL (20 Hz, Figure 30a, bottom) is on average 4 Hz greater than that in H$^{\downarrow}$L (16 Hz, Figure 30b, bottom).

Figure 30c further shows that L$^{\downarrow}$L sequences are phonetically indistinguishable from both HL and H$^{\downarrow}$L (the pitch drops by a similar 17Hz from L = 101 Hz to $^{\downarrow}$L = 84 Hz). This is expected, given (i) the near-absence of paradigmatic difference between H and L (i.e. the relative nature of tone, cf. Figure 4), and (ii) the total nature of downstep in Paicî (cf. Figure 9 and surrounding prose). If a H tone is realized at about the same pitch as a L tone, and if downstep lowers the following tone by one tone-step, then H($^{\downarrow}$)L and L$^{\downarrow}$L are phonetically identical. They only differ in whether they contrast with the immediately preceding tone.

This lack of distinction explains why the docking and spreading of the juncture H tone on a $4\mu+$ L-toned prosodic word blocks the application of phonological downstep: applying it in this case would indeed create a banned H$^{\downarrow}$L sequence. This is seen in (29) (see also (11b))).

(29) a. /è tɛ̀ɛ̀pàà.../
[è ⟨(tɛ̀ɛ̀)ꜜ(pàà)⟩]
(s)he arrive
'(S)he arrives...' (G:03'01")

b. /è ꜜmwa̰a̰^{H} tɛ̀ɛ̀pàà.../
[è ꜜmwa̰a̰ ⟨(tɛ́ɛ́)(pàà)⟩], *[...⟨(tɛ́ɛ́)ꜜ(pàà)⟩...]
(s)he SUCC arrive
'Then (s)he arrives...' (G:00'21")

Figure 30d-e gives F0 measurements of the pitch target of the two tones in all occurrences of the LꜜL realization [tɛ̀ɛ̀ꜜpàà] (19 tokens) and the HL realization [tɛ́ɛ́pàà] (12 tokens) of the verb /tɛ̀ɛ̀pàà/ 'arrive' in *Le Maître de Gobwinyara* (Rivierre 1967b). As can be seen, there is no phonetic distinction between LꜜL [tɛ̀ɛ̀ꜜpàà] (96 Hz ~76 Hz, ΔF0 = 20 Hz) and HL [tɛ́ɛ́pàà] (101 Hz ~78 Hz, ΔF0 = 23 Hz). This also confirms that phonological downstep and underlying downstep are phonetically identical. Interestingly, the function served by the phonological downstep is preserved, i.e. there is always a pitch drop after the initial bimoraic foot in words of four morae and above, whether it be through phonological downstep or through the realization of a juncture H tone, both phonetically identical.

In the three tone sequences HL, HꜜL and LꜜL in Figure 30a-c, the differences (i) between the pitch of the first tone in each sequence (H̲L vs. H̲ꜜL vs. L̲ꜜL), (ii) between the pitch of the second tone in each sequence (HL̲ vs. HꜜL̲ vs. LꜜL̲), and (iii) between the pitch difference within each sequence (ΔF0(HL) vs. ΔF0(HꜜL) vs. ΔF0(LꜜL)) are all statistically non-significant, with only three exceptions. These are the difference between the initial H in HL (105 Hz) and the initial L in LꜜL (101 Hz) (t(69.7) = 2.2, p = 0.02*), the difference between ΔF0(HL) (20 Hz) and ΔF0(LꜜL) (17 Hz) (t(62.1) = 2.4, p = 0.015*), and the difference between ΔF0(HL) (20 Hz) and ΔF0(HꜜL) (16 Hz) (t(23.3) = 2.3, p = 0.02*). As can be seen, the significance levels are rather low, with p-values barely lower than 0.05. Given the limited overall extent of the differences in question (never more than 4 Hz on average), and the non-significance of all other measurements, it is safe to conclude that these three sequences are acoustically indistinguishable. The same holds for the sequences LꜜL in [tɛ̀ɛ̀ꜜpàà] and HL in [tɛ́ɛ́pàà] in Figure 30d-e, for which none of the differences mentioned above are statistically significant. The exact measurements and significance levels are given in the Appendix.

6.2 Utterance-initial downstep

The cross-linguistic expectation is that downstep is only realized when it contrasts with an immediately preceding tone, and is left unrealized when utterance-initial. This expectation is not met in Paicî, where ꜜL contrasts with L utterance-initially. The realization of utterance-initial ꜜL, illustrated with the future marker /ꜜò/ in most of the examples below, depends on the following tone. When followed by a L tone, then the initial downstep is realized either as a pitch fall on the initial L-toned mora –/ꜜLL/ = [L$\widehat{\text{ꜜL}}$L], as in (30), (31a), and corresponding Figures 31 and 32– or as a downstep on the following L –/ꜜLL/ = [LꜜL], as in (31b) and Figure 33).

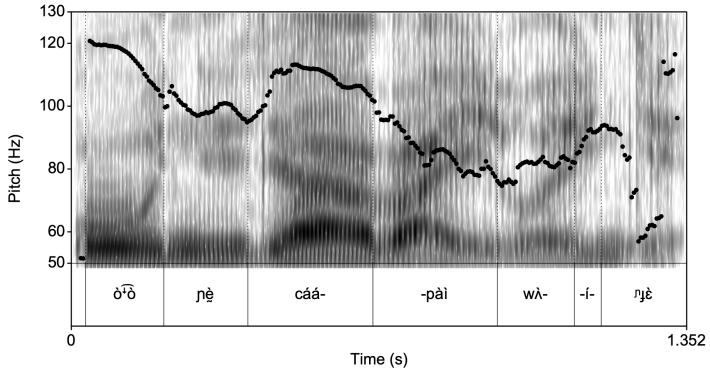

Figure 31: [òˈ͡ò ɲɛ̰̀ cáápàì wʌ́íⁿjɛ̀]' 'We will all enter together.' [NDP] (G:19'54")

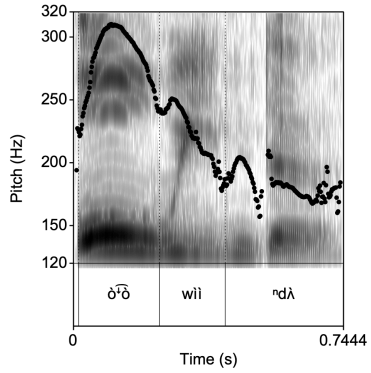

Figure 32: [òˈ͡ò =wìì =ⁿdʌ̀] 'When will it be' [AG] (191121-07-AG1:86)

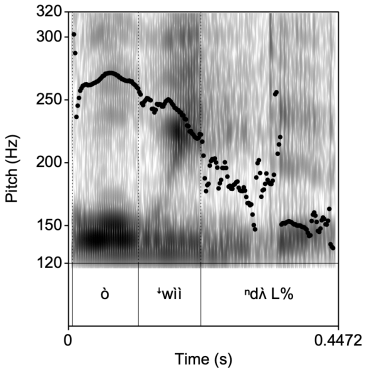

Figure 33: [ò =ˈwìì =ⁿdʌ̀] 'When will it be' [AG] (191121-12-AG1:54)

(30) /ˈò nyɛ̰̀ cáápàì wʌ́íjɛ̀/
[òˈ͡ò ɲɛ̰̀ cáápàì wʌ́íⁿjɛ̀]
FUT ASSERT all us
'We will all enter together.' (G:19'54")

(31) /ˈò =wi̊i̊ =ˈdʌ̀/
a. [òˈ͡ò =wìì =ⁿdʌ̀] (191121-07-AG1:86)
b. [ò =ˈwìì =ⁿdʌ̀] (191121-12-AG1:54)
FUT =TIME =what
'When will it be?'

When the initial ˈL is followed by a H tone, there are three possible realizations of the downstep. In some cases, it is realized as a fall on the initial L-toned mora: /ˈLH/ = [L˥͡˩LH], as seen in (32) and Figure 34.

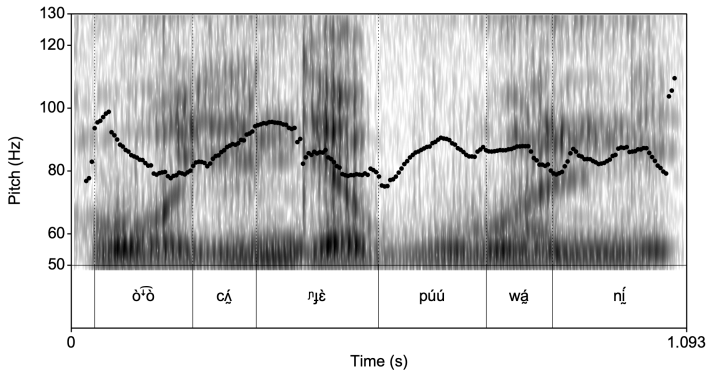

Figure 34: [ò᷄ò᷅ cA̰ ᵑɟè púú =wą̰ =nḭ́] ‘We will not sleep here.’ [NDP] (G:20’39”)

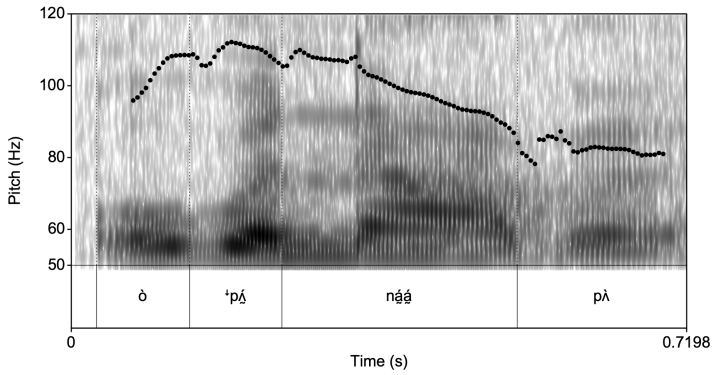

Figure 35: [ò ˡpA̰ =nąą̰ =pʌ̀] ‘We will not sleep here.’ [NDP] (G:20’39”)

(32) /ˡò cA̰ jɛ̀ púú =ˡwą̊ =nḭ̊
[ò᷄ò᷅ cA̰ jɛ̀ púú =wą̰ =nḭ́]
FUT NEG we sleep =LOC =here
‘We will not sleep here.’ (G”20’39”)

Due to the rapid succession of a fall and a rise, the initial pitch fall in this context often has a rather narrow range. It is sometimes so reduced as not to be realized, in which case the initial /ˡLH/ sequence is realized [LˡH], as illustrated in (33). Given the total nature of downstep, the L and the following ˡH are realized at the same pitch, as can be seen in Figure 35. This is the only case of downstepped ˡH in the language, and it clearly arises only as the occasional phonetic realization of an utterance initial /ˡLH/ sequence.

(33) /ˡò pA̰ =nąą̊ =ˡpʌ̊/
[ò ˡpA̰ =nąą̰ =pʌ̀]
FUT go =DIR =where
‘Where will it be?’ (191121-12-AG1:64)

Finally, in some cases in my elicited data, the initial downstep is simply not realized before a H tone: /ˡLH/ = [LH], as in (34) and Figure 36.

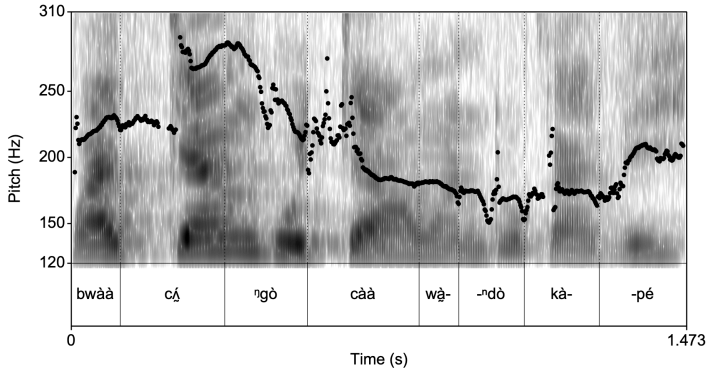

Figure 36: [bwàà cA̰ gò càà wa̰dò kàpé]'I don't drink coffee anymore.' [AG] (191121-12-AG1:17)

(34) /ˡbwàà cA̰ gò càà wa̰dò kàpé/
[bwàà cA̰ gò càà wa̰dò kàpé]
IPFV NEG I CHANGE drink coffee
'I don't drink coffee anymore.' (191121-12-AG1:17)

It is unclear at this stage whether the three realizations of utterance-initial ˡL are in free variation, or depend on other factors such as speaker, regional variation, speech rate, or specific morphosyntactic contexts.

6.3 Culminativity of downstep

The number of downsteps per utterance in Paicî is in principle unlimited. This is one of the main cross-linguistic properties of downstep (Rialland 1997; Leben 2018), and is illustrated in example (35), where a total of four downsteps are realized. In particulari, the utterance ends with three successive L-toned prosodic words which all have a downstep, underlying in ⟨ⁿ̩gò=ˡì⟨ (underlying downstep of /=ˡì/), phonological in ⟨ⁿdà =kḛ̀ˡḛ=wʌ̀⟩ and ⟨pwìrìˡdùà⟩. As seen in Figure 37, those three downsteps correspond to three successive register drops.

(35) a̰ è ˡmwà̰à̰ᴴ tì-ᴴnA̰pó gɔ̀ =ˡì dà =kɛ̰̊ɛ̰̊ =ˡwʌ̊ pwìrìdùà
a̰ è ˡmwà̰à̰ tì-nA̰pó ⟨gɔ̀ =ˡì⟩ ⟨(dà =kḛ̀)ˡ(ḛ =wʌ̀)⟩ ⟨(pwìrì)ˡ(dùà)⟩
and he SUCC adjust-propeller on =DEF spear =his =SBJ (name)
'And Pwiridua adjusts the propeller on his spear.' (G:06'40")

However, there are two domains within which the number of possible occurrences of downstep is limited to one: the prosodic word, and the preverbal field, consisting mostly of TAM markers and adverbials.

6.3.1 Culminativity within the prosodic word

Whenever there is enough material within a prosodic word for more than one downstep, only the leftmost one is realized. This is shown in example (36), which, as seen in Figure 38, is

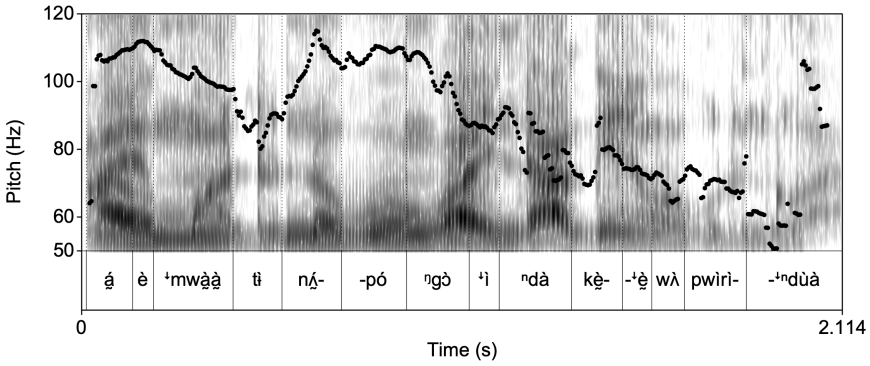

Figure 37: [á è ˡmwàà tì- nʌ́pó gɔ̀ =ˡì dà =kèˡè =wʌ pwìrìˡdùà] 'And Pwiridua adjusts the propeller onto his spear.' [NDP] (G:06'40")

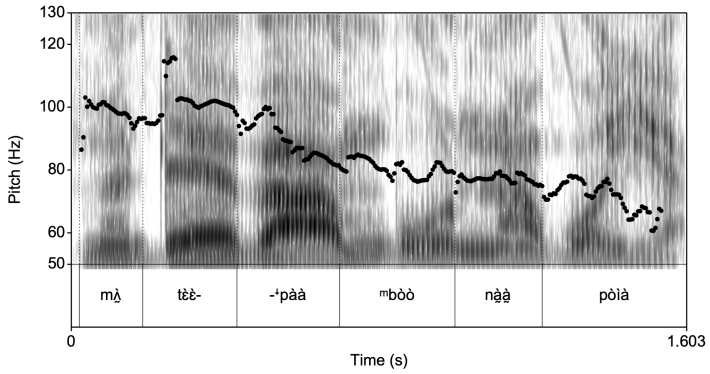

Figure 38: [... =mʌ̀ tɛ̀ɛ̀ˡpàà =bɔ̀ɔ̀ =nàà pòià] '...and he arrives in Poia.' [NDP] (G:12'22")

not realized with two downsteps, despite the fact that it contains eight morae, i.e. enough to parse two cola and trigger phonological downstep twice, as shown in (36b). Only the first colon triggers phonological downstep.[23]

(36) /=mʌ̀ tɛ̀ɛ̀pàà =bɔ̀ɔ̀ =nàà pòià/
a. [=mʌ̀ ⟨{(tɛ̀ɛ̀)ˡ(pàà)} =bɔ̀ɔ̀ =nàà⟩ pòià]
b. *[=mʌ̀ ⟨{(tɛ̀ɛ̀)ˡ(pàà)} {(=bɔ̀ɔ̀) ˡ(=nàà)}⟩ pòià]
=and arrive =down =DIR (place.name)
'...and [he] arrives in Poia.' (G:12'22")

This constraint applies to both phonological and underlying downstep. If a prosodic word meets the conditions of application of phonological downstep (i.e. is L-toned and at least four morae long) and contains one or more predownstepped enclitic, the earlier downstep in the prosodic word takes precedence, irrespective of its nature. This can be seen in (37) below, where underlying downstep is exceptionally represented with a superscript

[23]There is actually no evidence for foot and colon parsing past the initial colon, since phonological downstep and the realization of the juncture H tone, both of which are never attested past the third mora, consitute the only evidence for metrical structure (Lionnet 2019).

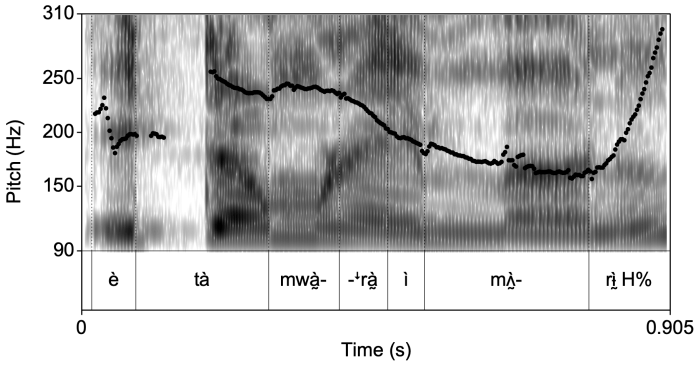

Figure 39: [è tà =mwə̀ˡrə̀ =ì mə̀rì] 'They are dancing down there.' [HN] (191121-02-AG1:02)

exclamation point "!", to distinguish it from phonological downstep, represented with the regular downward arrow "ꜜ" (unrealized downsteps are crossed out in the phonetic transcription).

(37) a. /è tà =mwə̀rə̀ =!ì mə̀rì/
[è ⟨(tà =mwə̀)ˡ(rə̀ =ꜜ̸ì)⟩ mə̀rì]
it fly =again =DEF bird
'The bird flies off again.' (171228-02-HN1:144)

b. / nλ =!dλ =!cɛ̀nə̀ wə̀ᴴ =bɔ̀ɔ̀ bàrà-wìà/
[⟨nλ =!ⁿdλ =ꜜ̸ ~ ↓̸cɛ̀nə̀⟩ wə̀ =ᵐbóò ᵐbàrà-wìà]
Q.EMPH =what =REL.INDF be.at =down edge-wave
'What on earth is going on down on the shore?' (191121-02-AG1:31)

In (37a), phonological downstep is realized at the expense of the following underlying downstep in the 4μ L-toned prosodic word ⟨tà =mwə̀ˡrə̀ =ꜜ̸ì⟩, as can be seen in Figure 39. In (37b), on the other hand, the first downstep encountered in the 4μ L-toned prosodic word ⟨nλ =!ⁿdλ =ꜜ̸~×↓̸cɛ̀nə̀⟩ is the underlying downstep preceding the second mora, i.e. occurring before the locus of phonological downstep, and blocking its application, as seen in Figure 40 (note that the third mora in this prosodic word is both the expected locus of phonological downstep, and underlyingly preceded by a underlying downstep, which is also left unrealized).

This constraint limiting the number of downsteps is actually a more general constraint against having more than one pitch drop within a prosodic word. This is shown by the fact that no downstep is realized after a non-isotonic nucleus: neither underlying non-isotonic nuclei, as seen in (38) and Figure 41, nor nuclei made non-isotonic, for example by the docking of a juncture H tone, as illustrated in (39) and Figure 42.

(38) /wʌ̀ílʌ̀ʌ̀ =ˡpɔ̀ =ˡnɔ̀…/
[⟨wʌ̀ílʌ̀ʌ̀ =pʌ̀ =nə̀⟩…]
them =where =REL
'Who is it that…?' (G:14'48")

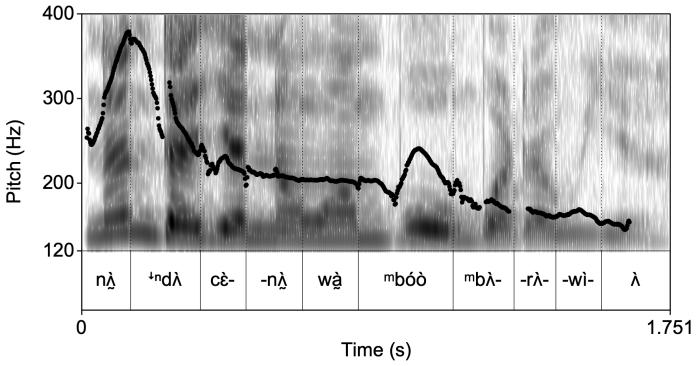

Figure 40: [nə̰ =ˡⁿdə =cɛ̀nə̰ wə̰ =ᵐbóò ᵐbərə-wìə] 'What on earth is going on down on the shore?' [AG] (191121-02-AG1:31)

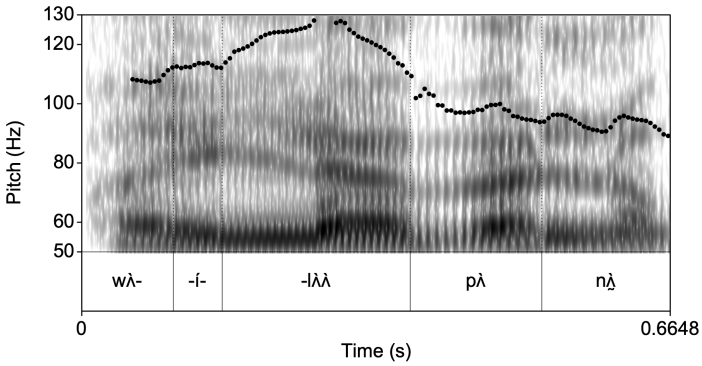

Figure 41: [wə́ílə́ə =pə nə̰...] 'Who is it that...?' [NDP] (G:14'48")

(39) /á̰ è ˡmwə̰ə̰^{H} tə̰rə̰ =ˡì pwá̰-rə̰ í...
[á̰ è ˡmwə̰ə̰ ⟨tárə́ =ì⟩ pwá̰-rá̰ í...]
and he SUCC hear =DEF noise-of cry
'Then he heard the crying noises [coming from Gobwinyara].' (G:14'37")

Culminativity is an accentual rather than tonal property. The "leftmost downstep wins" rule of Paicî is reminiscent of similar accentual phenomena, e.g. in Turkish, when underlyingly stressed morphemes (as opposed to stress-less morphemes receiving late default stress) are combined in a Turkish word, the leftmost wins (Inkelas 1999). We will see in §9 that these accentual properties have a diachronic explanation.

6.3.2 Culminativity within the pre-verbal field

What I call 'pre-verbal field' is defined as everything from the subject pronoun up to the verb. It includes the subject pronoun, one or more optional TAM markers, one or more optional pre-verbal adverbials, and the verb, in this order. Within the pre-verbal field thus defined, only one downstep is allowed. In sequences of adjacent pre-downstepped TAM

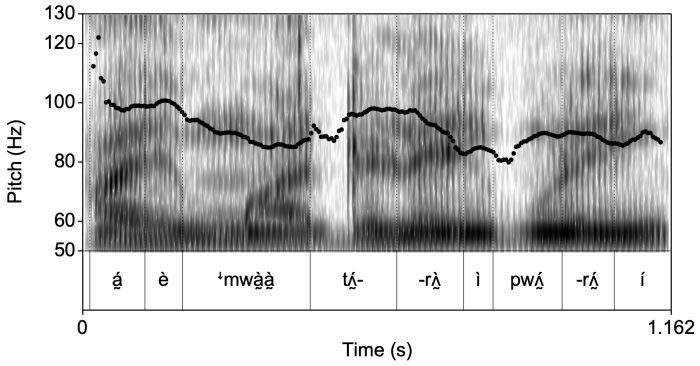

Figure 42: [á è ˡmwàà tírì =ì pwí-rá í...] 'Then he heard the crying noises [coming from Gobwinyara].' [NDP] (G:14'37")

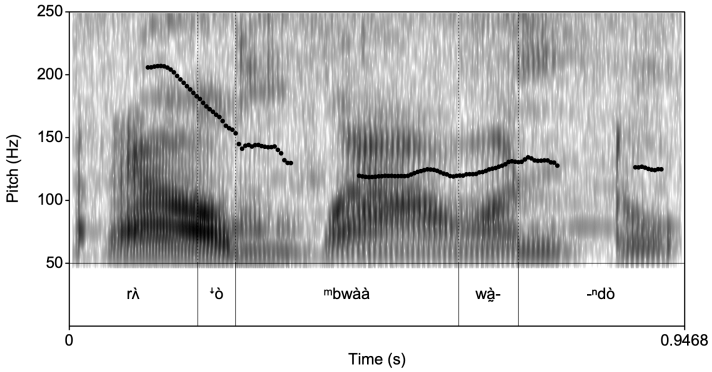

Figure 43: [rì ˡò ᵐbwàà wàⁿdò] 'They will still be drinking.' [HN]

markers, only the first downstep is realized (Rivierre 1974: 328), as shown in example (40) and Figure 43.

(40) /rì ˡò ˡbwàà wàdò.../ (cf. Figure 43)
[rì ˡò ᵐbwàà wàⁿdò...]
they FUT IPFV drink
'They will still be drinking [something]' (171228-02-HN1:90)

The same holds for utterance-initial sequences of predownstepped TAM markers: only one downstep is realized. In my own elicitation data and in the few examples that I was able to find in Rivierre's texts, the downstep is realized on the second TAM marker : /ˡLˡL/ = [LˡL], as shown in (41) and Figure 44. There is a confound as to the origin of this downstep: it could be the second TAM marker's underlying downstep, blocking the realization of the initial downstep, or it could be the first marker's underlying downstep realized late, as we saw utterance-initial ˡL often is (cf. **??** 31b and Figure 33 above). The latter hypothesis is more likely, since it does not require to treat these utterance-initial sequences as exceptional.

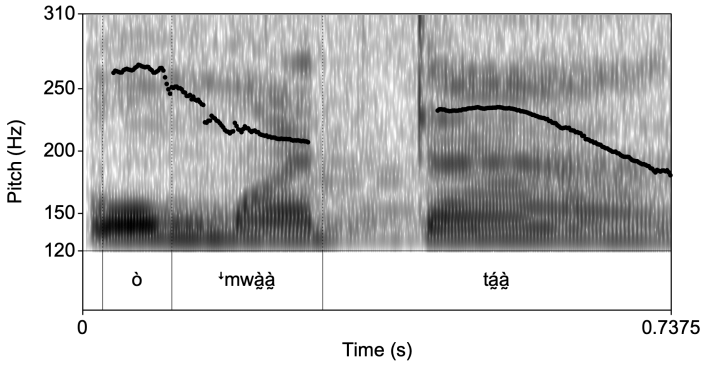

Figure 44: [ò ˈmwa̱a̱ ta̱a̱...] 'Once upon a time...' [AG] (191121-12-AG1-49)

(41) /ˈò ˈmwa̱a̱^{H} ta̱a̱.../
[ò ˈmwa̱a̱ ta̱a̱...]
FUT SUCC stay
'Once upon a time...' (191121-12-AG1-49)

7 Low as default tone

There are three contexts in which toneless morphemes cannot receive their tonal specification from the preceding tonal nucleus: when they are utterance-initial (§7.1), when they follow a juncture-H-assigning morpheme (§7.2), or when they follow a non-isotonic nucleus (§7.3). In these three contexts, toneless morphemes are realized with a default L tone.

7.1 Realization of utterance-initial enclitics

Many of the function words described earlier as tonal enclitics do not actually require the presence of a preceding tonal nucleus, as evidenced by the fact they can be used utterance-initially. These markers are thus not "enclitics" in the usual sense: it is not that they need prosodic support from a preceding word, but rather that they cannot resist being integrated in the prosodic word headed by the preceding tonal nucleus. When utterance-initial, all enclitics are realized with a L tone and lose their underlying downstep, with the exception of two of the three predownstepped L-toned enclitics, which keep their downstep, as shown in (42b). Note that /= ˈdʌ̀/ keeps its downstep only when it does not assign a juncture H tone (cf. examples (45) and (46) below).

(42) a. (predownstepped) toneless enclitics:

/=(ˈ)x̊/	→	/x̀/:	/=mn̊/	→	/mn̰/	‘and’
			/=ˈwå/	→	/wa̰/	LOC

b. predownstepped L-toned enclitics:

(i)

/=ˈx̀/	→	/x̀/:	/=ˈì/	→	/ì/	DEF
			/=ˈdʌ̀^{H}/	→	/dʌ̀^{H}/	‘what/which X’

(ii)

/=ˈx̀/	→	/ˈx̀/:	/=ˈḛ/	→	/ˈḛ/	DEF
			/=ˈdʌ̀/	→	/ˈdʌ̀/	‘what’

Two utterance-initial enclitics were already illustrated in (5) and (36) above. The contrast between initial L and ˈL is clearly illustrated by the difference between the utterance-initial realizations of the two determiners /=ˈḛ/, which keeps its downstep in this position, as in /ˈḛ àbòrò/ [ḛˈḛ a̰^{m}bòrò] (Figure 45), and /=ˈì/, which does not, as in /ì àbòrò/ [ì a̰^{m}bòrò] (Figure 46).

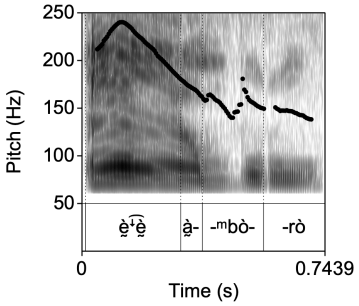

Figure 45: [ˈḛ a̰^{m}bòrò] ‘the person’ [HN] (171228-02-HN1:28)

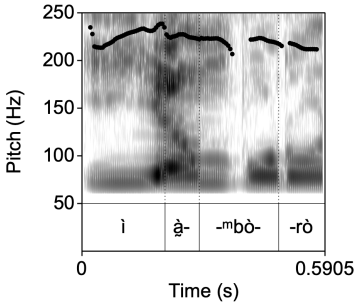

Figure 46: [ì a̰^{m}bòrò] ‘the person’ [HN] (171228-02-HN1:35)

I analyze this L-tone as a default tone. An alternative would be to consider that tonal enclitics are all underlyingly L-toned, but lose their L tone when not utterance-initial. The problem with this approach is that it it does not account for the difference between predownstepped toneless enclitics and predownstepped L-toned enclitics, i.e. why do some enclitics keep their underlying L? (See§8.3 for more discussion on this point). The default L hypothesis fares better on this point: toneless enclitics get default L when utterance-initial, predownstepped L-toned enclitics keep their tone and downstep, with /=ˈì/ and /=ˈdʌ̀^{H}/ being exceptional in that they are treated on a par with toneless enclitics when utterance-initial.

Utterance-initial enclitics realized with default L constitute tonal nuclei, as shown by the application of phonological downstep in (43) and Figure 47

(43) /(=ˈ)wa̰ =nı̰ = bo̰o̰ jàà-wʌ̰/
[⟨wa̰ =nı̰ = ˈᵐbòò⟩ ⁿ̪ɟàà-wʌ̀]
=LOC =here = down at-you.PL
‘down at your (pl) place’ (171228-01-HN1:139)

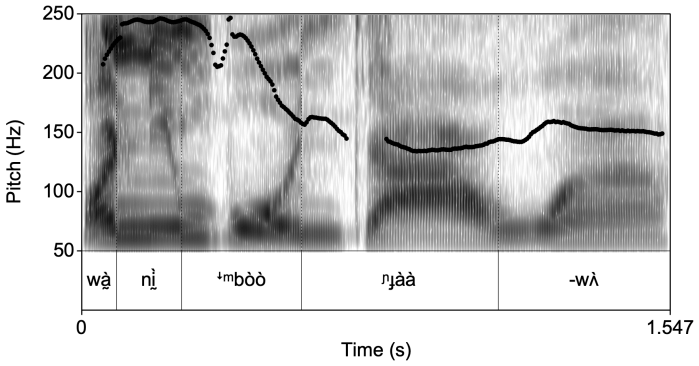

Figure 47: [wa̰ =nḭ̃ =ᵑᵐbòò ᶮɟàà-wʌ̀] down at your (pl) place' [HN] (171228-01-HN1:139)

7.2 Juncture-H on a toneless word

When a juncture H tone is assigned to a toneless word, the morae that are not affected by the H are realized with default L. In other words, toneless words receiving a juncture H tone are treated as L-toned, as shown in example (44). A pitch track corresponding to (44b) is given in Figure 48.

(44) a. /pwà-^{H} pʌ̊pʌ̀rʌ̊́/
[pwà- pʌ́pʌ̀rʌ̀
do- publicly
'act publicly' (Rivierre 1983)

b. /rʌ̀ ᵑbwàà nyɛ̰̀ wa̰^{H} =gɛ̊ɛ̊́/
[rʌ̀ ᵑᵐbwàà ɲɛ̰̀ wa̰ =ᶯgéè]
they IPFV ASSERT be.at =across
'They are still over there.' (171228-01-HN1:223)

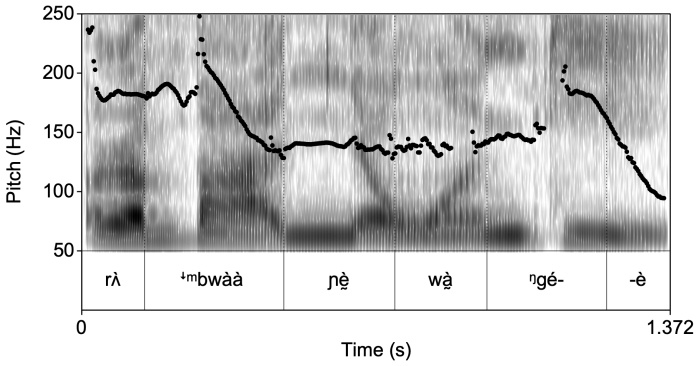

Figure 48: [rʌ̀ ᵑᵐbwàà ɲɛ̰̀ wa̰ =ᶯgéè] 'They are still over there.' [HN] (171228-01-HN1:223)

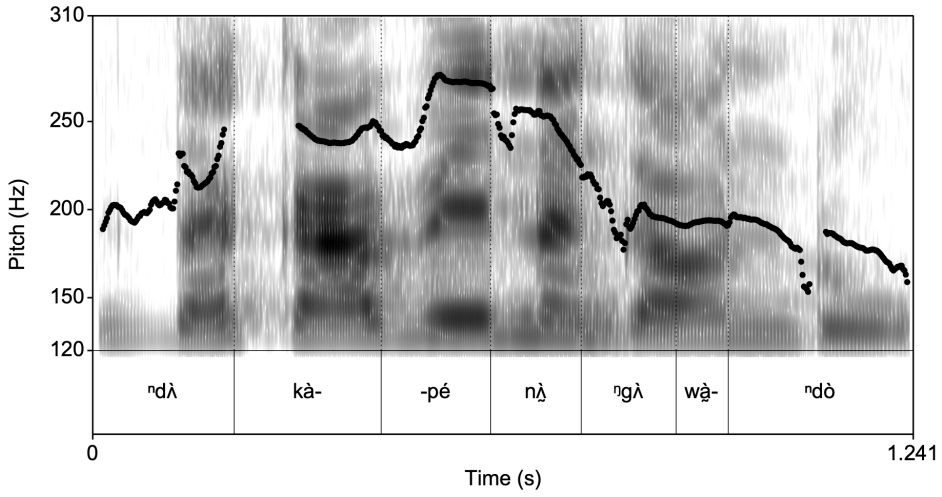

Figure 49: [ᵑdʌ̀ kàpé =nʌ̰̀ =ᵑgʌ̀ wà̰ⁿdò]'What coffee do you drink?' [AG] (191125-AG1:56)

7.3 Toneless enclitics after a non-isotonic nucleus

When toneless morphemes follow a non-isotonic nucleus, they are realized with default L, rather than being assigned the last tone of the nucleus. This is clearly shown with the LH nucleus /kàpé/ 'coffee' in example (45 and corresponding Figure 49.

(45) /=ˡdʌ̀ᴴ kàpé =ˡnɔ̰̀ =gɔ̀[24] wà̰dò/
[ⁿdʌ̀ ⟨kàpé =nʌ̰̀ =ᵑgʌ̀⟩ wà̰ⁿdò]
what coffee =REL =you.SG drink
'What coffee do you drink?' (191125-AG1:56)

The fact that the toneless enclitics following the LH nucleus [kàpé] in (45) are realized with a L-tone is clearly indicated by the fact that the last enclitic [=ᵑgʌ̀] does not contrast with the following L-toned word [wà̰ⁿdò]. Compare with the clear case of H-spread onto a following L-toned word in (46)/Figure 50.

(46) /=ˡdʌ̀ᴴ cá =ˡnɔ̰̀ =gɔ̀[24] tʌ̀pìrì/
[ⁿdʌ̀ ⟨cá =nɔ̰́ =ᵑgɔ́⟩ tʌ̀pìrì]
what oven =REL =you.SG open
'What oven did you open?' (191125-AG1:49)

The default L analysis is preferable to the alternative whereby the tone that spreads to the enclitic(s) is the initial L of the nucleus, skipping over the following H tone.

[24]Subject pronouns are L-toned, except when following complementizers, in which case they are toneless enclitics, e.g. /=gɔ̀/ 'you.SG' realized [=gʌ̀] after L in (45) and [=gɔ́] after H in (46).

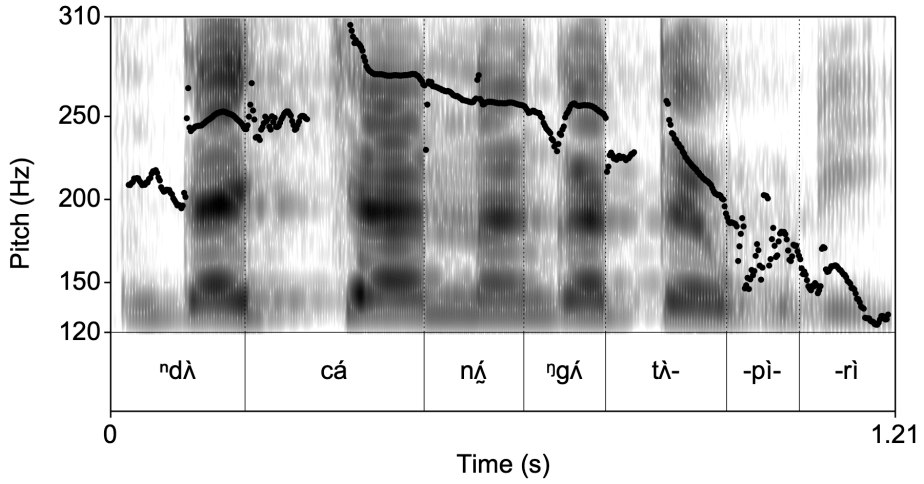

Figure 50: [ⁿdλ cá =nÁ̱ =ᵑgÁ tàpìrì] 'What oven did you open?' [AG] (191125-AG1:49)

8 Alternatives

I have proposed to account for the tone system of Paicî using three phonological primitives only: H, L and downstep /ˡ/. I have also proposed a representational account of the behavior of the different tonal enclitics that makes use of these primitives, namely a contrast between toneless enclitics /=x̊/, predownstepped toneless enclitics /=ˡx̊/, and predownstepped L-toned enclitics /=ˡx̀/. In this section I show that this approach fares better than a number of alternatives, on the basis of both descriptive/explanatory adequacy and economy.

8.1 Three-tone analyses

Rivierre (1974) initially posited three contrastive tones in Paicî: H (my H), M (my L), and L (my ˡL). He correctly identified phonological downstep (which he transcribes as a L tone for convenience only) as non-contrastive and entirely predictable, but recognized contrastive status to his L tone on the basis of the handful of non-enclitic predownstepped TAM markers described in §5.1 above.[25]

This analysis fails to recognize that the L tone in these markers behaves exactly as a M tone lowered by phonological downstep, as described by Rivierre himself, and demonstrated in §5.1 above, i.e. that "M" = L and "L" = ˡL throughout the system, and not just for phonological downstep.

In subsequent publications, Rivierre (1978: 430, 1993: 161, 2001) explicitly describes Paicî as a two-tone language, and states, without giving more detail, that '[...] the few low tones attested on short morphemes can be explained as resulting from prosodic-morphological

[25]Rivierre (1974) does not include the vocative particle /ˡcò/ in this category, although the examples he gives in his (1983) dictionary as well as my elicited data clearly show that it belongs in it. Rivierre (1974) also mentions a fifth "L"-toned morpheme: *mù* HABITUAL, which he appears to have reanalyzed as "M"-toned *mūū* in his (1983) dictionary. I have not done any elicitation work on this marker and trust Rivierre's latest transcription.

processes' (Rivierre 1978: 430, my translation).[26] The present paper is a full development of Rivierre's later intuition.

Another three-tone alternative that can be rejected is that which gives contrastive status to the downstepped ˈL tone. A mild improvement on Rivierre's initial three-tone proposal, this analysis still fails to account for the contrast between predownstepped toneless and predownstepped L-toned enclitics. The very existence of downstep in underlyingly toneless morphemes, as we saw, justifies the analysis of downstep as its own phonological primitive, not tied to any tone in underlying representation.

8.2 Privative tone system: H vs. Ø + downstep

A more compelling alternative is that which sees the L tone as underspecified, i.e. the default realization of toneless TBUs in a system that makes use of only two primitives: H and downstep /ˈ/ (as suggested in a footnote by Hyman (2001), citing Rivierre (1978)). Solid arguments can be put forth in support of this analysis. First, the fact that L is indeed used as a default tone, as we saw in §7. Another argument is that the L tone does not seem to be active in the language: the only grammatical tone is the juncture H, which is also the only tone that spreads (one mora to the right within the initial foot, cf. examples in (11) and surrounding prose). Indeed, the spreading of L from the tonal nucleus onto the following enclitics could just as easily be analyzed as default L being assigned to the toneless morae of both the nucleus and following material. One last, weaker argument in favor of the underspecification of L is the absence of L-toned second-position bound verb roots (V2). We saw in §5.2.1 above that there were about 30 toneless V2s. There is also one H-toned V2, /-nǫ́ǫ́rí/ 'to damage', realized H even after a L-toned V1: [cí-nǫ́ǫ́rí] 'to damage with the tip of an object', [cɔ̀-nǫ́ǫ́rí] 'to damage by stepping on'. The fact that there is no L-toned V2 does not in and of itself constitute a knock-out argument for the underspecification analysis, but is conform to what this analysis would predict.[27]

This very tempting analysis would make sense of the tone system of Paicî –both in synchrony and historically, as we will see in §9– were it not for exactly five morphemes, namely the three predownstepped L-toned enclitics (determiners /=ˈì/ and /=ˈè/, and question word /=ˈdʌ̀/ 'what, which') and the two "mixed" predownstepped toneless enclitics /=ˈnʌ̀ù/ 'in order to' and /=ˈbʌ̀ù/ 'with, and.' These show that there is a contrast between toneless and L-toned morae in Paicî: predownstepped toneless enclitics contrast with predownstepped L-toned ones, and the toneless initial mora of mixed enclitics contrasts with the following L-toned one. However minimal this contrast is, it is robust, and the underspecification analysis fails to adequately account for it.

8.3 Strength-based account

Given the default L realization of most enclitics, one could propose an alternative analysis whereby they are not toneless vs. L-toned, but all carrying L tones of different strengths

[26] Haudricourt (1971: 369–370) had already established in 1963 that "there are two registers" in Paicî, and that the lower register is non-contrastive.

[27] The few V2s that are transcribed with a L tone in Rivierre's dictionary are illustrated only with L-toned contexts, i.e. can easily be analyzed as toneless, which is the tentative analysis I choose here, in the absence of data on their behavior after a H-toned nucleus.

(Zimmermann 2018; Zimmermann and Trommer 2018). When utterance-medial, L toned items are in tonal competition with the preceding and following morphemes, and resist integration into the prosodic word headed by the preceding word with more or less success depending on their relative strength.

Three levels of strength can be determined. L-toned lexical items can be said to have full-strength L tones. Indeed, these are tonal nuclei, i.e. they head a prosodic word, spread their tone to the following enclitics, and are never integrated into the preceding prosodic word. They are only affected by the docking and spreading of the juncture H tone –perhaps an argument in favor of viewing H as inherently stronger than L (which is in keeping with the overall weak status of L, as we have seen). The L tone on predownstepped L-toned enclitics in one step weaker. These are not tonal nuclei, and are weak enough to be included in the prosodic word headed by the preceding tonal nucleus. But they are strong enough to resist H-spread from that nucleus. Finally, the weakest L tone is to be found on toneless enclitics (with or without pre-downstep), which do not resist the spread of a preceding H tone.

When in utterance-initial position, there is no competition with a preceding tonal nucleus, and the strength difference is invisible, i.e. all enclitics are realized L (*modulo* the deletion of underlying downstep in all but two, as we saw).

This analysis, however elegantly it might seem to account for the facts, is unnecessarily complex. Like the analysis I propose, it is representational. Both analyses posit three types of enclitics with three different representations: /ˈx + L$^{\text{mild}}$/ ∼/ = ˈx̀/, /ˈx + L$^{\text{weak}}$/ ∼/ = ˈx̊/, /x + L$^{\text{weak}}$/ ∼/ = x̊/. Both must posit an underlying downstep, since downstep cannot be explained by L tone weakness or strength alone. The only real difference is that the strength-based account posits a more complex tone inventory, with five categories (H L$^{\text{strong}}$, L$^{\text{mild}}$, L$^{\text{weak}}$, and /ˈ/) vs. only three in the analysis presented here: H L and /ˈ/ (with the representational possibility of toneless TBUs). The strength-based analysis is thus representationally less economic for no descriptive or explanatory gain.

8.4 Downstep conditioned by a floating tone

Finally, let us consider and reject possible arguments in favor of viewing downstep as conditioned by a floating L tone in Paicî. First, it is difficult to see how one could possibly analyze phonological downstep as triggered by a floating L tone. One way of getting it to work would be to insert a floating L tone between the first two L-toned feet in L-toned 4μ+ words, causing the second one to downstep. This convoluted process would be motivated by the same structural configuration as that required in the analysis I propose (foot, colon, prosodic word), and would necessitate one extra step, and one extra tone in the derivation, both unmotivated, since the conditions for the application of the *LL OCP effect are already met before insertion of the floating L, as we saw above.

Accounting for underlying downstep with a floating L tone might at first sight seem less unreasonable. In this approach, predownstepped morphemes would be preceded by a floating L tone: predownstepped toneless enclitics would be represented as /= $^{\text{L}}$x̊/, and predownstepped L-toned enclitics and non-enclitic functional words as /(=)$^{\text{L}}$x̀/. When following a L-toned nucleus, this floating L would (i) block spreading of the L of the nucleus onto following enclitics, (ii) spread onto following toneless morae, and (iii) trigger a downstep on a following underlying L tone, by virtue of a *LL OCP constraint. One would additionally need to limit this OCP effect to monomorphemic LL sequences, to avoid downstep applying be-

tween any two adjacent L-toned morphemes, including within the same prosodic word. The main problem with this analysis is that there is no independent evidence for the presence of this floating L tone, and even strong indications that it might not be there: in particular it does not prevent (or interact in any way with) H-spreading from a preceding H-toned nucleus or juncture H tone. This confirms that downstep in Paicî, be it underlying/lexical or phonological/predictable, is not caused by an underlying L tone.[28]

9 Comparison with the Xârâcùù accent system

The Paicî tone system presents striking, typologically rare similarities with the accentual system of Xârâcùù, another Kanak language of New Caledonia's main island. As noted by Rivierre (1978), this strongly suggests that Paicî, before becoming a tone language, was characterized by an accent system close to that of Xârâcùù. This explains some of the rare properties of the Paicî downstep.

The accentual system of Xârâcùù was described by Rivierre (1978). Accent is marked with a pitch drop after the initial mora in words of one to three syllables, after the second mora in words of four syllables and above, as illustrated in (47).

(47)	a. 1∼2μ:	[to$^{\downarrow}$a]	'arrive'	[ma$^{\downarrow}$a]	'bird sp.'
		[ka$^{\downarrow}$mu̱ru̱]	'person'	[a$^{\downarrow}$puu]	'chief'
	b. 4+ μ:	[kɔrɔ$^{\downarrow}$paa]	'canoe' (*kɔ$^{\downarrow}$rɔpaa)	[mɛɛ$^{\downarrow}$gɛɛ]	'yam sp.' (*mɛ$^{\downarrow}$ɛgɛɛ)

Accent is culminative –there can only be one pitch drop per word– and the domain of accent is the prosodic word, formed by a lexical item and any following enclitic (accentless) grammatical words (Rivierre 1978: 419, fn.3).

I propose to analyze this pitch drop as downstep, rather than tone (e.g. the assignment of a H tone to the initial mora or foot of a word, or of a HL tone pattern with the initial H being associated with the initial mora or foot). Evidence for the downstep analysis comes from a very interesting process of 'coupling' (after Rivierre's *couplage*), whereby the dependent in a specific set of morphosyntactic head-dependent groupings is prosodically recessive, i.e. its accentual properties are made subordinate to those of the head. In such contexts, the prominent mora(e) of the recessive element cannot be realized higher than the last pitch of the preceding dominant element. For example, the noun + adjective phrase /kɔrɔpaa kɛrɛnɑ̱wɑ̱/ (canoe + yellow), which is one of the above-mentioned 'coupled' head-dependent structures, is realized [ko^{5}ro^{5}pa^{3}a^{3} kɛ^{3}rɛ^{3}nɑ̱^{2}wɑ̱^{2}] (Rivierre 1978: 420), which is expected in the downstep analysis I propose: [kɔrɔ$^{\downarrow}$paa kɛrɛ$^{\downarrow}$nɑ̱wɑ̱] –but not in the alternative H(L)-tone analysis *[kórópàà kɛ́rɛ́nɑ̱̀wɑ̱̀], where one would expect the H tone of the second word to start higher than the L-toned mora at the end of the first one. Xârâcùù is thus a non-tonal language with downstep.

The mora-count-dependent downstep pattern of Xârâcùù is too strikingly similar to the phonological downstep of Paicî (both involve a quirky four-mora threshold) for them not to be historically related. As for underlying downstep in Paicî, its origin is less clear, but it is likely related to the morphophonological properties of accent described above. One can

[28]Note that the same arguments hold for analysis in terms of floating H tone (cf. Hyman's analyis of Nandi (Hyman 1984) and Bamileke Dschang (Hyman 1979: 14–15, Hyman 1985).

indeed hypothesize that the predownstepped functional morphemes of Paicî (TAM markers, vocative particle, predownstepped tonal enclitics) were once recessive morphemes in the accentual system that used to characterize the non-tonal ancestor of Paicî, with downstep being a mark of this recessivity (or the evolved version of a former marking now lost).

The accentual origin of downstep in Paicî explains many of its typologically rare properties. First, it explains its word-culminativity (cf. §6.3), a property typical of accent, not of tone. It also accounts for the fact that downstep is its own phonological object, not tied to a tone in underlying representation (although it relies on L tones exclusively for its realization), not triggered by a tone, not analyzable as the effect of a tone: it is simply not originally tonal. Finally, the accentual origin of the Paicî downstep also explains why it is intrinsically tied to L tones, and never affects H tones. Paicî, like all New Caledonian tonal languages, developed tone relatively recently through the innovation of a H tone from transphonologization of the aspiration contrast on stops (and voicing contrast on sonorants) into a tonal contrast, i.e. *CV vs. C^hV > CV̀ vs. CV́, as shown by Haudricourt (1968) and Rivierre (1972, 1993, 2001). As a consequence of tonogenesis, H-toned words were, so to speak, removed from the "regular" accent system, while the rest of the lexicon (the now L-toned words) kept its accentual properties, only reinterpreted as tonal. This also explains why the L tone has default status in Paicî (§7), and why it is only five morphemes away from not having any phonemic existence in the language (§8.2). Paicî may well have been a H vs. Ø + downstep system at an earlier stage, until the development of predownstepped L-toned enclitics and mixed predownstepped toneless enclitics. How and when exactly the latter two came to be the way they are and trigger tonemicization of L is unclear.

Another interesting point is that, despite the accentual origins of Paicî, tonogenesis in the language was independent (or at least not a direct consequence) of accent. Much to the contrary, accentual phenomena were reinterpreted as tonal only after the independent emergence of tone. As Rivierre put it, 'one can with good reason conclude that [in New Caledonia] tonal contrasts appeared in languages that were already characterized by accent hierarchy phenomena, and that this prosodic substrate may have, at most, favored their development' (Rivierre 1978: 428, my translation).

10 Discussion and conclusion

Downstep in Paicî shares most of the properties associated with downstep in tonal languages, summarized in Leben (2018) (building on Rialland (1997)): it 'preserves the affected tone's phonological identity' (ˡL is still a L tone); it 'affects not a single tone but the entire tonal sequence in its domain'; it 'changes the register for what follows'; it is phonologically distinct from a lower underlying tone (H vs. L. vs. ˡL is different from H vs. M vs. L); 'the number of instances of downstep that can occur –in succession or in combination with other tones in an utterance– is in principle unlimited'. Additionally, the existence of both phonological and underlying/lexical downstep is in keeping with the expectation that 'downstep can come from a variety of sources: phonological, syntactic, morphosyntactic, and lexical.' It is thus reasonable to analyze it as downstep.

However, as we saw, the Paicî downstep also has typologically unusual characteristics:

(i) First, downstep is its own phonological object in Paicî, a property shared with a few other languages only –e.g. Sinyar (Boyeldieu 2019), Nawdm (Nicole 1980), Päri (Andersen

1988)), among the few languages with ˡL.

(ii) Downstep is realized only on L tones, and never on H tones, a property found only in Nandi (Creider 1982; Hyman 1984), Podoko (Anderson and Swackhamer 1981), and Sinyar (Boyeldieu 2019), as far as I know. The other ten languages with downstepped ˡL that I was able to identify, listed in footnote 1 in the introduction, also have ˡH and/or ˡM.

(iii) Downstepped ˡL is additionally only attested after L, and never after H, a property shared with Kikuyu (Clements and Ford 1977, 1979, 1981), and perhaps Yala, Igala (Adeniyi 2016), and Ghotuo (Elugbe 1986) (the descriptions in the latter two papers is not precise enough on this point).

(iv) Paicî is also one of the few languages in which downstep is realized utterance-initially, a rare property it shares with Bamileke Dschang (Hyman 1979: 12; (Pulleyblank 1986: 39–42)), Ikaan (Salffner 2009: 93, 96–97, 289–296), and Kipare (Odden 1986: 263–264).

(v) Downstep in Paicî is "total" (Meeussen 1970: 270), like in Kikuyu, Päri and Bwamu (Riccitelli 1965; Meeussen 1970).

(vii) Downstep is not triggered by a floating L tone, nor is it historically related to a L (or any other) tone, but derives from a former accentual system.

(vii) Finally, as a consequence of its accentual origins, the Paicî downstep has accentual properties: it is culminative within the phonological domains in which it is attested (prosodic word and pre-verbal field), and it is metrically conditioned. (Leben 2018: 15) notes that while downstep is conditioned by accent (i.e. by metrical structure) in many downstepping intonation systems, there are no cases so far linking downstep and metrical structure in tone languages. Paicî clearly fills this gap, and it is interesting that the one downstep that is metrically conditioned in the language (phonological downstep) also happens to be the one whose accentual origin is beyond doubt.

It is my hope that this paper, building on Rivierre's seminal work, will contribute to filling the gap highlighted by Leben (2018) in the description and typological characterization of downstepped L tones, and pave the way to an improved understanding of downstep.

Abbreviations

In addition to abbreviations from the Leipzig Glossing Rules, the following are used in this article for language examples: SUCC successive; DIR directional; MID middle; ASSERT assertive.

Appendix

Table 1: F0 measurements and statistical significance for HL vs. HˡL sequences

	HL	HˡL	ΔF0 (Hz)	Significance
F0-T1 (Hz)	105	102	3	t(32.2) = -1.4, p = 0.1
F0-T2 (Hz)	85	86	-1	t(30.1) = 0.3, p = 0.7
ΔF0 (Hz)	20	16	4	t(23.3) = -2.3, p = 0.02*

Table 2: F0 measurements and statistical significance for HL vs. LˈL sequences

	HL	LˈL	ΔF0 (Hz)	Significance
F0-T1 (Hz)	105	101	4	t(69.7) = 2.2, p = 0.02*
F0-T2 (Hz)	85	84	1	t(72.1) = -0.7, p = 0.4
ΔF0 (Hz)	20	17	3	t(62.1) = 2.4, p = 0.015*

Table 3: F0 measurements and statistical significance for HˈL vs. LˈL sequences

	HˈL	LˈL	ΔF0 (Hz)	Significance
F0-T1 (Hz)			0	t(38.3) = 0.6, p = 0.4
F0-T2 (Hz)			0	t(34.7) = 0.9, p = 0.3
ΔF0 (Hz)			0	t(32.7) = -0.1, p = 0.8

Table 4: F0 measurements and statistical significance for LˈL and HL sequences in [tɛ̀ɛˈpàà] and [téépàà]

	tɛ̀ɛˈpàà (LˈL)	téépàà (HL)	ΔF0 (Hz)	Significance
F0-T1 (Hz)	96	101	5	t(27.5) = 1.9, p = 0.06
F0-T2 (Hz)	76	78	2	t(21.1) = -0.4, p = 0.6
ΔF0 (Hz)	20	23	3	t(21.9) = 2.1, p = 0.052

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