RUPKATHA JOURNAL
ON INTERDISCIPLINARY STUDIES IN HUMANITIES
ISSN 0975-2935

Understanding the Ùrhòbò Tonal Structure through Constraint-Based Framework

INTERACTIVE ARTICLE COVER

About the Journal

Journal DOI	**https://doi.org/10.21659/rupkatha**
Journal Home	**www.rupkatha.com**
Indexed in	**Web of Science Core Collection™ Emerging Sources Citation Index (ESCI)**
Journal Impact Factor (JIF)™	**2022: 0.2 | 5 year: 0.2** *Source:* Journal Citation Reports™ 2023

About the Issue

Issue	**Volume 15, Number 2, 2023**
Issue DOI	https://doi.org/10.21659/rupkatha.v15n2
TOC	https://rupkatha.com/v15n2.php

About the Article

Title	**Understanding the Ùrhòbò Tonal Structure through Constraint-Based Framework**
Author/s	**Don Chukwuemeka Utulu[1], Emuobonuvie Maria Ajiboye[2], Irene Eloho Edojaimoni[3]**
Affiliation	[1,2,3] Delta State University, Abraka, Nigeria
ORCID IDs	[1]0000-0002-4908-1839 and [2]0000-0002-4908-1839
Article DOI	**https://doi.org/10.21659/rupkatha.v15n2.02** **Pages:** 1-24
Abstract	https://rupkatha.com/v15n202
Full-text PDF	https://rupkatha.com/V15/n2/v15n202.pdf
Article History	**Submitted 11 Nov 22, modified 27 May 2023, accepted 28 May 2023, first published 01 June 2023**
Article Impact	**Check Dynamic Impact**
Copyright	*Authors*
Licensing	Creative Commons Attribution Non-Commercial 4.0

Understanding the Ùrhòbò Tonal Structure through Constraint-Based Framework

Don Chukwuemeka Utulu[1], Emuobonuvie Maria Ajiboye[2], Irene Eloho Edojaimoni[3]

[1]Senior Lecturer, Department of Linguistics, Faculty of Arts, Delta State University, Abraka. Email: dcutulu@delsu.edu.ng

[2]Lecturer, Department of Linguistics, Faculty of Arts, Delta State University, Abraka. Email: ajiboye@delsu.edu.ng

[3]Graduate Assistant, Department of Linguistics, Faculty of Arts, Delta State University, Abraka. Email: edojaimoni@delsu.edu.ng

Abstract

Ùrhòbò is a southwest Edoid language spoken in southern Nigeria. Its tonal patterns have been studied, but from a descriptive perspective, which, from a theoretical standpoint, potentially limits the understanding that tonal deviations from underlying forms are essentially due to resolutions of conflicts between some competing constraints. This study adopts the Optimality Theory (OT) to reveal the competing universal constraints: IDENT-T, MAX-T; NoFUSION; LINEARITY; DISASSOC; ALIGN-R CONTOUR; OCP; SPECIFY-T; *FLOAT; and NoCONTOUR. The study shows that these constraints crucially govern the Urhobo tonal patterns such as (i) downstep; (ii) single multiply-linked high (H) tone; (iii) single multiply-linked low (L) tone; (iv) boundary H.H and L.L tones fusion; (v); H-tone preservation; (vi) LH-tone preservation; (vii) floating H tone; and, (viii) final HL contour tone. Moreover, it highlights two Ùrhòbò-specific tonal alternations listed in (v) and (vi), which exhibit preservation of H and LH tones at the expense of L tone, post-lexically. Consequently, it proposes four markedness constraints NoH.L-T, NoL.H-T, NoH.LH-T, and NoL. to explain the preservation effects. Our findings support phonologists' view that, crosslinguistically, universal (and language-specific) constraints are those that motivate tonal deviations from input forms in tone languages, and that minimally marked tonal outputs are the result of markedness dominance over faithfulness.

Keywords: Downstep, Fusion, H-tone preservation, OT constraints, Ùrhòbò

1. Introduction

The well-attested multi-dimensional behaviour of tone, particularly the divergent patterns exhibited by tone languages, generally African tone languages, were not fully understood not until after the mid-70s, when the non-linear theory came on board. The first theory, Autosegmental Phonology (AP), proposes the concept of "autonomy" to show that tone, though mapped on a host segment, exists independently of it, based on the observation of a wide range of data that it (tone), among other representations, can migrate from its original source to another, or more so *spread* to surrounding segments within the word (Leben 1973, Goldsmith 1976, 1990, Clements & Ford 1979, McCarthy 1986, 1999, Odden 1986, Yip 2002). The second theory, Optimality Theory (OT), which is a constraint-based model, proposes varying universal constraints to show that tonal deviations from the underlying forms, such as OCP-induced tone deletion, downstep, single-multiply-linked tone to several syllables, etc., are the effects of the universal (optimality) constraints, (Bickmore 1996, Pulleyblank 1997, Myers 1997, Cassimjee & Kisseberth 1998, Yip 2002, among others), based on the theoretical constructs of Prince and Smolensky (1993).

The extreme behaviour of tone by way of *movement*, *spread*, *floating*, *segmentalisation*, *contraction*, *deletion*, to mention but a few, had long been recognised by linguists, thus paving way for a robust account of the tonal alternations in the orientation of the structuralists/descriptivists (e.g., Firth 1948, Pike 1948, Winston 1960, Armstrong 1968, Schachter & Fromkin 1968, Welmers 1969, 1973, Hyman and Schuh 1974, Hyman 1979, Emenanjo 1976, Elimelech 1976, Clements 1979, Chumbow 1982, Williamson 1986, among many others). However, with the adoption of the theoretical machineries of AP and OT, the characteristics of tone in (West) African languages (and, indeed, those of Asian languages) could well be understood. However, research reports have shed light on more attested striking cases, which are yet to be explored, specifically, from a nonlinear perspective. A case in point is the exceptional case of /L.H/, /H.L/ and /L.LH/ simplification as [H] in Urhobo, which will be one of the striking patterns that will tackled in this study.

In the present study, we explore the characteristics of the Ùrhòbò (Southwestern Edoid: West Benue-Congo, southern Nigeria) tone system via the OT. Specifically, we examine some of the Urhobo tonal patterns explored in the literature, but were earlier accounted for from the descriptive perspective (e.g., Aziza 1994, 1997, 2001, 2003, 2007, 2008, and 2010). Though the descriptive studies are quite robust, given the scope of the data, they are limited in some way; they do not advance the understanding of the set of universal (as well as Ùrhòbò-specific) constraints that enforce the tonal changes from the underlying forms in the first place. In order to reveal the constraints, we attempt to explore: (i) ***downstep***; (ii) ***consecutive high (H) tones,* i.e., '*single multiply-linked H tone*'**; (iii) ***successive low (L) tones,*** i.e., '***single multiply-linked L tone***'; (iv) ***boundary H.H and L.L tone fusion***; (v) ***H-tone preservation***; (vi) ***LH-tone preservation***; (vii) ***floating H tone***; and, (viii) ***final falling tone***. We explore the active competing constraints that regulate the well-formedness of the tone structure of the language, which, before now, were not known or understood. We account for the tonal changes by complementing the OT with the representational model of AP. In the analysis, we will show that the interactions of the following competing universal constraints: faithfulness constraints (IDENT-T, MAX-T, DIASSOC, NoFUSION, LINEARITY, ALIGN-R CONTOUR), and markedness constraints (OCP, *FLOAT, SPECIFY-T, NoCONTOUR) account for the attested tonal alternations. In addition, we will advance four Ùrhòbò-specific markedness constraints (NoL.H-T, NoH.L-T, NoH.HL-T, NoL.) to explain the exceptional case of grammatical L tone-deletion at the expense of both the H tone and LH contour tone.

2. Ùrhòbò tone system: a brief overview

Ùrhòbò is a register tone language with three level tones (Aziza 1997). It has two contrasting levels, the H and L tones, plus a level tone known as downstep (Ds), symbolised with an exclamation mark (ꜝH). Due to the restrictive behaviour of the downstep (see also Ajiboye 2014), Ùrhòbò belongs to a group of tone languages referred to as "two-tone languages" (Aziza 1997, 2003, 2007, 2010). Accordingly, the classification differentiates Urhobo from those labeled, "three-tone languages" such as Yoruba, Ebira, Nupe, etc., which operate three contrasting levels H, M(id) and L. In addition to the Ùrhòbò two levels and the downstep, there are two contour tones, the rising tone/LH (ˇ) and falling tone/HL (ˆ). The domain of assignment of the tones is the syllable. Only vowels are the tone bearing units (TBUs) in the language. Functionally, the use of these pitch melodies characteristically expresses a variety of lexical and grammatical information, which are briefly discussed below.

2.1 High and low tones

In distributional terms, the H and L tones occur in any syllable position within the word and morpheme (Aziza 1997). The two levels mark lexical meaning, as the forms in (1) illustrate:

(1)

a. /ùsì/ (L L) 'line'
   /ùsí/ (L H) 'starch'

b. /ùkpè/ (L L) 'year'
   /úkpè/ (H L) 'bed'

c. /ènì/ (L L) 'elephant'
   /èní/ (L H) 'head-pad'

d. /ɔ̀hɔ́/ (L H) 'sense'
   /ɔ́hꜜɔ́/ (H Ds H) 'chicken'

As (1a-d) indicates, the H and L tones alternate to define the semantic composition of the words that form minimal pairs.

2.2 Downstep

An interesting feature of the Ùrhòbò two-tone system, as mentioned in the foregoing, is downstep. The phenomenon has been extensively explored in the literature, in a wide range of African languages, but see particularly Clements and Ford (1979). Based on its natural patterning, downstep has been viewed as a covert (floating), unspecified L tone, having a progressive lowering effect on the second of two successive H tones specified for, typically, two-syllable words. The lowering effect characteristically creates an auditory impression of the M tone likened to that found in three tone languages (Welmers 1969, Aziza 1997, 2003), in which Yoruba is a good example. Ùrhòbò has two types of downstep based on their phonological behaviour. They are *non-automatic downstep* and *automatic downstep*. Our description of downstep in the foregoing relates to the former type. However, both the former and the latter types are fully discussed and illustrated below.

2.2.1 The Ùrhòbò nonautomatic downstep

Nonautomatic downstep is a type of tone in which disyllabic words at the lexical domain, and those found at the right edge of constructions are specified with two consecutive H tones, but the pitch of the second H, as we mentioned in the forgoing, surfaces with a relatively lower pitch resembling that of a mid-tone. It has been suggested (e.g., Clements and Ford 1979, Liberman et al 1993, Odden 1995) that its perceived relatively lower pitch is caused by *spread* of the pitch of a preceding underlying covert (floating) L tone. It is this floating L tone that is called nonautomatic downstep. In Ùrhòbò, it is normally found in some disyllabic nouns with successive Hs. The nominals in (2) illustrate the tonal phenomenon:

(2)

a. /í ꜝ ɣó/ [¯ _ -] (H DsH) ‘money’

b. /ɔ́ ꜝ gɔ́/ [¯ _ -] (H DsH) ‘in-law’

C /èwẽ́ ꜝrí/ [_ ¯ -] (L H DsH) ‘monkey’

As (2) demonstrates, in each case, the final H tones become downstepped by a floating L tone, which causes a lowering effect that leads to the use of the term ‘nonautomatic downstep’ in the tonal literature.

2.2.2 The Ùrhòbò automatic downstep

Automatic downstep, also known as *downdrift*, is a kind of tonal phenomenon involving the lowering of H tone by a ‘seen’ i.e., an overt L tone. This kind of downstep is attested in both the two-tone languages and three-tone languages. Its domain of operation is in longer utterances like phrases, clauses or sentences. Following the evidence of downdrift in Ùrhòbò, as Aziza (1997, 2003) shows, the forms in (3) exemplify the phenomenon:

(3)

a. /ɔ́kà wɛ̃́/ → [ɔ́kàw**ɛ̃́**] [¯ _ -] (H L **H**) ‘your maize’
‘maize’ ‘your’

b. /úkpɛ̀ ɔ̀mɛ́/ → [úkpɛ̀m**ɛ̃́**] [¯ _ -] (H L **H**) ‘my bed’
‘bed’ ‘my, mine’

c. /èɾù ótèté/ → [èɾw**ó**tèt**é**] [_ ¯ _ -] (L **H** L **H)** ‘a small cap’
‘cap’ ‘small’

The surface H tones (in bold print), coming after the covert L tone, are said to be downstepped, that is, lowered in pitch (when compared with those preceding the L tone). The lowering is due to the influence of the preceding L tones, an effect that yields downdrift. Evidence of downdrift as the data in (3) depict validates the view that Ùrhòbò, apart from being a register tone language, is a terraced tone language.

2.2.3 Contour tones

As we mentioned earlier, Ùrhòbò has two contour tones, the rising tone/LH and the falling tone/HL. The two contour tones are derived from the H and L level tones. They bear strong grammatical load, conveying certain syntactic information, which define the numerical system, certain locatives and interrogative constructions. In some instances, the contours signal tense and certain adverbials (Aziza 2003), as well as habitual/aspect and continuous markers (see Ajiboye 2022). On this basis, Ùrhòbò, in some respects, differs from some Nigerian languages, like central Igbo, Ewulu-Igbo, etc., whose contour tones are purely phonetic, lacking grammatical function. For example, in Ewulu and Igbo, the gliding tones are characteristically formed from a combination of two underlying H and L, or L and H level tone sequences due to the operations of two segmental rules: vowel deletion and glide formation rules. Respectively, the rules may delete and de-syllabify a tone-bearing unit, whose stranded tone subsequently reassociates with that of a neighbouring TBU (Ezenwafor 2014, Utulu 2022). The environments for the occurrence of Ùrhòbò contour-tone formation are shown in (4a-c), as follows:

(4) Ùrhòbò contour tones

(a) Rising tone as marker of numerals

i.	/ǐvɛ̀/	→	[ǐvɛ̀]	'two'
ii.	/ěrà/	→	[ěrà]	'three'

b. Rising tone as marker of present/habitual tense

i.	/ɔ̌-dɛ̀-ɔ̀nɛ́/	→	[ɔ̌dɔ̀nɛ]	'he/she buys/is buying yams'
Ii	/ɔ̌-dɛ̀-ɔ̀nɛ́/	→	[ɔ̌dɔ̀nɛɛ̃]	'he/she doesn't buy yam
iii.	/mǐ ʒí síɛ̀/	→	[mǐ ʒí sjɛ̀]	'I am still pulling/writing'
iv.	/wǒ ʒí ʋìɛ̃̀/	→	[wǒ ʒí ʋjɛ̃̀]	'You are still having babies'

c. Falling tone as marker of interrogatives (Note: AM =associative marker, H tone)

i.	/úkó + ɾɛ́ + ɔ́gbá + ɾɛ́ + ìtìv**ɔ́**/ 'cup' AM 'warlord' AM 'where'	→	[úkó ɾɔ́gbá ɾítìv**ɔ̂**] 'a cup belonging to a warlord from where?'
Ii	/íɣo̅ + ɾɛ́ + ɔ́gɔ̄ + ɔ̀v**ɔ́**/ 'money AM 'in-law' 'which'	→	[íɣo̅ɾɔ́gɔ̄v**ɔ̂**] 'which in-law's money?'
iii.	/ɔ̀ + dɛ̀ + ´ ɔ̀n**ɛ́**/ 's/he' 'buy' 'past' 'yam'	→	[ɔ̀dɔ́n**ɛ̂**] 'did s/he buy yam?'

As (4) indicates, it is evident that the Ùrhòbò contours convey grammatical information. However, it should be noted that the LH contour tone appears to be more prolific than its HL contour tone counterpart, given the frequency of its occurrence in the data available to us in this study.

3. Theoretical framework

3.1 Optimality theory

This work adopts the standard Optimality Theory proposed by Prince and Smolensky (1993) to do an analysis of the Ùrhòbò tonal alternations previously examined from a descriptive perspective. We adopt the OT to account for the tonal phenomena because we assume they are regulated by resolutions of conflicts between: (i) the Faithfulness constraints; and (ii), Markedness constraints (including the currently proposed Markedness constraints). In the following sub-Sections, we give a brief overview of how the two OT constraints influence the language's tonal patterns.

3.1.1 Faithfulness constraints

Universal Grammar (UG) incorporates a set of constraints known as Faithfulness Constraints (F-CONs) (Prince and Smolensky 1993, McCarthy and Prince 1993, Kager 1999, Yip 2002). These CONs require that output/phonetic forms *preserve* the properties of their basic forms (i.e., lexical forms).

This requirement ensures that properties of the output forms and input forms are similar. By this requirement, the output *must* preserve *all* segments or featural values present in the input. By implication, in the Ùrhòbò tonal representation, for example, the native input **/í ꜝ ɣó/ (<ígho̅>)** 'money', with H Ds H sequence, must have an output form **[í ꜝ ɣó]**, a fact that depicts output preservation of the tonal quality of the input. Tonal structures other than **[í ꜝ ɣó]**, such as [**íɣó]** or **[ɣó]** indicate that 'faithfulness' to input is lacking or violated, as both of them lack downstep. Thus, in the evaluation of the three candidates, the latter two cannot win the competition. Moreover, the notion, "faithfulness" functions in the tonal grammar by ensuring that 'deletion', 'insertion' or alteration of phonological/tonal elements (like the latter two output forms above) is prohibited in representations. This is because the removal, or introduction, or modification of an element(s) enforces *changes* rather than *preservation* of structures/features. So, all that F-CONs do is to ensure that an output form "must" match its input in order to express contrasts inherent in the semantic component of the tonal grammar of the Ùrhòbò language.

3.1.2 Markedness constraints

Like F-CONs, Markedness Constraints (M-CONs) is part of UG, which is central to the tenets of the OT model. It particularly expresses *marked* versus *unmarked* patterns, with specific aspect of it originating from the ranking of a set of constraints. The issue of ranking of a set of constraints arises because, language(s), by their very nature, do have marked (irregular) types of structures which diverge from input forms. The main function of M-CONs is to evaluate output representations. For instance, the tone structure of Ùrhòbò, illustrated in the preceding Section, potentially helps us understand how M-CONs concede to **[í ꜝɣó],** the "faithful" output of the input **/í ꜝɣó/**, so that other possible set of candidates, like [**íɣó]** and **[ɣó]**, are evaluated by EVAL for a given ranking of constraints. In principle, regardless of the *pressure* exacted on F-CON by M-CON, OT *must* select [í !ɣó] as the optimal candidate at the expense of [íɣó] and [ɣó], based on the ranking of a F-CON labelled IDENT-T over a M-CON tagged *FLOAT (anti-floating tone constraint). This is because, in Ùrhòbò, the lexico-semantic feedback of the word 'money' *must* be specified with the floating L tone (the downstep) between two Hs, otherwise the item stands the chance of losing its denotative meaning.

Against this backdrop, of the three output forms, [í ꜝɣó], [íɣó] and [ɣó], the first output will be considered the optimal form as opposed to the latter two competing outputs. Its *optimality*, so to speak, is computed by the ranking of IDENT-T over *FLOAT (*IDENT-T>>*FLOAT*). To oversimplify the ranking, the undominated IDENT-T (a F-CON) sanctions the well-formedness of [í ꜝɣó], the *phonosemantic* feedback of the Ùrhòbò word for 'money', which the other two candidates fatally violate. A deeper knowledge of why, in Ùrhòbò, no forms are better outputs for 'money' other than [í ꜝɣó] will be missing, if we merely accounted for the Ùrhòbò nonautomatic downstep on the basis of observational and descriptive adequacy without recourse to the active U-CONs (or the Urhobo-specific CONs) that regulate the tonal structure of the language. Essentially, the ranking of the possible output forms in Ùrhòbò (like any other language) from the OT perspective is typically captured in a 'Tableau'. A Tableau is a kind of table in which CONs are hierarchically arranged in a linear order, and the possible outputs listed for evaluation by EVAL for a given ranking of the relevant CONs.

In this study, we will use the OT Tableau for analysis of the Ùrhòbò tonal patterns, as Section 5 depicts. The patterns are (i) downstep; (ii) single multiply-linked high (H) tone; (iii) single multiply-linked low (L) tone; (iv) boundary H.H and L.L tones fusion; (v); H-tone preservation; (vi) LH contour tone preservation; (vii) floating H tone; and, (viii) final falling tone. To explain the patterns, we will employ the following relevant constraints, (a) F-CONs: (IDENT-T, MAX-T, DISASSOC, NoFUSION, LINEARITY, ALIGN-R CONTOUR); (b) M-CONs: (OCP, *FLOAT, SPECIFY-T, NoCONTOUR); and (c) Ùrhòbò-specific M-CONs: NoL.H-T, NoH.L-T, NoH.HL-T and NoL. These relevant CONs interact with one another to underscore the Ùrhòbò tonal patterns. They are listed and defined in (5) as follows:

(5)

Faithfulness constraints

IDENT-T	Correspondent (i.e., input-output) tones are the same.
MAX-T	No deletion of tones.
NoFUSION	Separate underlying tones must stay separate.
LINEARITY	Preserve underlying linear order.
DISASSCOC	No removal of association lines.
ALIGN-R CONTOUR	Contour tones should align with the right edge of the domain.

Markedness constraints

OCP	Adjacent identical tones are prohibited.
SPECIFY-T	A tone bearing unit (vowel) must be associated with a tone.
*FLOAT	A tone must be associated with a TBU (no floating of tone).
NoCONTOUR	A TBU may be associated with at most one tone.

The proposed markedness constraints in this study

**	NoH.L-T	Heterosyllabic/heteromorphemic H.L tone sequence is prohibited.
**	NoL.H-T	Heterosyllabic/heteromorphemic L.H tone sequence is prohibited.
**	NoH.LH-T	Heteromorphemic H-plus-rising tone sequence is prohibited.
***	NoL.	Juncture L tone preceding a rising (LH) tone is not allowed.

** We propose these Ùrhòbò-specific markedness constraints because they account for the language's dispreference for heterosyllabic/heteromorphemic /H.L/, /L.H/ tone sequences, in which the left-edge juncture H-tone is *consistently preserved* at the expense of the juncture L-tone, regardless of the loss of the H-tone TBU and its *direction* to the L-tone, see the forms in (18 & 19), (20 & 21) and (22 & 23).

*** This language-particular constraint is also visibly active in the Ùrhòbò tone system. We propose it in this work to account for Ùrhòbò preference for right-edge juncture LH contour tone, which is typically preserved at the expense of the left-edge juncture L-tone, that is, /L.LH/ sequence. The patterning is the reason the L-tone deletes at the expense of the rising tone, see the forms in (24b & 26).

4. Method

4.1 Data

The data set for this study were taken from previous works carried out by Aziza (1994, 1997, 2001, 2003, 2007, 2008 and 2010) on the Urhobo tone structure. Additional data set were gathered from works that account for attested segmental processes and grammatical structures in Urhobo. The data exhibited the following tonal patterns: (i) downstep; (ii) single multiply-linked high (H) tone; (iii) single multiply-linked low (L) tone; (iv) boundary H.H and L.L tones fusion; (v); H-tone preservation; (vi) LH-tone preservation; (vii) floating H tone; and, (viii) final falling (HL) tone. They were analysed using the theoretical machinery of the OT-cum-Association Conventions of the AP.

4.2 Analytical procedure

The basic and output forms of the Ùrhòbò lexical and postlexical tones were observed. Using the OT, GEN (generator) created a set of potential tonal outputs of the Ùrhòbò tonal grammar. EVAL (evaluation) then selected the optimal candidate from some output forms based on a set of relevant UG CONs and Urhobo-specific markedness CONs that was hierarchically ranked. With the constraint-based analysis, first, our understanding that constraints (whether faithfulness or markedness) may *conflict* or be *violable* was advanced; second, we could show that one of several candidates ultimately won the competition because it satisfied the higher-ranked constraint, regardless of whether it minimally violated some higher-/lower-ranked constraints or not; and third, we could show that all non-optimal candidates ultimately incurred fatal violation of a higher-ranked constraint and, therefore, conceded the winning status to the optimal candidate. With the analytical procedure, we were, therefore, able to establish the set of universal and language-specific constraints that govern the tonal patterns of the Ùrhòbò language, which before now was unknown.

5. Data presentation and Analysis

5.1 Downstep

As we illustrated in (2), the data in (6) further exemplify Ùrhòbò lexical downstep.

(6)

a.	/é ` gɔ́/	→	[é !gɔ]	‘in-laws’
b.	/í ` bró/	→	[í! bró]	‘halves’
c.	/ɔ́ ` sɛ́/	→	[ɔ́! sɛ]	‘father’
d.	/óré ` ré/	→	[óré !ré]	‘town, city’
e.	/úkó ` kó/	→	[úkó !kó]	‘association, meeting’
f.	/ùkú ` tá/	→	[ùkú !tá]	‘stone’

As can be seen in (6), there is an intervening covert L tone, that is, a floating L tone, which has a progressive assimilatory effect on the final H, leading to downstep. Below, we appeal to the OT in conjunction with the association conventions of the AP to explain the data (6a), which is the exemplar of (6b-f) in the tableau in (7), as follows:

Ùrhòbò lexical downstep:

IDENT-T>>MAX-T, *FLOAT, OCP

(7)	/é ` g ɔ́/ | | H(L) H	IDENT-T	MAX-T	*FLOAT	OCP
a. ☞	[é ` g ɔ́] | | H (L) H			*	
b.	[é g ɔ́] | | H H	*!			*
c.	[g ɔ́] | H	*!	*		

The hierarchical ranking of IDENT-T over MAX-T, *FLOAT, OCP by the Ùrhòbò tonal grammar in (7), selects the candidate (a) as the optimal output. Its mapping on the input form satisfies the higher-ranked constraint IDENT-T. The ranking explains that downstep in Ùrhòbò is faithful to input structure. Because structures other than the candidate (a) are not allowed in Ùrhòbò, such as the candidate (b) and candidate (c), both of them are consequently ruled out. They, in fact, violate the higher-ranked constraint, IDENT-T, as their tone pattern structure does not *correspond* with that of the input. Besides, an important aspect of the OT analysis in (7) is the violation of the lower-ranked OCP. In this case, candidate (b) violates the OCP constraint, which requires that consecutive tones must be distinct. The intervention of the covert L tone between two Hs in candidate (a), and the elision of the initial H-toned syllable in candidate (c), salvage them from incurring OCP violation.

5.2 Consecutive high tones and low tones

5.2.1 Consecutive high tones as single multiply-linked high tone

As it is the case in several tone languages, Ùrhòbò exhibits a tonal pattern whereby two or more syllables within the word/morpheme (or longer utterances, as the case may be) are individually mapped with the H tone. Such consecutive Hs are presented in (8a, i-ix), as follows:

(8)

(a) Word-based consecutive Hs

i. /ágádá/ → [ágádá] 'matchet'

ii. /éhóhó/ → [éhóhó] 'a hidden corner'

iii. /ɔ̋fúáfò/ → [ɔ̋fwáfò] 'white (ones)'

iv. /ígrógrȍ/ → [ígrógrȍ] 'long ones'

vi. /óbúébù/ → [óbwébȕ] 'much, plenty'

(b) Clausal consecutive Hs

i. /séré/ → [séré] 'read PST it'

ii. /síró/ → [síró] 'wrote it'

iii /kóró/ → [kóró] 'sewed it'
iv. /múró/ → [mṹró] 'carried it'
v. /ʃɛ́ɾɛ́/ → [ʃɛ́ɾɛ] 'sold it'
vi. /gɔ́ɾɔ́/ → [gɔ́ɾɔ] 'worshipped it'
vii. /sóɾɔ́/ → [sóɾɔ] 'sang it'
viii /táɾɔ́/ → [táɾɔ] 'said it'
ix /ɾéɾɔ́/ → [ɾéɾɔ] 'ate it'

The examples (8a) and (8b) exhibit sequences of identical tones, that is, repetition of H on consecutive syllables. Following Leben (1973), Goldsmith (1976), such duplication of Hs in (8a) and (b) violates the OCP, a constraint which prohibits adjacent identical tones. However, if we assume that the OCP is a primitive of AP (McCarthy 1986, 1988), and that the H.H, H.H.H sequences are simply multiply-linked H tone, the occurrence of successive Hs in the grammar can then be simplified as a singleton H tone, as long as the OCP violations are avoided. This assumption will then explain the OT treatment of (8a & b) in (9) and (10) respectively, adopting the exemplar forms in (8a, i) and (8b, i), as follows:

OCP-triggered single multiply-linked H tone:
OCP>>MAX-T, SPECIFY, IDENT-T

(9)	/agada/ H H H	OCP	MAX-T	SPECIFY	IDENT-T
a.	[agada] H H H	*!		*	
b. ☞	[agada] H		*		*
c.	[agada] H		*!	*	*

With our OT-AP analytical approach above, (9) explicates the Ùrhòbò avoidance of repetition of Hs phonetically by ranking OCP higher than MAX-T and IDENT-T. The language does so by conceding the anti-tone deletion constraint (MAX-T) to "spreading" via SPECIFY, as long as the OCP remains unviolated. The result of these treatments of Hs as H allows the candidate (b) to become the most harmonic output form, since candidate (a) and (c) fatally violate SPECIFY that strengthens the hierarchical ranking of the OCP that sanctions single multiply-linked H tone but prohibits H.H and H.H.H tone sequences.

In view of the ranking in (9), the same analytical procedure-cum-constraint ranking will account for the form in (8b, i), and others in the series, as (10) depicts:

OCP-triggered single multiply-linked H tone:
OCP>>MAX-T, SPECIFY, IDENT-T

(10)	/sere/	OCP	MAX-T	SPECIFY	IDENT-T

	H H				
a.	[sere] | | H H	*!		*	
b. ☞	[sere] \/ H		*		*
c.	[sere] | H		*!	*	*

Here, candidate (a) violates the OCP, since consecutive identical tones must not be mapped on multiple syllables. Candidate (b) satisfies this constraint by the *spreading* of a single H tone to adjacent syllable(s), thus according it the winning status. Though candidate (c) satisfies the higher-ranked constraint OCP, it fatally violates the anti-deletion constraint MAX-T for deleting the second H tone present in the input.

5.2.2 Consecutive low tones as single multiply-linked low tone

Like the H tone, the L tone is repeatedly mapped on two or more syllables within the word and constructions, such as in noun phrases/clauses, or compounds formed from verb-noun combination. The duplication of the L tone at the lexical and postlexical domains is illustrated in (11a) and (11b), respectively as follows:

(11)

(a) Word-based consecutive Ls

i.	/ɔ̀nà/	→	[ɔ̀nȁ]	'this (one)'
ii.	/ɔ̀jè/	→	[ɔ̀jè]	'that (one)'
iii.	/ùkpè/	→	[ùkpè]	'year'
iv.	/ìwȅʊ̏ì/	→	[ìwȅʊ̏ì]	'houses'
v.	/òdìbò/	→	[òdìbò]	'servant, slave'
vi.	/òhɔ̀rè/	→	[òhɔ̀rè]	'neck'

(b) Postlexical (noun phrases/clause & compounds) consecutive Ls

i.	/ɔ̀nànà/	→	[ɔ̀nȁnȁ]	'this one'
ii.	/ɔ̀jènà/	→	[ɔ̀jènȁ]	'that one'
iii.	/ènànà + ìwȅʊ̏ì/ 'this one' 'houses'	→	[ènànȉwȅʊ̏ì]	'these are houses'
iv.	/kàrè + òkɔ̀/ 'carve' 'boat'	→	[ɔ̀kàròkɔ̀]	'wood pecker'
v.	/sì + ɔ̀bè/ 'write' 'book'	→	[òsjɔ̀bè]	'secretary, writer'
vi.	/sȕ + ìgòdɛ̀/ 'lead' 'sheep'	→	[òswìgòdɛ̀]	'shepherd'

On the assumption that, like the repeated Hs, successive Ls violate the OCP, we assume that the successive Ls are a single multiply-linked tone. Consequently, the constraint ranking for the forms in (11) will be that in (12) and (13), following the constraint ranking for (8) in (9) and (10), adopting the forms in (11a, i) and (11b, iii):

OCP-triggered surface single multiply-linked H tone:
OCP>>MAX-T, SPECIFY, IDENT-T

(12)	/ɔna/ L L	OCP	MAX-T	SPECIFY	IDENT-T
a.	[ɔna] L L	*!		*	
b. ☞	[ɔna] L (multiply-linked)		*		*
c.	[ɔna] L		*!	*	*

In (12), candidate (b) which exhibits surface single multiply-linked H tone is the winning candidate. This is because it satisfies the higher-ranked constraint, OCP. The same constraint ranking will account for the form in (11b, iii), analysed in (13):

OCP-triggered surface single multiply-linked H tone:
OCP>>MAX-T, SPECIFY, IDENT-T

(13)	/enan**a** **i**weʋ̃i/ L L L L L L	OCP	MAX-T	SPECIFY	IDENT-T
a.	[enan**a** iweʋ̃i] L L L L L L	*!		*	
b. ☞	[enan**i**weʋ̃i] L (multiply-linked)		*		*
c.	[enan**i**weʋ̃i] L		*!	*	*

In (9), (10), (12) and (13), we have shown how M-CON dominates F-CON, unlike in (7) in which the latter constraint is undominated. Importantly, we want to argue here that these constraints are those which regulate the Ùrhòbò tonal patterns explored above. Below, we proceed to explore more tonal alternations and show how constraint interactions influence their individual optimal output.

5.3 Tone Fusion: High-high tones fusion and low-low tones fusion

5.3.1 High-high tones fusion

The data explored in Aziza (2007) showcase the occurrence of surface fusion of two consecutive H tones in words and constructions. The fusion of two successive Hs occurs whenever hiatus-resolution-triggered vowel deletion (VD) rule elides one of the two successive host TBUs. The fusion of adjacent Hs also occurs whenever glide formation (GF) applies for the purpose of resolving the vowel hiatus. As in (8a, iv-vi), the GF rule converts one of two adjacent TBUs, i.e., a high vowel /i/ to [j] and /u/ to [w], if either high vowel is followed by another vowel. The change of the high vowel to a glide leads to the loss of its H tone. In fact, the loss or gliding of high vowels followed by another vowel is quite common with Edoid and Igboid languages. It also affects the L tone, as we will illustrate in sub-Section 5.3.2. In what seems to be sheer accident or gap, our current working data do not exemplify VD-driven H.H tones fusion, except those driven by the GF rule. Consequently, in this Section, we will only examine the GF-motivated H.H tones fusion happening in nominals and infinitives/gerunds.

5.3.1.1 Glide formation-triggered high-high tones fusion

The following data in (14) illustrate GF-triggered high tones fusion:

(14)

(a) GF-triggered heterosyllabic H.H-tone fusion at the word level

i.	/út**íɛ̃́**/	→	[út**jɛ̃**]	'orange'
ii.	/óv**íɛ́**/	→	[óv**jɛ**]	'cry (noun)'
iii.	/òf**íá**/	→	[òf**já**]	'a lie'
iv.	/áɣ**úá**/	→	[áɣ**wá**]	'bush/farm'
v.	/ɔ́f**úá**fṍ/	→	[ɔ́f**wá**fṍ]	'cloth'

(b) GF-triggered heterosyllabic/-morphemic H.H-tone fusion at the postlexical level

i.	/f**í** + **í**ɣó/ 'spray' 'money'	→	[f**jí** ꜜɣó]	'spray money'
ii.	/údꜜ**ú** + **ɔ́**gágȁ/ 'heart' 'strong'	→	[úd**wɔ́**gágȁ]	'stubborn'
Iii	/èm**íó**/	→	[èm**jó**]	'act of wringing'
iv.	/èb**íó**/	→	[èb**jó**]	'act of blackening'
v.	/èk**úó**/	→	[èk**wó**]	'act of pouring'
vi.	/èm**úó**/	→	[èm**wó**]	'act of carrying'
vii.	/ɛ̀r**íɔ́**/	→	[ɛ̀r**jɔ**]	'act of eating'

As the output forms show, all the underlying Hs mapped on /i/-turned [j] and/u-turned [w] are respectively deleted. Aziza (2007) points out that the deleted Hs are floating tones. Curiously, however, her floating-tone claim seems to conflict with the precise notion of 'floating', which relates to the 'covert' tone, typically conceived of being an unassociated L or H tone. The forms in (14) have adjacent Hs associated with their individual TBUs underlyingly. For this reason, we should not expect the disappearing Hs in (14) to be viewed as 'floating' tones, following Aziza's opinion.

But rather we should assume them as 'stranded' covert Hs, which are merely 'absorbed' (i.e., fused/merged) into neighbouring H on the surface due to the loss of their respective TBU, a phenomenon we assume here is due to the OCP effect, which prohibits the occurrence of adjacent identical tones.

Against this backdrop, we argue that (14) is simply a case of H-tone fusion, (alternatively, H-tone absorption, or H-tone contraction), triggered by the OCP. Based on this claim, we suggest that the OCP will dominate the following faithfulness constraints, NoFUSION (requiring that separate tones stay separate), IDENT-T and MAX-T. The result of this constraint ranking is shown in Tableaus (15) and (16), adopting the forms in (14a, i) and (14b, i), as follows:

OCP-triggered surface H tones fusion/absorption via GF
OCP>>NoFUSION, IDENT-T, MAX-T

(15)	/ut**iɛ**/ H H H	OCP	NoFUSION	IDENT-T	MAX-T
a. ☞	[ut**jɛ**] H		*	*	*
b.	[ut**iɛ**] HH H	*!			

In (15), candidate (a) is the optimal output despite violating more constraints. Nonetheless, the violations are minimal. For this reason, the Ùrhòbò tonal grammar accords candidate (a) the winning status for satisfying the higher-ranked constraint OCP, which candidate (b) fatally violates for allowing three consecutive Hs. The result here will advance our understanding of the constraints ranking in (16), taking the form in (14b, i), as follows:

OCP-triggered surface H tones fusion/absorption via GF:
OCP>>NoFUSION, IDENT-T, MAX-T

(16)	/f**i** **i**ɣo/ H H H	OCP	NoFUSION	IDENT-T	MAX-T
a. ☞	[f**j** **i**ɣo] H		*	*	*
b.	[f**i** **i**ɣo] H H H	*!			

Like in (15), candidate (a) is the optimal form, having sanctioned fusion required to salvage the stranded H tone of the de-syllabified TBU. In doing so, a potential repetition of adjacent identical tones which would otherwise violate the OCP is avoided. In this case, markedness unequivocally takes precedence over faithfulness.

5.3.2 Low-low tones fusion

This Section examines GF-induced tone fusion that affects successive Ls.

5.3.2.1 Glide formation-driven low-low tones fusion

The following data in (17) illustrate GF-motivated L.L tones fusion, where, like in (14), all stranded Ls *contract* or *merge* with a following L tone due to the conversion of their [+high] TBUs to glides [j] or [w]. The pattern is as follows:

(17)

(a) GF-triggered L.L-tones fusion at the word level

i.	/òv**ìè**/	→	[òv**jè**]	'king'
ii.	/b**ìè**bí/	→	[b**jè**bí]	'blackish'
iii.	/òs**ìò**/	→	[òs**jò**]	'rain'
iv.	/g**ùè**g**ùè**/	→	[g**wè**g**wè**]	'frighten'
v.	/ùb**ùȅ**/	→	[ùb**wȅ**]	'dust'
vi.	/f**ùó**fṍ/	→	[f**wó**fṍ]	'whitish'

(b) post-lexical L.L-tone fusion

i.	/m**ì** + **à**ŋmá/ 'wring' 'cloth'	→	[m**jà**ŋma□]	'wring a cloth'
ii.	/s**ì** + **ɛ̀**tȍ/ 'pull' 'hair'	→	[s**jɛ̀**tȍ]	'pull hair'
iii	/ùwȅʋ**ì** + **ɔ̀**vò/ 'one' 'house'	→	[ùwȅʋ**jɔ̀**vò]	'one/a house
iv.	/èv**ȕ** + **ɔ̀**vò/ 'stomach' 'one'	→	[èv**wɔ̀**vò]	'oneness'
v.	/f**ȕ** + **ò**tá/ 'stop' 'word'	→	[f**w̃ȍ**tá]	'stop word, silence'

Given the congruent tonal pattern in (14a & b) and (17a & b), in terms of the occurrence of two successive identical tones, H.H and L.L tones, the same OT constraints militating against adjacent identical Hs in (15) and (16), i.e., OCP>>NoFUSION, IDENT-T, MAX-T, will account for the forms in (17a & b), where markedness also outranks faithfulness.

5.4 High-tone preservation

We recall that in Section 5.3, a stranded H or L tone typically absorbs into a following tone, in which /H.H/ and /L.L/ simplifies to singleton [H] and [L] respectively. We showed that that the tonal simplification process was triggered by either the VD or GF rules. In this Section, we exam a case in which the H or the L tone is followed by a distinct tone, that is, a context where a H tone is followed by a L tone and vice versa. The distinct tonal sequences (i.e., /H.L/ or /L.H/), found in certain constructions, are presented below.

5.4.1 H-tone preservation in high, low tone sequence

The following data in (18) illustrate the incidence of H-tone preservation when followed by a L tone in constructions. They are presented as follows:

(18)

H-tone preservation in H.L sequence after the application of VD

a.	/ík**ó** + **è**nà/ 'cups' 'the'	→	[ík**ó**nȁ]	'the cups'
b.	/ík**ó** + **è**wɛ̃́/ 'cups' 'your/yours'	→	[ík**ó**wɛ̃́]	'your cups'
c.	/èŋm**á** + **è**kpókpɔ̀/ 'cloths' 'new'	→	[èŋm**a**□kpókpɔ̀]	'new (pieces of) cloth'
d.	/ík**ó** **+ ù**ʒúvɛ̀/ 'cups' 'forty'	→	[ík**ú**ʒúvɛ̀]	'forty cups'
e.	/àɣ**á** + **ɔ̀**ròdè/ 'broom' 'big'	→	[àɣ**á**ròdè]	'a big broom'

As (18) indicates, each L tone following the H tone automatically deletes, even when its (the L tone's) TBU is preserved, as in (18d), a situation we expect it ought to remain stable at the expense of the H tone. In some Nigerian languages (e.g., Yoruba, Central Igbo, Ewulu-Igbo etc.), the L tone, rather than delete, is typically left stranded. Subsequently, it unites with a neighbouring H tone, and the two form a contour tone (see Akinlabi 2004, Ezenwafor 2014, Utulu 2019, 2022). In some Edoid languages, both the H and L tone in close proximity characteristically result in downstep. The peculiarity of the Ùrhòbò tonal grammar, in terms of how it handles the juncture H and L tones (or L and H tones), has been pointed out in the Ùrhòbò tonal literature. According to Aziza (2007: p. 470-471):

> '…the coalescing of a high tone and a low tone does not produce a downstep in Ùrhòbò as one would find in the tone systems of languages such as Edo…, Ghotuo…, Emai, all of which are also Edoid languages. What we find is that a low tone…in the immediate environment of a high tone deletes and leaves no effect on the high tone.'

It is interesting to note that, like the juncture L tone, the juncture LH contour tone does succumb to the deletion rule at the expense of a preceding juncture H tone, as (22) exemplifies. On account of this unique Ùrhòbò tonal pattern, we propose three language-specific markedness constraints **NoH.L-T, NoL.H-T and NoH.LH-T** (see 5) along with the set of universal constraints employed in the foregoing to explain the language-particular processes. The first two constraints mirror the *direction* of the H tone, which may appear before or after the deletion-prone L tone, as in (18a, b, c, e) versus (18d & 20a-f). We adopt the exemplar form in (18a) for an OT analysis of the ranking of NoH.L-T, as follows:

H-tone preservation in heterosyllabic/heteromorphemic H.L tone sequence:

NoH.L-T>>OCP, MAX-T, IDENT-T

(19)	/ik**o** **e**na/ H **H. L** L	NoH.L-T	OCP	MAX-T	IDENTT-T
a.	[ik**o** **e**na]	*!	*		

	H **H. L** L				
b. ☞	[ik**o**na] H L			*	*
c.	[ik**o**na] H **H** L		*!	*	*

As the tableau in (19) indicates, the optimal output is candidate (b). This is because it satisfies the Ùrhòbò markedness constraint NoH.L-T which requires that a L tone *preceded* by a H tone *must* be deleted. Candidates (a), however, fatally violates this constraint, which is why it concedes defeat to candidate (b). Though candidate (c) satisfies NoH.L-T, it also loses the competition to candidate (b) for fatally violating the anti-identical tones constraint OCP sanctioned by candidate (b). The least harmonic candidate (a) is ruled out of the competition for failing to observe the Ùrhòbò tonal rule requiring that /H.L/ must simplify as [H] on the surface.

5.4.2 H-tone preservation in low, high tone sequence

This Section presents data primarily to further validate the fact that heterosyllabic/morphemic H tone is always conserved at the expense of its neighbouring L tone in Ùrhòbò, whether it (H tone) precedes or follows the L tone. The H-tone conservation is presented in (20):

(20)

H-tone preservation in L.H sequence after the application of VD and GF

a. /íkp**è** + **ì**jójòʊì/ → [íkp**ì**jójòʊì] 'nice beds'
'bed' 'nice'

b. /ɔ́mɔ́t**ɛ̀** + **ó**jójòʊì/ → [ɔ́mɔ́t**ó**jójòʊì] 'a beautiful girl'
'girl' 'beautiful'

c. /ìɣ**ò** + **ó**búébṵ̏/ → [ìɣ**ó**bwébṵ̏] 'plenty of money'
'money' 'plenty'

d. /ùd**ì** + **ɔ́**gágà/ → [ùd**jɔ́**gágà] 'alcoholic drink'
'drink' 'strong'

e. /èɾ**ù** + **ó**tèté/ → [èɾ**wó**tèté] 'a small cap'
'cap' 'small'

f. /ékp**ù** + **ó**tèté/ → [ékp**wó**tèté] 'a small bag'
'bag' 'small'

Like in (18), the L tone yet again succumbs to the deletion rule triggered by VD and GF, leaving the H tone stable. Given the re-direction of the H tone, in which, in this case, it is preceded by the L tone, the relevant constraint NoL.H-T will be ranked, as in (21). We adopt (20a), the representative of (20b-f) for analysis, as follows:

H-tone preservation in heterosyllabic/heteromorphemic L.H Tone sequence:

NoL.H-T>>OCP, MAX-T, IDENT-T

(21)	/ikp**e** **i** jojoʊi/	NoL.H-T	OCP	MAX-T	IDENTT-T

	| | | | | | H **L.** **H** H L L				
a.	[ikp**e** **i** jojoʋi] | | | | | | H **L.** **H** H L L	*!	*		
b. ☞	[ikp**i**jojoʋi] H L			*	*
c.	[ikp**i**jojoʋi] | | | | | H **H** H L L		*!	*	*

Like NoH.L-T which outranked other constraints in (19), NoL.H-T outranks the same set of constraints. Consequently, candidate (b) becomes the winning candidate, while candidate (a) and candidate (c) lose outright in the competition for fatally violating NoL.H-T and OCP respectively.

Below, the *tenacity* of the juncture H tone is further expressed, where the rising LH contour tone preceded by the H tone is the one eliminated by the VD rule. The stability of the H tone at the expense of LH contour is shown in (22a & b), as follows:

(22)

H-tone preservation in quantification

a. /ènɛ́ + **ǐ**jòrì/ [èn**í**jòrì] 'five yams'
'yams' 'five'

b. /íkó + ěsá/ [íkésá 'six cups'
'cups' 'six'

The Ùrhòbò preference for the H tone over the LH contour (as it is the case over the L tone), can be captured in an OT analysis of (22a) in (23), taking the relevant constraint NoH.LH-T, as follows:

H-tone preservation before rising (LH) tone:
NoH.LH-T>>, NoCONTOUR, MAX-T, DISASSOC, OCP

(23)	/enɛ **i**jor i/ L **H.** **LH** L	NoH.LH-T	NoCONTOUR	MAX-T	DISASSOC	OCP
a. ☞	[en**i**jori] L **H** L			*	*	
b.	[enɛ **i**jor i] L **H.** **LH** L	*!	*			*

As (23) depicts, candidate (a) is the winner, since, unlike candidate (b), it satisfies the higher-ranked constraint NoH.LH-T, which requires that the rising tone preceded by a H tone *must* be eliminated in the output. The winning candidate also satisfies next higher-ranked NoCONTOUR, which requires that a TBU may be associated with at most one tone. Candidate (b) violates this very crucial constraint of the Ùrhòbò no-heterosyllabic-contour. On typological grounds, however, languages like Central Igbo, Ewulu, etc., where /H.L/ and /L.H/ sequences naturally become HL and LH contour tones, respectively on the surface, NoCONTOUR will rank quite lowly.

5.5 More on Ùrhòbò contour tones

As discussed in Section 2.2.3, the Ùrhòbò contour tones, realised from the concatenation of two levels, H, L or L, H, carry with them heavy grammatical load, particularly productive in numerals and personal pronouns. Below, we explore the patterns and their *preservation* within the word, and within constructions, and then show how OT deals with them.

5.5.1 Rising tone preservation

Continuing from (4), we present the rising contour (LH) in (24), as follows:

(24)

(a) Rising tone (LH) in Ùrhòbò numeral system

i. /ěrà/ → [ěrà] 'three'
ii. /ɛ̌nè/ → [ɛ̌nè] 'four'
iii. /ǐjòrì/ → [ǐjòrì] 'five'
iv. /ěsá/ → [ěsá] 'six'
v. /ǐɣwrɛ̃́/ → [ǐɣwrɛ̃́] 'seven'
vi. /ɛ̌rérẽ́/ → [ɛ̌rérẽ́] 'eight'
vii. /ǐríɾĩ́/ → [ǐríɾĩ́] 'nine'
viii. /ǐhwè/ → [ǐhwè] 'ten'

b. Rising tone (LH) preservation at the phrasal level (quantification)

i. /íkpè + ǐvè/ → [íkpǐvè] 'two beds'
'beds' 'two'

ii /àbɔ̀ + ěrà/ → [àběrà] 'three hands'
'hands' 'three'

In (24a), it will be observed that a TBU potentially bears two tones, LH contour tone underlyingly; even at the phonetic level, the contour surfaces. Given the OT theoretical tenet, we should, therefore, expect IDENT-T (including some relevant faithfulness constraints to be undominated by markedness, i.e., NoCONTOUR, as in (25), where we analyse the archetype (24) string /ěrà/ 'three':

The Ùrhòbò word-based rising tone:

IDENT-T>>MAX-T, DISASSOC, NoCONTOUR

(25)	/era/ **L H** L	IDENT-T	MAX-T	DISASSOC	NoCONTOUR
a.	[era] H L	*!	*	*	
b.	[era]	*!	*	*	

	L H				
c. ☞	[era] L **H** L				*

Of the three candidates in (25), the optimal form is candidate (c), which is faithful to the input structure. Candidate (a) and candidate (b) are eliminated from the competition for not being faithful to the input, as they violate the three faithfulness constraints IDENT-T, MAX-T and DISASSOC (anti-removal of association lines). Besides, in the descriptive data in (24b), it will be observed that, like the H tone, the LH contour tone can be preserved at the expense of the preceding juncture L tone. In this context, the same LH contour that easily yielded to the VD pressure due to the presence of the H tone in (22), seems to be resistant to the deletion rule. As Aziza shows, the rising tone only resists deletion whenever it is preceded by a juncture L tone, a scenario that shows that the Ùrhòbò juncture L tone is quite "feeble", so to speak, unable to survive the VD rule, unlike the H tone.

At this point, we proceed to show how some fundamental constraints in (26) capture the potentially stable LH contour occurring in the vicinity of the L tone illustrated in (24), adopting the string in (24b, i), as follows:

The Ùrhòbò construction-based rising tone:

NoL.>>OCP, MAX-T, LINEARITY

(26)	/íkp**è** **ǐ**vè/ H **L**. **LH** L	NoL.	OCP	MAX-T	LINEARITY
a.	[ikp**e** **i**ve] H **L**. **LH** L	*!	*		
b.	[ikp**i**ve] H L L		*!	*	*
c. ☞	[ikp**i**ve] H **LH** L			*	*

Adopting our proposed Ùrhòbò-specific markedness constraint NoL. in (26), candidate (c) is the most harmonic string. This is because it reflects the true picture of the Ùrhòbò tonal pattern, in which the boundary L tone preceding the rising tone *must* delete, unlike the H tone that is preserved in the similar context. The constraint crucially requires that a juncture L tone is prohibited before a LH contour tone, and that it is undominated by two faithfulness constraints MAX-T and LINEARITY, a fact that substantiates the dominance of markedness over faithfulness in tonal structure like (24b) and (26).

5.5.2 H tone floating and final falling tone

The HL contour tone, like its LH counterpart, conveys some grammatical information. Specifically, the examples in (4c) mark interrogation in Ùrhòbò. For ease of reference, we re-present the forms in (27), as follows

(27)

i.	/úkó + ɾɛ́ + ɔ́gbá + ɾɛ́ + ìtìvɔ́/ 'cup' AM 'warlord' AM 'where'	→	[úkó ɾɔ́gbá ɾítìvɔ̂] 'a cup belonging to a warlord from where?'
ii	/íɣō + ɾɛ́ + ɔ́gɔ̄ + ɔ̀vɔ́/ 'money AM 'in-law' 'which'	→	[íɣōɾɔ́gɔ̄vɔ̂] 'which in-law's money?'
iii.	/ɔ̀ + dɛ́ + ́ ɔ̀nɛ́/ 's/he' 'buy' 'past' 'yam'	→	[ɔ̀dɔ́nɛ̂] 'did s/he buy yam?'

It will be observed that the adverbial 'where', the demonstrative adjective, 'which', and the nominal 'yam', with H tone, respectively alternate to HL in the output. In addition, we observe a persistent dislodge of the L tone by the H tone, leading to a *mismatch* between input and output tonal structures. Our point of interest here is the fact that, while the L tone disappears, the final H tone metamorphoses into surface HL. These tonal characteristics are transparently captured in OT (28), taken the form (27, iii):

The Ùrhòbò float H and falling tones in interrogatives:
*FLOAT>>OCP, ALIGN-R CONTOUR, NoCONTOUR, MAX-T, IDENT-T

(28)	/ɔ̀ dɛ́ ́ ɔ̀nɛ́/ L H (H) L H	*FLOAT	OCP	ALIGN-R CONTOUR	NoCONTOUR	MAX-T
a. ☞	/ɔ̀dɔ́nɛ̂/ L H L				*	*
b.	/ɔ̀dɔ́nɛ̂/ L H HL		*!		*	*
c.	/ɔ̀dɛ́ ́ ɔ̀nɛ́/ L H (H) L H	*!		*		

In (28), candidate (a), which is void of a floating H tone, a duplication of identical tones, but is specified with right-edge contour tone is the winner. This tonal pattern is expressed in the OT constraints *FLOAT, OCP and ALIGN-RIGHT CONTOUR, respectively. It will be observed that a fatal violation of *FLOAT and OCP respectively rules out candidate (c) and candidate (b) as optimal outputs.

6. Conclusion

This study has re-examined the descriptive accounts of the tonal patterns posited in both the tonal-/segmental-/grammatical-oriented studies of the Ùrhòbò language in the works of Aziza (1994, 1997, 2001, 2003, 2007, 2008, and 2010). A re-analysis of the data posited in the descriptive studies has revealed the set of relevant universal constraints that underlie the tonal patterns attested crosslinguistically, as well as the language-specific constraints that underlie the unique patterns of the Urhobo tone system, which, before now, were unknown thereby inhibiting the understanding of the set of active constraints governing the well-formedness of the Ùrhòbò tone structure. This study has identified the set of faithfulness constraints: IDENT-T; MAX-T; NoFUSION; DISASSOC; LINEARITY; ALIGN-R CONTOUR; and, markedness constraints OCP; SPECIFY-T;

*FLOAT; NoCONTOUR as restrictions that explain the tonal input-output structures. Moreover, the study has proposed four Ùrhòbò-specific markedness constraints: NoH.L-T; NoL.H-T; NoH.LH-T; and NoL., as the set of language-specific constraints that underlie the survival of the H and the LH at the expense of the L tone in constructions. In sum, the Urhobo tonal data strongly support the claim that, crosslinguistically, universal (and language-specific) constraints are those that motivate tonal deviations from input forms in tone languages, and that minimally marked tonal outputs are the result of markedness dominance over faithfulness.

Declaration of Conflicts of Interests

The authors declare no potential conflicts of interest.

Acknowledgement

We acknowledge *Professor Rose Oro Aziza* for granting us access to her works consulted for this work. Her comments in the first draft were quite invaluable, contributing to a successful outcome of this article. We are deeply appreciative of her support and mentoring.

References

Ajiboye, Emuobonuvie M. (2014). Compounding in Urhobo. *Journal of West African Languages*, XLI (1).

Ajiboye, Emuobonuvie M. (2022). The place of syntax in Urhobo morpho-phonology: The case of vowel reduplication in Urhobo. *ARIDON: The International of Urhobo Studies, 2 & 3.*

Akinlabi, Akinbiyi. (2004). Fixed segmentism in Yoruba deverbal nouns. In Owolabi K, Dasylva A (eds.), *Forms and functions of English and indigenous languages in Nigeria: A festschrift in honour of Ayo Banjo*, pp. 273-295. Ibadan: Group Publishers,

Armstrong Robert G. (1968). Yala (Ikom), a terraced-level language with three tones. *Journal of West African Languages 5*, 41-50.

Aziza, Rose O. (1994). Vowel harmony in Ùrhòbò. *Nigerian Language Studies 2*, 1-7.

Aziza, Rose O. (1997). Ùrhòbò tone system. Ibadan: University of Ibadan. Unpublished PhD Thesis.

Aziza, Rose O. (2001). An overview of the tone system of Ùrhòbò. Paper read at the 32nd ACAL, University of California, Berkely, March 23-25, 2001.

Aziza, Rose O. (2003). Tonal alternations in the Ùrhòbò noun phrase. *Studies in African Linguistics 32* (2), 1-23.

Aziza, Rose O. (2007). Phonological processes and their effect on lexical tones in Ùrhòbò. In Ozo-Mekuri Ndimele (ed.), *Nigerian languages, Literatures, culture and reforms: A festschrift in Honour of Ayo Bamgbose*, pp. 461-474, Port Harcourt: M & J Grand Orbit Communication Ltd and Emhai Press.

Aziza, Rose O. (2008). Neutralization of contrast in the vowel system of Ùrhòbò. *Studies in African Linguistics 37* (1), 1-19.

Aziza, Rose O. (2010). Ùrhòbò phonology, morphology and syntax. In Ore Yusuf (ed.), *Basic Linguistics for Nigerian Languages*, pp. 278-331. Ijebu-Ode: Shebiotimo Publications.

Bickmore, Lee S. (1996). Bantu tone spreading and displacement as alignment and minimal misalignment. *ROA#*, 161-1196.

Cassimjee, Farida and Charles W. Kisseberth (1998). Optimal domains theory and Bantu tonology: A case study from Isixhosa and Shingazidja. In Hyman, L and C. Kisseberth, pp. 33-132. *ROA#*, 176-0297.

Chumbow, Beban S. (1982). Contraction and tone polarization in Ogori. *Journal of West African Languages 12* (1), 89-103.

Clements, George N. (1979). The description of terraced-level tone languages. *Language 55*, 536-558.

Clements, George N., and Kevin C. Ford 1979. Kikuyu tone shift and its synchronic consequences. *Linguistics Inquiry 10*, 179-210.

Elimelech, Baruch (1976). A tonal grammar of Etsako. *UCLA Working Papers in Phonetics 35*.

Emenanjo, Emmanuel N. (1978). *Elements of modern Igbo grammar*. Ibadan: Oxford University Press.

Ezenwafor, Chikelu I. (2014). Contour tones in Igbo: 'Where they come from'. *Theory and Practice in Language Studies 4* (4), 661-667.

Firth, John R. (1948). Sounds and prosodies. *Transactions of the Philosophical Society*, 127-152. Also, in F.R. Palmer (ed.), *Prosodic Analysis,* pp. 1-26. Oxford: OUP, 1970.

Goldsmith, John A. (1976). An overview of autosegmental phonology. *Linguistic Analysis 2* 23-68.

Goldsmith, John (1990). *Autosegmental and metrical phonology*. Oxford: Blackwell.

Hyman, Larry (1979). A reanalysis of tonal downstep. *Journal of African Languages and Linguistics 1,* 9-29.

Hyman, Larry and Russell G. Schuh (1974). Universals of tone rules: Evidence from West Africa. *Linguistic Inquiry 5*, 81-115.

Kager, René. (1999). *Optimality theory*. Cambridge: Cambridge University Press.

Leben, William (1973). Suprasegmental phonology. Michigan Institute of Technology: PhD Thesis.

Liberman, Mark, Schultz, Michael J., Hong Soonhyun, Okeke Vicent (1993). The phonetic interpretation of tone in Igbo. *Phonetics 50* (3), 147-160.

McCarthy, John (1986). OCP effects: gemination and antigemination. *Linguistic Inquiry 20*, 71-99.

McCarthy, John (1988). Feature geometry and dependency: A review. *Phonetica 45*, 84-108.

McCarthy, John (1999). Sympathy and phonological opacity. *Phonology 16*, 331-399.

McCarthy, John, and Alan Prince (1993). Prosodic morphology I: Constraint interaction and satisfaction. MS, University of Massachusetts, Amherst and Rutgers University.

Myers, Scott P. (1997). OCP effects in optimality theory. *Natural Language and Linguistic Theory*, *15* (4), 847-892.

Odden, David, (1986). On the role of the obligatory contour principle in phonological theory. *Language 62*, 353-383.

Odden, David (1995). Tone: African languages. In John Goldsmith (ed.). In *Handbook of Phonological Theory*, pp.445-475. Oxford: Blackwell.

Pike, Kenneth L. (1948). Tone languages: A technique for determining the number and type of pitch contrasts in a language, with studies in tonemic substitutions and fusion. *University of Michigan Publications in Linguistics*, 4. Ann Arbor: University of Michigan Press.

Prince, Alan, and Paul Smolensky. (1993). *Optimality theory: Constraint interaction in generative grammar*. Rutgers University Cognitive Science Centre Report TR-2. Available at http://ruccs.rutgers.edu/publicationsreport.html.

Pulleyblank, Douglas (1997). Optimality theory and features. In Archangeli and Langendoen, 85-101.

Schachter, Paul and Victoria A. Fromkin (1968). A phonology of Akan: Akuapem, Asante and Fante. *UCLA Working Papers in Phonetics 9*.

Utulu, Don C. (2019). Vowel doubling in Ùrhòbò: The case of loanword. *Journal of West African Languages 46* (1), 32-46.

Utulu, Don C. (2022). Identical tones and the OCP in Ewulu: An optimality account. *Theory and Practice in Language Studies 12* (8), 1468-1482.

Welmers, William E. (1969). Structural notes on Ùrhòbò. *Journal of West African Languages 1*, 85-107.

Welmers, William E. (1973). *African language structures*. University of California Press, Berkely and Los Angeles.

Williamson, Kay (1986). Igbo specific and associative constructions. In K. Rogers, H. van der Hulst and M. Mous (eds.), *The phonological representation of suprasegmentals,* pp. 195-208. Dordrecht: Foris.

Winston, Ford D.D. (1960). The mid tone in Efik. *African Language Studies 1*, 185-192.

Yip, Moira (2002). *Tone*. Cambridge: Cambridge University Press.

Don Chukwuemeka Utulu, PhD**,** is a Senior Lecturer at the Department of Languages and Linguistics, Faculty of Arts, Delta State University, Abraka, Delta State, south-south, Nigeria. His areas of specialisation are L1-L2 phonetics and phonology (with special attention given to unknown/under-researched, small Nigerian languages). Other areas of interest are morphology, morphology-phonology interface, lexicography and historical linguistics. He is a member of The Linguistic Association of Nigeria (LAN), and The Association of Phoneticians and Phonologists in Nigeria (APPN). He has published in scholarly local, national and international journals.

Emuobonuvie Maria Ajiboye, PhD, is a lecturer at the Department of Languages and Linguistics, Delta State University, Abraka (Nigeria). Her PhD research focused on how the morpho-syntactic behaviour of vowel reduplication in Urhobo language can facilitate a review of Urhobo Orthography in line with current best practices. She has attended a number of trainings and conferences within Africa, Germany and America relating to indigenous language issues. She is a Fellow both of the National African Language Resource Centre, University of Wisconsin – Madison (USA), and Ife Institute of Advanced Studies of Obafemi Awolowo University, Ile Ife (Nigeria). Her areas of specialization are Syntax, Semantics and Applied Linguistics.

Irene Eloho Edojaimoni is a Graduate Assistant at the Department of Languages and Linguistics, Delta State University, Abraka, Nigeria. She is a doctoral student in Linguistics at the Department of Linguistics, University of Benin, Benin City, Nigeria. She is a member of The Association of Phoneticians and Phonologists in Nigeria. She has interest in phonology.