OCP effects in Malawian CiTonga tone patterns[1]

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Abstract

The Obligatory Contour Principle (OCP) has been shown to both motivate certain tonological processes, as well as act as a constraint, blocking an otherwise productive process. In this paper, we describe and analyze the role of the OCP in Malawian CiTonga, an under-described Malawian Bantu language. We show that OCP violations involving High tones are sometimes repaired and sometimes not. When they are repaired, there is not a single repair strategy, but five possible ones, where the strategy employed depends on two crucial factors: 1) the morpho-syntactic domain containing the two High tones, and 2) whether the H autosegments in question are linked to a single TBU or multiple TBUs.

Key words: tone, Obligatory Contour Principle, CiTonga, Bantu

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Introduction

In this paper, we describe and analyze the stem tone patterns of Malawian CiTonga. Central to understanding the complex array of tonal patterns is the role of the Obligatory Contour Principle (OCP). We show that while some OCP violations are tolerated, those which are repaired are resolved in one of five different ways. The strategy employed will be shown to depend on two crucial factors: 1) the morpho-syntactic domain containing the two High tones, and 2) whether the H autosegments in question are linked to a single TBU or multiple TBUs. After laying out our basic assumptions regarding the tonology (section 1), we document and analyze each of the productive tonal rules in the language with a focus on the role of the OCP (section 2) and then conclude (section 3).

CiTonga is a Bantu language spoken mainly in Nkhata Bay, a lakeshore district in northern Malawi. In 2008, it was estimated that 1.7% of Malawi's 13.1 million people (about 220,000) speak the language. It is classified by Guthrie (1967-71) as belonging to Zone N, Group 10 (N.15). (This language should not be confused with the Tonga language spoken in Zambia, classified as M.64.) Other, better known, languages in Zone N include Tumbuka and Chichewa. There is relatively little literature available on the tonal system of the language, the notable ones being Mtenje (1994/5) and Mtenje (2006), which focus on the tone patterns of only a small set of the tensed verbs.[2]

CiTonga is one of the many Bantu languages which preserve a two-way underlying tonal contrast. We will show below that only High tones are active in the language, in the sense of being either the trigger or target of tonological processes. Due to this, we posit that the underlying distinction in the language is H vs. Ø, rather than H vs. L (Stevick 1969, Hyman & Byarushengo 1984, Myers 1997). This tonal contrast can be seen below in 3 minimal pairs of verbal imperatives (formed by suffixing a neutral Final Vowel /-a/ to the root):

(1) a. dììk-à 'spill'
b. dìík-à 'cover oneself'
c. thèèl-à 'arrive'
d. thèél-à 'give up'
e. vììmb-à 'cover'
f. vìímb-à 'be constipated'

In (1a,c,e) the root is toneless, while in (1b,d,f) the root is High-toned. We take up below exactly how underlying H tones get realized in different environments. With regard to surface tonal contrasts, a short vowel can surface as either level High or level Low, and long vowels can surface as level Low, Rising or Falling (but not level High). Given that, we posit that the Tone Bearing Unit (TBU) of the language is the mora.

CiTonga has lost the Proto Bantu vowel length contrast. While all vowels are underlyingly short, there is a regular process that lengthens the penultimate vowel of the last word in a

[2] All data presented in this paper were elicited from Winfred Mkochi, the second co-author, a native CiTonga speaker. The vast majority of the CiTonga forms found in this work are new additions to the linguistic literature, not having been previously published. The data is presented in the language's conventional orthography. The only deviations from the IPA are: <j> = [ɟ], <ny> = [ɲ], <ŵ> = [ʋ], <y> = [j], <Ch> = [C^h] (aspirated voiceless stops). Acute and grave accents mark the phonological tone as High or Low respectively. Pitch lowering due to a range of depressor consonants is not pursued here.

phonological phrase. This can be seen in the examples below.

(2) a. [mùlììmì]$_{\phi}$ 'farmer'
b. [mùlìmì yùúwà]$_{\phi}$ 'that farmer'
c. [mùlììmì]$_{\phi}$ [wàngùthéèlà]$_{\phi}$ 'the farmer arrived'

In a phrase consisting of a single word, as in (2a), the penultimate vowel is long. When phrases of two or more words are considered, the syntax of those phrases ultimately determines where the phonological phrase boundaries (marked by ɸ) are located. When a lexical head is followed by a modifier, as seen in (2b), the two words combine to form a single phonological phrase. When this is not the case, as in (2c) where a noun functions as the subject of a following conjugated verb, the two words are in separate phonological phrases. (Further elaboration on the conditions for grouping words into phrases are not pursued here, as they are orthogonal to the concerns of this paper.)

Tonological Processes

Given the preliminaries outlined above, let us now describe and analyze the productive tonal processes found in the language. The first is a process of Tone Doubling (TD) by which a High tone spreads onto the following TBU. This is illustrated below in the singular/plural pairs of two DPs found below.

(3)	a.	kàpààlà	'sp. fish (sg)'	/kapala/
	b.	á-kápààlà	'sp. fish (pl)'	/á-kapala/
	c.	nyàlùùbwè	'leopard'	/nyalubwe/
	d.	á-nyálùùbwè	'leopards'	/á-nyalubwe/

The singular forms of the two nouns in (3a,c) have no High tone and surface as all-Low. In (3b,d), the Class 2a plural prefix /á-/ has been added.[3] As seen, the H on this prefix is realized not only on the prefixal vowel itself, but on the following vowel as well. We formalize Tone Doubling as in (4).

(4) Tone Doubling

μ μ
H

[3] CiTonga exhibits a noun class system common to Bantu languages, where nouns fall into a number of groups, each with distinctive singular and plural prefixes. (Guthrie 1967, Meeussen 1967)

That Tone Doubling is a word-level process, not applying between words is seen below, where the H-toned nominal root /só/ does not spread onto the following toneless adjective.

(5) mà-só ngà-cààndà
C6-eye C6-smart
'smart eyes'

We observe some restrictions on Tone Doubling within words in phase-final position with long penults. As seen below, a High tone does not double from the first to the second mora of a long vowel (6a), or onto the first mora of long vowel (6c). (Examples in (6b,d) show that Doubling occurs as expected in the corresponding non-phrase-final forms, where all vowels are short.) [4]

(6) a.	ngàmíìlà	'camel'	/ngamíla/
b.	ngàmílá cáà	'not a camel'	
c.	mbwíyààwò	'cat'	/mbwíyawo/
d.	mbwíyáwò cáà	'not a cat'	

To account for (6a), we propose that there is a constraint in the language which prohibits a High-toned TBU in phrase-final position.

(7) $$\begin{array}{l} *\ \mu\ ]_{\phi} \\ \ \ \ | \\ \ \ \ H \end{array}$$

This constraint, operative in (6a), will prevent Tone Doubling from spreading a High onto a phrase-final TBU. We assume Penult Lengthening subsequently applies in (6a) to add a mora to the right of the underlying one. We take up the question of the lack of surface doubling in forms such as (6c) later in this section.[5]

This constraint against phrase-final Hs motivates the second major tone rule. When the phase-final TBU is underlyingly H, this H shifts one TBU to the left, creating a Rising tone on the immediately preceding long vowel. This is illustrated in the data below.[6]

[4] The negative *cáà* is one of a limited number of morphemes which surface with a long vowel on the final (and sometimes sole) syllable. In many cases, including this one, it likely results historically from *CVlV, where the intervocalic *l* has deleted when it is the onset of the final syllable. Cf. Tumbuka negative *cala*. We leave it as an open question, not material to our concerns here, exactly how to account for these long vowels synchronically.

[5] An anonymous reviewer correctly points out that an alternative to the present analysis of the lack of doubling in (6a,c) would be to eliminate the constraint in (7) and complicate the Tone Doubling rule in (4). But it is not possible to simply add two syllables after the second mora in the formalization, in an attempt to prevent the rule from spreading a H onto a final or penultimate syllable. While this might account for the lack of spreading in (6a,c), it would erroneously prevent spreading in (6b,d) where it does occur. In this alternative analysis, one would need multiple Tone Doubling rules, one targeting a H in a phrase-final word (preventing spreading onto the penult or ultima) and another targeting a H in non-phrase-final words, allowing doubling onto any following TBU. While we recognize each analysis has some advantages and disadvantages, we think our analysis, in which there is a single, simple Tone Doubling rule, is preferable overall.

[6] The forms in (8a,c) raise the issue as to how adjacent TBUs linked to distinct Hs at the end of the phonology are realized phonetically. We will see below that this depends on the morpho-syntactic domain in which the two Hs are found. When they are found across words, as in (8a,c) they are realized on the same pitch, but in other

(8)	a.	mù-tú cáà	‘not a head’	/mu-tú/
	b.	mùú-tù	‘head’	
	c.	mà-só cáà	‘not eyes’	/ma-só/
	d.	màá-sò	‘eyes’	

The negative forms in (8a,c) reflect the underlying tone pattern of the noun, where the class prefix is toneless and the monosyllabic stem is High. When such words are phrase-final, as in (8b,d), the H on the stem shifts to the second mora of the lengthened penult. Phrase-final Left Shift is formalized below.

(9) Phrase-final Left Shift (PFLS)

$\mu \quad \mu\ ]_{\phi}$

$\quad\ \ +$

$\quad\ \mathrm{H}$

Having motivated the two central tonological rules in the language, let us now turn to a description and analysis of tone patterns found within verbs. As noted above, CiTonga preserves a two-way Proto Bantu tonal contrast in verb roots, where one group is completely toneless and the other group contributes a High tone. We begin by examining verbal infinitives, whose morphological structure is found below.

(10) ku $[_{\text{stem}}$ Root-Extensions-Final.Vowel

Infinitives are marked by the toneless prefix /ku-/. In the examples below this is followed by the verb root, which in turn is followed by verbal “extensions” (generally derivational affixes) and a “Final Vowel” indicating mood. The extensions (both toneless) found in the examples below include the causative /-is/ and the reciprocal /-an/. Below we show verbal infinitives with stems of 1–4 syllables, containing toneless roots in (11), and High toned roots in (12). The phrase-final pronunciation is represented by the affirmative form in the left column, and the non-phrase-final one is found in the right column where it is followed by the negative *cáà*. All monosyllabic verb roots in CiTonga are toneless.[7]

cases the second of the two Hs is downstepped. This is developed and discussed in detail below after the relevant forms are introduced, where ultimately the level pitch across two Hs, as exhibited in (8a,c), is accounted for by a process of H Tone Fusion.

[7] The evidence that monosyllabic roots in the language are toneless is that when an extension is added (to any of them), the tone pattern of the resulting form is identical to the patterns exhibited in (11), and not (12). E.g. *kù-lí-ìs-à* ‘to cause to eat’ (**kù-lì-ís-à*), *kù-ly-áàn-à* ‘to eat each other’ (**kù-ly-ààn-à*), *kù-l-ís-ààn-à* ‘to cause each other to eat’ (**kù-l-ís-àán-à*).

(11) Verbal Infinitives: toneless roots

	Affirmative		Negative	
a.	kùú-ly-à	e.	kù-ly-á cáà	'to eat'
b.	kù-púùm-à	f.	kù-púm-á cáà	'to beat'
c.	kù-púm-ììs-à	g.	kù-púm-ís-à cáà	'to cause to beat'
d.	kù-púm-ís-ààn-à	h.	kù-púm-ís-àn-à cáà	'to cause each other to beat'

(12) Verbal Infinitives: H roots

	Affirmative		Negative	
a.	kù-nàám-à	d.	kù-nàm-á cáà	'to lie'
b.	kù-nám-iís-à	e.	kù-nám-ís-á cáà	'to cause to lie'
c.	kù-nám-ís-ààn-à	f.	kù-nám-ís-àn-á cáà	'to cause each other to lie'

In each of the forms in (11), there is evidence of a single H tone. This H is associated to the first TBU of the stem (except in the case of (11a) where it undergoes Phrase-final Left Shift (9)), and will undergo Tone Doubling (4) in the appropriate environments (as discussed above). Turning to the forms in (12), each is tonally distinct from its counterpart in (11), with the forms in (12 b,c,f) clearly exhibiting two different H tones. Before turning to the analysis, we note here that the addition of a toneless object marker (Class 2 /ŵa-/, Class 5 /li-/) does not affect the stem tone patterns in any way, as seen below.

(13) Verbal Infinitives: toneless roots

	Affirmative		Negative	
a.	kù-ŵàá-ly-à	e.	kù-ŵà-ly-á cáà	'to eat them'
b.	kù-ŵà-púùm-à	f.	kù-ŵà-púm-á cáà	'to beat them'
c.	kù-ŵà-púm-ììs-à	g.	kù-ŵà-púm-ís-à cáà	'to cause them to beat'
d.	kù-ŵà-púm-ís-ààn-à	h.	kù-ŵà-púm-ís-àn-à cáà	'to cause them to beat each other'

(14) Verbal Infinitives: H roots

	Affirmative		Negative	
a.	kù-lì-nàám-à	d.	kù-lì-nàm-á cáà	'to lie (it)'
b.	kù-ŵà-nám-ìís-à	e.	kù-ŵà-nám-ís-á cáà	'to cause them to lie'
c.	kù-lì-nám-ís-ààn-à	f.	kù-lì-nám-ís-àn-á cáà	'to cause each other to lie (it)'

In addition to positing that the roots in (11) are toneless, while those in (12) contribute a High tone, we propose that in every case a floating "melodic" High is present. Melodic H tones, commonly posited in Bantu languages, are tones which are added to a form (typically but not exclusively verbs) due to one or more inflectional properties of the verb (Odden & Bickmore (2014), Bickmore (forthcoming)). In most Bantu languages exhibiting melodic tones, such are present in some verbs, but not others (again, based on inflectional properties of the verb such as TAM, polarity and clause type). CiTonga seems to have generalized this, such that a melodic H is present in every verb form.[8] Given these assumptions, then, the forms in (11) have a single H tone (the melodic H), and those in (12) have two: the root H and the melodic H. As the literature on melodic Highs makes clear, the way that these H tones dock is language-specific. In CiTonga, if the only H in the verb is the melodic one (as is the case in (11)), it will dock onto the first TBU of the stem. In the event that the stem-initial TBU is already H (as is the case in (12)), then the melodic H will dock onto the stem-final TBU. [9] This is illustrated below in the derivations of two non-phrase-final forms: (11h) and (12f).

(15) Derivations of toneless and H-toned infinitives ([= stem boundary; H_m = Melodic High)

```
a. ku-[pum-is-an-a          b. ku-[nam-is-an-a          UR
                                    |
             Hm                     H     Hm

   ku-[pum-is-an-a             ku-[nam-is-an-a          MH Docking
       |                            |         |
       Hm                           H         Hm

   ku-[pum-is-an-a             ku-[nam-is-an-a          Tone Doubling
        \ /                          \ /      |
        Hm                            H       Hm

   [kù-púm-ís-àn-à]            [kù-nám-ís-àn-á]         PR
```

In (15a) the only H in the form is the melodic H. This H docks onto the stem-initial TBU as it is free, and then undergoes Tone Doubling. In (15b), there are two H tones—the lexical one contributed by the verb root as well as the melodic H. In this case, since the stem-initial TBU is already H, the melodic H docks onto the stem-final TBU.[10] The root H then undergoes Tone Doubling.

[8] We note here that a language like CiTonga in which there is an underlying tonal contrast in verb roots and in which a melodic High appears in all verb forms falls under the 'reversive' classification within the typology proposed in Marlo (2013). Finally, as an alternative to positing that a melodic H is added to every verb form, it would also be possible to maintain that in this language, it is simply the Final Vowel (which is present in every verb form) which contributes a High tone.

[9] This type of association is quite similar to what Goldsmith (1987) referred to as the "complex pattern" found in Lacustrine Bantu languages.

[10] It is also possible to assume that the root H is underlyingly floating as well. In that case, the generalization would be that a single floating H docks onto the stem-initial TBU, while in the event that there is more than a single floating H, one docks onto the stem-initial TBU, while the other docks onto the stem-final one. While not directly relevant to our focus here, we note that this latter analysis appears to have one additional advantage. While all object markers (such as those seen in (13) and (14)) are toneless, the reflexive prefix /jí-/ which occupies the same pre-stem position, is H toned. (See Marlo 2013, 2015 for other cases where the reflexive behaves differently than other object markers.) When it precedes a H-toned verb root, the stem pattern is unaffected. (E.g. *kù-jì-nám-ìís-à* 'to cause ourselves to lie') When it precedes a toneless verb root, the stem tone pattern behaves as if the root were High. (E.g. *kù-jì-púm-ìís-à* 'to cause ourselves to beat') Assuming the H on the reflexive as

Let us now consider whether the rule of Tone Doubling might be sensitive to the OCP. Northern Bemba, for instance, also has a productive rule of High Doubling, but such is blocked if it would incur an OCP violation, as seen in the (non-phrase-final) examples below (Sharman & Meeussen 1955):

(16) Tone Doubling in Northern Bemba

a.	bá-ká-fik-à	'they will arrive'	/bá-ka-fik-a/
b.	bá-kà-pít-á	'they will pass'	/bá-ka-pít-a/

Tone Doubling spreads the H tone of the subject prefix /bá-/ onto the Future prefix /ka-/ in (16a), but the process is blocked in (16b) as such would result in an OCP violation given the fact that the TBU following /ka-/ is H-toned. To assess whether Doubling in CiTonga within the verbal stem is also sensitive to the OCP, let us consider the derivation of (12e).

```
(17) ku-nam-is-a         UR
        |
        H    H

     ku-nam-is-a         MH Docking
        |      |
        H      H

     ku-nam-is-a         Tone Doubling
        |  /   |
        H      H

     [kù-nám-ís-á]       PR
```

The above derivation shows that, unlike Northern Bemba, Tone Doubling in CiTonga applies, even when an OCP violation results, as all three stem TBUs surface as High. As seen below in the derivation of (11f), Tone Doubling also applies, even if an OCP violation is created across a word boundary.

```
(18) ku-pum-a caa        UR
               |
            H  H

     ku-pum-a caa        MH Docking
        |      |
        H      H
```

well is floating, then the analysis is that, when there is a single floating H, it docks onto the stem-initial TBU, when there are two or more floating Hs, one docks onto the stem-initial TBU and the other to the stem-final TBU, and any additional Hs remain floating.

```
      ku-pum-a caa          Tone Doubling
         |  /    |
         H       H

      [kù-púm-á cáà]        PR
```

As seen, the melodic H, which docks onto the stem-initial TBU undergoes Doubling, even though that creates an OCP violation across a word boundary. [11]

Let us now turn to cases where an OCP violation is present after MH Docking. In the case of a bisyllabic stem where each TBU is linked to a distinct H, the first H deletes. This can be seen in the derivation of (12d), presented below.

```
(19)  ku-nam-a              UR   (12d)
         |
         H  H

      ku-nam-a              MH Docking
         |  |
         H  H

      ku-nam-a              Reverse Meeussen's Rule (20)
            |
      ø ←H  H

      [kù-nàm-á]            PR
```

After the melodic H docks onto the FV, there is an OCP violation within the stem. In such cases, the first H deletes, accounting for the surface Low tone on the verb root. This process of a H deleting next to another H within Bantu is quite common, so much so that it has been named after the linguist who first noted it—A. E. Meeussen. When the second of the two Hs deletes (the more common pattern), it is referred to as "Meeussen's Rule." When the left H deletes, as is the case in (19), it is referred to as "Reverse Meeussen's Rule." This is formalized below.

```
(20)  Reverse Meeussen's Rule

         μ  μ
         |  |
      ø ←H  H               Domain of Application: Stem
```

Having considered the analysis of several non-phrase-final forms, let us now examine two phrase-final forms ((11b) and (11a)) where penultimate lengthening applies.

[11] As noted in fn. 6, two Hs across a word boundary are realized on the same pitch, something ultimately accounted for by a rule of High Tone Fusion, introduced below within the discussion of downstep.

```
(21)  a.  ku-pum-a        b.  ku-nam-a              UR
                                 |
                    H            H   H

          ku-pum-a            ku-nam-a              MH Docking
               |                 |    |
               H                 H    H

                              ku-nam-a              Reverse Meeussen's Rule
                                  |    |
                              ø ←H    H

          blocked (7)         n/a                   Tone Doubling

          ku-puum-a           ku-naam-a             Penult Lengthening
               |                      |
               H                      H

                              ku-naam-a             Phrase-final Left Shift
                                   |
                                   H

          [kù-púùm-à]         [kù-nàám-à]           PR
```

We assume the derivations of the phrase-final forms begin the same way that the non-phrase-final forms do. First, MH Docking applies, docking this H to the stem-initial TBU in (21a) and the stem-final TBU in (21b). This creates the configuration for RMR (20) to apply in (21b). The next rule, Tone Doubling, will not apply in (21a), as it is blocked by the constraint in (7) which prohibits a phrase-final High. Penult Lengthening then adds a mora to the right of the underlying one, after which Phrase-final Left Shift applies in (21b).

Having posited this ordering, we can now consider whether Phrase-final Left Shift is sensitive to creating OCP violations by examining (12b) (the phrase-final counterpart to (17)).

```
(22)  ku-nam-is-a           UR
         |
         H    H

      ku-nam-is-a           MH Docking & Tone Doubling
         |  /   |
         H      H

      ku-nam-iis-a          Penult Lengthening
         |  /    |
         H       H
```

```
ku-nam-iis-a          P-final Left Shift
     |  / |
     H    H

ku-nam-iis-a          Intrasyllabic OCP Resolution
     |    |
     H    H

[kù-nám-ìís-à]        PR
```

In this form, the MH docks onto the stem-final TBU, after which the root H undergoes Doubling. Penult Lengthening then adds a mora to the penultimate syllable. As can be seen, Phrase-final Left must apply, even though it creates an OCP violation. This intrasyllabic OCP violation is ultimately resolved by delinking the first of the two Hs, accounting for the surface Rising tone. This is formalized below.

(23) Intrasyllabic OCP Resolution

```
   σ
  / \
 μ   μ
 +   |
 H   H
```

To sum up thus far, the stem tonal patterns of the verbs in (11) and (12) can be accounted for with the following rules: Melodic High Docking, Tone Doubling (4), Phrase-final Left Shift (9), Penultimate Lengthening, and Intrasyllabic OCP Resolution (23), as well as one constraint (7) which blocks Tone Doubling (and motivates PFLS).

While it is the case that in some languages the tonology of infinitive forms can exhibit important differences from the tonology of finite verbal forms (e.g. Cilungu (Bickmore 2007)), such is not the case in CiTonga. The stem tone patterns seen in the infinitives above (in (11) and (12)) are identical to those found in finite forms with the same underlying tonal structure. The morphological structure of finite verbs is given below in (24). The main difference with respect to infinitives is that finite forms begin with a subject marker, and can be followed by one or more tense/aspect/mood (TAM) prefixes.

(24) Morphological Structure of finite verbs

Subject.Marker-TAM-Object.Marker-$[_{\text{stem}}$ Root-Extension(s)-Final.Vowel

That the stem tone patterns of the infinitives are identical to those found in finite verbs can be illustrated by comparing the infinitival forms in (11) and (12) to those of the Simple Past in (25) and (26) below (where /ti-/ is the 1st plural subject marker and /ngu-/ is the Simple Past, both underlyingly toneless.)

(25) Simple Past: toneless root

	Affirmative		Negative	
a.	tì-ngùú-ly-à	e.	tì-ngù-ly-á cáà	'we ate'
b.	tì-ngù-púùm-à	f.	tì-ngù-púm-á cáà	'we beat'
c.	tì-ngù-púm-ìis-à	g.	tì-ngù-púm-ís-à cáà	'we caused to beat'
d.	tì-ngù-púm-ís-ààn-à	h.	tì-ngù-púm-ís-àn-à cáà	'we caused each other to beat'

(26) Simple Past: H root

	Affirmative		Negative	
a.	tì-ngù-nàám-à	d.	tì-ngù-nàm-á cáà	'we lied'
b.	tì-ngù-nám-ìís-à	e.	tì-ngù-nám-ís-á cáà	'we caused to lie'
c.	tì-ngù-nám-ís-ààn-à	f.	tì-ngù-nám-ís-àn-á cáà	'we caused each other to lie'

Each of the above forms can be accounted for in the same way that its infinitival counterpart was.

A number of CiTonga TAMs can be modified to have an Itive meaning ('go and Verb'), by adding the TAM prefix /cí-/ before the stem. Below we see that this has a non-trivial effect on the stem tone pattern.

(27) Simple Past Itive: toneless root

	Affirmative		Negative	
a.	tì-ngù-cíì-ly-à	e.	tì-ngù-cí-ly-á cáà	'we went and ate'
b.	tì-ngù-cí-pùùm-à	f.	tì-ngù-cí-púm-à cáà	'we went and beat'
c.	tì-ngù-cí-púm-ìis-à	g.	tì-ngù-cí-púm-ìs-à cáà	'we went and caused to beat'
d.	tì-ngù-cí-púm-ìs-ààn-à	h.	tì-ngù-cí-púm-ìs-àn-à cáà	'we went and caused eo to beat'

(28) Simple Past Itive: H root

	Affirmative		Negative	
a.	tì-ngù-cí-nàám-à	d.	tì-ngù-cí-nám-á cáà	'we went and lied'
b.	tì-ngù-cí-nám-ìís-à	e.	tì-ngù-cí-nám-ìs-á cáà	'we went and caused to lie'
c.	tì-ngù-cí-nám-ìs-ààn-à	f.	tì-ngù-cí-nám-ìs-àn-á cáà	'we went and caused eo to lie'

As the surface stem patterns in (27) and (28) are not identical to those in (25) & (26), an additional rule is motivated to account for these differences. In this regard, examining the beginning of derivations of the forms in (27h) and (28f) will be instructive.

(29)

a.	b.	
ti-ngu-ci-pum-is-an-a | H H	ti-ngu-ci-nam-is-an-a | | H H H	UR
ti-ngu-ci-pum-is-an-a | | H H	ti-ngu-ci-nam-is-an-a |	| H H H	MH Docking

Our current rules predict that the melodic H on /pum/ and the lexical H on /nám/ should spread to the following TBU via Tone Doubling, and that perhaps the H on /cí-/ in both cases would delete (via Reverse Meeussen's Rule (20). Yet, neither happens. To account for the actual outputs [cí-púm-ìs] and [cí-nám-ìs], where the H remains on /cí-/ and the stem-initial H does *not* undergo Tone Doubling, we propose that when two adjacent Hs are found *across* (as opposed to within) a stem boundary, the second H deletes. The surviving H then undergoes Doubling. This is formalized as Meeussen's Rule below.

(30) Meeussen's Rule

$$\begin{array}{ll} \mu & [_{St}\ \mu \\ | & \quad | \\ H & \quad H \rightarrow \emptyset \end{array}$$

We continue the derivation started in (29) below, showing that the application of Meeussen's Rule derives the correct surface tone pattern.

(31) Derivation of (29) continued…

a.	b.	
ti-ngu-ci-[pum-is-an-a | H H → ø	ti-ngu-ci-[nam-is-an-a | | H H→ ø H	Meeussen's Rule (30)
ti-ngu-ci-[pum-is-an-a | / H	ti-ngu-ci-[nam-is-an-a | / | H H	Tone Doubling
[tì-ngù-cí-púm-ìs-àn-à]	[tì-ngù-cí-nám-ìs-àn-á]	PR

Thus, we see that the tonal status of the pre-stem syllable can affect the stem tone pattern. The patterns in (25) & (26) obtain when the pre-stem syllable is toneless, while the patterns in (27) and (28) obtain when the pre-stem syllable is underlyingly High. In this case the differences between the two sets of forms can all be accounted for by Meeussen's Rule (30).

The third and final possible pre-stem tonal environment occurs when the pre-stem syllable bears a derived High tone (via Tone Doubling). This obtains when the Simple Past Itive forms contain a toneless object marker. The object markers used in the examples below are, again, the (plural) Class 2 /ŵa-/, and (singular) Class 5 /li-/. One additional extension is found, the applicative /-il/.

(32) Simple Past Itive: toneless root with OM

	Affirmative		Negative	
a.	tì-ngù-cí-**ŵ**àá-ly-à	e.	tì-nù-cí-**ŵ**á-ly-á cáà	'we went and ate them'
b.	tì-ngù-cí-**ŵ**á-pùúm-à	f.	tì-ngù-cí-**ŵ**á-pùm-á cáà	'we went and beat them'
c.	tì-ngù-cí-**ŵ**á-pùm-íìs-à	g.	tì-ngù-cí-**ŵ**á-pùm-ís-á cáà	'we went and caused them to beat'
d.	tì-ngù-cí-**ŵ**á-pùm-íl-ìs-ààn-à	h.	tì-ngù-cí-**ŵ**á-pùm-íl-ìs-àn-à cáà	'we went and caused them to beat for eo'

(33) Simple Past Itive: H root with OM

	Affirmative		Negative	
a.	tì-ngù-cí-lí-nàám-à	d.	tì-ngù-cí-lí-nàm-á cáà	'we went and lied (it)'
b.	tì-ngù-cí-**ŵ**á-ꜜnám-ìís-à	e.	tì-ngù-cí-**ŵ**á-ꜜnám-ís-á cáà	'we went and caused them to lie'
c.	tì-ngù-cí-**ŵ**á-nàm-íl-ìs-ààn-à	f.	tì-ngù-cí-**ŵ**á-nàm-íl-ìs-àn-á cáà	'we went and caused them to lie for eo'

The stem patterns of these forms differ from the previous two sets of forms, requiring additional rules, some of which lead to a tonal neutralization between corresponding toneless and H-toned stems. To see the need for an additional tonal process, let us consider partial derivations of (32h) and (33f).

```
(34) a. ti-ngu-ci-ŵa-pum-il-is-an-a   b.   ti-ngu-ci-ŵa-nam-il-is-an-a   UR
                  |                             |     |
                  H         H                   H     H     H

        ti-ngu-ci-ŵa-pum-il-is-an-a      ti-ngu-ci-ŵa-nam-il-is-an-a      MH Docking
                  |    |                        |     |        |
                  H    H                        H     H        H

        ti-ngu-ci-ŵa-pum-il-is-an-a      ti-ngu-ci-ŵa-nam-il-is-an-a      Tone Doubling
                  | /   | /                     | /   | /      |
                  H     H                       H     H        H
```

The partial derivation of the two forms above reflects MH Docking and Tone Doubling. To account for the fact that the roots /pum/ and /nám/ both surface as Low, we propose a third process (in addition to Reverse Meeussen's Rule (20) and Meeussen's Rule (30)) to repair an OCP violation. OCP Delinking, as formalized below in (35) will delink the first association line of a doubly-linked H when immediately preceded by another doubly-linked H. (The additional requirement that there be an additional toneless mora following will be discussed and justified further below.)

(35) OCP Delinking

```
μ  μ  μ  μ  μ
 \ /    ǂ /
  H     H
```

Below, we continue the derivation started in (34)

(36) Derivation of (32f) and (33f) continued…

```
ti-ngu-ci-ŵa-pum-il-is-an-a         ti-ngu-ci-ŵa-nam-il-is-an-a          OCP Delinking
          | /      |                          | /      |      |
          H        H                          H        H      H

[tì-ngù-cí-ŵá-pùm-íl-ìs-àn-à]       [tì-ngù-cí-ŵá-nàm-íl-ìs-àn-á]        PR
```

In each case, OCP Delinking will apply, correctly accounting for the fact that the root V (whether underlyingly toneless or H-toned) surfaces as Low. We note that the process exhibited above is not one of tone shift of the root H, as subsequent Tone Doubling would incorrectly predict a H on the third TBU of the stem.

Next, let us consider the form in (32c), derived below.

(37)

```
ti-ngu-ci-ŵá-pum-is-a          UR
          |
          H        H

ti-ngu-ci-ŵa-pum-is-a          MH Docking
          |     |
          H     H

ti-ngu-ci-ŵa-pum-is-a          Tone Doubling
          | /   | /
          H     H

ti-ngu-ci-ŵa-pum-is-a          OCP Delinking
          | /      |
          H        H

ti-ngu-ci-ŵa-pum-iis-a         Penult Lengthening
          | /      |
          H        H

[tì-ngù-cí-ŵa-pùm-íìs-à]       PR
```

As can be seen, the MH which has docked on the stem-initial TBU undergoes Doubling, which then triggers OCP Delinking, resulting in a Falling tone on the penult. This can be contrasted with the phrase-final forms in (6c), (11c) and (25c), where the penult surfaces as a level Low, and not a Fall. (In the non-phrase-final counterparts of these latter 3 forms, however, Tone Doubling does apply.) While more than one account might be possible here, we assume that Tone Doubling always applies (when its structural description is met), and that there is a post-lexical rule following Penult Lengthening, which simplifies a Falling tone to level Low when it is immediately preceded by a H.

(38) Fall to Low Simplification

```
σ      σ
|     / \
μ  μ    μ
\ ǂ
 H
```

The final forms to be accounted for are (33b) and (33e), the phrase-final and non-phrase-final realizations of the same verb. First we consider (33b).

```
(39)    ti-ngu-ci-ŵ̂á-nam-is-a            UR
                  |      |
                  H      H   H

        ti-ngu-ci-ŵ̂á-nam-is-a            MH Docking
                  |      |     |
                  H      H     H

        ti-ngu-ci-ŵ̂á-nam-is-a            Tone Doubling
                  | /    | /   |
                  H      H     H
        n/a                              OCP Delink

        ti-ngu-ci-ŵ̂á-nam-iis-a           Penult Lengthening
                  | /    | /    |
                  H      H      H

        ti-ngu-ci-ŵ̂á-nam-iis-a           P-final Left Shift
                  | /    | / |
                  H      H   H

        ti-ngu-ci-ŵ̂á-nam-iis-a           Intrasyllabic OCP Resolution
                  | /    |   |
                  H      H   H

        [tì-ngù-cí-ŵ̂á-ꜜnám-ìís-à]        PR
```

This form is different from the ones derived in (34) and (36) in that the root vowel does not surface as Low. To account for this difference, we formalize OCP Delinking (35) to apply only when the second doubly-linked H is followed by a toneless TBU. In examining the outputs in (39) we note a configuration, not seen up to this point, where a derived H is immediately followed by another H across the stem. We saw in (17) that when this configuration was found within the stem, it resulted in a string of 3 level High-toned TBUs. However, when this same OCP-violating configuration is found *across* the stem, as in (39), a downstep results between the two TBUs linked to different H autosegments.

Within the phonological literature, downsteps have been analyzed in two main ways. In languages which contrast H vs. L underlyingly, it is often the case that when a TBU bearing a L either deletes or glides, that L remains floating, and can trigger a downstepping of a following H-toned TBU (Clements & Ford (1981), Pulleyblank (1986)). In languages like CiTonga, however, where the underlying contrast is H vs. Ø, downstep can be signaled without recourse to a floating Low. As proposed by Odden (1986), in such languages a downstep from High to downstepped High can be signaled as a transition from one TBU to an immediately following TBU, where each is linked to a different H autosegment. This is illustrated below.[12]

```
(40)  a.  µ   µ        b.  µ   µ
           \ /             |   |
            H              H   H

          [ µ́  µ́ ]         [ µ́ ꜜµ́ ]
```

Using this approach, we directly account for the downstep present in (39) with no additional assumptions or rules. In forms such as the one derived in (17), however, where there is no downstep (i.e. the three stem TBUs are all pronounced on the same pitch), we must posit a process which fuses the two High tones, formalized in (41).

(41) Tone Fusion

```
          µ  µ          µ   µ
          |  |    →      \ /
          H  H            H
```

Such a rule of fusion must be sensitive to the domain in which the two Hs are found. While it must not apply to Hs across a stem boundary, in order to account for (39), it must apply both within the stem (17), as well as across words. Examples of its application across words is motivated by forms such as (8a,c), and evident in the phrase examined in (18). Two additional cases confirming its application across words are given below (where the UR given reflects the docking of the melodic H).

(42) a.	tì-ngù-vw-á fólómààni	‘we heard the captain’	/ti-ngu-vw-á fólomani/
b.	tì-ngù-púm-á fólómààni	‘we beat the captain’	/ti-ngu-púm-a fólomani/

[12] See Bickmore (2000) and (2007) for the same treatment of downstep in other Bantu (Zone M) languages.

Lastly, we consider the form in (33e), the non-phrase-final counterpart to (33b).

```
(43)    ti-ngu-ci-ŵ̂á-nam-is-a        UR
                  |       |
                  H       H   H

        ti-ngu-ci-ŵ̂á-nam-is-a        MH Docking
                  |        |       |
                  H        H       H

        ti-ngu-ci-ŵ̂á-nam-is-a        Tone Doubling
                   | /     | /     |
                   H       H       H
        n/a                           OCP Delink

        ti-ngu-ci-ŵ̂á-nam-is-a        Fusion
                   | /      \ | /
                   H          H

        [tì-ngù-cí-ŵ̂á-ꜜnám-ís-á]      P.R.
```

Here again, OCP Delinking will not apply since there is a H-toned TBU after the second multiply-linked H. Fusion will apply to the two adjacent Hs in the stem, but not between the Hs across the stem boundary, which results in a downstep. We order Fusion (clearly a post-lexical rule as it also applies at the phrasal level between words) after Penultimate Lengthening, accounting for the fact that it will not apply within the stem in the phrase-final form of this verb as derived in (39).

To conclude this section, we want to emphasize that the stem tone patterns exhibited in the data sets involving the Simple Past, viz. (25)-(26), (27)-(28), and (32)-(33), are general throughout the language, and are not, e.g., confined to this TAM, or the presence of the Itive /cí-/. The patterns exhibited in (25)-(26) are found whenever the TBU preceding the stem surfaces as Low. This was demonstrated above for the infinitival forms in (11) and (12). These same patterns also occur in the Potential (/nga-/), Distant Future (/zamu-/), Future Transitional (/amu/), and the Indefinite Future (/kaa-/), whether a (toneless) object marker is present or not. The patterns found in (27)-(28), exhibited whenever the pre-stem TBU is underlyingly H-toned, are found not only in other Itive TAMs, such as the Present Perfect Itive (/a-cí-/), but also in the Simple Present and Near Future, where the stem is immediately preceded by a H-toned subject marker (the TAM prefix being Ø in both cases). When an object marker is found within these three TAMs, then the final pattern, exhibited in (32)-(33), obtains, as the mora immediately preceding the stem will have a derived High tone.[13]

[13] There are two TAMs, the imperative (1) and subjunctive, that prima facie seem to be exceptional in their tonal behavior. We argue elsewhere, however, that both do in fact adhere to all the tonal processes described here, but this is masked on the surface due to an absolute neutralization of prefixal tones, which happens just in these two TAMs.

Summary and Conclusion

Cross-linguistically, the OCP has been shown to be both a rule blocker, as well as a repair trigger (see Myers 1997 for a good summary and OT solutions). In CiTonga, we have seen the OCP function in this second respect. The OCP does not block the application of Tone Doubling, either within the stem (17), (26e), across the stem (28d), (34a,b), or across words (18). Neither does the OCP block the application of Phrase-final Left Shift, either within the stem (22), or across the stem (32a).

Turning to OCP violations which are either underlying, or created by rule, we have seen that in some cases the violation is countenanced, while in many others it is repaired by rule. But of particular interest to us, and what makes CiTonga especially interesting in this regard, is that the language does not implement one consistent repair strategy. Rather there are five different ones: Meeussen's Rule (30), Reverse Meeussen's Rule (20), OCP Delinking (35), Fusion (41) and Intrasyllabic OCP Resolution (23). We have shown above that the determination as to which strategy is employed depends on two factors 1) the domain containing the two Hs, and 2) whether the H autosegments in question are linked to a single TBU or multiple TBUs. This is summarized in the table below, where the example numbers locate either a form or derivation where that type of OCP repair (or non-repair) is exhibited.

(44) OCP Structures and their resolutions

```
     Structure        Across the Stem        Within the Stem        Across Words
a.   μ  μ             μ  [ μ   (29)               μ   μ   (21b)     μ    μ   (18)
     |  |             |    |                      |   |              \  /
     H H              H    H → ø             ø ←H   H                 H

b.   μ  μ  μ          μ  μ ꜜ[ μ  (39)        μ  μ  μ   (26e)        μ   μ   μ (11f)
      \/   |           \/      |              \ |  /                 \  |  /
      H    H           H      H               H                        H

c.   μ  μ  μ                                                        μ   μ   μ   (42a)
     |   \/                                                          \  |  /
     H   H                                                             H

d.   μ  μ  μ  μ       μ  μ [μ  μ  (36)                              μ  μ  μ  μ  (42b)
      \/    \ /        \/      /                                     \ \ / /
      H     H          H     H                                         H

e.      σ                σ   (22)                σ   (32a)
       / \              / \                     / \
     μ    μ           μ    μ                  μ    μ
     |    |           +    |                  +    |
     H    H           H    H                  H    H
```

First, it should be understood that the morae shown in (44a-d) all belong to separate syllables. The syllable nodes have been suppressed here only for considerations of space. The one case involving two morae belonging to a single syllable is given in (44e). In this one, post-lexical case, the OCP resolution is resolved by delinking the first H (which will always also be linked to the mora of the immediately preceding syllable as well).

Turning to (44a-d), four different structures are examined: 1) two singly-linked Hs, 2) a doubly-linked H followed by a singly-linked H, 3) a singly-linked H followed by a doubly-linked H, and 4) two doubly-linked Hs. Let us first address the few gaps in the table. While the configuration in (44c) can be found across words, it will never occur within a word—either within a stem or across one. Within a stem, the only positions where two Hs will be found (after MH docking) are on the stem-initial and stem-final morae. Thus there is never an input HHØ string within a stem, where the second H would undergo doubling to create the configuration in (44c). While it is possible to have a HH string across a stem, Meeussen's Rule will apply in such cases, bleeding any chance for the second H to spread. The configuration in (44d) will never occur within a stem for the same reason just mentioned above. Such a configuration would have to result from an underlying HØHØ sequence within a stem. While the first of the two Hs is possible as a stem-initial H, a second H would always be found in stem-final position, never on the penult.

We finish by briefly summarizing the attested OCP repair strategies found in the attested configurations in (44a-d). When two Hs are underlyingly associated to adjacent TBUs, one will delete. Within the stem the first deletes, while across the stem, the second deletes. When two underlying Hs are separated by a single TBU, the first will undergo Doubling, creating an OCP violation of type (44b,d). When the second H is doubly-linked, OCP Delinking will apply (44). Post-lexically, any two Hs linked to adjacent TBUs within the stem or across the word will undergo Fusion. Any remaining OCP violation, such as (44b) across the stem (as well as the one in (43)), goes unrepaired.

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