

## "Lexical tone contrast in Izon as ubiquitous floating tone"

The purpose of this paper is to establish the lexical tone contrasts across morphemes in the Nigerian language Izon, which I analyze as involving ubiquitous floating tone. Most languages that exhibit effects of floating tone do so in a restricted way, such as being contrastive on only a minority of morphemes or restricted to certain grammatical environments. For Izon, the claim here is that all lexical items exhibit floating tone, making it ubiquitous across the lexicon and as common as pre-associated tone. The motivation for floating tone comes from tonal patterns of morphemes in isolation and within multi-morpheme 'tone groups'. From these patterns, all lexical morphemes are placed into one of four 'tone classes', defined primarily based on which floating tones they end in. This is illustrated below with nouns in object position, whose floating tones replace those of the verb /èrɪ/ 'see':

(i)	Class A	ⓁⓂ	/ tǎ <sup>ⓁⓂ</sup> + èrɪ /	→	tǎ èrɪ	'see wife!'
(ii)	Class B	Ⓜ	/ fù <sup>Ⓜ</sup> + èrɪ /	→	fù èrɪ	'see salt!'
(iii)	Class C	Ⓛ	/ wún <sup>Ⓛ</sup> + èrɪ /	→	wún èrɪ	'see sand!'
(iv)	Class D	ⓂⓁ	/ wò <sup>ⓂⓁ</sup> + èrɪ /	→	wò èrɪ	'see him!'

This paper highlights a number of issues which emerge under floating tone representations. Such issues include (a) the allowance of OCP(T) violations within a morpheme if the first tone is pre-associated and the second floating (i.e. /H Ⓜ/), and (b) the misalignment of morphological and prosodic constituents as evidenced by distinct floating tone association patterns with vowel-initial targets. This paper concludes by comparing and contrasting the ubiquitous floating tone analysis forwarded here with an alternative involving obligatory tone spreading.

# 1 Introduction

One of the most influential developments in 20<sup>th</sup> century phonology was formally separating the segmental tier from the suprasegmental tier, codified in the work of ‘Autosegmental Phonology’ (Goldsmith 1976). A major part of its continuing success is its ability to represent multiple kinds of tonal configurations involving a tone (T) and a tone-bearing unit (TBU, conventionalized as  $\tau$ ), the structural unit to which the tone associates. Such configurations are shown in Table 1, which include ‘deficient’ structures lacking either a tone (a.) or a TBU (b.), non-deficient structure where the two are associated (c.), structure where they both occur but remain unassociated (d.), or some combination (e.):

	$\textcircled{T}$		T		$\textcircled{T}$		T	$\textcircled{T}$
a. $\tau$	b.	c. $\tau$		d. $\tau$	e. $\tau$			

Table 1: Types of tonal configurations using autosegmental representation

Several of these configurations involve tones unassociated to TBUs, a representation referred to as ‘floating tone’ and notated with a circled  $\textcircled{T}$ . In most languages, floating tones are restricted in some way, such as appearing only on a minority of morphemes within their lexicon, or being restricted to some grammatical context (i.e. grammatical tone). In numerous cases, they are transparently related to tone formerly associated to a TBU which has been lost.

The analytic claim of this paper is that in Izon – an endangered Ijoid language of Nigeria’s Niger Delta region – *all* lexical morphemes contain floating tones as part of their underlying representation. I refer to this as ‘ubiquitous floating tone’, a typologically unusual system wherein floating tones constitute a core component of phonological contrast, with remarkable stability across the Izon dialect continuum. The motivation for floating tone comes from the tonal effects lexical morphemes exhibit in isolation and within multi-morpheme ‘tone groups’. The tone of all non-initial morphemes within the tone group is deleted, and replaced by floating tones idiosyncratically associated by the initial morpheme.

Building on Williamson (1988), I show evidence for four sets of replacement patterns in two closely related dialects of Izon – Gbarain Izon and Kolokuma Izon – which I label as ‘tone classes’. These involve replacement with a LH pattern (class A), with all H (class B), with all L (class C), or with a HL pattern (class D). Each of these replacement patterns is analyzed as a sequence of floating tones which appear after any pre-associated tones. This is illustrated below with four examples of nouns in object position, whose floating tones replace those of the verb / $\text{\textcircled{e}}\text{\textcircled{r}}\text{\textcircled{i}}$ / ‘see’:

- (1) Four tone classes in Izon – Defined based on their replacive tone pattern [Gb-20190706:30];[Gb-20190714:60]
- |    |          |  |   |  |             |
|----|----------|--|---|--|-------------|
| a. | Class A: | ends in $\textcircled{L}\textcircled{H}$ | / $\text{\textcircled{t}}\text{\textcircled{a}}^{\textcircled{H}} + \text{\textcircled{e}}\text{\textcircled{r}}\text{\textcircled{i}}$ /                       | → [ $\text{\textcircled{t}}\text{\textcircled{a}}\text{\textcircled{e}}\text{\textcircled{r}}\text{\textcircled{i}}$ ]                       | ‘see wife!’ |
| b. | Class B: | ends in $\textcircled{H}$                | / $\text{\textcircled{f}}\text{\textcircled{u}}^{\textcircled{H}} + \text{\textcircled{e}}\text{\textcircled{r}}\text{\textcircled{i}}$ /                       | → [ $\text{\textcircled{f}}\text{\textcircled{u}}\text{\textcircled{e}}\text{\textcircled{r}}\text{\textcircled{i}}$ ]                       | ‘see salt!’ |
| c. | Class C: | ends in $\textcircled{L}$                | / $\text{\textcircled{w}}\text{\textcircled{u}}\text{\textcircled{n}}^{\textcircled{L}} + \text{\textcircled{e}}\text{\textcircled{r}}\text{\textcircled{i}}$ / | → [ $\text{\textcircled{w}}\text{\textcircled{u}}\text{\textcircled{n}}\text{\textcircled{e}}\text{\textcircled{r}}\text{\textcircled{i}}$ ] | ‘see sand!’ |
| d. | Class D: | ends in $\textcircled{H}\textcircled{L}$ | / $\text{\textcircled{w}}\text{\textcircled{o}}^{\textcircled{H}\textcircled{L}} + \text{\textcircled{e}}\text{\textcircled{r}}\text{\textcircled{i}}$ /        | → [ $\text{\textcircled{w}}\text{\textcircled{o}}\text{\textcircled{e}}\text{\textcircled{r}}\text{\textcircled{i}}$ ]                       | ‘see him!’  |

This paper highlights a number of issues which emerge under ubiquitous floating tone representations. First, Izon allows OCP(T) violations within a morpheme if the first tone is pre-associated and the second floating (i.e.  $\textcircled{H}$ ), as long as the identical tones are linked to different phonological words. Second, vowel-initial target have special effects on floating tone association, wherein a preference emerges for low tone and onsetless syllables to coincide. I consider the initial vowel here as extrametrical, analyzed the misalignment of morphological and prosodic constituency (following Downing 1998). Moreover, I compare the floating tone analysis to an alternative involving ‘obligatory tone spreading’, whereby the final tone of a word is required to spread across its word boundary. Common to both analyses is that the tonal effects can be interpreted as the phonologization of pitch carry-over within its tonal domain.

This paper is structured as follows. Section 2 provides a brief overview of the Izon language, its tone system, and defines terms 'tone class' and 'tone group' used throughout this paper. Section 3 establishes the four tone classes which morphemes fall into (A-D, above), explicates their analysis via floating tone, and summarizes the frequency of each within the two dialects of Izon examined. Section 4 presents discussion on three final issues: the frequency of each tone class, a comparison of the attested Izon patterns to the logically possible combinations of pre-associated and floating tone to determine systematic gaps, and contrasting the analysis of this paper with the alternative involving obligatory tone spreading. A summary is in Section 0, followed by several appendices.

## 2 Preliminary background on Izon

### 2.1 The Izon language

Izon [orthography: Ẫzon – IPA: ɪzɔ̃ – ISO code: [ijc](#)] is an Ijoid language spoken in the extreme south of Nigeria in the Niger Delta region, often known by alternative names 'Ijo', 'Ijɔ', or 'Ijaw'. Jenewari (1989) characterizes Izon as constituting approximately 30 dialects, the most prominent in the linguistics literature being Kolokuma due to the work by Kay Williamson. Despite a high ethnic population of at least one million (Jenewari 1989:107), Izon is an endangered language due to the growing dominance of Nigerian Pidgin English [[pcm](#)] (as well as Standard Nigerian English). In what follows, I use 'Izon' to refer to the language and 'Ijoid' to refer to the language family, and avoid the name 'Ijo'.<sup>1</sup>

The focus of this paper are two dialects of Izon, Gbarain Izon ([gbàrà] or [gbàrà́]) and the aforementioned Kolokuma Izon ([kólókùmá]). They are geographically proximate and each other's closest Izon relative (99% cognates in a modified Swadesh list – Lee & Williamson 1990). The data from Gbarain Izon were collected by the author in collaboration with [*consultant name*] during fieldwork in Nigeria in 2017 and 2019. The Kolokuma Izon data come from Williamson (1965, 1978, 1983, 1988) and Williamson & Timitimi's (1983) Izon dictionary (updated as Williamson & Blench 2011). For all data points in this paper, I cite the source in subscripted square brackets, which minimally includes the dialect (abbreviated as [Gb] and [Ko]), the date collected, and the page number within the archived field notes. See Appendix A4 for further information on these conventions, as well as background on data collection, subsequent databases, and archiving information.

### 2.2 Basic properties

I now briefly overview Izon segmental phonology and morphosyntax. All Izon varieties exhibit advanced tongue root (ATR) harmony, with [+ATR] /i e o u ɪ ē ò ù/, [-ATR] /ɪ ɛ ɔ u ĩ ẽ õ ù/, and neutral /a ǎ/. As common in Nigerian orthographies, [-ATR] is written as a dot under the vowel and contrastive nasal vowels are written with an <n> following the vowel, e.g. as in the name *Izon* and throughout Williamson & Timitimi (1983). Within a word, all non-low vowels must agree in ATR value, but the neutral vowels /a ǎ/ may co-occur with both sets. ATR harmony is a robust property within morphemes but few alternations are seen across morphemes. For example, the [+ATR] root *sei* [sèi] 'be bad, be spoiled' appears in a derived causative form *seimo* [sèimɔ̃] 'spoil' and shows mixed ATR values. In general, Izon has a very low degree of bound segmental morphology, and bound morphemes are generally treated as simple cliticization. There is no clear vowel length distinction. For this paper, the few morphemes which appear to have long vowels are interpreted as adjacent short vowels, e.g. [gbèèkĩ] 'short'.

Consonants are /p b t d k g kp gb m n ŋ f v s z r l y w/ (where y is IPA [j]), with some variation across dialects (and depending on analysis). Syllable structure is generally V or CV, although homorganic nasals preceding voiced stops are found in some words, e.g. *anda* [àndá] 'wrestle'. Syllabic nasals are common

<sup>1</sup> Several Ijoid languages are represented in the Africanist literature, such as Kolokuma Izon (references listed above, but also Carstens 2002), Bumo Izon (Efere 2001), Nembe [[ijs](#)] (Rowlands 1960), and Kalabari [[ijn](#)] (Jenewari 1977, Harry 2004, Blench 2008, Harry & Hyman 2014). As a whole, however, the Ijoid family is critically underdescribed, in part attributable to the ongoing strife in the Niger Delta concerning Nigerian oil resources.

variants of high vowels in a nasal context, e.g. *indou* ‘breast’ as [ɪndóú~ɲdóú], *mí* PERFECTIVE (PFTV) as [mɪ~ɱ], *inter alia*. Although there are no morpheme-final codas underlyingly, in faster speech deletion of /i~ɪ/ at morpheme boundaries is common, resulting in surface codas (e.g. *wari bì* [wár bì] ‘the house’).

Like all Ijoid languages, Izon shows head-final properties such as (i) postpositions, (ii) adjectives, numerals, demonstratives, possessors, and relative clauses before nouns, but determiners and quantifiers after nouns, (iii) adjunct-object-verb word order, and (iv) verb-auxiliary order, which includes a large number of inflectional enclitics denoting tense, aspect, mood, negation, and question marking. These basic properties are schematized in (2):

- (2) Schema of head-final properties in Izon
- a. [SUBJECT] [ADJUNCT] [OBJECT] [VERB] [INFLECTIONAL CLITICS]
  - b. [MODIFIERS] [NOUN] [DETERMINER/QUANTIFIER]
  - c. [NOUN PHRASE] [POSTPOSITION]

These properties make it extremely anomalous compared to all neighboring language families, which generally show head-initial properties (Niger-Congo sub-families Defoid, Edoid, Cross-River, Igboid).<sup>2</sup>

### 2.3 Tone in Izon

Tone in Izon is a contrastive property of morphemes, therefore meeting the definitional criteria of a tone language (Welmers 1959, 1973, Hyman 2018). Izon has two tonemes, high tone /H/ and low tone /L/. In this paper, all tone is marked overtly with standard conventions, e.g. acute [á] for high tone and grave [à] for low tone. Instances of falling [â] and rising [ǎ] are interpreted as a sequence of high and low tones on a single mora, which I assume to be the tone-bearing unit (TBU) for our purposes.

The position of underlying tones is not predictable, e.g. Gbarain H.L.L [áŋgìsì] *ànggìsì* ‘handkerchief’ (< Eng.), L.H.L [òtókò] *otoko* ‘mud’, and L.L.H [àkàlú] *akalu* ‘moon’. Surface contours are typically found at the right word edge, e.g. L.L.H̄L [ìsùsò] *isusu* ‘garden egg’ or L.L.L̄H [ègbèrì] *egberi* ‘story’. Surface patterns of strings of high tones are very common, e.g. L.H.H [ìkókú] *ikoku* ‘waist’ and H.H.H [tékélé] *tekele* ‘lift up’, and nearly all lexical items occur with a H tone somewhere (either pre-associated or floating). Entirely L-toned surface patterns do not occur in the Gbarain Izon dialect and are rare in the Kolokuma dialect where they are restricted to names for places or people, e.g. L.L [ìgbò] *igbon* ‘northerner, Hausa’.

This paper does not examine regular tone rules in Izon which are not morphologically-/lexically-conditioned. There are at least two such operations in Gbarain Izon, H-absorption and low-to-mid raising. These are described in Appendix A1. I do not discuss regular tone rules for Kolokuma.

### 2.4 Tone classes

It is impossible to discuss underlying tonal contrast in Izon without discussing ‘tone classes’ and ‘tone groups’, terminology stemming from Williamson (1978). In Izon, morphemes belong to idiosyncratic **tone classes**, defined as the following:

- (3) **Tone class:** a lexical item’s unique combination of (i) pre-associated tones, and (ii) the systematic tonal effect it has on the following words to their right

The number of tone classes in Izon depends on dialect and level of analysis. For the Gbarain and Kolokuma dialects, I establish four tone classes labeled A, B, C, and D, and a number of subclasses. Class A lexical

<sup>2</sup> Due to such a strikingly distinct structural profile compared to the neighboring Niger-Congo families, as well as the lack of convincing systematic sound correspondence or clear form-meaning vestiges of a Niger-Congo noun class system or verbal extension system, sources such as Glottolog (Hammarström *et al.* 2020) in fact treat Ijoid as a separate family altogether.

items assign a LH pattern to the following sequence of words to its right, Class B an all H pattern, Class C an all L pattern, and Class D a HL pattern, as established above in (1). In this paper, I attribute these tonal effects as stemming from sequences of underlying floating tones. These floating tones cannot be predicted based on the pre-associated tone of either the triggering morphemes or the target, seen in the following tone class minimal pair which have identical segments and pre-associated tonal structure:

- (4) Izon minimal pair based on tone class (Kolokuma dialect) [Ko-K&B11:5]  
 a. Class B: / àká<sup>Ⓜ</sup> / 'tooth' → [ àká óvú<sup>Ⓜ</sup> ] 'space between two front teeth'  
 b. Class C: / àká<sup>Ⓛ</sup> / 'corn' → [ àká àpù<sup>Ⓛ</sup> ] 'corn sheath'

In the underlying representation, floating tones appear only at the right edge of a lexical item and replace all tones to its right. In (4) above, the underlying tones of the second word – /òvù<sup>Ⓜ</sup>/ 'space between' and /àpù<sup>Ⓛ</sup>/ 'skin' – show no effects on the surface.

Note hereafter that in tonal representations, a floating tone which is not pre-associated to a TBU in the input is circled and superscripted, i.e. <sup>Ⓜ</sup>. In contrast, a floating tone which becomes associated to a TBU is circled but not superscripted in representations, i.e. Ⓜ. Furthermore, I use the conventional orthography for Izon segments, even when representations are placed in slashes or brackets, rather than IPA. As stated above, the most relevant aspect of this is that [-ATR] vowels are indicated with a dot beneath the vowel, and nasal vowels are indicated with <n> following the vowel.

## 2.5 Tone groups

The domain within which these floating tones show an effect is called the **tone group**, defined as the following:

- (5) **Tone group:** The multi-morphemic unit which includes the lexical item sponsoring the floating tone and those morphemes to its right to which the floating tones are systematically assigned

Crudely, within a tone group the tone of all morphemes but the first are deleted, and are replaced by the floating tones of this first morpheme. Within the Africanist literature, this type of tonal phenomenon is often called **replacive tone** (Welmers 1973:132-133), and can be classified as a type of dominance effect (Kiparsky & Halle 1977, Inkelas 1998, Rolle 2018).

The result is a complete neutralization of the underlying tones of the target morphemes, shown in the [MODIFIER NOUN] phrases in Table 2. Within tone groups, the lexical tone contrast of the nouns is neutralized and obligatorily replaced with the floating tones of the modifiers, whether Ⓜ from class A, Ⓜ from class B, or Ⓛ from class C. The data below is from Gbarain Izon.

	Tone class	bùrù <sup>Ⓜ</sup> 'yam'	námá <sup>Ⓜ</sup> 'meat'	
Modifier	A èbì <sup>Ⓜ</sup> 'good'	[ èbì bùrù ] 'good yam'	[ èbì nàmá ] 'good meat'	[ LL ⓂⓂ ]
	B2 èndì <sup>Ⓜ</sup> 'that'	[ èndì bùrù ] 'that yam'	[ èndì námá ] 'that meat'	[ LL ⓂⓂ ]
	B3 òwọ́ <sup>Ⓜ</sup> 'alive, fresh, raw'	[ òwọ́ bùrù ] 'raw yam'	[ òwọ́ námá ] 'raw meat'	[ LH ⓂⓂ ]
	C kálá <sup>Ⓛ</sup> 'small'	[ kálá bùrù ] 'small yam'	[ kálá nàmà ] 'small meat'	[ HH ⓁⓁ ]

Table 2: Gbarain data – Tone neutralization of modified nouns in tones groups

These changes cannot be reduced to general phonological principles. A simple spreading rule is insufficient to capture the tonal changes: subclass B2 morphemes end in L but sponsor a floating Ⓜ tone, while some

Class C morphemes end H but sponsor  $\textcircled{L}$ . Nor is a simple dissimilation rule sufficient, since class A both ends in and sponsors low, while class B3 ends in and sponsors a high. I emphasize that the target in these cases is completely inert in the sense that its inherent lexical tones neither license nor prevent tonal replacement. This demonstrates that the tonal changes here are orthogonal to any phonological markedness conditions, e.g. the grammar preferring H over L, non-contours to contours, phrase-final low tones, *etc.*

What defines a tone group? In Izon, tone groups largely correspond to major phrases: crudely, the noun phrase (NP) consisting of pre-modifiers and ending with the noun, and the verb phrase (VP) consisting of the complement object and ending in the verb. These may combine too, for example a [MODIFIER] [NOUN] [VERB] construction forms a single tone group. This paper will not discuss the details of tone group formation, only the tonal effects which take place after its formation, namely tonal replacement of all but the first. See Rolle (2018:§6.3ff.) for one proposal on tone group formation, discussing several competing analyses. An important issue which I return to is the behavior of the proposed floating tones when the following word's tones are *not* replaced (§3.2.3).

### 3 The four tone classes in Izon

In each subsection below, I detail the patterns of the four tone classes (and their subclasses), including their forms in isolation and their forms in various tone groups. By virtue of all lexical items being classified into one of these four classes, this amounts to claiming that all lexical items carry a floating tone (with a possible exception of certain C subclasses). If this analysis is accepted, Izon represents a typologically unusual system in which floating tone is ubiquitous across the lexicon. I refer to this analysis as **ubiquitous floating tone**. In some ways, this analysis resembles Williamson's (1988) analysis of Kolokuma Izon tone, which also captured tonal behavior by positing a combination of pre-associated and floating tones. Space does not permit a full comparison of the key differences, but a rudimentary comparison is provided in Appendix A3.

#### 3.1 Tone class A – Analysis as floating $\textcircled{LH}$

We begin our discussion with class A, analyzed as ending in a floating tone sequence  $\textcircled{LH}$ . I first lay out the basic patterns of the Gbarain Izon dialect, then compare it to Kolokuma Izon.

##### 3.1.1 Core patterns of class A in Gbarain Izon

Class A items bear all low tones and sponsor a floating  $\textcircled{LH}$  sequence. Monosyllabic class A items as pronounced in isolation in Gbarain Izon are provided in (6). Both those with a single vowel (a.) and those with two vowels forming a (surface) diphthong (b.) are realized with a rising tone. This is straightforwardly interpreted as the floating  $\textcircled{H}$  docking and co-occurring with the lexical low.

(6) Gbarain Izon – Sample of class A ( $\textcircled{LH}$ ) monosyllabic forms in isolation

a.	dì <sup><math>\textcircled{LH}</math></sup>	[ dǐ ]	'look at'	b.	bòù <sup><math>\textcircled{LH}</math></sup>	[ bòú ]	'the bush'
	fà <sup><math>\textcircled{LH}</math></sup>	[ fǎ ]	'finish'		dìè <sup><math>\textcircled{LH}</math></sup>	[ dìé ]	'share' (split into sections)
	lè <sup><math>\textcircled{LH}</math></sup>	[ lě ]	'hit'		sàì <sup><math>\textcircled{LH}</math></sup>	[ sàí ]	'carry' (in vehicle)
	sù <sup><math>\textcircled{LH}</math></sup>	[ sǔ ]	'fight'		tùò <sup><math>\textcircled{LH}</math></sup>	[ tùó ]	'cook'

With multi-syllabic class A items, multiple surface patterns are attested. The majority of tokens collected show an all low-pattern with a rise on the final TBU, mirroring the patterns in (6). An example set is in (7), including forms which end in a single vowel (a.-b.) and those with two (c.).

(7) Gbarain Izon – Majority surface pattern of class A multi-syllabic forms in isolation

		[L...LH]	
a.	bùrù <sup>ⓁⓂ</sup>	[ bùrǔ ]	'yam'
	dòrò <sup>ⓁⓂ</sup>	[ dòrǒ ]	'shout'
	àsìn <sup>ⓁⓂ</sup>	[ àsɪn ]	'blood'
b.	tùkòní <sup>ⓁⓂ</sup>	[ tùkòní ]	'praise'
	òkòlò <sup>ⓁⓂ</sup>	[ òkòlǒ ]	'voice'
	ògòdùmá <sup>ⓁⓂ</sup>	[ ògòdùmǎ ]	'duck'
c.	òsùò <sup>ⓁⓂ</sup>	[ òsùò ]	'rain'
	sùbèì <sup>ⓁⓂ</sup>	[ sùbèí ]	'gun'

In these patterns, the floating  $\text{Ⓜ}$  docks to the final TBU of the word which sponsors it, a process I refer to as 'self-association'. In general, self-association in Izon primarily occurs when there is no host to the right of the trigger, though certain exceptions exist which I bring up at the appropriate point. However, in these patterns there is no clear evidence of the floating  $\text{Ⓛ}$  having any effect, and I therefore assume that it has been deleted when pronounced in isolation. Below, I justify its existence from patterns in tone groups.

There exist a minority of surface patterns for class A isolation forms which deviate from these majority findings. Certain tokens show a minority pattern of all low ending in a level H on the final TBU, e.g. tokens of /tùkpà<sup>ⓁⓂ</sup>/ 'lamp' pronounced as [tùkpá], and /ìkpòsò<sup>ⓁⓂ</sup>/ 'dirt' as [ìkpòsó]. Others show a different minority pattern of an entirely all low with no final H at all, e.g. tokens of /tùbò<sup>ⓁⓂ</sup>/ 'child' as [tùbò], and /bilè<sup>ⓁⓂ</sup>/ 'dive in' as [bilè]. The lexical items exhibiting these minority patterns pattern identically to other class A items in all other regards, and in general Class A is subject to pattern variation more than other tone classes. I therefore take these surface forms to be incidental surface variants.

In Gbarain, when class A lexical items are leftmost within the tone group, the floating  $\text{ⓁⓂ}$  sequence associates to the phonological words to the right of the sponsoring morpheme. This is exemplified below with a single phonological word target. Example a. shows the class A noun /bùrù<sup>ⓁⓂ</sup>/ 'yam' assigning its floating tones to the following lexically toneless words /kpọ/ 'also' and /kùmọ/ 'only'. Example b. shows a pre-nominal modifier /èbì<sup>ⓁⓂ</sup>/ 'good' whose floating tones overwrite the lexical tones of the following noun. With multiple-TBU targets, the majority of tokens show a [L...H] pattern.

(8) Gbarain Izon – Class A  $\text{ⓁⓂ}$  association in a tone group

a.	/bùrù <sup>ⓁⓂ</sup>	kpọ /	→	[ bùrù kpǒ ]	'also yam'
	/bùrù <sup>ⓁⓂ</sup>	kùmọ /	→	[ bùrù kùmó ]	'only yam'
b.	/èbì <sup>ⓁⓂ</sup>	bùrù <sup>ⓁⓂ</sup> /	→	[ èbì bùrú ]	'good yam'
	/èbì <sup>ⓁⓂ</sup>	fùrọ̀ <sup>Ⓛ</sup> /	→	[ èbì fùrọ̀ú ]	'good stomach'
	/èbì <sup>ⓁⓂ</sup>	dángìlòkó <sup>Ⓛ</sup> /	→	[ èbì dàngìlòkó ]	'good giant'

Here we see the evidence motivating the floating  $\text{Ⓛ}$ , not seen when pronounced in isolation: the TBUs immediately following the first word are low-toned. We return to the interpretation of this fact in §4.3 below, where I discuss a floating tone versus spreading analysis.

In tone groups with more than two morphemes, the  $\text{ⓁⓂ}$  sequence docks between the second and third phonological words in the tone group. In (9), the floating tones of first word replace those tones of the second and third words. The second word appears with all low tones while the third appears with all high tones. This happens regardless of the number of TBUs in the second word, i.e. with 2 TBUs in (a.), 3 in (b.), and 4 in (c.). The tone group in c. is in parenthesis for clarity, and underlined in the underlying representation; the words before and after it are not part of the tone group.

- (9) Gbarain Izon – Class A (L<sup>⊕</sup>H) association between second and third words in tone group
- a. / òsì<sup>L<sup>⊕</sup></sup> ná má<sup>H</sup> wá rí<sup>L</sup> / [ òsì nàmà wá rí ] [Gb-20170711:21]  
 snail meat house ‘house of snail meat’
- b. / ì n è<sup>L<sup>⊕</sup></sup> gb è è k ì<sup>L<sup>⊕</sup></sup> bù r ù<sup>L<sup>⊕</sup></sup> / [ ì n è gb è è k ì bù r ú ] [Gb-20190705:23]  
 my short yam ‘my short yam’
- c. [ d è n g í k ì (ì n è t è g è r è ì bù r ú) bì à ] [Gb-20190705:23]  
 / d è n g í<sup>L</sup> k ì ì n è<sup>L<sup>⊕</sup></sup> t è g è r è ì<sup>L<sup>⊕</sup></sup> bù r ù<sup>L<sup>⊕</sup></sup> bì à /  
 where FOC my round yam DEF QUES  
 ‘where is my round yam?’

Gbarain examples in (10) illustrate that the straddling of the floating tone sequence between the second and third words occurs in larger tone groups as well. All target TBUs in the third word and thereafter are high-toned, regardless of their length.

- (10) Gbarain Izon – Uniform association of class A (L<sup>⊕</sup>H) in larger tone groups
- a. / ì n è<sup>L<sup>⊕</sup></sup> t á r á<sup>H</sup> ò b à<sup>L<sup>⊕</sup></sup> bù r ù<sup>L<sup>⊕</sup></sup> / [ ì n è t à r à ò b á bù r ú ]  
 my three big yam ‘my three big yams’ [Gb-20170806:135]
- b. / ì n è<sup>L<sup>⊕</sup></sup> t á r á<sup>H</sup> ò b à<sup>L<sup>⊕</sup></sup> k ù l ú k ù l ú<sup>H</sup> bù r ù<sup>L<sup>⊕</sup></sup> / [ ì n è t à r à ò b á k ù l ú k ù l ú bù r ú ]  
 my three big black yam ‘my three big black yams’ [Gb-20190705:23]
- c. / ò d ù à<sup>L<sup>⊕</sup></sup> n á m á<sup>H</sup> k ù l ú k ù l ú<sup>H</sup> t ì b í<sup>H</sup> ò d ù m ú<sup>H</sup> / [ ò d ù à n à m à k ù l ú k ù l ú t ì b í ò d ù m ú ]  
 some animal black head hair ‘some animals’ black hair’ [Gb-20190705:22]

One observation we can make is that while the floating H associates to the rightmost TBU in a single-word target – i.e. [èbì dàngìlòkó] in (8) – it does *not* in fact associate solely to the rightmost word in the larger tone groups in (9). In other words, association is right-oriented within the word, but more left-oriented within the phrase.

Although this description covers the majority of patterns collected for Gbarain class A (L<sup>⊕</sup>H) lexical items, a limited amount of variation exists. For example, a minority of tokens were collected where a 1-TBU target surfaces as a level high, and a 2-TBU target surfaces with a final rising tone. This is shown in (11), with comparison of the majority and minority patterns.

- (11) Gbarain Izon – Class A (L<sup>⊕</sup>H) variation: Majority cf. Minority
- a. / bù r ù<sup>L<sup>⊕</sup></sup> k p ọ / → [ bù r ù k p ọ ] [ ... k p ọ ] ‘also yam’
- b. / bù r ù<sup>L<sup>⊕</sup></sup> k ù m ọ / → [ bù r ù k ù m ọ ] [ ... k ù m ọ ] ‘only yam’

This variation is found with larger targets as well, e.g. targets with three or more TBUs (12). The floating L consistently associates to the initial TBU of the target and the floating high to the final. Between them, there are various surface realizations which are acceptable to various degrees.

- (12) Gbarain Izon – Class A variation of larger tone groups [Gb-20190702:7]
- a. / ì n è<sup>L<sup>⊕</sup></sup> t è b ù l ù<sup>L</sup> / ‘my table’  
 [ ì n è t è b ù l ú ] ~ [ ì n è t è b ù l ǔ ] ~ [ ì n è t è b ú l ú ]
- b. / ì n è<sup>L<sup>⊕</sup></sup> k ú k í n ò d ù k ú<sup>L</sup> / ‘my sweet potato’  
 [ ì n è k ù k í n ò d ù k ú ] ~ [ ì n è k ù k í n ò d ú k ú ]
- c. / ì n è<sup>L<sup>⊕</sup></sup> k ú k í n ò d ù k ú<sup>L</sup> ọ m ọ / ‘my sweet potatoes’ (w/ toneless ọ m ọ INDEF.PL)  
 [ ì n è k ù k í n ò d ú k ú ọ m ọ ] (form given by consultant)  
 [ ì n è k ù k í n ò d ú k ú ọ m ọ ] (forms accepted by consultant when they were provided)  
 ~ [ ì n è k ù k í n ò d ù k ú ọ m ọ ] ~ [ ì n è k ù k í n ò d ù k ù ọ m ọ ] ~ [ ì n è k ù k í n ò d ù k ù ọ m ọ ]

In what follows, I summarize the Gbarain data only as it appears in the majority patterns.



The tonal association statements thus far hold for consonant-initial target words. Different patterns emerge if the target is vowel-initial, i.e. begins with an onsetless TBU (effects of this type were previously identified in Williamson & Timitimi 1983:xxx). I refer to such vowel-initial TBUs as ‘V-TBUs’ (and its counterpart as consonant-initial ‘C-TBUs’). In (13), the floating  $\textcircled{L}$  docks to the first V-TBU and the floating  $\textcircled{H}$  must dock immediately after it, onto the second TBU of the word (and thereafter).

- (13) Gbarain Izon – Class A ( $\textcircled{L}\textcircled{H}$ ) association with V-TBU targets
- |    |  |  |                       |                |                   |
|----|--|--|-----------------------|----------------|-------------------|
| a. | / ìnè <sup><math>\textcircled{L}\textcircled{H}</math></sup> | ínkí <sup><math>\textcircled{L}</math></sup> /   | [ ìnè ìnkí ]          | ‘my ink’       | [Gb-20170711:20]  |
|    | / màà <sup><math>\textcircled{L}\textcircled{H}</math></sup> | ìsàní <sup><math>\textcircled{L}\textcircled{H}</math></sup> /   | [ màà ìsání ]         | ‘two peppers’  | [Gb-20190702:4]   |
|    | / èbì <sup><math>\textcircled{L}\textcircled{H}</math></sup> | ìgbémá <sup><math>\textcircled{H}</math></sup> /   | [ èbì ìgbémá ]        | ‘good bell’    | [Gb-20170723:78]  |
|    | / òpù <sup><math>\textcircled{L}\textcircled{H}</math></sup> | òpóríópò <sup><math>\textcircled{L}</math></sup> /   | [ òpù òpóríópó ]      | ‘big pig’      | [Gb-20170711:21]  |
| b. | / ìnè <sup><math>\textcircled{L}\textcircled{H}</math></sup> | ègbèrì <sup><math>\textcircled{L}\textcircled{H}</math></sup> ọmọ /  | [ ìnè ègbèrì ọmọ ]    | ‘my stories’   | [Gb-20170809:159] |
|    | / ìnè <sup><math>\textcircled{L}\textcircled{H}</math></sup> | ìmbèlẹ́ <sup><math>\textcircled{L}</math></sup> ̀bùrù <sup><math>\textcircled{L}\textcircled{H}</math></sup> / | [ ìnè ìmbèlẹ́ ̀bùrù ] | ‘my tasty yam’ | [Gb-20190705:23]  |

That the floating  $\textcircled{H}$  associates to the second TBU of the target contrasts with the data already seen with C-TBUs. There, in the majority patterns this  $\textcircled{H}$  associates to the rightmost TBU in the next word, e.g. [èbì dàngìlòkó] ‘good giant’. Such effects on association with V-TBUs happens regardless of the number of TBUs in the target (a.), or the number of words (b.). Importantly, the variation exhibited above with C-TBUs is not replicated with V-TBUs; variants like \*[òpù òpòrìòpó] ‘big pig’ are not attested.

From these data, two key generalizations can be established: (i) low tones are attracted to V-TBUs, and (ii) the floating tones in the  $\textcircled{L}\textcircled{H}$  sequence dock to adjacent TBUs. Attraction of the  $\textcircled{L}\textcircled{H}$  sequence to a V-TBU is illustrated with a 4-word tone group in (14) below. In a., the  $\textcircled{L}\textcircled{H}$  associates between the second and third words. In contrast, in b. the sequence docks entirely within the second word, pulled to the left from its ‘normal’ position of association. The pattern in c. shows that this floating sequence can also be pulled to the right if the third word begins with a V-TBU. Finally, d. shows that when both the second and third begin with V-TBUs, the sequence is oriented to the left.

- (14) Gbarain Izon – Class A association with V-TBU targets in larger tone groups [Gb-20170806:135]
- |    |  |  |   |   |                      |
|----|--|--|---|---|----------------------|
| a. | / ìnè <sup><math>\textcircled{L}\textcircled{H}</math></sup> | tára <sup><math>\textcircled{H}</math></sup>               | dìbà <sup><math>\textcircled{L}\textcircled{H}</math></sup> | bùrù <sup><math>\textcircled{L}\textcircled{H}</math></sup> / | [ìnè tàrà dǐbá búrú] |
|    | my   | three  | big   | yam   | ‘my three big yams’  |
| b. | / ìnè <sup><math>\textcircled{L}\textcircled{H}</math></sup> | èbì <sup><math>\textcircled{L}\textcircled{H}</math></sup> | dìbà <sup><math>\textcircled{L}\textcircled{H}</math></sup> | bùrù <sup><math>\textcircled{L}\textcircled{H}</math></sup> / | [ìnè èbí dǐbá búrú]  |
|    | my   | good   | big   | yam   | ‘my good big yam’    |
| c. | / ìnè <sup><math>\textcircled{L}\textcircled{H}</math></sup> | tára <sup><math>\textcircled{H}</math></sup>               | òpù <sup><math>\textcircled{L}\textcircled{H}</math></sup>  | bùrù <sup><math>\textcircled{L}\textcircled{H}</math></sup> / | [ìnè tàrà òpú búrú]  |
|    | my   | three  | big   | yam   | ‘my three big yams’  |
| d. | / ìnè <sup><math>\textcircled{L}\textcircled{H}</math></sup> | èbì <sup><math>\textcircled{L}\textcircled{H}</math></sup> | òpù <sup><math>\textcircled{L}\textcircled{H}</math></sup>  | bùrù <sup><math>\textcircled{L}\textcircled{H}</math></sup> / | [ìnè èbí ópú búrú]   |
|    | my   | good   | big   | yam   | ‘my good big yam’    |

How can we account for the disparate behaviors of C- vs. V-TBU targets? I adopt an analysis where the initial vowel of the target domain is ‘extrametrical’ and not parsed as part of the following phonological word (p-words,  $\omega$ ). Compare the C- and V-TBU targets in (15) and Table 3 below, using data introduced above. In the a. and b. examples, the  $\textcircled{L}$  associates to the initial TBU in both. However, the initial vowel to which the  $\textcircled{L}$  associates is marked as extrametrical in <> brackets. This therefore entails that the following C-TBU is what actually begins the phonological word. We may assume that the floating  $\textcircled{H}$  preferably associates to a word edge: if the left edge is occupied by the  $\textcircled{L}$  tone then it associates to the right edge (a.), but otherwise associates to the leftmost free left-edge (b.). In (15), the TBU which the high associates to is underlined. In the autosegmental representations in Table 3, the underlying tonal structure of the target is in grey which is systematically replaced. The TBU to which the floating tones associated is represented as a solid line and any TBUs which this tone subsequently spreads to is represented as a dashed line.

This also holds for multi-word targets as well (c.-e. below). In c.-d., the  $\textcircled{L}$  docks to the following TBU, which is a C-TBU in c. but an extrametrical V-TBU in d. Consequently, the  $\textcircled{H}$  docks to the leftmost TBU

of the first free phonological word, which is the third word (dǐbá) in c. but the second word (bí) in d. (from <è>(bí) ebi 'good'). Finally, in e. I assume that the floating  $\textcircled{\text{L}}$  is attached to the extrametrical <ò>, and that the  $\textcircled{\text{H}}$  docks immediately after this.<sup>3</sup>

(15) Gbarain Izon – Extrametricality of an initial V-TBU of the target

- a. èbì<sup>ⓁⓂ</sup> dangiloko → (èbì)<sub>Ⓛ</sub> (dàngilòkó)<sub>Ⓛ</sub> 'good giant'
- b. òpù<sup>ⓁⓂ</sup> oporiopo → (òpù)<sub>Ⓛ</sub> <ò>(póríópó)<sub>Ⓛ</sub> 'big pig'
- c. ìnè<sup>ⓁⓂ</sup> tara dǐba buru → (ìnè)<sub>Ⓛ</sub> (tàrà)<sub>Ⓛ</sub> (dǐbá)<sub>Ⓛ</sub> (búru)<sub>Ⓛ</sub> 'my three big yams'
- d. ìnè<sup>ⓁⓂ</sup> ebi dǐba buru → (ìnè)<sub>Ⓛ</sub> <è>(bí)<sub>Ⓛ</sub> (dǐbá)<sub>Ⓛ</sub> (búru)<sub>Ⓛ</sub> 'my good big yam'
- e. ìnè<sup>ⓁⓂ</sup> tara opu buru → (ìnè)<sub>Ⓛ</sub> (tàrà)<sub>Ⓛ</sub> <ò>(pú)<sub>Ⓛ</sub> (búru)<sub>Ⓛ</sub> 'my three big yams'

Trigger	Target	Tone group
a. L $\textcircled{\text{LH}}$ ^ èbì	+ ^     dangiloko	→ L $\textcircled{\text{L}}$ $\textcircled{\text{H}}$ ^     (èbì) (dàngilòkó)
b. L $\textcircled{\text{LH}}$ ^ òpù	+           oporiopo	→ L $\textcircled{\text{L}}$ $\textcircled{\text{H}}$ ^         (òpù) <ò>(póríópó)
c. L $\textcircled{\text{LH}}$ ^ ìnè	+ ^ ^ ^ ^ ^ tara dǐba buru	→ L $\textcircled{\text{L}}$ $\textcircled{\text{H}}$ ^         (ìnè) (tàrà) (dǐbá) (búru)
d. L $\textcircled{\text{LH}}$ ^ ìnè	+ ^ ^ ^ ^ ^ ebi dǐba buru	→ L $\textcircled{\text{L}}$ $\textcircled{\text{H}}$ ^         (ìnè) <è>(bí) (dǐbá) (búru)
e. L $\textcircled{\text{LH}}$ ^ ìnè	+ ^ ^ ^ ^ ^ tara opu buru	→ L $\textcircled{\text{L}}$ $\textcircled{\text{H}}$ ^         (ìnè) (tàrà) <ò>(pú) (búru)

Table 3: Gbarain Izon – Autosegmental representations of initial V-TBU extrametricality

Cross-linguistically, vowel-initial syllables/words often show anomalous prosodic effects compared to consonant-initial patterns. Odden (1995) and Downing (1998) present evidence of such effects looking at tone and prosodic domains in several Bantu languages (see both for extensive references, as well). For example, in Odden's (1995) study of Kikerewe [ked], vowels without onsets cannot bear tone. In a conditional construction, subject markers are assigned a high tone if it is consonant-initial (a.), and subsequently doubles to the following syllable. However, if the subject marker is vowel-initial, this high tone shifts to the following TBU (which again shows tone doubling).

(16) Kikerewe – Vowels without onsets cannot bear tone [Odden 1995:97]

- a. bá-ká-luunduma 'if they growl'
- b. a-ká-lúúnduma 'if he growsl'

The core of the analyses of Downing and Odden is that vowels without onsets are non-optimal for starting prosodic constituents, and also non-optimal as tone-bearing units. I follow Downing (citing Inkelas 1989,

<sup>3</sup> The reader will notice that this entails that the low tones of the word (tàrà) are due to spreading of the trigger rather than valued from the floating low. This of course is not detectable from the surface pronunciation, but rather follows from a larger Optimality Theoretic analysis which is outside of the scope of this paper (*AUTHOR in preparation*). For this paper, nothing hinges on this decision.

1993, a.o.) in interpreting extrametricality here in Izon as misalignment between morphological and prosodic constituents. We will see with the other tone classes in Izon how V-TBUs behave exceptionally, which further strengthens this position.

### 3.1.2 Core patterns of class A in Kolokuma Izon

Largely identical patterns are found for class A ( $\text{L}\text{H}$ ) lexical items in the other dialect of focus, Kolokuma Izon. Beginning with forms in isolation, while the high of the floating  $\text{L}\text{H}$  sequence generally docks to final TBU of the trigger, Williamson & Timitimi's (1983) Kolokuma dictionary (hereafter [W&T83]) describe a complex set of conditions dictating whether the final TBU surfaces as rising or level high. This is reflected in their dictionary's transcription convention, with rising tones represented as a doubled vowel (but note that the vowel is not inherently long, and its phonetic duration is unclear). Representative examples are in (17). This dictionary is updated as Williamson & Blench (2011), hereafter [W&B11].

(17)	Kolokuma Izon – Sample of class A items which end in H in their isolation forms		[Ko-W&T83]
a.	sù <sup>LH</sup>	[ sùú ]	‘fight’
	lẹ̀ <sup>LH</sup>	[ lẹ̀é ]	‘beat, sharpen’
b.	òpù <sup>LH</sup>	[ òpùú ]	‘big, great, famous’
	àmà <sup>LH</sup>	[ àmàá ]	‘right’
c.	dùò <sup>LH</sup>	[ dùó ]	‘follow’
	pẹ̀ <sup>LH</sup>	[ pẹ̀í ]	‘break (a fragile thing)’
	ògòù <sup>LH</sup>	[ ògòú ]	‘axe’
	òwẹ̀ <sup>LH</sup>	[ òwẹ̀í ]	‘fear, be forbidden’
d.	bìlà <sup>LH</sup>	[ bìlá ]	‘elephant’
	pẹ̀rẹ̀ <sup>LH</sup>	[ pẹ̀rẹ̀ ]	‘be rich’
	àbàdì <sup>LH</sup>	[ àbàdí ]	‘ocean’
e.	bùrù <sup>LH</sup>	[ bùrú ~ bùrùú ]	‘yam’
	wùrùdù <sup>LH</sup>	[ wùrùdùú ]	‘be noisy’

If a morpheme is monosyllabic (a.), of the shape VCV (b.), or ends in a diphthong (c.), the form in isolation is realized with a final rising tone. In other contexts (d.), the final TBU is a level high tone, e.g. CVCV or VCVCV words. However, in a minority of the dictionary entries there is "doubl[ing of] the final vowel when standing alone or emphasized" (W&T83:*xliii*), e.g. variation in [bùrú]~[bùrùú] ‘yam’ (e.). The authors note that “this varies somewhat with different speakers” (p. *xliv*), and that in general vowel doubling can be found for emphasis and stylistic effect (p. *xlvi*). Whether there is an underlying short vs. long vowel distinction is currently not resolved in Izon, compounding the already complex patterns of derived length.<sup>4</sup>

In Kolokuma Izon only, there exists a small exceptional subclass which I classify as subclass A2 (all other A morphemes are consequently classified as A1 in Kolokuma). With these A2 morphemes, K&W83 state that their pronunciation is low even in isolation, with no final high. A complete list of A2 lexical items is in (18), which can end in a single vowel (a.), a diphthong (b.), or a double vowel (c.). I represent A2 as  $\text{L}\text{L}\text{H}^*$ , where the asterisk on the  $\text{H}$  indicates that this floating tone does not show self-association. Given the variation in surface pronunciation documented for Gbarain Izon, it remains to be tested whether these two classes in Kolokuma are consistently differentiated or are merely incidental variants.

<sup>4</sup> The fact that VCV forms are [t.č] but CVCV and VCVCV forms are [t.č] and [t.č.t.č] may be interpreted as another effect of extrametricality of initial V-TBUs. I leave this possibility aside in this paper, as it would require further scrutiny of Kolokuma phonetics.

- (18) Kolokuma Izon – Exceptional class A2 which surface as all L in isolation [Ko-W&T83]
- |    |                          |            |  |
|----|--------------------------|------------|--|
| a. | ùgè <sup>ⓁⓂ</sup> *      | [ùgè]      | ‘cry one calls when declared innocent’ |
|    | sèrì <sup>ⓁⓂ</sup> *     | [sèrì]     | ‘time, period’                         |
|    | lùèkè <sup>ⓁⓂ</sup> *    | [lùèkè]    | ‘sway up and down’                     |
|    | ìnìmà <sup>ⓁⓂ</sup> *    | [ìnìmà]    | ‘be stunted’                           |
| b. | kpàì <sup>ⓁⓂ</sup> *     | [kpàì]     | ‘completely finished’                  |
|    | vài <sup>ⓁⓂ</sup> *      | [vài]      | ‘disappear completely’                 |
|    | gbàìgbàì <sup>ⓁⓂ</sup> * | [gbàìgbàì] | ‘thump on’                             |
| c. | dèbèè <sup>ⓁⓂ</sup> *    | [dèbèè]    | ‘quiet, calm’                          |
|    | fòlòò <sup>ⓁⓂ</sup> *    | [fòlòò]    | ‘be worn out’                          |

Outside of the lexical items surveyed here, there are in fact many ideophones of class A2 in Kolokuma, e.g. [bèdèdè] ‘gently, calmly’, [gbàù] ‘with a thud’, [gèpèè] ‘stretching forward and gaping in an absorbed, rather unintelligent way (of people, animals, fish)’, [zàùù] ‘lonesome’, [zìì] ‘sound of heavy rain’, among others. All such ideophones end in a long vowel or diphthong. I do not survey ideophones in either dialect in this paper, which likely have phonological properties distinct from other parts of speech.

Within tone groups, Kolokuma class A patterns by and large replicate the Gbarain patterns. In (19), with a 1-TBU target the floating sequence docks to this final TBU (a.), while with two TBUs each tone docks to a TBU (b.). In larger tone groups the  $\text{ⓁⓂ}$  sequence straddles the second and third word with an initial C-TBU (c.), but associates entirely within the second word with an initial V-TBU (d.). These association patterns are identical to the findings of Gbarain.

- (19) Kolokuma Izon – Class A  $\text{ⓁⓂ}$  association in a tone group
- |    |                       |                     |                        |                     |
|----|-----------------------|---------------------|------------------------|---------------------|
| a. | / ìfirì <sup>ⓁⓂ</sup> | fí <sup>Ⓜ</sup> /   | [ ìfirì fí ]           |                     |
|    | repayment             | eat                 | ‘receive compensation’ | [Ko-W&T83:59,79]    |
| b. | / ìnè <sup>ⓁⓂ</sup>   | wàrí <sup>Ⓛ</sup> / | [ ìnè wàrí ]           |                     |
|    | my                    | house               | ‘my house’             | [Ko-W65:27]         |
| c. | / bùrù <sup>ⓁⓂ</sup>  | gbòrò <sup>ⓁⓂ</sup> | kímì <sup>Ⓜ</sup> /    | [ bùrù gbòrò kímì ] |
|    | yam                   | plant               | person                 | ‘yam-planter’       |
|    |                       |                     |                        | [Ko-W88:260]        |
| d. | / ìnè <sup>ⓁⓂ</sup>   | òpù <sup>ⓁⓂ</sup>   | wàrí <sup>Ⓛ</sup> /    | [ ìnè òpù wàrí ]    |
|    | my                    | big                 | house                  | ‘my big house’      |
|    |                       |                     |                        | [Ko-W65:98]         |

However, one can observe an important difference in Kolokuma. In Gbarain, the floating  $\text{Ⓜ}$  spreads rightward to all following toneless TBUs within the group, e.g. [ìnè tàrà dǎbá búrú] in (14) above. In contrast, in Kolokuma toneless TBUs after the floating tones are realized with default low tone, i.e. [ìnè òpù wàrí] ‘my big house’ in d. above. We can conclude that Gbarain prefers to value toneless TBUs via spreading of the floating tone, while Kolokuma prefers a default.<sup>5</sup>

### 3.2 Tone class B – Analysis as floating $\text{Ⓜ}$

Next we examine tone class B which sponsors a floating  $\text{Ⓜ}$  tone. I treat Gbarain and Kolokuma Izon together as they show virtually identical patterns. For each data set, I still denote it as Gbarain or Kolokuma.

#### 3.2.1 Core patterns of class B in both dialects

Tone class B is split into three subtypes. The first (B1) is as an all H-toned morpheme which sponsors a floating  $\text{Ⓜ}$  tone, the second (B2) is represented as an all L-toned morpheme which sponsors a floating  $\text{Ⓜ}$ ,

<sup>5</sup> In Kolokuma, smaller tone groups show surface [LH], e.g. [ìnè wàrí] ‘my house’. This provides evidence against locating this dialect difference as Kolokuma having a tone sequence  $\text{ⓁⓂⓁ}$  for class A, as we would therefore expect the unattested \*[ìnè wàrí]. Such a surface form is otherwise tonotactically permitted.

and the third (B3) is a LH morpheme which sponsors a floating  $\textcircled{\text{H}}$  tone (though note the representation of B3 is modified below). These three subclasses are illustrated below with Gbarain Izon data:

- (20) Gbarain Izon – Class B ( $\textcircled{\text{H}}$ ) subclasses:      Isolation      Tone group
- |    |     |                       |             |          |               |              |
|----|-----|-----------------------|-------------|----------|---------------|--------------|
| a. | B1: | / tárá <sup>Ⓜ</sup> / | 'three'     | [ tárá ] | [ tárá búrú ] | 'three yams' |
| b. | B2: | / èndì <sup>Ⓜ</sup> / | 'that'      | [ èndì ] | [ èndì búrú ] | 'that yam'   |
| c. | B3: | / ìné <sup>Ⓜ</sup> /  | 'your' (SG) | [ ìné ]  | [ ìné búrú ]  | 'your yam'   |

In each of these, the tones of the target word (/bùrú<sup>Ⓜ</sup>/ 'yam') are replaced with high tone, while the trigger bears a HH, LL, or LH pattern. Example (21) shows that these patterns emerge regardless of the number of TBUs (a.) or words (b.-c.) within the target portion of the tone group.

- (21) Gbarain Izon – Class B ( $\textcircled{\text{H}}$ ) targets receive all high pattern
- |    |  |                              |                  |
|----|--|------------------------------|------------------|
| a. | / ìné <sup>Ⓜ</sup> kúkíndúkú <sup>Ⓜ</sup> /                                      | [ ìné kúkíndúkú ]            |                  |
|    | your sweet.potato  | 'your sweet potato'          | [Gb-20190702:2]  |
| b. | / tárá <sup>Ⓜ</sup> ðìbà <sup>Ⓜ</sup> bùrú <sup>Ⓜ</sup> /                        | [ tárá ðìbà búrú ]           |                  |
|    | three big yam  | 'three big yams'             | [Gb-20190703:11] |
| c. | / kúlúkúlú <sup>Ⓜ</sup> òbórí <sup>Ⓜ</sup> píná <sup>Ⓜ</sup> tǐbì <sup>Ⓜ</sup> / | [ kúlúkúlú òbórí píná tǐbì ] |                  |
|    | black goat white head  | 'a black goat's white head'  | [Gb-20190704:22] |

In isolation, there is no evidence of this floating  $\textcircled{\text{H}}$  when the word ends in high tone already. In the B2 pattern, however, the floating  $\textcircled{\text{H}}$  self-associates to its sponsor, resulting in a rising tone [èndì]. In (22), this modifier appears in subject position in a separate tone group, and consequently surfaces as [èndì] with a final rise. [The || indicates a tone group boundary, here between the subject and predicate.]

- (22) Gbarain Izon – Class B2 in isolation [Gb-20170727:100]
- |  |                                   |
|--|-----------------------------------|
| / èndì <sup>Ⓜ</sup>    dírí <sup>Ⓜ</sup> fúró <sup>Ⓜ</sup> a kímí <sup>Ⓜ</sup> / | → [ (èndì)    dírí fúró á kímí ]  |
| that medicine steal NEG person   | 'that man did not steal medicine' |
| (More literally: that is someone who did not steal medicine)                     |                                   |

The presence of this rising tone helps to distinguish its modificational use (a. below) from its use in isolation as the subject (b.):

- (23) Gbarain Izon – Class B2 minimal pair [Gb-20190702:2]
- |    |   |                             |                          |
|----|---|-----------------------------|--------------------------|
| a. | / èndì <sup>Ⓜ</sup> kúkíndúkú <sup>Ⓜ</sup> /    | → [ (èndì kúkíndúkú) ]      | 'that sweet potato'      |
| b. | / èndì <sup>Ⓜ</sup>    kúkíndúkú <sup>Ⓜ</sup> / | → [ (èndì)    (kúkíndúkú) ] | 'that is a sweet potato' |

I return to evidence for this floating  $\textcircled{\text{H}}$  with all B subclasses in fact in Section 3.2.3 below.

Unlike classes B1 and B3 which have many members, I have found only two words of class B2 in Gbarain, the other being /ìndà<sup>Ⓜ</sup>/ 'how many'; in Kolokuma, there are no members. Two examples with this latter modifier are in (24). Note that the question particle /à/ falls outside of the tone group, and therefore surfaces with its lexical low tone.

- (24) Gbarain Izon – Class B2 nominal modifier /ìndà<sup>Ⓜ</sup>/ 'how many' [Gb-20170711:22]
- |    |   |                   |  |
|----|---|-------------------|--|
| a. | / ìndà <sup>Ⓜ</sup> bùrú <sup>Ⓜ</sup> à / | [ (ìndà búrú) à ] |  |
|    | how.many yam QUES                         | 'how many yams?'  |  |
| b. | / ìndà <sup>Ⓜ</sup> ìndì <sup>Ⓜ</sup> à / | [ (ìndà ìndì) à ] |  |
|    | how.many fish QUES                        | 'how many fish?'  |  |

Notice in b. that the  $\text{H}$  does not directly dock to the initial V-TBU of the target, unlike consonant-initial targets. This represents another instance of V-TBUs showing exceptional tonal behavior, preferably associating to low tone of the first word rather than the floating high. Parallel data are found with / $\text{H}^{\text{H}}$ / 'that', e.g. in [ $\text{H}^{\text{H}}$  òpóríópó] 'that pig'.

Parallel class B patterns are found for Kolokuma Izon (25), for subclasses B1 (/H<sup>H</sup>/) and B3 (/LH<sup>H</sup>/). As stated, there are no B2 (/L<sup>H</sup>/) morphemes in this dialect.

(25) Kolokuma Izon – Class B examples

a.	B1:	/ dírí <sup>H</sup>	gùó <sup>H</sup>	kímí <sup>H</sup> /	[ dírí gùó kímí ]
		medicine	make	person	'sorcerer' [Ko-W88:269]
b.	B3:	/ àmá <sup>H</sup>	nàná <sup>LH</sup>	òwéí <sup>H</sup> /	[ àmá náná ówéí ]
		town	own	man	'king' [Ko-W88:259]

One thing to note is that the floating  $\text{H}$  spreads to all subsequent TBUs in the tone group in Kolokuma Izon, as it does in Gbarain. This is unlike the floating  $\text{H}$  of class A in Kolokuma which associated only to one TBU and those thereafter were valued with default low. Compare the form of the final words in class B [dírí gùó kímí] 'sorcerer' in a. above to class A [bùrù gbòrò kímí] 'yam-planter' in c. from (19).

### 3.2.2 Near complementarity of B1 and B3

While I have presented B1 and B3 as two subclasses, in both dialects they are in near complementary distribution. In the majority of cases if a class B morpheme begins with a consonant then the sponsor bears all H tones (the B1 pattern), but if it is vowel-initial then this vowel bears a L tone followed by H (the B3 pattern). This is shown in the Gbarain data in (26). There are numerous members of the B3 class which begin with a low-toned vowel, a sample of which is given in a. In contrast, there are very few class B1 members which begin with a high-toned vowel; the complete list found for Gbarain is in b.

(26) Gbarain Izon – Near complementarity of B1 and B3

a.	B3 vowel-initial (sample)			
	àlá <sup>H</sup>	'lazy'	ìsélé <sup>H</sup>	'seed'
	àmá <sup>H</sup>	'town'	òróró <sup>H</sup>	'gutter, stream'
	èré <sup>H</sup>	'name'	òwó <sup>H</sup>	'alive, fresh, raw' etc.
b.	B1 vowel-initial (complete list)			
	árú <sup>H</sup>	'canoe'	óú <sup>H</sup>	'calm air'
	óú <sup>H</sup>	'(to) cry'	órú <sup>H</sup>	'native Izon deity'
	óú <sup>H</sup>	'masquerade'	óyí <sup>H</sup>	'ten'
c.	B3 consonant-initial (complete list)			
	bùùbùú <sup>H</sup>	'very soft'		
	bùùbùú <sup>H</sup>	'rotten'		

All of these exceptional B1 forms begin with a non-high vowel, and either have no medial consonant (/óú<sup>H</sup>/ 'cry') or a high-sonorant medial consonant /r y/. The consonant-initial B3 class is even smaller (c.), for which I have found only two forms (both of which show internal reduplication). An example is in (27), which is transparently related to Class A /bùrù<sup>LH</sup>/ 'be rotten'.

(27) Gbarain Izon – B3 consonant-initial example

/ bùùbùú <sup>H</sup>	bèribàà <sup>LH</sup> /	[ bùùbùú béríbáá ]
rotten.REDUP	plantain	'rotten plantain' [Gb-20190702:2]

No non-derived two-TBU morpheme exists in either dialect of the form /LH<sup>H</sup>/ with an initial C-TBU, i.e. non-attested \*[bàrá<sup>H</sup>].

This complementarity is replicated in Kolokuma Izon. There, a greater number of exceptional vowel-initial B1 morphemes are found due to the available resources on Kolokuma being much greater at this point compared to Gbarain. The complete list is provided in (28).

- (28) Kolokuma Izon – Exceptional class B1 morphemes with high-toned initial vowel [Ko-W&T83]
- |    |                      |                                  |   |
|----|----------------------|----------------------------------|---|
| a. | árí <sup>Ⓜ</sup>     | ‘trick’                          | (cf. àrú <sup>Ⓜ</sup> ‘she’)              |
| b. | árigídí <sup>Ⓜ</sup> | ‘handwoven cloth from the north’ |   |
| c. | árú <sup>Ⓜ</sup>     | ‘canoe’                          |   |
| d. | érí <sup>Ⓜ</sup>     | ‘dry’                            | (cf. èréín <sup>Ⓜ</sup> ‘day’)            |
| e. | ẹrí <sup>Ⓜ</sup>     | ‘see’                            |   |
| f. | óí <sup>Ⓜ</sup>      | ‘ten’                            |   |
| g. | óín <sup>Ⓜ</sup>     | ‘(to) swell’                     | (cf. òwéín <sup>Ⓜ</sup> ‘bite’)           |
| h. | órú <sup>Ⓜ</sup>     | ‘deity, god, divinity, juju’     | (cf. òróró <sup>Ⓜ</sup> ‘gutter, stream’) |
| i. | óú <sup>Ⓜ</sup>      | ‘(to) cry’                       |   |
| j. | óú <sup>Ⓜ</sup>      | ‘masquerade’                     |   |
| k. | óú <sup>Ⓜ</sup>      | ‘air, steam’                     |   |

Despite the near complementarity, this distinction is still not fully predictable, e.g. B1 /érí<sup>Ⓜ</sup>/ ‘dry’ vs. B3 /èréín<sup>Ⓜ</sup>/ ‘day’ in Kolokuma. This can be interpreted as another instance of an initial vowel as showing extrametrical properties. We may represent the unexceptional B3 patterns as <è>réín<sup>Ⓜ</sup> ‘day’ and the exceptional B1 form as érí<sup>Ⓜ</sup> ‘dry’ without initial extrametricality. This allows us to state that class B1 and B3 morphemes have entirely high tones across the tone group.

### 3.2.3 An argument for /H<sup>Ⓜ</sup>/ structure

Classes B1/B3 are analyzed as ending in the sequence /H<sup>Ⓜ</sup>/, where the final associated tone is followed by a floating tone of the same value. One might ask why posit this representation rather than simply allowing for the pre-associated high to spread. This would constitute an analysis as /H/ without a floating tone. Evidence for /H<sup>Ⓜ</sup>/ comes from the behavior of this class in complex tone groups, which we will briefly go through here using data from Gbarain. Importantly, the reader should note that there is no contrast between /H/ vs. /H<sup>Ⓜ</sup>/ in either dialect, regardless of analysis.

To understand the argument, some background is required. It has been shown that within tone groups it is the initial morpheme which assigns its floating tones to the morpheme to its right; the initial morpheme’s tone is always retained. The tones of non-initial morphemes are deleted or retained based on the syntactic relation between the morphemes. For our purposes here, let us assume that morphemes are co-extensive with phonological words ( $\omega$ ). For any two words  $\omega_1$  and  $\omega_2$  in a tone group, if  $\omega_1$  corresponds to a syntactically ‘higher’ morpheme (e.g. c-commands) compared to  $\omega_2$ , then the tones of  $\omega_2$  are deleted. In contrast, if it is  $\omega_2$  which is ‘higher’ compared to  $\omega_1$ , then the tones of both words are retained. These generalizations are summarized below:

- (29)
- |    |                 |                                   |                                   |   |                                   |   |   |
|----|-----------------|-----------------------------------|-----------------------------------|---|-----------------------------------|---|---|
|    |                 | $\omega_1$                        | $\omega_2$                        |   | $\omega_1$                        | $\omega_2$  | Syntactic condition:                            |
| a. | Tone deletion:  | ( $\omega$ $\acute{t}\grave{t}$ ) | ( $\omega$ $\acute{t}\grave{t}$ ) | → | ( $\omega$ $\acute{t}\grave{t}$ ) | ( $\omega$ $\underline{\underline{t}}\grave{t}$ ) | If $\omega_1$ is ‘higher’/‘outer’ to $\omega_2$ |
| b. | Tone retention: | ( $\omega$ $\acute{t}\grave{t}$ ) | ( $\omega$ $\acute{t}\grave{t}$ ) | → | ( $\omega$ $\acute{t}\grave{t}$ ) | ( $\omega$ $\underline{\underline{t}}\grave{t}$ ) | If $\omega_1$ is ‘lower’/‘inner’ to $\omega_2$  |

The clearest place to see this generalization is with pre-nominal and post-nominal modification. Pre-nominal modifiers have already been introduced, e.g. /èndì<sup>Ⓜ</sup>/ ‘that’ and /íné<sup>Ⓜ</sup>/ ‘your’:

- (30) Gbarain Izon – Pre-nominal modifiers replacing tone of noun
- |    |   |                    |                     |
|----|---|--------------------|---------------------|
| a. | /íné <sup>Ⓜ</sup> tébùlù <sup>Ⓜ</sup> /     | [ ìné tébùlú ]     | ‘your table’        |
| b. | /èndì <sup>Ⓜ</sup> kúkíndùkú <sup>Ⓜ</sup> / | [ èndì kúkíndúkú ] | ‘that sweet potato’ |

In all these cases, the modifier ( $\omega_1$ ) is syntactically higher compared to the lexical noun ( $\omega_2$ ). As such, the noun's tonemic structure is deleted, and the floating  $\textcircled{H}$  docks to it.

In contrast, consider post-nominal modifiers. These modifiers may be toneless – e.g. / $\textcircled{H}$ om $\textcircled{H}$ / INDEFINITE.PLURAL and /kum $\textcircled{H}$ / ‘only’ – or have inherent tone such as low-toned /b $\textcircled{H}$ / DEFINITE and /m $\textcircled{H}$ / DEFINITE.PLURAL. These are shown with the class B noun /námá $\textcircled{H}$ / ‘animal, meat’:

- (31) Gbarain Izon – Post-nominal modifiers
- |    |  |                                |               |
|----|--|--------------------------------|---------------|
| a. | / námá $\textcircled{H}$ om $\textcircled{H}$ /  | [ námá om $\textcircled{H}$ ]  | ‘animals’     |
|    | / námá $\textcircled{H}$ kum $\textcircled{H}$ / | [ námá kum $\textcircled{H}$ ] | ‘only meat’   |
| b. | / námá $\textcircled{H}$ b $\textcircled{H}$ /   | [ námá b $\textcircled{H}$ ]   | ‘the animal’  |
|    | / námá $\textcircled{H}$ m $\textcircled{H}$ /   | [ námá m $\textcircled{H}$ ]   | ‘the animals’ |

The toneless modifiers in a. are valued by the floating  $\textcircled{H}$  tone sponsored by the noun; they have no tone to delete or to retain.<sup>6</sup> In contrast, underlying tone of post-nominal modifiers in b. is retained and *not* deleted. Instead, the floating  $\textcircled{H}$  co-occurs with the inherent L tone, resulting in falling tone [m $\textcircled{H}$ ] and [b $\textcircled{H}$ ]. This can be attributed to the fact that post-nominal modifiers are syntactically higher than the noun, expressing meanings associated with determiners and quantifiers ( $D^0$  and  $Q^0$  heads). Taken together, the syntactic structure corresponding to nominal modification is in (32).

- (32) Syntactic structure of nominal modification:  $\llbracket_{\text{ZP}} \llbracket_{\text{VP}} \text{MOD} \llbracket_{\text{XP}} \text{NOUN} \rrbracket \rrbracket \text{MOD} \rrbracket$

We therefore predict that if both pre- and post-nominal modifiers are present, the pre-nominal modifier can affect the post-nominal modifier only if the latter is toneless. This is borne out, shown below:

- (33) Gbarain Izon – Pre- and post-nominal modifier co-occurrence
- |    |   |                                     |                       |                  |
|----|---|-------------------------------------|-----------------------|------------------|
| a. | / wó $\textcircled{H}$ tébùlù $\textcircled{L}$ om $\textcircled{H}$ /  | [ wó tébùlù om $\textcircled{H}$ ]  | ‘our tables’          | [Gb-20190702:10] |
|    | / èndì $\textcircled{H}$ námá $\textcircled{H}$ kum $\textcircled{H}$ / | [ èndì námá kum $\textcircled{H}$ ] | ‘only that animal’    | [Gb-20190702:8]  |
| b. | / èndì $\textcircled{H}$ námá $\textcircled{H}$ b $\textcircled{H}$ /   | [ èndì námá b $\textcircled{H}$ ]   | ‘that animal’         | [Gb-20190702:8]  |
|    | / wó $\textcircled{H}$ wárí $\textcircled{L}$ m $\textcircled{H}$ /     | [ wó wárí m $\textcircled{H}$ ]     | ‘many houses of ours’ | [Gb-20170711:20] |

Example a. show cases where the floating  $\textcircled{H}$  docks onto the noun (whose tones are deleted) and then spreads to the toneless post-N modifier. In contrast, example b. show cases where the floating  $\textcircled{H}$  docks only to the noun and does not affect the underlying low tone of the post-nominal modifier. These facts are consistent with the interpretation that post-nominal modifiers are structurally higher than the pre-nominal ones, and consequently why the tones of the latter are retained.

Returning to our argument, the important contrast to observe is between forms like [námá m $\textcircled{H}$ ] ‘the animals’ from (31) versus [wó wárí m $\textcircled{H}$ ] ‘many houses of ours’ from (33). In the former, the floating  $\textcircled{H}$  docks to the post-nominal modifier, while in the latter it associates to the noun only and does not spread onto the post-nominal modifier. These facts fall out naturally if we adopt the /H $\textcircled{H}$ / analysis with a floating tone. I illustrate this in Table 4 below.

<sup>6</sup> These two modifiers are interpreted as toneless because there are no contexts where their lexical tones emerge.



	Proposed underlying forms				⊕ association		Alternative (rejected)
a.	H	⊕	L		H	⊕ L	H L
	∧			→	∧	∨	(Cf. ∨ )
	námá	#	mò		námá	mò	námá mò
b.	H	⊕	HL	⊕	L	H	⊕ L
				→		∧	
	wó	#	wárí	#	mò	wó wárí	mò

Table 4: Gbarain – Floating tones dock to following post-nominal modifier only as last resort

Under the floating tone analysis, the floating ⊕ in row a. associates to the post-nominal modifier (co-occurring with its L) only when there are no free TBUs for it to dock to. In contrast, in row b. the ⊕ can associate to the toneless TBUs of the noun. Because it has a host already, it does not associate to the modifier, which it only does as a last resort.

Consider the alternative in the rightmost column, which I reject. Here, class B morphemes have an underlying pre-associated H tone only, without a floating tone. The pre-associated tone would spread in row a. to the modifier, but not in row b. To capture this, we would be forced to say that spreading of the high *must* happen at least once. This would be a trigger-driven requirement, rather than a target-driven one. This is undesirable given the normal understanding of tone spreading, being licensed to avoid some marked structure (e.g. \*TONELESS). If spreading of a phonological feature [F] is due to some markedness constraint prohibiting specific configurations, it is unclear what kind of constraint would require spreading onto *mò* in row a. but not b. This cannot be attributed to any boundedness of the spreading operation, whose unboundedness we have encountered in many examples thus far (e.g. [wó tébúlú òmò] ‘our tables’ in (33), and [kúlúkúlú óbóri píná tǐbí] ‘a black goat’s white head’ in (21), a.o.).

We return to discussing this alternative later in §4.3, and its implications for Izon and beyond.

### 3.3 Tone class C – Analysis as floating ⊕ (or no floating tones)

#### 3.3.1 Core patterns of class C in Gbarain Izon

The next class to discuss is Class C, which sponsors either a floating low tone (or no floating tone depending on subclass and analysis). Beginning with Gbarain Izon, we can split this class into subclasses C1, C2, and C3, illustrated in (34). Subclass C1 ends in pre-associated L with a H somewhere before it, and sponsors a floating ⊕ tone. Subclass C2 is all high-toned with a final floating ⊕, and C3 ends in pre-associated H (with a L before it) and sponsors a ⊕ tone.

(34)	Gbarain Izon – Class C subclasses with floating ⊕					
a.	C1 / ...HL <sup>⊕</sup> /	dùrùkùú <sup>⊕</sup> 'dark'	[ dùrùkùú wàrì ]	'a dark house'	[Gb-20190702:4]	
		òpóríópò <sup>⊕</sup> 'pig'	[ òpóríópò kùmò ]	'only a pig'	[Gb-20170711:22]	
b.	C2 / H <sup>⊕</sup> /	kálá <sup>⊕</sup> 'small'	[ kálá tǔbò ]	'a small child'	[Gb-20170727:98]	
		bárá <sup>⊕</sup> 'hand'	[ bárá kùmò ]	'only a hand'	[Gb-20190702:5]	
c.	C3 / ...LH <sup>⊕</sup> /	àkú <sup>⊕</sup> 'bitter'	[ àkú wùrù ]	'a bitter drink'	[Gb-20190702:4]	
		ìngò <sup>⊕</sup> 'trap type'	[ ìngò kùmò ]	'only an <i>ingo</i> trap'	[Gb-20170711:22]	

In multi-word targets, the floating ⊕ spreads to all TBUs, resulting in low-toned stretches in surface forms:

(35)	Gbarain Izon – Class C in multi-word targets					
a.	/ béí <sup>⊕</sup> màà <sup>⊕</sup> bùrù <sup>⊕</sup> /		[ béí màà bùrù ]			
	this two yam		'these two yams'	[Gb-20170711:23]		
b.	/ ébí <sup>⊕</sup> kúkíndùkú <sup>⊕</sup> òmò /		[ ébí kúkíndùkú òmò ]			
	Ebi sweet.potato INDEF.PL		'Ebi's sweet potatoes'	[Gb-20190702:7]		

When subclasses C2 and C3 which end H<sup>Ⓛ</sup> are in isolation, in Gbarain the most common pattern is for floating L to self-associate to its sponsor. This is shown below where /béi<sup>Ⓛ</sup>/ is in subject position in a tone group by itself. [Recall that || indicates a tone group boundary, here between the subject and predicate.]

- (36) Gbarain Izon – Class C self-association in isolation  
 / béi<sup>Ⓛ</sup> || dírí<sup>Ⓜ</sup> fúú<sup>Ⓜ</sup> aa kímí<sup>Ⓜ</sup> / [ (béi) || dírí fúú áá kímí ]  
 this medicine steal NEG person ‘this man did not steal medicine’  
 (More literally: this is someone who did not steal medicine) [Gb-20170727:100]

However, there is frequent variation in isolation forms. Many examples waver between a final low tone (or falling tone if monomoraic) and a final high, as documented below:

- (37) Gbarain Izon – Class C variation in isolation
- |    |                        |                   |                      |
|----|------------------------|-------------------|----------------------|
| a. | / wún <sup>Ⓛ</sup> /   | [ wún ~ wún ]     | ‘sand’               |
|    | / tén <sup>Ⓛ</sup> /   | [ tén ~ tén ]     | ‘to flow (of water)’ |
| b. | / níńí <sup>Ⓛ</sup> /  | [ níńí ~ níńí ]   | ‘nose’               |
|    | / kírí <sup>Ⓛ</sup> /  | [ kírí ~ kírí ]   | ‘ground’             |
|    | / dǎngí <sup>Ⓛ</sup> / | [ dǎngí ~ dǎngí ] | ‘tall’               |
| c. | / ñgbáí <sup>Ⓛ</sup> / | [ ñgbáí ~ ñgbáí ] | ‘today’              |
|    | / pùkèí <sup>Ⓛ</sup> / | [ pùkèí ~ pùkèí ] | ‘morning’            |

In the data collected, self-association of the L only takes place if it is a mono-moraic high-toned form (e.g. *wun* [wún] in a.), or if the final two moras have high tone (b. and c.).

Certain words consistently end in a falling tone, whether in isolation or in context. We saw one already from (34), /dùrùkú<sup>Ⓛ</sup>/ 'dark'. I denote these with a final underlying pre-associated low tone, in contrast to those in (37) which show variation, which I denote with a final underlying high.

### 3.3.2 Gbarain variation in underlying representation: /L/ vs. /L<sup>Ⓛ</sup>/

In at least Gbarain, there appears to be variation in the underlying representation of class C words which end in low tone (subclass C1), between /L/ and /L<sup>Ⓛ</sup>/. We can use the post-verbal particle /kùmọ/ PROHIBITIVE (PROH) 'don't, shouldn't' to illustrate this variation, a particle with particular tonal properties. When a verb and this particle form a tone group, the floating tones of the verb associate to /kùmọ/ (38).

- (38) Gbarain Izon – Floating tones of verb associate to post-verbal particle
- |    |                       |                           |              |               |                  |
|----|-----------------------|---------------------------|--------------|---------------|------------------|
| a. | A (L <sup>Ⓛ</sup> H): | / sù <sup>ⓁH</sup> kùmọ / | [ sù kùmọ ]  | ‘don’t fight’ | [Gb-20190703:14] |
| b. | B (H):                | / mú <sup>H</sup> kùmọ /  | [ mú kùmọ ]  | ‘don’t go’    | [Gb-20170716:48] |
| c. | C (L):                | / gbé <sup>L</sup> kùmọ / | [ gbé kùmọ ] | ‘don’t pay’   | [Gb-20170716:48] |

From these data, no pre-associated tones with /kùmọ/ are detected, and I therefore take it to be underlyingly toneless. However, in larger contexts we see that it displays tone polarity properties when the floating tone within a tone group does not directly associate to /kùmọ/. Consider the examples below, which are ‘headed’ by A, B, and C nouns respectively:

- (39) Gbarain Izon – Post-verbal particle /kùmọ/ shows tonal polarity [Gb-20190704:17]
- |    |   |                       |          |                    |        |                              |
|----|---|-----------------------|----------|--------------------|--------|------------------------------|
| a. | A | /bùrù <sup>Ⓜ</sup>    | ọmọ      | gbòrò <sup>Ⓜ</sup> | kùmọ / | [ (bùrù ọmọ gbóró) kùmọ ]    |
|    |   | yam                   | INDEF.PL | plant              | PROH   | ‘don’t plant yams’           |
| b. | B | /ìsẹ̀lẹ̀ <sup>Ⓜ</sup> | ọmọ      | gbòrò <sup>Ⓜ</sup> | kùmọ / | [ (ìsẹ̀lẹ̀ ọmọ gbóró) kùmọ ] |
|    |   | seed                  | INDEF.PL | plant              | PROH   | ‘don’t plant seeds’          |
| c. | C | /àkà <sup>Ⓜ</sup>     | ọmọ      | gbòrò <sup>Ⓜ</sup> | kùmọ / | [ (àkà ọmọ gbòrò) kùmọ ]     |
|    |   | corn                  | INDEF.PL | plant              | PROH   | ‘don’t plant corn’           |

In a., we see that the floating tones on the object /bùrù<sup>Ⓜ</sup>/ ‘yam’ dock to the toneless post-nominal modifier and the verb. Importantly, the <sup>Ⓜ</sup> does not spread onto kùmọ. Instead it appears with the opposite tone of whatever surface tone is on the verb. Example b. is similar with the floating <sup>Ⓜ</sup> spreading to the verb, and the particle bears a polar low tone. Finally, in c. we see the floating <sup>Ⓜ</sup> spread to the verb, but the particle bears the polar value high.

We can exploit this property to diagnose underlying tonal structure of class C1 as /L/ or /L<sup>Ⓜ</sup>/. If a Class C verb ends in /L/ without a floating tone, then we expect the surface form [kùmọ] to emerge with a polar H when they are adjacent. In contrast, if it ends in a floating <sup>Ⓜ</sup>, we expect this floating tone to associate directly to the particle and for it to surface as [kùmọ] without polar tone.

The results are mixed. Only a small number of class C verbs end in a pre-associated low, such as [dọ̀] ‘be calm, peaceful, cool’, [dúùn] ‘be dusty’, and inherently reduplicated [púkẹ̀púkẹ̀] ‘put mouth where it doesn’t belong’ (≈ ‘gossip’). In (40), the verb [púkẹ̀púkẹ̀] appears with [kùmọ] bearing polar high tone, suggesting that the verb does not sponsor a floating <sup>Ⓜ</sup>.

- (40) Gbarain Izon – Supports analysis as /L/: [púkẹ̀púkẹ̀ kùmọ] ‘don’t gossip’ [Gb-20190715:68]

However, multiple patterns were accepted with the other two verbs, as below:

- (41) Gbarain Izon – Support for /...L/~...L<sup>Ⓜ</sup>/ underlying variation:
- |    |                         |                         |                                  |
|----|-------------------------|-------------------------|----------------------------------|
| a. | Provided by consultant: | [ yọ̀ bì    dúùn kùmọ ] | ‘this place should not be dusty’ |
|    | Accepted by consultant: | [ yọ̀ bì    dúùn kùmọ ] | [Gb-20190708:41]                 |
| b. | Provided by consultant: | [ ári    dọ̀ kùmọ ]     | ‘you shouldn’t be peaceful’      |
|    | Accepted by consultant: | [ ári    dọ̀ kùmọ ]     | [Gb-20190715:67]                 |

In these latter examples, the consultant provided surface forms with the verb ending low and [kùmọ] with polar high, supporting /L/ without a floating tone. However, the consultant also fully accepted forms where [kùmọ] was low which supports /L<sup>Ⓜ</sup>/. This variation cannot be attributed to all class C items in general, e.g. in the form from (39) [àkà ọmọ gbòrò kùmọ] ‘don’t plant corn’, a hypothetical variant \*[...gbòrò kùmọ] is unattested and was explicitly rejected when presented to the consultant.

I interpret these findings as showing variation in the underlying form in the lexicon. This is plausibly due to analytic indeterminacy, noting that contexts which would differentiate /L/ vs. /L<sup>Ⓜ</sup>/ are rare. I emphasize that regardless of analysis, there is no contrast between /L<sup>Ⓜ</sup>/ versus /L/.

### 3.3.3 Core patterns of class C in Kolokuma Izon

For Kolokuma Izon, there is clear evidence for three subclasses of class C: C1 (...HL<sup>Ⓜ</sup>), C3 (...LH<sup>Ⓜ</sup>), and C4 (L<sup>Ⓜ</sup>). As stated earlier, class C4 is found in Kolokuma but not in Gbarain. Even in Kolokuma, it is rare and restricted to names for places or people.

(42)	Kolokuma Izon – Class C subclasses with floating $\textcircled{L}$				
a.	C1 ...HL $\textcircled{L}$	àdùkùú $\textcircled{L}$	[ àdùkùú ]	'dark'	[Ko-W&B11:189]
			[ àdùkùú pàìnpùlù ]	'dark pineapple'	
b.	C3 ...LH $\textcircled{L}$	òsún $\textcircled{L}$	[ òsún ]	'cassava starch'	[Ko-W&B11:173]
			[ òsún tàbù ]	'pour water on broken up starch'	
			[ òsún-gbè-bèlè ]	'pot for preparing starch' (starch-stir-pot)	
c.	C4 L $\textcircled{L}$	ìgbòn $\textcircled{L}$	[ ìgbòn ]	'northerner, Hausa'	[Ko-W88:262]
			[ ìgbòn òtiti ]	'pied-crow'	

Class C2 (all high plus floating low, /H $\textcircled{L}$ /) is attested in only two lexical items in Kolokuma, both of which show variation with a final low and both appear to be derived. These are /fíkíffíkí $\textcircled{L}$  ~ ìffíkíffíkí $\textcircled{L}$ / 'saw' and /kíríyé $\textcircled{L}$  ~ kíríyéì $\textcircled{L}$ / 'power of the ancestors' (< ground-thing) [W&B11:54,113]. In tone groups, these pattern as they do in Gbarain: all high on the sponsor and a low tone on the first TBU target, e.g. [kíríyé wàrì] 'type of ancestor shrine'. See Appendix A2 for correspondences of C2 in Gbarain with B and D classes in Kolokuma.

How are C3 (/...LH $\textcircled{L}$ /) items pronounced in isolation in Kolokuma? Within the Kolokuma dictionary (W&T83, updated as W&B11), most entries of class C3 morphemes are transcribed without a final low or falling tone (representing an isolation pronunciation), indicating that the floating  $\textcircled{L}$  generally does not self-associate to its sponsor (43). Williamson (1965:101) in fact notes this overtly: “a unit of class [C] in initial position keeps its isolation tone pattern”, whether ending in a single TBU (a.) or two (b.).

(43)	Kolokuma Izon – Lack of self-association of class C3 in isolation				[Ko-W&T83]
a.	/ àyán $\textcircled{L}$ /	[ àyán ]	'face'		
	/ èngédú $\textcircled{L}$ /	[ èngédú ]	'red-headed malimbe bird'		
	/ kúkúndùkú $\textcircled{L}$ /	[ kúkúndùkú ]	'sweet potato'		
b.	/ èméín $\textcircled{L}$ /	[ èméín ]	'manatee'		
	/ ìzózóbáú $\textcircled{L}$ /	[ ìzózóbáú ]	'type of fish spear'		

However, there are a few morphemes which are transcribed with a final fall in isolation but have a final high tone in a tone group. These exceptional patterns suggest self-association:

(44)	Kolokuma Izon – Limited evidence for self-association of class C in isolation				
a.	/ ìtáú $\textcircled{L}$ /	[ ìtáú ~ táú ]	'grand-' (familial relations)		
		cf. [ táú tọ̀bọ̀ ]	'grandchild'	[Ko-W&T83:166]	
b.	/ tìbú $\textcircled{L}$ /	[ tìbú ]	'incitement'		
		cf. [ tìbú t̀t̀ ]	'incite' (< t̀t̀ 'put')	[Ko-W&T83:169]	

It is unclear at this point whether this is truly self-association of a floating  $\textcircled{L}$ , some type of tone class variation in either underlying or surface forms, or some other explanation. Further data is required. For the purposes of generalizing over the data, I assume that for /...H $\textcircled{L}$ / sequences in isolation, the floating  $\textcircled{L}$  tone self-associates in Gbarain but deletes in Kolokuma, which is faithful to Williamson's original analytic generalization. Those which show the variation in (44) are classified as having an underlying final pre-associated low and thus classified as C1 (/...HL $\textcircled{L}$ /).

### 3.3.4 Class C tone alignment with V-TBU targets (both dialects)

Finally, let us examine exceptional effects of vowel-initial words for class C, effects which we saw for both class A and B. There, I attributed these effects due to the initial vowel (the V-TBU) being extrametrical, i.e. Kolokuma <è>rén $\textcircled{H}$  'day' (cf. érí $\textcircled{H}$  'dry'). Such effects are seen with class C as well.

There is a clear asymmetry in the distribution initial high and low tone across class C morphemes. For morphemes which begin with a vowel, this vowel is overwhelmingly low-toned with a ratio of 15:1 in the

Kolokuma lexicon, shown in Table 5 with representative examples and total numbers. Compare to this consonant-initial class C morphemes (#CV...) which are more evenly distributed.

Initial T \ Initial $\sigma$	#V...	#CV...
L	/ ùgbákà <sup>Ⓛ</sup> / 'dam' (n=301)	/ sùkákà <sup>Ⓛ</sup> / 'ship mast' (n=61)
H	/ ógùrù <sup>Ⓛ</sup> / 'potassium iodide' (n=18)	/ kẹ̀kùrù <sup>Ⓛ</sup> / 'small squirrel' (n=78)

Table 5: Kolokuma Izon – Co-occurrence of V-TBU and low tone (across class C)

While this shows that initial V-TBUs generally bear low tone, just as with class B there are exceptions. In Gbarain Izon, examples are more limited (e.g. functional class C morphemes like /árì<sup>Ⓛ</sup>/ 2SG.SUBJ ‘you’, and loanwords like /ínkì<sup>Ⓛ</sup>/ ‘ink’, /ánggìsì<sup>Ⓛ</sup>/ ‘handkerchief’, a.o.). In Kolokuma Izon a broader set of lexical items show an initial high-toned vowel, in (45). From W&T83’s dictionary, this only includes nouns, many of which are culturally-salient (b.) plants and animals (c.), or substances (d.)

- (45) Kolokuma Izon – Class C items with high-toned initial vowel [Ko-W&T83]
- |    |                        |   |
|----|------------------------|---|
| a. | ápìlé <sup>Ⓛ</sup>     | ‘cartwheel’   |
|    | érí <sup>Ⓛ</sup>       | ‘thread’  |
|    | ìkpà <sup>Ⓛ</sup>      | ‘pudding’   |
| b. | ámà <sup>Ⓛ</sup>       | ‘type of charm’                                     |
|    | áyù <sup>Ⓛ</sup>       | ‘God’   |
|    | ínà <sup>Ⓛ</sup>       | ‘mother, mum’                                       |
| c. | íngbè <sup>Ⓛ</sup>     | ‘mangrove oyster’                                   |
|    | ílálì <sup>Ⓛ</sup>     | ‘herb type’ ( <i>Ludwigia decurrens</i> )           |
|    | ìlààdù <sup>Ⓛ</sup>    | ‘small tree type’ ( <i>Clappertonia ficifolia</i> ) |
|    | ìkìnrìnrì <sup>Ⓛ</sup> | ‘bush okra’ ( <i>Corchorus olitorius</i> )          |
| d. | òùn <sup>Ⓛ</sup>       | ‘sand’  |
|    | ógùrù <sup>Ⓛ</sup>     | ‘potassium iodide’                                  |

Within tone groups an unexpected pattern emerges in Gbarain, however. This involves classes C2 /H<sup>Ⓛ</sup> / and C3 /...LH<sup>Ⓛ</sup>/ and variation as to the association of the floating low and a vowel-initial target. In one variant, the floating  $\text{Ⓛ}$  associates to the initial TBU of the target, just as with the consonant-initial targets in (42) above. This variant is what is expected as it shows low tone on a V-TBU, shown in (46). In another variant, however, the final H of the sponsor spreads to this first V-TBU, and the floating  $\text{Ⓛ}$  associates immediately after it. This results in the [H#H $\text{Ⓛ}$ ] pattern of (47), which is not expected given the propensity for onsetless syllables and low tone to coincide. Both patterns were common in the Gbarain data collected.

- (46) Gbarain Izon – Expected association of class C floating  $\text{Ⓛ}$  to a word-initial V-TBU
- |    |                     |                         |   |   |   |                  |
|----|---------------------|-------------------------|---|---|---|------------------|
| a. | / béí <sup>Ⓛ</sup>  | òpóríópò <sup>Ⓛ</sup> / | [ béí <sup>Ⓛ</sup> òpòríópò ]             | [Gb-20170711:20]                          |   |                  |
|    | this                | pig                     | ‘this pig’                                |   |   |                  |
| b. | / píná <sup>Ⓛ</sup> | òbóri <sup>Ⓛ</sup>      | kúlúkúlú <sup>Ⓛ</sup> tìbí <sup>Ⓛ</sup> / | [ píná <sup>Ⓛ</sup> òbòrí kùlùkùlù tìbì ] | [Gb-20190705:22]                                  |                  |
|    | white               | goat                    | black                                     | head                                      | ‘a white goat’s black head’                       |                  |
| c. | / béí <sup>Ⓛ</sup>  | òwèì <sup>Ⓛ</sup>       | gbé <sup>Ⓛ</sup>                          | amè /                                     | [ béí <sup>Ⓛ</sup> òwèì    gbé <sup>Ⓛ</sup> àmè ] | [Gb-20190703:14] |
|    | this                | man                     | pay                                       | COMPL                                     | ‘this man did pay’                                |                  |
| d. | / Ébí <sup>Ⓛ</sup>  | àkà <sup>Ⓛ</sup>        | òvìnmò <sup>Ⓛ</sup>                       | mì /                                      | [ Ébí    àkà <sup>Ⓛ</sup> òvìnmò mì ]             | [Gb-20190714:61] |
|    | Ebi                 | corn                    | put.out                                   | PFTV                                      | ‘Ebi put out the corn’                            |                  |

- (47) Gbarain Izon – Unexpected association of floating  $\textcircled{L}$  to second TBU of target
- |    |                          |                       |                    |                                     |
|----|--------------------------|-----------------------|--------------------|-------------------------------------|
| a. | / dèngí <sup>Ⓛ</sup> /   | amá <sup>Ⓜ</sup> /    | [ dèngí ámà ]      | [Gb-20170711:22]                    |
|    | which                    | town                  | ‘which town?’      | (Cf. [ dèngí bùrù ] ‘which yam?’)   |
| b. | / àkú <sup>Ⓛ</sup> /     | ìsàní <sup>ⓁⓂ</sup> / | [ àkú ísàní ]      | [Gb-20190702:4]                     |
|    | bitter                   | pepper                | ‘bitter pepper’    | (Cf. [ àkú wùrù ] ‘a bitter drink’) |
| c. | / gbánrán <sup>Ⓛ</sup> / | apapa <sup>ⓁⓂ</sup> / | [ gbánrán ápàpà ]  | [Gb-20190716:72] <sup>7</sup>       |
|    | fry                      | groundnut             | ‘fried groundnuts’ | (Cf. [ gbánrán nàmà ] ‘fried meat’) |
| d. | / èké <sup>Ⓛ</sup> /     | òmọ /                 | [ èké òmọ ]        | [Gb-20190702:3]                     |
|    | rat                      | INDEF.PL              | ‘rats’             |                                     |

We may tentatively state that within a tone group, there is an constraint which forbids a falling tone across adjacent vowels in separate words, i.e. \*...ŵ#ŵ..., but that it applies only optionally.

This constraint is only found in Gbarain Izon. The Kolokuma Izon data uniformly shows the expected pattern where the floating  $\textcircled{L}$  associates to the initial TBU of the next word, whether it begins with a consonant (42), or with a vowel (48).

- (48) Kolokuma Izon – Uniform association of class C floating  $\textcircled{L}$  to a word-initial V [Ko-W&B11:5,9,24,246]
- |    |                         |                     |                   |                            |
|----|-------------------------|---------------------|-------------------|----------------------------|
| a. | / àgbùnù <sup>Ⓛ</sup> / | ‘type of clap-net’  | [ àgbùnù ìmbì ]   | ‘to fish with a clap-net’  |
| b. | / àká <sup>Ⓛ</sup> /    | ‘corn, maize’       | [ àká ùngbòù ]    | ‘empty maize-cob’          |
| c. | / àmàtá <sup>Ⓛ</sup> /  | ‘circumcised woman’ | [ àmàtá ìkìrìkà ] | ‘older married women’      |
| d. | / bìsá <sup>Ⓛ</sup> /   | ‘that’ (DEM)        | [ bìsá àràù ]     | ‘that girl’                |
| e. | / ùkàsú <sup>Ⓛ</sup> /  | ‘Antelope grass’    | [ ùkàsú ìnkì ]    | ‘(red) Antelope grass ink’ |

### 3.4 Tone class D – Analysis as floating $\textcircled{H}\textcircled{L}$

The final class is Class D, which sponsors a floating  $\textcircled{H}\textcircled{L}$  sequence, which fills out the logically possible floating tone sequences:  $\textcircled{L}$ ,  $\textcircled{H}$ ,  $\textcircled{L}\textcircled{H}$ , and now  $\textcircled{H}\textcircled{L}$ .

#### 3.4.1 Core patterns of class D in Gbarain Izon

Beginning with Gbarain, no lexical items belong to class D. The only class D members are a small series of ‘pre-vocalic pronouns’. Across Izon varieties, pronouns have two allomorphs, one used before consonants and one before vowels, as shown below in an imperative construction.

- (49) Gbarain Izon – Pronoun allomorphy based on following segment (consonant or vowel)
- |    |            |               |    |             |             |
|----|------------|---------------|----|-------------|-------------|
| a. | [ ò kùlé ] | ‘greet them!’ | b. | [ òrì érì ] | ‘see them!’ |
|----|------------|---------------|----|-------------|-------------|

The segmental shape and underlying tone of the pre-vocalic series is clearly related to their pre-consonantal counterpart, but any alternations cannot be reduced to any regular phonological process.

All pre-vocalic object pronouns are class D by virtue of sponsoring  $\textcircled{H}\textcircled{L}$  floating tones which replace the tones of the following word, in (50). They represent three subclasses, D1 /H<sup>Ⓜ</sup>Ⓛ/ in a., D2 /L<sup>Ⓜ</sup>Ⓛ/ in b., and D3 /LH<sup>Ⓜ</sup>Ⓛ/ in c. All are shown with the vowel-initial verb /èrì<sup>Ⓜ</sup>/ ‘to see’. Note that in these tokens, there is an independent process which assimilates the vowel of the pre-vocalic pronoun.

<sup>7</sup> Recall that the final <n> indicates a nasal vowel. In IPA, this example is [gbánránápàpà].

- (50) Gbarain Izon – Class D pre-vocalic pronouns with vowel-initial verb /èrì<sup>(H)</sup>/ ‘to see’ [Gb-20190706:30]
- |    |                           |                      |        |             |                |                         |
|----|---------------------------|----------------------|--------|-------------|----------------|-------------------------|
| a. | D1 /H <sup>(H,L)</sup> /  | wó <sup>(H,L)</sup>  | 'us'   | [ wó èrì ]  | (→ [ wéèrì ])  | ‘see us!’               |
| b. | D2 /L <sup>(H,L)</sup> /  | ìnè <sup>(H,L)</sup> | 'me'   | [ ìnè èrì ] | (→ [ ìnèèrì ]) | ‘see me!’               |
|    |                           | wò <sup>(H,L)</sup>  | 'him'  | [ wò èrì ]  | (→ [ wèèrì ])  | ‘see him!’              |
|    |                           | òrì <sup>(H,L)</sup> | 'them' | [ òrì èrì ] | (→ [ òrèèrì ]) | ‘see them!’             |
| c. | D3 /LH <sup>(H,L)</sup> / | àrì <sup>(H,L)</sup> | 'her'  | [ àrì èrì ] | (→ [ àrèèrì ]) | ‘see her!’ <sup>8</sup> |

In contrast, the pre-consonantal pronouns are strictly the already introduced A, B, and C classes, in (51). In Gbarain, all lexical items are interpreted as A, B, and C classes and consistently show such patterns before vowel-initial targets (52).<sup>9</sup>

- (51) Gbarain Izon – Pre-consonantal pronoun series (classes A, B, and C only) [Gb-20190706:30]
- |    |         |                    |             |               |
|----|---------|--------------------|-------------|---------------|
| a. | Class A | ò <sup>(L,H)</sup> | [ ò kùlé ]  | ‘greet them!’ |
| b. | Class B | à <sup>(H)</sup>   | [ à kùlé ]  | ‘greet her!’  |
| c. | Class C | wó <sup>(L)</sup>  | [ wó kùlè ] | ‘greet us!’   |
- (52) Gbarain Izon – Class A, B, and C nouns with vowel-initial verb [Gb-20190714:60]
- |    |         |                     |             |             |
|----|---------|---------------------|-------------|-------------|
| a. | Class A | tà <sup>(L,H)</sup> | [ tà èrì ]  | ‘see wife!’ |
| b. | Class B | fù <sup>(H)</sup>   | [ fù èrì ]  | ‘see salt!’ |
| c. | Class C | wún <sup>(L)</sup>  | [ wún èrì ] | ‘see sand!’ |

Interestingly, there are no tonal effects due to the vowel-initial target (53). The floating <sup>(H)</sup> uniformly associates to the initial vowel (a.). Other association patterns are rejected as ungrammatical (b.).

- (53) Gbarain Izon – Class D floating <sup>(H)</sup> tone associating only to following vowel [Gb-20190714:61]
- |    |                           |                      |                         |      |                                  |                    |
|----|---------------------------|----------------------|-------------------------|------|----------------------------------|--------------------|
| a. | Ébì <sup>(L)</sup>        | ìnè <sup>(H,L)</sup> | òvìnmò <sup>(L,H)</sup> | mì   | [ Ébì ìnè òvìnmò m ]             | (→ [...ìndòvì...]) |
|    | Ebi                       | 1S.OBJ.PREV          | put.out                 | PFTV | ‘Ebi put me out’ (as if on fire) |                    |
| b. | Cf. *[ Ébì ìnè òvìnmò m ] |                      |                         |      |                                  |                    |

### 3.4.2 Core patterns of class D in Kolokuma Izon

In Gbarain, tone class D is limited to the small class of pronouns. In contrast, in Kolokuma they have a much wider distribution, found with many lexical items as well as several modifiers (e.g. some demonstratives). However, even here class D is much smaller than the other three classes. Examples of lexical items of class D1, D2, and D3 are in (54).

- (54) Kolokuma Izon – Class D lexical items in tone groups
- |    |                           |                           |                        |                       |                             |                |
|----|---------------------------|---------------------------|------------------------|-----------------------|-----------------------------|----------------|
| a. | D1 /H <sup>(H,L)</sup> /  | wá rì <sup>(H,L)</sup>    | kò rì <sup>(L,H)</sup> | kì m ì <sup>(H)</sup> | [ wá rì kò rì k ì m ì ]     |                |
|    |                           | house                     | build                  | person                | ‘builder’                   | [Ko-W88:260]   |
| b. | D2 /L <sup>(H,L)</sup> /  | ì mbè lè <sup>(H,L)</sup> | dú má <sup>(H)</sup>   | tún <sup>(H)</sup>    | [ ì mbè lè dú mà tún ]      |                |
|    |                           | pleasant                  | song                   | sing                  | ‘sing a pleasant song’      | [Ko-W88:262]   |
| c. | D3 /LH <sup>(H,L)</sup> / | ù kù l á <sup>(H,L)</sup> | kì m ì <sup>(H)</sup>  |                       | [ ù kù l á k ì m ì ]        |                |
|    |                           | crippled                  | person                 |                       | ‘crippled person, lameness’ | [Ko-W&T83:182] |

Let us examine the D subclasses in isolation. For D1 (/H<sup>(H,L)</sup>/) and D3 (/LH<sup>(H,L)</sup>/), the floating <sup>(L)</sup> does not self-associate to its sponsor in isolation, as transcribed and described in K&W83’s dictionary. This

<sup>8</sup> Second person pre-vocalic pronouns are also D3 – ìné<sup>(H,L)</sup> ‘you’ (SG) and òrì<sup>(H,L)</sup> ‘you’ (PL) – not shown.

<sup>9</sup> In principle, D1 and D3 which end in a pre-associated high might be reanalyzed as class C after the (optional) cross-word falling tone restriction has applies (i.e. ...ú#v̂... → ...ú#v̂...). However, this could not explain the patterns with D2, which have only pre-associated low tones.

suggests that the  $\textcircled{L}$  deletes in these contexts, exactly as the majority of patterns showed for class C, e.g. C3 /LH $\textcircled{L}$ / [èméín] ‘manatee’ in (43). This is demonstrated in (55).

(55) Kolokuma Izon – Class D lack of self-association of floating  $\textcircled{L}$  in isolation [Ko-W&T83]

a.	D1	bára <sup>(H)L</sup>	[ bárá ]	‘hand/arm’
		wárí <sup>(H)L</sup>	[ wárí ]	‘house’
		fúmú <sup>(H)L</sup>	[ fúmú ]	‘dirty’
		fóún <sup>(H)L</sup>	[ fóún ]	‘drag’
		dángáín <sup>(H)L</sup>	[ dǎngáín ]	‘be long’
b.	D3	àkú <sup>(H)L</sup>	[ àkú ]	‘bitter’
		ùwó <sup>(H)L</sup>	[ ùwó ]	‘alive, fresh, raw’
		èpépéré <sup>(H)L</sup>	[ èpépéré ]	‘stammer’
		ùsǎ <sup>(H)L</sup>	[ ùsǎ ]	‘hot’ (of pepper)
		ìffíyóú <sup>(H)L</sup>	[ ìffíyóú ]	‘(to) whistle’

Notice as well that D1 and D3 are in complementary distribution: D1 always begins with a consonant and is all high-toned, while D3 begins with a low-toned vowel, following by all high tones. This is exactly parallel to the patterns in class B, where B3 patterns were analyzed as initial extrametricality of the low-toned vowel, i.e. <è>réín<sup>(H)</sup> ‘day’. I therefore extend the extrametricality analysis to the b. forms in (55), e.g. <ì>ffíyóú<sup>(H)L</sup> ‘whistle’. While in class B there was only near complementarity due to the presence of exceptional B1 forms such as érí<sup>(H)</sup> ‘dry’, in class D there is complete complementarity, i.e. no items of the shape \*/bàtá<sup>(H)L</sup>/ or \*/átá<sup>(H)L</sup>/.

With Kolokuma subclass D2 /L<sup>(H)L</sup>/ items in isolation, the floating  $\textcircled{H}$  of the  $\textcircled{H}\textcircled{L}$  sequence always docks to the final TBU of the sponsor, resulting in a surface high or rising tone. D2 surface forms are never realized with a final falling tone, indicating that the floating low goes unrealized (as with D1 and D3). This renders D2 morphemes in isolation surface identical with class A morphemes (/L<sup>(L)H</sup>/), only differentiated when in tone groups. Representative examples are in Table 6, compared to analogous Class A form.

Class D2		( Class A )	
a.	èkè <sup>(H)L</sup> [ èkèé ]	‘rat’	( èdè <sup>(L)H</sup> [ èdèé ] ‘yam barn’ )
	òndù <sup>(H)L</sup> [ òndùú ]	‘that other’	( ìndì <sup>(L)H</sup> [ ìndìí ] ‘fish’ )
b.	òmbìì <sup>(H)L</sup> [ òmbìí ]	‘rub self with’	
	ìngbàì <sup>(H)L</sup> [ ìngbàí ]	‘today’	
c.	bèkè <sup>(H)L</sup> [ bèké ]	‘English, European’	( bùrù <sup>(L)H</sup> [ bùrú ] ~ [ bùrúú ] ‘yam’ )
	tìtè <sup>(H)L</sup> [ tìté ]	‘sit’	( bùrù <sup>(L)H</sup> [ bùrú ] ‘be rotten’ )
	ìmbèlè <sup>(H)L</sup> [ ìmbèlé ]	‘sweet, tasty’	( ìgònì <sup>(L)H</sup> [ ìgòní ] ‘stranger’ )
	èkùrèkùrè <sup>(H)L</sup> [ èkùrèkùré ]	‘steep slope’	

Table 6: Kolokuma Izon – Self-association of class D2 floating  $\textcircled{H}$  (cf. A)

With VCV words (a.) and words ending in with a bimoraic syllable (b.), the surface form ends in a rising tone. However, CVCV (or bigger) forms end in high (c.). These patterns mirror the patterns of class A in isolation in Kolokuma (as detailed in §3.1). This high tone is only found in isolation, suggesting that it is truly a floating  $\textcircled{H}$  and not a pre-associated H on the final TBU.

Recall that class D does not exist in Gbarain outside of the few pre-vocalic pronouns. Given this, which tone classes do the class D lexical items in Kolokuma Izon correspond to in Gbarain Izon? I briefly take this up in Appendix A2, where D1 largely corresponds to C2 and D2 to C3, but D3 is inconclusive.<sup>10</sup>

<sup>10</sup> Kolokuma Izon also shows the same distinction between pre-consonantal and pre-vocalic pronoun allomorphs, as provided below. These show three tone-class pairings, in (i)-(iii) below. One observation is that there is a regularity



### 3.4.3 Class D tone alignment with V-TBU targets (Kolokuma only)

In her discussion of class D in Kolokuma, Williamson (1988) states that the floating  $\textcircled{H}$  "is thrown back on the final syllable of the first morpheme when the second morpheme begins with a vowel" (W88:262), showing another effect of V-TBU targets. This is demonstrated with the class D word / $\textcircled{H}\textcircled{L}$ mbèlè/ 'sweet, tasty, interesting'.

- (56) Kolokuma Izon – Effect of V-initial TBU on  $\textcircled{H}\textcircled{L}$  association in class D [Ko-W&T83:91]
- [  $\textcircled{H}\textcircled{L}$ mbèlè fɸyàì ] 'tasty food'
  - [  $\textcircled{H}\textcircled{L}$ mbèlè ègbèrì ] 'good news' (lit. interesting story)

In a., the  $\textcircled{H}\textcircled{L}$  associates as expected, while in b. the floating  $\textcircled{H}$  self-associates to its sponsor while the  $\textcircled{L}$  associates to this initial V-TBU.

This appears to be a robust pattern in Kolokuma, seen in the collection of phrasal forms in (57) derived from / $\textcircled{H}\textcircled{L}$ bèkè/ 'English, European' ([bèké] in isolation). If the target word begins with a vowel, the  $\textcircled{H}$  consistently self-associates to the sponsor itself.

- (57) Kolokuma Izon –  $\textcircled{H}\textcircled{L}$  association with derivatives of class D / $\textcircled{H}\textcircled{L}$ bèkè/ [Ko-W&B11]
- [ bèkè bɸbì ] 'English' (language)
    - [ bèkè fɸrì ] 'salaried job'
    - [ bèkè kírì ] 'trading station'
    - [ bèkè súò ] 'work in modern urban sector'
  - [ bèké àmà ] 'Europe'
    - [ bèké ìgbà ] 'European rope'
    - [ bèké ùndù ] 'pawpaw' (fruit)
    - [ bèké àpàpà ] 'breadnut' (fruit)
    - [ bèké èdèìn ] 'European-style knife'
    - [ bèké ògònèì ] 'calendar month'
    - [ bèké èkèn-òvùrù ] 'week' (of seven days)

The examples in (56)-(57) above were with class D2 / $\textcircled{H}\textcircled{L}$ / items which end in a pre-associated low. There is more variation in the surface patterns with classes D1 (/ $\textcircled{H}\textcircled{L}$ /) and D3 (/L $\textcircled{H}\textcircled{L}$ /) which end in high. Consider the D1 word /wáɸɸ/ 'house', whose floating tones straightforwardly associate to the target if it is consonant-initial, e.g. [wáɸɸ tèmè] 'wall gecko' (lit. house spirit). However, (58) shows that if the following word is vowel-initial, there is variation between the  $\textcircled{L}$  associating to the vowel (a., presumably with deletion of the  $\textcircled{H}$ ), versus the  $\textcircled{H}$  associating to the vowel with the  $\textcircled{L}$  following (b.). There does not appear to be a consistent pattern and I take this to be incidental variation. For example, the same sequence for 'wall' which had  $\textcircled{L}$  align to the vowel in a. shows  $\textcircled{H}$  aligning to this vowel in the sentence in c.

across these pairings: if the pre-consonantal form is class A (L $\textcircled{H}$ ) then its pre-vocalic form is class D (L $\textcircled{H}\textcircled{L}$ ), but if the former is class B (L $\textcircled{H}$ ) then the latter is class C (L $\textcircled{H}\textcircled{L}$ ). Compare these Kolokuma data to the Gbarain equivalents, which uniformly pattern as class D with floating tones  $\textcircled{H}\textcircled{L}$ . This may suggest some kind of levelling in this series.

Kolokuma	Class pair	C	V	[Ko-W65]	
(i)	A / D	ì $\textcircled{H}\textcircled{L}$	ìnè $\textcircled{H}\textcircled{L}$	'me'	(cf. Gbarain pre-V D2 ìnè $\textcircled{H}\textcircled{L}$ 'me')
		ù $\textcircled{L}\textcircled{H}$	wò $\textcircled{H}\textcircled{L}$	'him'	
		ò $\textcircled{L}\textcircled{H}$	òrò $\textcircled{H}\textcircled{L}$	'them'	
(ii)	B / C	ì $\textcircled{H}$	ìné $\textcircled{L}$	'you' (SG)	(cf. Gbarain pre-V D3 ìné $\textcircled{H}\textcircled{L}$ 'you')
		à $\textcircled{H}$	àrá $\textcircled{L}$	'her'	
		ò $\textcircled{H}$	òró $\textcircled{L}$	'you' (PL)	
(iii)	C / C	wó $\textcircled{L}$	wó $\textcircled{L}$	'us'	(cf. Gbarain pre-V D1 wó $\textcircled{H}\textcircled{L}$ 'us')

- (58) Kolokuma Izon – Variation in  $\text{H}(\text{L})$  association with derivatives of D1 /wáɾɪ<sup>⊙(L)</sup>/ 'house'
- |    |   |                     |                |
|----|---|---------------------|----------------|
| a. | [ wáɾɪ àkpàkpà ]  | 'wall'              | [Ko-W&B11:256] |
|    | [ wáɾɪ ùdùbù ]  | 'tomb, grave'       | [Ko-W&B11:241] |
|    | [ wáɾɪ ùtù ]  | 'roof of the house' | [Ko-W&B11:245] |
| b. | [ wáɾɪ ótù ]  | 'house people'      | [Ko-W65:101]   |
|    | [ wáɾɪ ófɪn ]   | 'sweep a house'     | [Ko-W&B11:256] |
| c. | [ èrí wáɾɪ àkpàkpà tìèmèjìn nìmí ]  |                     | [Ko-W&B11:227] |
|    | / èrí wáɾɪ <sup>⊙(L)</sup> àkpàkpà <sup>(L)</sup> tìèmèjìn <sup>⊙(L)</sup> nìmí / |                     |                |
|    | he house wall lean.against ASP  |                     |                |
|    | 'he is leaning against the wall'  |                     |                |

While it appears rare, this variation also affects D2 /L<sup>⊙(L)</sup>/ words, e.g. the derivatives of /kènɪ<sup>⊙(L)</sup>/ 'one, a certain' in (59). Example a. shows the expected pattern where the  $\text{H}$  self-associates to its sponsor, while b. shows additional examples of it associating to the initial vowel of the target.

- (59) Kolokuma Izon – Variation in  $\text{H}(\text{L})$  association with derivatives of D2 /kènɪ<sup>⊙(L)</sup>/ 'one'
- |    |                       |   |                |
|----|-----------------------|---|----------------|
| a. | [ kènɪ òbìrì dīì mì ] | 'looked at a (certain) dog'                 | [Ko-W88:262]   |
| b. | [ kènɪ ángà ]         | 'twining herb, Calopo plant' (< 'one side') | [Ko-W&B11:109] |
|    | [ kènɪ ópù òfònì ]    | 'one big bird'                              | [Ko-W65:108]   |

Interestingly, a limited amount of variation is found even with consonant-initial targets, as well.

- (60) Kolokuma Izon – Variation in class D  $\text{H}(\text{L})$  association with C-TBU targets [Ko-W&B11:239,180]
- |    |                            |                                     |   |
|----|----------------------------|-------------------------------------|---|
| a. | / tùbù <sup>⊙(L)</sup> /   | [ tùbù ]                            | '(from) the beginning, ancient times'   |
|    |                            | [ tùbù kùmò ~ tùbù kúmò ]           | 'from time immemorial'  |
| b. | / ògònèì <sup>⊙(L)</sup> / | [ ògònèì ]                          | 'moon' (< / ògònò <sup>(L)⊙</sup> / 'top, above' + / yé <sup>⊙</sup> / 'thing') |
|    |                            | [ ògònèì bọlọ̀bù ~ ògònèì bọlọ̀bù ] | 'first quarter of the moon'   |

Accounting for the variation is beyond the scope of this paper. For our purposes, I generalize that the  $\text{H}$  self-associates with D2 before a vowel-initial target, i.e. [bèké àmà] 'Europe'; otherwise, it associates to the initial of the TBU of the target.

### 3.5 Summary of tone class pattern

A summary of the tone class patterns found in this section is provided in Table 7. It is provided in tau-notation, where  $\tau$  = a TBU. The tone classes on the left, and the type of environments which they appear in are at the top (in isolation, or in tone groups). For each dialect,  $\checkmark$  indicates the class is attested for lexical morphemes, ( $\checkmark$ ) indicates attested for other morphemes (e.g. pre-nominal modifiers, place names), (\*) indicates it is marginal in that dialect, and \* indicates it is absent. The TBUs to which the floating tones associate are indicated in red. Unless indicated, a given pattern applies to both dialects.

Class	UR	Izon dialect			Tone groups			
		Gb	Ko	Isolation:	1 TBU: ___ τ	Multi-TBU: ___ ττ	Vowel-initial (V-TBU): ___ vττ	Multi-word: ___ (ττ) <sub>o</sub> (ττ) <sub>o</sub> (ττ) <sub>o</sub>
A	L <sup>LH</sup>	✓	✓	(t̃t̃) ~ (t̃t̃)	(t̃t̃) (t̃)	(t̃t̃) (t̃t̃)	Gb: (t̃t̃) <ṽ>(t̃t̃) Ko: (t̃t̃) <ṽ>(t̃t̃)	Gb: (t̃t̃) (t̃t̃) (t̃t̃) (t̃t̃) Ko: (t̃t̃) (t̃t̃) (t̃t̃) (t̃t̃)
B1	H <sup>H</sup>	✓	✓	(t̃t̃)	(t̃t̃) (t̃)	(t̃t̃) (t̃t̃)	(t̃t̃) (ṽt̃t̃)	(t̃t̃) (t̃t̃) (t̃t̃) (t̃t̃)
B2	L <sup>H</sup>	(✓)	*	Gb: (t̃t̃)	Gb: (t̃t̃) (t̃)	Gb: (t̃t̃) (t̃t̃)	Gb: (t̃t̃) <ṽ>(t̃t̃)	Gb: (t̃t̃) (t̃t̃) (t̃t̃) (t̃t̃)
B3	<ṽ>H <sup>H</sup>	✓	✓	<ṽ>(t̃)	<ṽ>(t̃) (t̃)	<ṽ>(t̃) (t̃t̃)	<ṽ>(t̃) (ṽt̃t̃)	<ṽ>(t̃) (t̃t̃) (t̃t̃) (t̃t̃)
C1	...HL <sup>L</sup>	✓	✓	(t̃t̃)	(t̃t̃) (t̃)	(t̃t̃) (t̃t̃)	(t̃t̃) (ṽt̃t̃)	(t̃t̃) (t̃t̃) (t̃t̃) (t̃t̃)
C2	H <sup>L</sup>	✓	(*)	(t̃t̃) ~ (t̃t̃)	(t̃t̃) (t̃)	(t̃t̃) (t̃t̃)	Gb: (t̃t̃) <ṽ>(t̃t̃) ~ (t̃t̃) (ṽt̃t̃) Ko: (no data)	(t̃t̃) (t̃t̃) (t̃t̃) (t̃t̃)
C3	...LH <sup>L</sup>	✓	✓	(t̃t̃)	(t̃t̃) (t̃)	(t̃t̃) (t̃t̃)	Gb: (t̃t̃) <ṽ>(t̃t̃) ~ (t̃t̃) (ṽt̃t̃) Ko: (t̃t̃) (ṽt̃t̃)	(t̃t̃) (t̃t̃) (t̃t̃) (t̃t̃)
C4	L <sup>L</sup>	*	(✓)	Ko: (t̃t̃)	Ko: (t̃t̃) (t̃)	Ko: (t̃t̃) (t̃t̃)	Ko: (t̃t̃) (ṽt̃t̃)	Ko: (t̃t̃) (t̃t̃) (t̃t̃) (t̃t̃)
D1	H <sup>H<sup>L</sup></sup>	(✓)	✓	Gb: – Ko: (t̃t̃)	(no data)	Gb: – Ko: (t̃t̃) (t̃t̃)	Gb: (t̃t̃) (ṽt̃t̃) Ko: (t̃t̃) (ṽt̃t̃) ~ (t̃t̃) (ṽt̃t̃)	Gb: – Ko: (t̃t̃) (t̃t̃) (t̃t̃) (t̃t̃)
D2	L <sup>H<sup>L</sup></sup>	(✓)	✓	Gb: – Ko: (t̃t̃) ~ (t̃t̃)	(no data)	Gb: – Ko: (t̃t̃) (t̃t̃)	Gb: (t̃t̃) (ṽt̃t̃) Ko: (t̃t̃) (ṽt̃t̃) ~ (t̃t̃) (ṽt̃t̃)	Gb: – Ko: (t̃t̃) (t̃t̃) (t̃t̃) (t̃t̃)
D3	<ṽ>H <sup>H<sup>L</sup></sup>	(✓)	✓	Gb: – Ko: <ṽ>(t̃)	(no data)	Gb: – Ko: <ṽ>(t̃) (t̃t̃)	Gb: <ṽ>(t̃) (ṽt̃t̃) Ko: (no data)	Gb: – Ko: <ṽ>(t̃) (t̃t̃) (t̃t̃) (t̃t̃)

Table 7: Summary of tone class patterns (unless indicated, pattern applies to both dialects)

['Izon dialect' column: ✓ = attested for lexical morphemes, (✓) = attested for other morphemes, (\*) = marginal, \* = absent]

[Red = TBUs which floating tone associates to, <ṽ> = extrametrical word-initial vowel, ~ = variation between forms, – = not possible]

## 4 Discussion

### 4.1 Frequency of each tone class

What is the frequency of each tone class in the Izon lexicon? In this section, I catalogue their frequencies in both dialects, based only on lexical morphemes, i.e. nouns, verbs, and adjectives. This sample does not include proper names, transparently derived words, ideophones/adverbials, or any grammatical morphemes (including numerals, quantifiers, determiners, auxiliaries/light verbs, inflectional enclitics, among others).

Gbarain Izon frequencies are shown in Table 8. From a sample of 513 lexical morphemes, classes A, B, and C are evenly distributed, constituting about a third of the vocabulary. If a lexical item showed variation between two classes, each class was given 0.5.

Class	$n=513$	Subclass	$n$	Subclass	$n$	Subclass	$n$
A	$\text{L}^{\text{H}}$ 165 (32.2%)	A1	$\text{L}^{\text{L}^{\text{H}}}$ 165	C1	$\dots\text{HL}^{\text{L}}$ 52.5	D1	$\text{H}^{\text{H}^{\text{L}}}$ 0
B	$\text{H}$ 173 (33.7%)	B1	$\text{H}^{\text{H}}$ 102	C2	$\text{H}^{\text{L}}$ 46.5	D2	$\text{L}^{\text{H}^{\text{L}}}$ 0
C	$\text{L}$ 175 (34.1%)	B2	$\text{L}^{\text{H}}$ 0	C3	$\dots\text{LH}^{\text{L}}$ 76	D3	$\langle\text{L}\rangle\text{H}^{\text{H}^{\text{L}}}$ 0
D	$\text{H}^{\text{L}}$ 0	B3	$\langle\text{L}\rangle\text{H}^{\text{H}}$ 71	C4	$\text{L}^{\text{L}}$ 0		

Table 8: Gbarain Izon – Tone class frequency of lexical morphemes (N, V, Adj)

These 513 items were collected sporadically and opportunistically in order to have a large enough sample of vocabulary for deducing phrase and sentence level tonal changes. Nouns and verbs are represented in each subclass, however nouns of subclass C2 ( $\text{H}^{\text{L}}$ ) are quite rare compared to verbs.

Within class B ( $\text{H}$ ), no lexical morphemes are of class B2. This subclass strictly consists of a small number of grammatical morphemes, e.g. the demonstrative  $\text{/}\dot{\text{e}}\text{nd}\dot{\text{i}}^{\text{H}}\text{/}$  ‘that’. Within class C, the distribution is fairly even internally, but recall that class C4 ( $\text{L}^{\text{L}}$ ) is missing in Gbarain. Finally, class D ( $\text{H}^{\text{L}}$ ) is limited in Gbarain to the pre-vocalic pronouns; no class D lexical morphemes exist.

A much wider sample of lexical morphemes is catalogued for Kolokuma Izon, summarized from Williamson & Timitimi’s (1983) dictionary. Excluding non-lexical morphemes (as well as proper names and ideophones), this results in a database of 1868 lexical morphemes. As above, the .5 designation indicates morphemes which varied between two subclasses.

Class	$n=1868$	Subclass	$n$	Subclass	$n$	Subclass	$n$
A	$\text{L}^{\text{H}}$ 609 (32.6%)	A1	$\text{L}^{\text{L}^{\text{H}}}$ 600	C1	$\dots\text{HL}^{\text{L}}$ 271.5	D1	$\text{H}^{\text{H}^{\text{L}}}$ 38.5
B	$\text{H}$ 713.5 (38.2%)	A2	$\text{L}^{\text{L}^{\text{H}}*}$ 9	C2	$\text{H}^{\text{L}}$ 2	D2	$\text{L}^{\text{H}^{\text{L}}}$ 22
C	$\text{L}$ 459 (24.6%)	B1	$\text{H}^{\text{H}}$ 422.5	C3	$\dots\text{LH}^{\text{L}}$ 184.5	D3	$\langle\text{L}\rangle\text{H}^{\text{H}^{\text{L}}}$ 26
D	$\text{H}^{\text{L}}$ 86.5 (4.6%)	B2	$\text{L}^{\text{H}}$ 0	C4	$\text{L}^{\text{L}}$ 1		
		B3	$\langle\text{L}\rangle\text{H}^{\text{H}}$ 291				

Table 9: Kolokuma Izon – Tone class frequency of lexical items (N, V, Adj)

Classes A, B, and C are fairly evenly distributed, though fewer class C items occur than we saw in Gbarain. Class A were almost entirely  $\text{/L}^{\text{L}^{\text{H}}}\text{/}$ , with a marginal number of A2 in which the floating  $\text{H}$  does not self-dock (indicated by the asterisk). Subclass B2 is entirely missing in Kolokuma, both in lexical items and in its grammar in general. Class C is particularly skewed. Classes C1  $\text{/}\dots\text{HL}^{\text{L}}\text{/}$  and C3  $\text{/}\dots\text{LH}^{\text{L}}\text{/}$  are well represented, but C2  $\text{/H}^{\text{L}}\text{/}$  and C4  $\text{/L}^{\text{L}}\text{/}$  are marginal classes for lexical morphemes. Finally, class D constituted the smallest class by far. It is therefore not surprising that this class does not exist in Gbarain Izon (a loss reported to be happening in Kolokuma among certain speakers as well – W&T83:xxxvii).

Nouns and verbs in general are well-represented within each class, but have an interesting distribution within class D. While D1 has only a moderately skewed distribution of nouns ( $n=10.5/38.5$ ) versus verbs and adjectives ( $n=28/38.5$ ), class D2 is made up almost entirely of nouns ( $n=20/22$ ) while class D3 almost entirely of verbs/adjectives ( $n=25/26$ ). Although D2 is rare with verbs, a productive process derives D2

verbs with the final intransitivizing suffix *-i/i* INTR. Part of the morphological expression is changing the tone pattern to D2 (L<sup>⊕L</sup>), overwriting the inherent tone structure, shown in (61).

(61) Kolokuma Izon – Productive derivation of D2 verbs with intransitive *-i/i* [Ko-W&T83]

a.	A1	finì <sup>⊕⊕</sup>	[ finí ]	‘open, unlock’
	D2	finì-ì <sup>⊕L</sup>	[ finí ]	‘be opened, unlocked’
b.	B1	gbábú <sup>⊕</sup>	[ gbábú ]	‘hold between lips, teeth’
	D2	gbàbù-ì <sup>⊕L</sup>	[ gbàbùí ]	‘be contracted’ (e.g. of oysters)
c.	D1	fìná <sup>⊕L</sup>	[ fìná ]	‘tie, bind’
	D2	fìnà-ì <sup>⊕L</sup>	[ fìnàí ]	‘get entangled’
d.	D3	ìndé <sup>⊕L</sup>	[ ìndé ]	‘be thick’ (e.g. of soup)
	D2	ìndè-ì <sup>⊕L</sup>	[ ìndèí ]	‘be thickened’

#### 4.2 Logically possible combinations of pre-associated tone and floating tone

I have proposed that tone class contrasts be analyzed as underlying sequences of pre-associated and floating tones. How do these representations stack up against all the logically possible combinations of pre-associated tone and floating tone? This exercise will allow us to see common gaps, and help interpret them as accidental or systematic. In the tables below, possible combinations range from 0 to 6 individual tones in the input, forming various tone strings of H and L. For example, from a tone string of two tones H L, possible representations are (i) both pre-associated, HL, (ii) one pre-associated and the other floating, H<sup>⊕L</sup> and <sup>⊕</sup>L, or (iii) both floating, <sup>⊕L</sup>. As throughout, underlying floating tones are indicated as circled and superscripted.

We can begin by examining tone strings of 0-2 tones, and comparing it to the databases of lexical morphemes for both dialects (§4.1). In Table 10, lexical morphemes consisting of 0 tones (i.e. toneless) or 1 tone are absent in both dialects (a.-c.). I interpret this as a systematic gap for both dialects. All systematic gaps are denoted with asterisks, and are shaded gray. While absent for lexical morphemes, several functional morphemes are toneless or are inherently low-/high-toned, already seen.

Tone string	Patterns	Gb	Ko
a. $\emptyset$ (no tone)	$\emptyset$	*	*
b. L	L	*	*
	$L^{\circ}$	*	*
c. H	H	*	*
	$H^{\circ}$	*	*
d. LL	LL	*	*
	$L^{\circ}L$ (C4)	0	1
	$L^{\circ}L$	*	*
	$L^{\circ}L^{\circ}$	*	*
e. LH	LH	*	*
	$L^{\circ}H$ (B2)	0	0
	$L^{\circ}H$	*	*
	$L^{\circ}H^{\circ}$	*	*
f. HL	HL	*	*
	$H^{\circ}L$ (C2)	46.5	2
	$H^{\circ}L$	*	*
	$H^{\circ}L^{\circ}$	*	*
g. HH	HH	*	*
	$H^{\circ}H$ (B1)	102	422.5
	$H^{\circ}H$	*	*
	$H^{\circ}H^{\circ}$	*	*

Table 10: Tone strings of 0-2 tones (lexical morphemes, both dialects)

Tone strings consisting of 2 tones correspond to several attested Izon patterns (d.-g.), though most logically possible combinations are unattested. These include the four gaps in (62), which I interpret as systematic (they equally apply in larger tone strings, to be shown).

(62) Systematic gaps in Izon tone class contrasts

- Tone identity: No adjacent identical tones of the same type (pre-associated or floating), e.g. LL, HH,  $L^{\circ}L^{\circ}$ ,  $H^{\circ}H^{\circ}$  (note: this does *not* exclude  $L^{\circ}$  or  $H^{\circ}$ )
- Floating tone position: No floating tones before pre-associated tone, e.g.  $L^{\circ}H$ ,  $H^{\circ}L$ ,  $L^{\circ}L$ ,  $L^{\circ}H$ ,  $H^{\circ}L$ , etc.
- Floating tone requirement: No sequences without floating tones, e.g. L, H, LH, HL, etc.
- No all floating: No sequences consist only of floating tones, e.g.  $L^{\circ}$ ,  $H^{\circ}$ ,  $H^{\circ}L^{\circ}$ , etc.

This results in four remaining patterns,  $L^{\circ}$ ,  $L^{\circ}H$ ,  $H^{\circ}L$ , and  $H^{\circ}$ , which correspond to B and C tone classes in Izon (as indicated). While  $L^{\circ}$  is absent in Gbarain and rare in Kolokuma, it exists in enough names for places or people that it should not be considered a systematic gap. The same holds for  $L^{\circ}H$ , which does not occur as a lexical morpheme but found for some pre-nominal modifiers in Gbarain (/ɛ̀ndɪ<sup>H</sup>/ 'that', §3.2.1). Because I interpret these as non-systematic gaps, I denote them with 0 rather than \*.

Next, consider tone strings consisting of three tones, in Table 11. Certain patterns are automatically ruled out from the systematic gaps established in (62), e.g. gaps due to tone identity (rows a., h.) and the floating tone requirement (c., f.). Many other logically possible patterns are not shown, as they would be automatically ruled out as well, e.g. sequences of all floating tones.

Tone string	Patterns	Gb	Ko
a. L L L	$LL^{\text{L}} \sim L^{\text{L}} \sim \text{etc.}$	*	*
b. L L H	$L^{\text{LH}}$ (A1)	165	600
	$L^{\text{LH}*}$ (A2)	0	9
c. L H L	LHL	*	*
	$LH^{\text{L}}$ (C3)	68	146.5
	$L^{\text{HL}}$ (D2)	0	22
d. L H H	$LH^{\text{H}}$ (B3)	2	0
	$\langle L_V \rangle H^{\text{H}}$ (B3)	68	291
e. H L L	$HL^{\text{L}}$ (C1)	20.5	83.5
f. H L H	HLH	*	*
	$HL^{\text{H}}$	*	*
	$H^{\text{LH}}$	*	*
g. H H L	$H^{\text{HL}}$ (D1)	0	38.5
h. H H H	$HH^{\text{H}} \sim H^{\text{HH}} \sim \text{etc.}$	*	*

Table 11: Tone strings of 3 tones (lexical morphemes, both dialects)

From these data, we can establish another systematic gap on tonal 'troughs' in (63), to be amended in (69).

- (63) Systematic gap – No troughs (amended in (69)): No sequences of tonal 'troughs' H L H, e.g. HLH,  $HL^{\text{H}}$ ,  $H^{\text{LH}}$ , *etc.*

Such a constraint is common cross-linguistically and tonologically natural, often formalized as a \*TROUGH (e.g. Yip 2002:137). This automatically rules out all of the patterns in f.

Thus far, I have proposed that there is a contrast between pre-associated tones and tones which are not pre-associated and thereby 'floating'. It is worth asking at this juncture whether we can conflate these two tone types into a simpler representation. One alternative is having only pre-associated tones which delink under specific conditions, i.e. no floating tones in the input. A second alternative is having *only* floating tones which link to the sponsoring morpheme and target morphemes under specific conditions, i.e. no pre-associated tones in the input.

- (64) Possible alternative representations for class D2  
a. / $L^{\text{HL}}$ / (this paper)    b. /LHL/ (no floating)    c. / $L^{\text{HL}}$ / (no pre-associated)

Such alternatives would have the advantage of being representationally uniform, and in most cases the corresponding surface pattern of the tone string is predictable from the tones in the input. For example, the tone string H L always corresponds to a morpheme with an underlying form / $H^{\text{L}}$ /, which does not contrast with /HL/ or / $H^{\text{L}}$ / representations.

The crucial evidence for positing representations with mixed pre-associated and floating structure comes from L H L tone strings (row c. in Table 11). Here, there *is* such a contrast, namely between pattern / $LH^{\text{L}}$ / (C3) vs. / $L^{\text{HL}}$ / (D2) in Kolokuma Izon. Kolokuma examples are below:

- (65) Kolokuma Izon – L H L tone string contrast: / $LH^{\text{L}}$ / (C3) vs. / $L^{\text{HL}}$ / (D2) [Ko-W&T83]
- |    |                        |                          |     |                         |                     |
|----|------------------------|--------------------------|-----|-------------------------|---------------------|
| a. | ègi <sup>L</sup>       | 'ganglion'               | vs. | èkè <sup>HL</sup>       | 'rat'               |
| b. | bèyó <sup>L</sup>      | 'floating mass of grass' | vs. | bèkè <sup>HL</sup>      | 'English, European' |
| c. | àndèr <sup>L</sup>     | 'small tsetse fly'       | vs. | ìngbàì <sup>HL</sup>    | 'today'             |
| d. | àtàngbàlá <sup>L</sup> | 'ant species'            | vs. | òkòlòbìrì <sup>HL</sup> | 'parrot'            |

These data show that it is not predictable whether the H in these strings will be pre-associated to the final TBU of the sponsor or will be floating and self-associating only in the absence of a suitable target host.

Finally, let us examine tone strings of 4 to 6 tones, which represent the upper limit of tones for single lexical morphemes. Most of the logically possible patterns in Table 12 are ruled out by the systematic gaps above. To rule out a tone string L L H L mapping to /L<sup>Ⓛ</sup><sup>Ⓜ</sup>/ (row c.), I propose a systematic gap on a sequence of three floating tones, in (66). Otherwise, such a sequence would be possible from the conjunction of attested patterns /L<sup>Ⓛ</sup><sup>Ⓜ</sup>/ (A) and /L<sup>Ⓜ</sup><sup>Ⓛ</sup>/ (D2).

(66) Systematic gap – No 3Ⓜ: No sequences of three floating tones, i.e. <sup>Ⓛ</sup><sup>Ⓜ</sup>

Tone string	Patterns	Gb	Ko
a. L L L L	LLL <sup>Ⓛ</sup> ~ etc.	*	*
b. L L L H	LL <sup>Ⓛ</sup> <sup>Ⓜ</sup> ~ etc.	*	*
c. L L H L	L <sup>Ⓛ</sup> <sup>Ⓜ</sup> <sup>Ⓛ</sup> ~ etc.	*	*
d. L L H H	LLL <sup>Ⓜ</sup> ~ etc.	*	*
e. L H L L	LHL <sup>Ⓛ</sup> (C1)	32	185
f. L H L H	LHLH LHL <sup>Ⓜ</sup> LH <sup>Ⓛ</sup> <sup>Ⓜ</sup> L <sup>Ⓜ</sup> <sup>Ⓛ</sup> <sup>Ⓜ</sup>	*	*
g. L H H L	LH <sup>Ⓜ</sup> <sup>Ⓛ</sup> <L <sub>v</sub> >H <sup>Ⓜ</sup> <sup>Ⓛ</sup> (D3)	0	0
h. L H H H	LHH <sup>Ⓜ</sup> ~ etc.	*	*
i. H L L L	HLL <sup>Ⓛ</sup> ~ etc.	*	*
j. H L L H	HL <sup>Ⓛ</sup> <sup>Ⓜ</sup> ~ etc.	*	*
k. H L H L	HLHL HLH <sup>Ⓛ</sup> (C3) HL <sup>Ⓜ</sup> <sup>Ⓛ</sup> H <sup>Ⓛ</sup> <sup>Ⓜ</sup> <sup>Ⓛ</sup>	3	9
l. H L H H	HLH <sup>Ⓜ</sup> ~ etc.	*	*
m. H H L L	HHL <sup>Ⓛ</sup> ~ etc.	*	*
n. H H L H	H <sup>Ⓜ</sup> <sup>Ⓛ</sup> <sup>Ⓜ</sup> ~ etc.	*	*
o. H H H L	HH <sup>Ⓜ</sup> <sup>Ⓛ</sup> ~ etc.	*	*
p. H H H H	HHH <sup>Ⓜ</sup> ~ etc.	*	*
q. L H L H L	LHLHL LHLH <sup>Ⓛ</sup> (C3) LHL <sup>Ⓜ</sup> <sup>Ⓛ</sup>	4	29
r. H L H L L	HLHL <sup>Ⓛ</sup> (C1)	0	2
s. L H L H L L	LHLHL <sup>Ⓛ</sup> (C1)	1	1

Table 12: Tone strings of 4-6 tones (lexical morphemes, both dialects)

The systematic gap on 'no troughs' automatically rules out several logically possible patterns (e.g., within rows f., j., k., l., and n.). However, underlying sequences of a pre-associated HLH trough are actually attested in both Gbarain Izon and Kolokuma Izon (k., q., r., s.). Such sequences are rare, appearing in 8 of 513 lexical morphemes in Gbarain (1.6%), and 41 of 1868 (2.2%) in Kolokuma (cf. pre-associated /LHL/ sequences in Kolokuma,  $n=217/1868$ , ~11.6%). Examples are in (67).



- (67) Gbarain Izon – Lexical morphemes with pre-associated trough /HLH/ ( $n=8/513$ )
- kúkíndùkú<sup>Ⓛ</sup> ‘sweet potato’
  - òdóbìá<sup>Ⓛ</sup> ‘cocoyam’
  - dángfìdókó<sup>Ⓛ</sup> ‘giant’ (n.)
  - òkókópòlì<sup>Ⓛ</sup> ‘parrot’
  - òpóriópò<sup>Ⓛ</sup> ‘pig’
  - òvûnrûn<sup>Ⓛ</sup> ‘crab’
  - àkákùmbá<sup>Ⓛ</sup> ‘praying mantis’
  - kìlǒ<sup>Ⓛ</sup> ‘nearest, closest; do quickly, briefly, smartly, efficiently’
- (68) Kolokuma Izon – Lexical morphemes with pre-associated trough /HLH/ ( $n=41/1868$ ) [Ko-W&T83]
- Core vocab. áràú<sup>Ⓛ</sup> ‘female, she (subject pronoun)’  
fúròú<sup>Ⓛ</sup> ‘stomach’
  - Loans kírisímésì<sup>Ⓛ</sup> ‘Christmas’  
tòrótòró<sup>Ⓛ</sup> ‘turkey’ (cf. Igbo [tòrótòró])
  - Plants/animals èfèbùá<sup>Ⓛ</sup> ‘cassava’  
òdúbèrì<sup>Ⓛ</sup> ‘stingray’
  - Reduplicants gènígèní<sup>Ⓛ</sup> ‘be spotted’  
kèlékèlé<sup>Ⓛ</sup> ‘trawl net’

In both dialects, many of these words are loans, peripheral/special vocabulary (such as plants and animals), or reduplicants. Many words appear to have multi-morphemic origins. For example, /òkókópòlì<sup>Ⓛ</sup>/ ‘parrot’ exhibits mixed vowel harmony categorically banned in single morphemes, and Williamson & Blench (2011:166) attribute this anomalous word to borrowing from Igbo ([òkòòkó] ‘parrot’) in combination with the English word *Polly*, a common name for a parrot. Still, there are some basic vocabulary which cannot be explained away in this way, e.g. in Kolokuma /áràú<sup>Ⓛ</sup>/ ‘she (full subject pronoun), female’ and /fúròú<sup>Ⓛ</sup>/ ‘stomach’.

These findings cause us to revise the systematic gap to only applying to *derived* troughs, i.e. those where the HLH pattern are not in a pre-associated sequence in the input.

- (69) Systematic gap (revised) – No derived troughs: No sequences of tonal ‘troughs’ H L H in the output which were not pre-associated in the input, e.g. HL<sup>Ⓜ</sup>, H<sup>Ⓛ</sup>Ⓜ (note: HLH is okay)

A list of banned structures due to ‘no derived troughs’ is in Table 13.

Banned structures					Not banned												
a.	*	H	L	Ⓜ	c.	*	H	L	H	Ⓜ	e.	H	L	H			
		´	˘	#	´		´	˘	´	#	´		´	˘	´		
b.	*	H	Ⓛ	Ⓜ	d.	*	H	L	Ⓛ	Ⓜ	f.	H	L	H	Ⓛ		
		´	#	˘	´		´	˘	#	˘	´		´	˘	´	#	˘

Table 13: Banned structures due to ‘no derived troughs’

Note that the banned HLH structures do not have to form a contiguous string of tones. Sequences in c. and d. above are equally banned, even though they have an intervening tone.

The existence of the ‘no derived troughs’ ban is in line with general constraints across Ijoid varieties. In Table 14 below, I present a glimpse of Williamson’s (1988) comparison of tone classes across these varieties (many of which are dialects of Izon). She systematically elicited the same phrase the varieties (or

its closest equivalent, structurally and semantically), and records remarkable diversity in how the tones of different tone classes are mapped within multi-word tone groups. For example, the counterparts to the Kolokuma Izon phrases [à má náná ówéí] ‘king’ (class B) and [bára tọ̀rù] ‘wrist’ (class D) are shown in three other varieties. The phrase [bára tọ̀rù] in Kolokuma Izon with [HH HL] comes out as [LH LH] in West Tarakiri Izon and [LL HH] in Iduwini Izon, and as [HH HL] in the related language Oruma [orr].

Ijoid variety	‘king’ (Class B)			‘wrist’ (Class D)	
	<i>ama</i> ‘town’	<i>yana</i> ‘own’	<i>oweí</i> ‘man’	<i>bara</i> ‘hand’	<i>kongo ~ toru</i> ‘neck’ ~ ‘eye’
Kolokuma Izon	( LH	HH	HHH )	( HH	HL )
West Tarakiri Izon	( LH	HH	HHH )	( LH	LH )
Oruma	( HH	HH	HLL )	( HH	HL )
Iduwini Izon	( LL	LL	LLL )	( LL	HH )
...	...	...	...	...	...

Table 14: Tone classes across Ijoid, showing rarity of [HLH] sequences within tone groups [W88:255]

Williamson’s full study looked at 28 varieties of Ijoid in three contexts (classes A, B, D), resulting in 83 cells (one cell was incidentally missing). Of these 83 cells, only two cells had a HLH trough sequences within the tone group. These were in West Tarakiri Izon class D tone group (boxed above), and its equivalent forms in Kumbo Izon. Compare this to sequences of LHL in a tone group, which were found in 26/83 of the cells (31.3%). I take this as indicative of the rarity of a derived [HLH] sequence across Ijoid.<sup>11</sup>

Returning to the strings of 4-6 tones in Table 12, by inspecting one of the tone strings /LHL<sup>Ⓛ</sup>/ (row e., a class C1 pattern), we see additional evidence that at least some tones must be pre-associated. In four and five TBU words, it is not predictable which TBUs the tones will associate to, e.g. whether the H will associate to the second TBU, the third, or both, among other possibilities considering the two L's (dots indicate syllable boundaries).

- (70) Kolokuma Izon – Unpredictable association of tones in /LHL<sup>Ⓛ</sup>/ [Ko-W&T83]
- a. L.H.LL<sup>Ⓛ</sup> ìbérià<sup>Ⓛ</sup> ‘love potion’
  - b. L.L.H.L<sup>Ⓛ</sup> àbùlúkù<sup>Ⓛ</sup> ‘kilt’
  - c. L.H.H.L<sup>Ⓛ</sup> èkérékù<sup>Ⓛ</sup> ‘water lettuce’
  - d. L.H.HH.L<sup>Ⓛ</sup> àkákáíndà<sup>Ⓛ</sup> ‘face mask’
  - e. L.L.HH.L<sup>Ⓛ</sup> àlàlálíndà<sup>Ⓛ</sup> ‘orange’
  - f. LL.H.L.L<sup>Ⓛ</sup> pà̀nàp̀ùl̀ù<sup>Ⓛ</sup> ‘pineapple’
  - g. L.L.L.H.L<sup>Ⓛ</sup> àgbàlàkókò<sup>Ⓛ</sup> ‘spotted’

Finally, one row from Table 12 still remains without explanation: the string of tones L H H L in row g., which would correspond to a pattern /LH<sup>Ⓛ</sup>/, which is unattested. A clearly related string L H H (row d. in Table 11) mapping to /LH<sup>Ⓛ</sup>/ is also virtually non-occurring in either dialect. Any examples with a surface pattern from a L H H L string involves an initial extrametrical vowel, i.e. D3 <à>kù<sup>Ⓛ</sup> ‘bitter’. To account for their non-occurrence, I posit the final systematic gap: \*LH#H.

- (71) Systematic gap – \*LH#H: No sequences of L H following by H across a word boundary

<sup>11</sup> The ‘no derived troughs’ ban does not prohibit sequences of [HL#H] or [H#LH] across word boundaries if the tones are sponsored from separate morphemes. This was seen in several places already, e.g. [yó bì dú̀n kù̀m̀ò] ‘this place should not be dusty’ in (41). This requires a further refinement of the ban in (69), but the definition as it is suffices for the purposes of this paper.

This gap would not rule out forms like <à>kú<sup>(H)</sup> because the initial vowel would be outside of the domain where this ban is evaluated. A ban on LH#H sequences across words is attested found in another Ijoid language Kalabari (Harry & Hyman 2014). There, if such a sequence arises across a word boundary, it is broken up by a downstep, i.e. [LH#<sup>↓</sup>H]. This happens even if the LH#H sequence comes from the spreading of the first H across word boundaries (a case of ‘tonal mitosis’ – Hyman 2014:374).

### 4.3 Competing analyses: Ubiquitous floating tone vs. obligatory spreading

The analysis presented here accounts for the tonal effects through ubiquitous floating tone: every lexical item in Izon has both pre-associated tone as well as floating tone at its right edge (with the possible exception of some class C subclasses – §3.3.2). This is typologically unusual, as floating tones are typically associated with only a minority of items in a lexicon.

Part of this analysis involved a floating tone being sponsored which is identical to the final pre-associated tone, i.e. adjacent low tones in class A /L<sup>(L)</sup>/ and classes C1 and C4 /...L<sup>(L)</sup>/, and adjacent highs for classes B1 and B3 /...H<sup>(H)</sup>/ and D1 and D3 /...H<sup>(H)</sup>/. One obvious objection to this analysis is that it is a contradiction of the OCP (Obligatory Contour Principle), which bans adjacent identical elements (Leben 1973, Goldsmith 1976, Kager 1999:398, a.o.). Early on, however, there emerged several analyses of tone systems which tolerated OCP violations, e.g. Odden (1982) for Shambala [ksb] and Clements’ (1984:288) discussion of ‘geminate tone melodies’ in Kikuyu [kik]. Furthermore, given the widespread adoption of Optimality Theory (Prince & Smolensky 2004 [1993]) where constraints are violable with there being no restrictions on underlying structure (i.e., Richness of the Base), underlying sequences such as /H<sup>(H)</sup>/ must be seriously entertained.

An analysis similar to the one of this paper has been recently argued for the Papuan language Awa [awb] in McPherson (2016) based on Loving (1973). From the tonal facts in Awa, McPherson (2016:e43) concludes that “all L-final nouns are followed...by a floating L tone”, a representation which “may be viewed as the phonologization of phonetic L carryover”. Izon may have had a similar trajectory.

An anonymous reviewer asks whether tone is a ubiquitous as it has been claimed here. Specifically, they suggest an alternative involving **obligatory tone spreading** of the final tone of the first word of a tone group, with more limited floating tone representations. Under this alternative, the structure /H<sup>(H)</sup>/ of this paper would be rendered as simply /H/ which spreads rightward. The difference is illustrated in Table 15.

Ubiquitous floating tone: (analysis of this paper)	H <sup>(H)</sup>		H L <sup>(L)</sup>	→	H <sup>(H)</sup>
		#			\
	wó	#	wari		wó wáří
Obligatory tone spreading: (alternative analysis)	H		H L	→	H
					\
	wó	#	wari		wó wáří

Table 15: Ubiquitous floating tone vs. obligatory tone spreading (class B2 *wo* 'our')

For this alternative to be viable, all tone classes should show obligatory tone spreading. A rendition of how this would look for each subclass is provided in Table 16, which consists of a proposed underlying representation for each tone class, and how tone would spread within a tone group (here, spread tones are denoted with a checked underline).

Class	Ubiquitous floating tone		Obligatory tone spreading alternative		
	UR	In tone group	UR	In tone group	→ Surface form
A	L <sup>Ⓞ</sup> H	(L.L) . (Ⓞ.Ⓞ)	L <sup>Ⓞ</sup>	(L.L) . (Ⓞ.Ⓞ)	
B1	H <sup>Ⓞ</sup>	(H.H) . (Ⓞ.Ⓞ)	H	(H.H) . (Ⓞ.Ⓞ)	
B2	L <sup>Ⓞ</sup>	(L.L) . (Ⓞ.Ⓞ)	L.LH	(L.LH) . (Ⓞ.Ⓞ)	→ [(L.L).(H.H)]
B3	<L>H <sup>Ⓞ</sup>	<L> . (H.H) . (Ⓞ.Ⓞ)	<L>H	<L> . (H.H) . (Ⓞ.Ⓞ)	
C1	...HL <sup>Ⓞ</sup>	(H.L) . (Ⓞ.Ⓞ)	...HL	(H.L) . (Ⓞ.Ⓞ)	
C2	H <sup>Ⓞ</sup>	(H.H) . (Ⓞ.Ⓞ)	H.HL	(H.HL) . (Ⓞ.Ⓞ)	→ [(H.H).(L.L)]
C3	...LH <sup>Ⓞ</sup>	(L.H) . (Ⓞ.Ⓞ)	...L.HL	(L.HL) . (Ⓞ.Ⓞ)	→ [(L.H).(L.L)]
C4	L <sup>Ⓞ</sup>	(L.L) . (Ⓞ.Ⓞ)	L	(L.L) . (Ⓞ.Ⓞ)	
D1	H <sup>Ⓞ</sup> L <sup>Ⓞ</sup>	(H.H) . (Ⓞ.Ⓞ)	H <sup>Ⓞ</sup>	(H.H) . (Ⓞ.Ⓞ)	
D2	L <sup>Ⓞ</sup> H <sup>Ⓞ</sup>	(L.L) . (Ⓞ.Ⓞ)	L.LH <sup>Ⓞ</sup>	(L.LH) . (Ⓞ.Ⓞ)	→ [(L.L).(H.L)]
D3	<L>H <sup>Ⓞ</sup> L <sup>Ⓞ</sup>	<L> . (H.H) . (Ⓞ.Ⓞ)	<L>H <sup>Ⓞ</sup>	<L> . (H.H) . (Ⓞ.Ⓞ)	

Table 16: Analysis comparison

One can see several commonalities here. First, while the tone spreading alternative eliminates floating tone in classes B and C, it still requires it for classes A and D. Second, both analyses require spreading at some level: in the alternative, it is the primary means for valuing toneless TBUs within the tone group, whereas under ubiquitous floating tone it is secondary to floating tone association. Third, I mentioned above the idea that identical floating tones are the "phonologization of phonetic carryover". Such a functional motivation equally applies if one interprets obligatory spreading as what has been phonologized.

Looking at the key differences, if one were to adopt the spreading analysis, two key issues need to be settled. First, as stated all classes must exhibit tone spreading. For classes such as C3 and D2 above, such spreading is not seen in the surface form of tone groups, i.e. the proposed surface forms under the floating tone analysis, [(L.H).(Ⓞ.Ⓞ)] and [(L.L).(Ⓞ.Ⓞ)] respectively. In both cases, the final tone of the first word does not appear on the second word. Under the alternative, to account for this one must posit underlying representations with final contours, i.e. /L.HL/ and /L.LH<sup>Ⓞ</sup>/. This is shown below with C3 and D2 examples from Kolokuma.

- (72) Kolokuma Izon – Alternative analysis representations and tone groups (C3 vs. D2)
- a. C3 / òsún / 'starch' [ òsún tàbù ] 'pour water on broken up starch'
- b. D2 / bèkè<sup>Ⓞ</sup> / 'English, European' [ bèkè bíbì ] 'English' (language)

Analysis		Underlying representation		Intermediate		Surface
Obligatory tone spreading: (alternative analysis)	C3	L HL	L <sup>Ⓞ</sup>	L HL	( →	L H L
		V	∧	V	( →	∧ )
	òsún	# tabu	òsún tàbù		[ òsún tàbù ]	
	D2	L H L <sup>Ⓞ</sup>	H	L H L <sup>Ⓞ</sup>	( →	L HL
∧ /		∧	∧ /	( →	∧     )	
bèkè	# bíbì	bèkè bíbì		[ bèkè bíbì ]		
Ubiquitous floating tone: (analysis of this paper)	C3	L H L <sup>Ⓞ</sup>	L L <sup>Ⓞ</sup> H	L H L <sup>Ⓞ</sup>		
			∧			
	òsún	# tabu	òsún tàbù			
	D2	L H L <sup>Ⓞ</sup>	H H	L H L <sup>Ⓞ</sup>		
∧		∧	∧			
bèkè	# bíbì	bèkè bíbì				

Table 17: Ubiquitous floating tone vs. obligatory tone spreading (classes C3 and D2)

Under the alternative we must posit intermediate representations, followed by decontouring rules: falling  $\widehat{HL}\#L$  becomes  $[H\#L]$ , and rising  $L\widehat{H}\#H$  becomes  $[L\#H]$ .

Although the latter is actually attested in Izon independently (see general tone rules in Appendix A1), the former rule involving falling tones is not a general rule. We have seen data of falling tones before low already, which do not undergo decontouring. These are repeated below:

- (73) C1 forms showing final falling tone before low tone
- a. Gbarain Izon –  $dùrùkùù^{\textcircled{L}}$  'dark' → [  $dùrùkùù\ wàrì$  ] 'a dark house'
  - b. Kolokuma Izon –  $àdùkùù^{\textcircled{L}}$  'dark' → [  $àdùkùù\ pàì\ nàp\ ùl\ ù$  ] 'dark pineapple'

One way to maintain the alternative analysis is to assume that in the intermediate representation for C3 – e.g.  $[\grave{o}s\grave{u}n\ t\grave{a}b\grave{u}]$  from Table 17 – the falling tone falls on a single TBU, while in the cases in (73) above it is distributed over two TBUs. As stated above, not enough has been determined yet regarding vowel length in Izon to evaluate this proposal.

Second, under the ubiquitous floating tone analysis, non-initial words of the tone group are valued with floating tones due to a straightforward constraint against unassociated tones in the output (e.g. \*FLOAT). The alternative analysis would be required to employ some equivalent constraint to enforce tone spreading, this must take place even in those contexts when all TBUs are already valued, and thus cannot be reduced to toneless TBUs needing valuation. This was established already in §3.2.3 providing evidence for the floating  $\textcircled{H}$ . When class B1 items appear before a post-nominal modifiers whose tone is *not* replaced, the floating tone co-occurs with its lexical tone:  $/n\acute{a}m\acute{a}^{\textcircled{H}}\ m\grave{o}/$  →  $[n\acute{a}m\acute{a}\ m\grave{o}]$  'the animals'. Under the alternative, we need spreading to obligatory take place here, but obligatorily *not* take place when the floating tone already associates to a toneless word:  $[w\acute{o}\ w\acute{a}r\acute{i}\ m\grave{o}]$  'many houses of ours' ( $*[...m\grave{o}]$ ).

Two types of constraints in the literature could accomplish this task. One type are constraints which favor spreading, e.g. constraints EXPRESS(F) (Cole & Kisseberth 1994), SHARE(F) (McCarthy 2011), or SPREAD(F) (Kimper 2011), where F stands for a phonological feature (in the Izon data, it would be replaced by 'T' for tone). The other type of constraints are indirect, prohibiting sequences of mixed values of some feature in or across some domain, e.g. a generalized constraint \*INTERWORD $[\alpha F][\beta F]$ . This is specified as \*INTERWORD $[-ATR][+ATR]$  in Kügler (2015) and \*INTERWORD $[H][L]$  in Kula & Bickmore (2015). By spreading one of the values this constraint is satisfied, but it could just as well be satisfied via deletion, which is not the case with the first set. For whatever type of constraint employed, it must specifically *not* apply iteratively to capture the fact that tone does not spread in the  $[w\acute{o}\ w\acute{a}r\acute{i}\ m\grave{o}]$  cases. How to accomplish this requires amending the grammar in a constraint-based analysis somehow, e.g. by requiring Harmonic Serialism (Kimper 2011). Any amendment must allow flexibility though, as the \*INTERWORD $[H][L]$  of Kula & Bickmore specifically *does* apply iteratively. Any architectural changes must accommodate both patterns. I leave further comparison of these analyses to future work.<sup>12</sup>

## 5 Summary

I have proposed that all lexical morphemes (and many functional morphemes) fall into one of four tone classes in Izon, with several subclasses. This classification was based on the tonal behavior of morphemes in isolation and in multi-morphemic tone groups. To account for this behavior, all tone classes were decomposed into sequences of pre-associated tone and floating tone in their underlying representation. The four classes A-D are repeated in (74), which end with floating  $\textcircled{L}\textcircled{H}$ ,  $\textcircled{H}$ ,  $\textcircled{L}$ , or  $\textcircled{H}\textcircled{L}$ , respectively. The tonal

<sup>12</sup> The exact domain over which such a constraint operates would also need to be established. To illustrate, recall that under the alternative analysis class A items such as *opu* 'big' would be rendered  $/\grave{o}p\grave{u}^{\textcircled{L}}/$  with obligatory spreading of the pre-associated low. In contexts such as  $/\grave{o}p\grave{u}^{\textcircled{L}}\ \text{oporiopo}/$  →  $[(\grave{o}p\grave{u})\ <\grave{o}>(\text{p}\acute{o}r\acute{i}\acute{o}p\acute{o})]$  'big pig', the low tone spreads to this initial vowel but it is not parsed as part of the following word under the extrametricality proposal. If one accepts the proposal, then the relevant domain cannot be between words, as the low does *not* spread into the second word.

structure of all non-initial morphemes in the tone group are deleted and replaced by these floating tones, e.g. that of the verb /èrì<sup>Ⓜ</sup>/ 'to see' below.

(74) Four tone classes in Izon

- a. Class A: ends in  $\text{L}^{\text{H}}$  / tà<sup>Ⓜ</sup> + èrì<sup>Ⓜ</sup> / → tà èrì 'see wife!'
- b. Class B: ends in  $\text{H}$  / fù<sup>Ⓜ</sup> + èrì<sup>Ⓜ</sup> / → fù èrì 'see salt!'
- c. Class C: ends in  $\text{L}$  / wún<sup>Ⓜ</sup> + èrì<sup>Ⓜ</sup> / → wún èrì 'see sand!'
- d. Class D: ends in  $\text{H}^{\text{L}}$  / wò<sup>Ⓜ</sup> + èrì<sup>Ⓜ</sup> / → wò èrì 'see him!'

By virtue of all lexical morphemes falling into one of these four classes (with the potential exception of certain class C subclasses), floating tone is found across the Izon lexicon, which I have referred to as 'ubiquitous floating tone'.

This paper examined two closely related dialects of Izon – Gbarain (Gb) and Kolokuma (Ko) – whose surface patterns were virtually identical. From a basic lexicon of Gbarain, classes A, B, and C are evenly distributed, but class D is absent outside of certain pre-vocalic pronoun objects, e.g. d. in (74) above. In the Kolokuma dictionary (Williamson & Timitimi 1983), classes A, B, and C dominate but a smaller number of class D lexical morphemes occur as well. These frequencies are summarized in Table 18.

Tone class	Gb (n=513)	Ko (n=1868)
A $\text{L}^{\text{H}}$	165 (32.2%)	609 (32.6%)
B $\text{H}$	173 (33.7%)	713.5 (38.2%)
C $\text{L}$	175 (34.1%)	459 (24.6%)
D $\text{H}^{\text{L}}$	0	86.5 (4.6%)

Table 18: Tone class frequency across lexical morphemes (both Izon dialects)

The proposed underlying representations of all Izon subclasses are summarized in Table 19.

Class A	Class B	Class C	Class D
A1 $\text{L}^{\text{H}}$	B1 $\text{H}^{\text{H}}$	C1 ...HL <sup>Ⓜ</sup>	D1 $\text{H}^{\text{H}^{\text{L}}}$
(A2 $\text{L}^{\text{H}*}$ )	B2 $\text{L}^{\text{H}}$	C2 $\text{H}^{\text{L}}$	D2 $\text{L}^{\text{H}^{\text{L}}}$
	B3 <L>H <sup>Ⓜ</sup>	C3 ...LH <sup>Ⓜ</sup>	D3 <L>H <sup>Ⓜ</sup> <sup>Ⓜ</sup>
		C4 $\text{L}^{\text{L}}$	

Table 19: Proposed underlying representations of Izon subclasses

Based on examining the logically possible combinations of pre-associate and floating tone, I established the following systematic gaps in tone class contrasts:

(75) Systematic gaps in Izon tone class contrasts

- a. No adjacent identical tones of same type (pre-associated or floating), e.g. HH, <sup>Ⓜ</sup>Ⓜ, etc.
- b. No floating tones before pre-associated tone, e.g. <sup>Ⓜ</sup>H, L<sup>Ⓜ</sup>L, etc.
- c. No sequences without floating tones, e.g. L, H, LHL, etc.
- d. No sequences of only floating tones, e.g. <sup>Ⓜ</sup>, <sup>Ⓜ</sup>, <sup>Ⓜ</sup><sup>Ⓜ</sup>, etc.
- e. No sequences of three floating tones, e.g. <sup>Ⓜ</sup><sup>Ⓜ</sup><sup>Ⓜ</sup>
- f. No sequences which would result in derived tonal 'troughs', e.g. HL<sup>Ⓜ</sup>, H<sup>Ⓜ</sup><sup>Ⓜ</sup>, etc.
- g. No sequences which would result in LH followed by H across a word boundary, e.g. LH<sup>Ⓜ</sup>

Finally, by default floating tones associate to the first TBU of the target. However, if the target is a vowel-initial word (a V-TBU), then several exceptional tone patterns occur, summarized in (76).

- (76) Exceptional tonal effects with vowel-initial word targets
- a. Class A: floating  $\textcircled{L}$  docks to the V-TBU, and floating  $\textcircled{H}$  docks immediately after it
  - b. Class B (Gbarain only): L tone from initial word spreads to V-TBU,  $\textcircled{H}$  docks immediately after it
  - c. Class C: vowel-initial words overwhelmingly have an initial low tone rather than high tone (e.g. ratio of 15:1 in Kolokuma)
  - d. Class D (Kolokuma only): if target is vowel-initial, floating  $\textcircled{H}$  self-associates rather than appearing on the V-TBU (shows variation with regular association to target)
  - e. Class B and D: Subclasses B3 and D3 begin with an initial low-toned vowel, in (near) complementary distribution with consonant-initial high-toned B1 and D1

To account for these behaviors, in at least some of these contexts I have interpreted the initial vowel as being extrametrical, which following Downing (1998) constitutes misalignment between morphological and prosodic constituents.

Finally, I compared the ubiquitous floating tone analysis advocated for here with an alternative involving obligatory tone spreading. While a full evaluation of this alternative remains, I identified several key differences and similarities. Importantly, positing ubiquitous floating tones at the right edge of a word or positing obligatory spreading of the final pre-associated tone both can be interpreted as the phonologization of pitch carry-over into the target domain.

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## 7 Appendices

### 7.1 A1: General tone rules in Gbarain: H-absorption and low-to-mid raising

There are two general tone rules in Gbarain Izon. The first rule is **H-absorption**, whereby the high component of a rising tone is lost and becomes a non-contour low before a high tone, i.e. /LH.H/ → [L.H]. Examples (77)-(78) illustrate the absorption of the high component of an underlying rising tone.

- (77) Gbarain – H-absorption with /kùrèì/ ‘be able to, can’ [Gb-20190716:71]
- a. / àrì<sup>LH</sup> lá<sup>H</sup> kùrèì bùrù<sup>LH</sup> gbòrò<sup>LH</sup> mí / [ àr lá kùrèì bùrù gbòrò mí ]  
 I reach be.able yam plant PRFV ‘I was able to plant yam’
- b. / àrì<sup>LH</sup> lá<sup>H</sup> kùrèì ná má<sup>H</sup> fẹ́<sup>H</sup> mí / [ àr lá kùrèì ná má fẹ́ mí ]  
 I reach be.able meat buy PRFV ‘I was able to buy meat’
- (78) Gbarain – H-absorption with /kíḷò<sup>L</sup>/ ‘do quickly, briefly, smartly, efficiently’ [Gb-20190715:67]
- a. / kíḷò<sup>L</sup> bárá<sup>L</sup> kị mìn<sup>LH</sup> / [ kíḷò bàrà kị mìn ]  
 quickly how FOC do ‘do it smartly (and fast)’
- b. / kíḷò<sup>L</sup> mú<sup>H</sup> mà bó<sup>H</sup> / [ kíḷò mú mà bó ]  
 quick go and come ‘quickly go and come’

Further, (79) shows a rising variant [ǎr] of /àrì<sup>LH</sup>/ ‘I’ before a low tone (a.), but a low variant [àr] before a high tone (b.).

- (79) Gbarain – H-absorption with self-docking on reduced form of /àrì<sup>LH</sup>/ ‘I’ [Gb-20190713:57]
- a. / àrì<sup>LH</sup> sù<sup>LH</sup> ngị tí mí / [ ǎr sù ngị tí mí ] ‘I should have fought’
- b. / àrì<sup>LH</sup> mú<sup>H</sup> ngị tí mí / [ àr mú ngị tí mí ] ‘I should have gone’

Moreover, example (80) shows that the floating <sup>H</sup> from /bèi<sup>H</sup>/ ‘some’ can fall on the postposition /ọ/. If this sequence is before a low tone, it creates a type of derived floating tone [bèi ọ] by virtue of /ọ/ being onsetless (a.). However, this same postposition in this sequence surfaces as low before a high tone (b.).

- (80) Gbarain – H-absorption with derived rising tone [Gb-20190712:56]
- a. / ìné<sup>H</sup> ná má<sup>H</sup> bèi<sup>H</sup> ọ tị tẹ́<sup>L</sup> kù mọ / [ ìné ná má bèi ọ tị tẹ́ kù mọ ]  
 your animal some on sit PROH ‘don’t sit on some of your animals’
- b. / ìné<sup>H</sup> ná má<sup>H</sup> bèi<sup>H</sup> ọ bárá<sup>L</sup> sìn<sup>LH</sup> / [ ìné ná má bèi ọ bárá sìn ]  
 your animal some on hand remove ‘leave some of your animals alone’

The second rule is **low-to-mid raising**, and applies when a high-low sequence appears at the end of an utterance, i.e. HL# > HM# utterance finally. This final TBU was produced higher in some tokens ([1 1]) and lower in others ([1 1], with a non-falling low tone), but was not produced with low tone which falls to the lowest part of the pitch range (i.e. \*[1 1]). The examples in (81) illustrate low-to-mid raising.

- (81) Gbarain – Low-to-mid raising: HL# → HM# utterance finally [Gb-20190706:30]
- a. / wá rì<sup>L</sup> kpò / [ wár kpò ] ‘also a house’
- b. / wó<sup>H(L)</sup> ẹrì<sup>H</sup> / [ wẹ ẹrì ] ‘see us!’
- c. / ì nẹ́<sup>H(L)</sup> ẹrì<sup>H</sup> / [ ì nẹ ẹrì ] ‘see me!’

Utterance final tokens across recording sessions consistently exhibited low-to-mid raising.

This rule applies only in declarative statements. In questions there is a final low tone which may be either interpreted as a floating  $\textcircled{L}$  tone, or as the suspension of this low-to-mid raising rule. This creates quite salient sentence-level minimal pairs, distinguishing statements from questions:

- (82) Gbarain – Low-to-mid raising does not apply in questions [Gb-20190710:44]
- a. [ béì kpò wárī ] ‘this is also a house’  
 b. [ béì kpò wárì ] ‘is this also a house?’

That this final mid tone is actually underlying low (rather than a bona fide mid toneme /M/) is revealed when it precedes a H-toned word, e.g. the clause-final particle /bâ/ ‘if’ which begins with high tone:

- (83) Gbarain – Demonstration that *sin* ‘remove’ is underlyingly low-toned [Gb-20190708:41]
- a. / èrí ìné<sup>(H)L</sup> ọ bárá<sup>L</sup> sìn<sup>(L)H</sup> / [ èrí ìnòḍò bárá sìn ]  
 he you on hand remove ‘He should leave you alone’  
 b. / èrí ìné<sup>(H)L</sup> ọ bárá<sup>L</sup> sìn<sup>(L)H</sup> bâ / [ èrí ìnòḍò bárá sìn bâ ]  
 he you on hand remove if  
 ‘I thought you said he should leave you alone’, ‘If he should leave you alone...’

Independent corroboration of the low-to-mid rule comes from Williamson’s (1988:254-255) comparison of tone classes across Ijoid. Where I have transcribed [HL] for several tone class C morphemes in Gbarain – e.g. [kírì] (~[kírí]) ‘ground’, [kálá # bùrù] ‘small yam’, a.o. – she transcribes analogous forms with her Gbarain consultant as a high-downstep sequence [H<sup>+</sup>H] – e.g. [kí<sup>+</sup>rí] ‘ground’ and [bára # <sup>+</sup>tòrù] ‘wrist’. In her comparative dialect study, Williamson is careful to transcribe [HH] vs. [H<sup>+</sup>H] vs. [HL] across Ijoid varieties, indicating that she transcribed Gbarain as [H<sup>+</sup>H] purposely and in contrast with [HL] in other dialects. Importantly, in both Williamson’s transcriptions of Gbarain Izon as well as in this paper’s study, there is no underlying contrast between any of [H<sup>+</sup>H ~ HM ~ HL<sup>o</sup>] (non-falling low) versus [HL].

One additional context in Gbarain involves low-to-mid raising, but it is not fully understood at this point. A group of class C tokens exist with the post-nominal definite marker /bì/ ‘the’, preceded by nouns with underlying /HL<sup>L</sup>/ tone (sometimes vacillating with /H<sup>L</sup>/). In this context, the noun’s low tone becomes mid (i.e. HL#L → HM#L). I leave understanding these data to future work.

- (84) Gbarain – Low-to-mid raising before low: HL#L → HM#L [Gb-20190703:11];[ Gb-20190704:20]
- a. bárá<sup>L</sup> ~ bárá<sup>L</sup> ‘hand’ [ bárá bì ] ‘the hand’  
 b. búnù<sup>L</sup> ‘grey hair’ [ búnū bì ] ‘the grey hair’  
 c. kírì<sup>L</sup> ~ kírì<sup>L</sup> ‘ground’ [ kírì bì ] ‘the ground’  
 d. tòngò<sup>L</sup> ‘penis’ [ tòngò bì ] ‘the penis’  
 e. tórù<sup>L</sup> ‘eye’ [ tórū bì ] ‘the eye’  
 f. wárì<sup>L</sup> ‘house’ [ wárī bì ] ‘the house’  
 g. bẹdì<sup>L</sup> ‘bed’ [ bẹdī bì ] ‘the bed’  
 h. ínkì ‘ink’ [ ínkī bì ] ‘the ink’  
 i. pánì<sup>L</sup> ‘plate’ [ pánī bì ] ‘the plate’

## 7.2 A2: Gbarain and Kolokuma tone class correspondences

Having established the complete set of tone class contrasts in Gbarain and Kolokuma, we can now determine correspondences between the two dialects. An initial summary of major tone class correspondences is in Table 20. Keep in mind that at this point there are over three times as many lexical morphemes in the Kolokuma database compared to Gbarain. (As stated above, note that the .5 indicates variation of a morpheme across two tone classes.)

	Gbarain class				Kolokuma class		<i>n</i> =
a.	A	L <sup>Ⓛ</sup> H <sup>Ⓢ</sup>	↔	A	L <sup>Ⓛ</sup> H <sup>Ⓢ</sup>		135.5
b.	B1	H <sup>Ⓢ</sup>	↔	B1	H <sup>Ⓢ</sup>		96
c.	B3	<L>H <sup>Ⓢ</sup>	↔	B3	<L>H <sup>Ⓢ</sup>		57
d.	C1	...HL <sup>Ⓛ</sup>	↔	C1	...HL <sup>Ⓛ</sup>		26
e.	C2	H <sup>Ⓛ</sup>	↔	B1	H <sup>Ⓢ</sup>		25
f.	C3	...LH <sup>Ⓛ</sup>	↔	<i>(common in all four classes)</i>			
g.	C2	H <sup>Ⓛ</sup>	↔	D1	H <sup>Ⓢ</sup> L <sup>Ⓛ</sup>		14.5
h.	C3	L...H <sup>Ⓛ</sup>	↔	D2	L <sup>Ⓢ</sup> L <sup>Ⓛ</sup>		21
i.	C3/B3 <i>(both small)</i>		↔	D3	<L>H <sup>Ⓢ</sup> L <sup>Ⓛ</sup>		11

Table 20: Tone class correspondences

Classes A and B in Gbarain correspond straightforwardly to the same classes in Kolokuma (a.-c.). The same holds for the C1 subclass in Gbarain (d.). Thereafter, there are mixed class correspondences (e.-i.).

Subclass C2 /H<sup>Ⓛ</sup>/ in Gbarain is marginal in Kolokuma (only two examples back in §3.3.3, both which appear derived). The majority of C2 lexical morphemes correspond to B1 /H<sup>Ⓢ</sup>/ in Kolokuma. Class C3 in Gbarain is the most complicated and irregular set. It corresponds fairly evenly to all four tone classes in Kolokuma (and many subclasses as well), with no clear majority and all being relatively small (*n*<15).

As established, class D is absent in Gbarain (except for the few pre-vocalic pronouns). Class D lexical morphemes in Kolokuma generally correspond to the class C in Gbarain. One can see for D1 and D2 that the floating H<sup>Ⓢ</sup> is 'pulled' one TBU to the left in Gbarain, having no effect in g. and docking to the final TBU in h. In contrast, no major patterns emerge with D3 given their limited number, but fairly evenly correspond to C3 (...LH<sup>Ⓛ</sup>) and B3 (<L>H<sup>Ⓢ</sup>) in Gbarain.

### 7.3 A3: Comparison to the tone class analysis of Kay Williamson

The proposed analysis differs in crucial ways from the analyses in Williamson (1965, 1978, 1988) and Williamson & Timitimi (1983) of Izon and the Ijoid family in general. The clearest differences are with Williamson (1988), which examines tone in Kolokuma Izon against three other Ijoid varieties. Here, she posits three types of tone: pre-linked tone, domain tone, and floating tone.

Pre-linked tone stays on the TBU syllable “with which it is associated in the lexicon” (Williamson 1988:257). It is both immobile and does not spread to other TBUs. In contrast, domain tone (which I conventionalize as a circled lowercase ①) is directly associated to the tone group itself, rather than to a traditional tone-bearing unit such as the mora. Williamson notes that the “defining feature of a domain tone is that it links to the leftmost free TBU and then automatically spreads through its domain until interrupted” (p. 256). Finally, floating tones – circled uppercase ② – are mobile and “surfaces in different positions in accordance with rules which vary from dialect to dialect” (p. 256), and are pre-linked or associated to an entire domain. The behavior of these three tone types are summarized below:

(85) Williamson’s three types of tone across Ijoid:

	Mobile	Spreads	Docked in input
Pre-linked T :	N	N	Y (syllable)
Domain ① :	N	Y	Y (tone group)
Floating ② :	Y	N	N

Williamson proposes that these three types combine to form five tone classes across Ijoid, which she variably labels with Roman numerals (W65)<sup>13</sup>, common (Western Arabic) numerals (W&T83), and finally

<sup>13</sup> In Williamson (1965), the roman numerals contrasted with the use of regular numerals which were used to classify the tonal behavior of grammatical items.

letters (W88). This is summarized in Table 21. Note that the letter conventions in W88 and the ones used in this paper are different, and not meant to line up.

This work:			W88 representation					
Class	Representation	Cf.	W65	W&T83	W88	Pre-linked T	Domain (t)	Floating (T)
A	/L <sup>Ⓛ</sup> Ⓜ/		I	1	C		Ⓛ	ⓁⓂⓂ
B	/H <sup>Ⓜ</sup> / & /L <sup>Ⓜ</sup> /		II	2	A		Ⓜ	
C	/...L <sup>Ⓛ</sup> / & /...H <sup>Ⓜ</sup> /		IV	4	D	...(H)...		
D1/D3	/H <sup>Ⓜ</sup> Ⓛ/		III	3	B		Ⓜ	Ⓜ
D2	/L <sup>Ⓜ</sup> Ⓛ/		V	5	E		Ⓛ	Ⓜ

Table 21: Tone class equivalences compared to work of Kay Williamson

Williamson proposes a complex grammar based on these tone classes, coupled with multiple phonological cycles interacting with default tone. A full comparison between her analysis and the one in this paper would be too lengthy to include here. The interested reader should compare the analyses directly.

#### 7.4 A4: Data collection and supplemental materials

The Gbarain data in this paper were collected in the summers of 2017 and 2019, in Port Harcourt and Ibadan, Nigeria. All data comes from one proficient speaker named [*name*], from the Gbarain Izon community Okolobiri [òkólóbìrì] in Bayelsa State (approximately 5°02'N 6°19'E). He is highly proficient in Izon and uses it frequently with family and fellow Izon people. Recordings were made with a Tascam DR-100MKII recording with an Audio-Technica AT803B omnidirectional lapel microphone. Due to environmental factors, sound quality varies by session. Recording sessions were transcribed using a Livescribe Echo smartpen, which aligns a set of recordings with the transcribed notes.

The primary goal of the fieldwork was to exhaustively document Izon grammatical tone patterns, based against hypotheses drawn from previous analysis of Izon tone, in particular on Kolokuma Izon (Williamson 1965, 1988, Williamson & Timitimi 1983) and on Bumo Izon (Efere 2001). The most effective way to complete this was through careful elicitation of particular words in isolation and in a set of carrier contexts designed to determine multi-word tonal effects. Due to the exhaustive (and exhausting) nature of this work, consultant choice was of utmost importance. The consultant was selected due to his fluency in the language, his ability to focus on subtle prosodic differences, and his consistency in replicating tone patterns across different recording sessions. Widespread dialectal differences in tone made working with multiple consultants simultaneously difficult. Sustained and widespread unrest in the Niger Delta made it unfeasible to reside in the indigenous Izon area to collect data. All recordings were made in Port Harcourt and Ibadan, large Nigerian cities.

All Gbarain data points in this paper are found in the supplemental materials files. The primary data on Izon has been archived at the [*Anonymous Archive*], collection number [*Anonymous Collection*]. This includes the original recordings (.wav format), copies of the original notes, as well as these notes aligned with the recording as made by the Livescribe Echo smartpen (non-.wav format). The Gbarain and Kolokuma databases from which the frequency counts were made are included in the supplemental materials.