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ARTICLE

The stratal structure of Kuria morphological tone

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Abstract

Marlo *et al.* (2015) claim that Kuria verbal tone morphology undermines three well-established principles of locality and modularity: (1) *Phonological Locality*: the assumption that rules and constraints may only evaluate a small window of phonological objects; (2) *Cyclic Locality*: the stratal organization of morphophonology into stems, words and phrases; and (3) *Indirect Reference*: the claim that phonological rules and constraints cannot directly access morphosyntactic information. Sande *et al.* (2020) turn this claim into an argument for a new model of the morphosyntax–phonology interface, Cophonologies by Phase, which erases the separation between phonology and morphology and abandons standard locality domains in favour of syntactic phases. In this article, I show that the conclusions of both articles are unfounded: the Kuria data follow naturally from an analysis based on autosegmental tone melodies in a version of Stratal Optimality Theory which embraces all three restrictions, Phonological and Cyclic Locality and Indirect Reference, the latter implemented by Coloured Containment Theory. I argue that this approach obviates the technical and conceptual objections raised by Marlo *et al.* against a tone-melody analysis of Kuria, and makes more restrictive predictions about possible systems of tonal morphophonology compared to construction phonology frameworks.

Contents

1. Introduction

The Eastern Bantu language Kuria marks verbal Tense/Aspect/Mood (TAM) paradigms on stems by tone patterns of a single high-tone span, starting on the first stem mora in the past tense (1a), on the second mora in the past progressive (1b), on the third in the remote future (1c) and on the fourth in the inceptive (1d), spreading in all cases to the penultimate mora of the phrase (data from Marlo *et al.* 2015, henceforth MMP). Note that verb roots do not have distinctive underlying tones in Kuria. Square brackets indicate stem domains, including the obligatory inflectional final vowel (FV).[1]

(1) *Kuria mora-counting tone morphology* (MMP: 252–253)

a. *Past μ1*
n-to-o-[hóótóótér-a]
FOC-1PL-TAM-[reassure-FV]
'we have reassured'

b. *Past progressive μ2*
n-to-oka-[hoótóótér-a]
FOC-1PL-TAM-[reassure-FV]
'we have been reassuring'

c. *Remote future μ3*
n-to-re-[hootóótér-a]
FOC-1PL-TAM-[reassure-FV]
'we will reassure'

d. *Inceptive μ4*
to-ra-[hootoótér-a]
1PL-TAM-[reassure-FV]
'we are about to reassure'

MMP claim that the Remote Future and the Inceptive require rules (or constraints) which specify an arbitrary number of phonological objects, thus crucially violating the standard assumption in theoretical linguistics that phonological processes apply in a small local evaluation window (Hewitt & Prince 1989; McCarthy 2003). In addition to challenging phonological locality, Kuria also seems to disregard standard morphosyntactic *cyclic* locality domains of phonological processes, established in work on Lexical Phonology and Morphology (Bermúdez-Otero 2018b; Kiparsky 2020), which include stems, words and phrases (see Hyman 2008 and Downing & Kadenge 2020 on the role of the stem and word domains in Bantu). If verb stems are too short to accommodate the required position of a H and the verb has an object, the domain for the start of the H-tone span extends to the object, as shown in (2) for the remote future and the inceptive:

[1] I am adopting here the abbreviated labels for Tense-Aspect-Mood categories used by MMP. See Appendix A.1 in the Supplementary Material for the corresponding category labels from Mwita (2008), which represent the semantics and function of these categories more faithfully. Abbreviations used in glosses are: AUG = augment, CLS = (nominal) class, FOC = Focus, FV = final vowel, INF = infinitive, NEG = negation, PL = plural, PFV = perfective, SG = singular, TAM = tense-aspect-mood affix, √ = lexical root. Tones are abbreviated as H (high, marked by an acute accent) and L (low, unmarked in the data). Grave accent marks superlow tone (see §2.2.3 for discussion).

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(2) *Morphological H on a following object* (MMP: 259)

a. *Remote future µ3*
n-to-re-[rom-a] é̲ɣétɔ́ɔ́kɛ
FOC-1PL-TAM-[bite-FV] banana
'we will bite a banana'

b. *Inceptive µ4*
to-ra-[rom-a] eɣé̲tɔ́ɔ́kɛ
1PL-TAM-[bite-FV] banana
'we are about to bite a banana'

MMP claim that the extension of stem-level tone morphology to independent syntactic words provides direct counterevidence against one of the cornerstones of lexicalist architectures, Bracket Erasure (Kiparsky 1982): Tone melody assignment must happen at the phrase level to apply across the word boundary, but would then need to recover the morphological content (i.e., remote past) and boundaries (the word-internal left stem boundary anchoring the tone) at the stem level, which is just the type of information made inaccessible to subsequent strata by Bracket Erasure.

Whereas MMP provide an analysis using morphologically restricted derivational rules applying at the phrase level, Sande *et al.* (2020; henceforth SJI) sketch an account with construction-specific weightings of constraints, arguing that the unusual domain of H-tone assignment exemplified in (2) – a stem and a following object noun excluding word-internal prefixes – provides evidence for constraint evaluations and rankings linked to syntactic phases in a Distributed Morphology model where words are built in phrasal syntax. Thus, both articles claim that, on top of non-canonical phonological and syntactic domains, Kuria also requires abandoning the Indirect Reference Hypothesis (Nespor & Vogel 1986; Bermúdez-Otero 2012), which disallows direct reference to morphosyntactic information in phonological rules and constraints. To highlight the common features of the rule-based framework of MMP and the constraint-based one of SJI, I will call these in the following *Global Construction Phonology* approaches. The central goal of this article is to provide a reanalysis of the Kuria data which avoids the adoption of this type of approach and is compatible with all three tenets of classical lexical and modular architectures, Phonological Locality, word- and stem-based Cyclic Locality, and Indirect Reference.

In a nutshell, my reanalysis of the Kuria data relies on standard autosegmental representations (Goldsmith 1976; Yip 2002) and Stratal Optimality Theory (Kiparsky 2000; Bermúdez-Otero 2018b), a combination implying that floating tones can be 'inherited' across strata (Hyman & Ngunga 1994; Paschen 2018). Following Cammenga (2004), I assume that stem-initial H tones are underlyingly simple H prefixes, whereas patterns with later H tones have morphemic tonal melodies with additional leading L tones. Thus, the tonal remote future morpheme (µ3) is LLH and the inceptive (µ4) is LLLH. As a consequence, with verb stems of sufficient length, the Hs emerge on the third and fourth moras simply by left-to-right association, as shown in (3a) for the inceptive example in (2b). At the same time, this account also predicts that in the case of shorter stems only Ls are associated and that the remaining tones may stay floating at the right periphery of the verb. The first crucial contribution of this article is to show by the way of a detailed analysis that the tone-melody approach not only

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obeys Phonological Locality and Indirect Reference, but also naturally accounts for the apparent violation of Cyclic Locality. Under the assumption that the stem-level and word-level phonology preserve floating tones at the right edge, these survive to the phrase level, where they may then be associated, preserving the overall tone contour since both L and H tones are transferred (3b):

(3) a. *Stem level:*

L L L H	→	L L L H
ro ma		ro ma

b. *Phrase level:*

L L L H	→	L L L H
ro ma e ɣe tɔ ɔ kɛ		ro ma e ɣe tɔ ɔ kɛ

MMP object to Cammenga's tonal melody representations on the grounds of three alleged problems connected to Ls: (1) they lead to technical difficulties in the formalization of H-spreading since a phonological process cannot simultaneously remove Ls and spread Hs; (2) there is no evidence for underlying L tones in Kuria apart from capturing the position of H-tones; and (3) representations such as LLLH violate the OCP – the ban against adjacent identical elements/tones. The second crucial contribution of the current article is to show that all three objections are resolved under the assumption of Stratal Optimality Theory, since OT inherently applies phonological processes such as deletion and spreading in parallel but – by Richness of the Base (Prince & Smolensky 1993) – does not allow for constraints on underlying representations that would exclude Ls from underlying representations. In fact, I will show that in a representational analysis respecting Indirect Reference, morphological Ls also *have* effects independent of ensuring the linear position of Hs: They overwrite Hs, they block association of floating tones, and they limit the application of spreading. OT and Richness of the Base also form a natural backdrop for tone melodies with respect to the OCP which in OT does not (and cannot) hold for input representations but is a violable constraint on output representations (Myers 1997; Yip 2002) in line with the substantial independent evidence against the OCP as a universal restriction on inputs (Goldsmith 1976; Odden 1986; Cahill 2007; McPherson 2016; Rolle 2021). Hence, consecutive L-tones as in (3) neither can nor should be in principle excluded in the lexical representation of tonal morphemes.

A further objection against Cammenga's tone melody representations raised by an anonymous reviewer is that it does not actually eliminate 'counting' from grammar, but simply shifts it from phonology to morphology without a gain in restrictiveness. In the following, I will deliberately avoid the term 'counting' used prominently in the discussion of Kuria (see, e.g., Paster 2019) and other discussions of phonological locality, since I think it is misleading. A genuinely counting constraint would use numbers in a way abstracting away from phonological substance, for example, by requiring that a well-formed word should have the same number of vowel and consonants. The issue relevant for Kuria is clearly not arithmetic computation of this type, but the existence of a principled local evaluation window for phonological constraints. Below in §5.1, I will argue that this consists in a constraint locus of a single autosegmental object with an optional left and right context specification of the same type. This allows for the constraints implementing left-to-right association assumed here, but not for the rules/constraints assumed by MMP and SJI, which capture the Inceptive as attraction or shifting to a position separated by four moras from its underlying position (or from the left stem boundary). Crucially, I will show that the lack of a locality condition of this type predicts unattested empirical long distance effects in tonal phonology excluded by the overall approach adopted here.

The article is structured as follows: In §2, I lay out my theoretical background assumptions, autosegmental representations in Stratal Optimality Theory and Coloured Containment Theory (van Oostendorp 2007; Trommer 2011, 2022). §3 develops the detailed reanalysis for the central Kuria data provided by MMP. §4 shows that the problems raised by MMP as decisive counterarguments against a similar approach to Kuria by Cammenga (2004) dissolve under the natural assumption that H-spreading in the language is an epiphenomenon of two heterogeneous processes: a general spreading process to provide moras with tone, and Plateauing of Hs. Building on this result, §5 shows that the Stratal OT framework does not only account for Kuria, but is also preferable to the Global Construction Phonology approaches employed by MMP and SJI because it makes better typological predictions for possible systems in the morphophonology of tone. §6 shortly discusses other approaches to Kuria suggested in the literature. §7 summarises and concludes the article.

2. Theoretical background

2.1 Stratal Optimality Theory and the Four-Hypothesis Program

The goal of this article is to show that Kuria tone association can be captured under coherent and restrictive theoretical assumptions in a model which maintains modularity and the standard domain structure from Lexical Phonology, stems, words and phrases (utterances). Therefore, I will adopt here the most explicit recent research program along these lines, the Four-Hypothesis Program of Bermúdez-Otero (2012) (slightly rephrased):

(4) *The Four-Hypothesis Program* (Bermúdez-Otero 2012: 44, 50)

a. *Indirect Reference:* Phonological rules and constraints do not have direct access to morphosyntactic structure and substance (e.g., to headedness, or to morphosyntactic features such as plural).

b. *Morph Integrity Hypothesis:* Morphological operations do not alter the syntactic specifications or phonological content of morphs.

c. *Cyclic Locality:* Phonology applies cyclically over specific morphosyntactic constituents, subject to 'Bracket Erasure', that is, the inaccessibility of any morphosyntactic information of an inner stratum to outer strata.

d. *Phonetic Interpretability:* Derived phonological representations must be phonetically interpretable.

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Whereas the issue of Phonetic Interpretability is largely orthogonal to the problems discussed in this article, the three conditions on morphology and phonology are immediately relevant. Indirect Reference and Cyclic Locality are two of the major theoretical assumptions defended here. With Bermúdez-Otero (2018b), I assume that the latter implies a minimal version of Stratal Optimality Theory which only comprises three strata: stem, word and phrase levels (pace Kiparsky 1982). See Hyman (2008) and Downing & Kadenge (2020) on overviews of the broad literature providing evidence for stems and words as phonological domains in Bantu, and Myers (1997), Mutaka (1994) and Hyman (2017) for case studies providing detailed evidence for these domains in a three-level stratal architecture as assumed here. As shown by Bermúdez-Otero (2012), Morph Integrity is an important complementary assumption to Indirect Reference by prohibiting the relocation of morphologically triggered phonological rules and constraints to the morphology component, which would deprive the Indirect Reference hypothesis of most of its empirical predictions. Thus, Morph Integrity effectively commits morphology to a strictly concatenative approach: It may just add phonological structure such as segments or tones, but not alter phonological representations.

2.2 Coloured Containment Theory

The framework I will adopt here for implementing the first component of the Four-Hypothesis Program, Indirect Reference, is Coloured Containment Theory (van Oostendorp 2007; Trommer 2011; Paschen 2018), since it is the only version of OT which has developed a comprehensive Indirect Reference approach to nonconcatenative morphology covering length-manipulating morphology (Zimmermann 2014), vocalic and consonantal mutation morphology (Paschen 2018; Trommer 2021), reduplication (Paschen 2018) and tonal morphology (Trommer 2022). Historically, Coloured Containment Theory is a conservative extension of the original implementation of OT in Prince & Smolensky (1993) with a more limited set of possible structural changes than Correspondence Theory – restricting them basically to insertion and marking for non-pronunciation.

2.2.1 Indirect reference by colouring

The central restriction of the phonology–morphology interface in Coloured Containment Theory is the assumption that at the transition from morphosyntax to phonology, all specific information about single morphemes (e.g., features like first person, plural, or the specific information identifying a root like [go]) is replaced by a set of arbitrary colours, resulting in a morpheme-level implementation of Indirect Reference. A useful analogy for this process is anonymisation in the context of a behavioural experiment, where subjects are assigned arbitrary labels such as *A* and *B*. This still allows for retracing internal identity (e.g., that subject *B* reacted in the same ways to tasks 1 and 2 of the experiment), but makes it impossible to access individual data like name or height. Similarly, by Colouring all phonological material belonging to a particular morpheme *M* is assigned the same arbitrary colour *C*, whose only substantial property is that it is different from the colours assigned to other morphemes and to colourless epenthetic material.

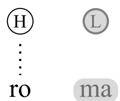
I illustrate this with the toy example in (5), a hypothetical H root [ro], followed by the past tense suffix [-ma] with a floating H tone. For phonological evaluation, the relevant input is the structure in (5a), where colour identifies the floating L as part of the same morpheme as the syllable [ma] (and distinct from [ro] and its H-tone) with a different colour, even though they do not form a coherent phonological object, a fact which would be difficult to capture by morpheme boundaries. To ensure compatibility between the online and the printed version of the article, I will code colours by background shading. For convenience, the colour of lexical roots or stems will be marked implicitly by white background.

(5) *Autosegmental representations in Coloured Containment Theory*

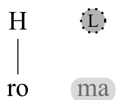
a. *Input*

b. *Candidates*

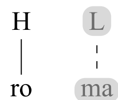
i. *'Deleted' association line*



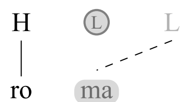
ii. *'Deleted' tone*



iii. *Epenthetic association line*



iv. *Epenthetic tone*



Trommer (2022) describes the role of colouring in restricting the phonology–morphology interface by the declarative principle in (6):

(6) *Colour Map Hypothesis:* The only morphological information visible to phonology is presence and difference of morphological colour

Put derivationally, all morphological information is deleted after Colour Assignment and before phonological evaluation. Thus, OT constraints may refer to whether two phonological elements are tautomorphemic or not, but cannot invoke specific colours, that is, particular morphemes. Crucially, this results in a proper subset of the ways constraints may access morphological structure compared to Correspondence Theory and colourless versions of Containment (as in Prince & Smolensky 1993). To cite just one example, there can be general alignment constraints for *all* morpheme boundaries in a language (e.g., aligning them to syllable boundaries), but not morpheme-specific alignment constraints, as for the Tagalog *-um-* infix (Kager 1999: 115, 122). Specific restrictive predictions of the Colour Map Hypothesis will be discussed in §5.3.

Trommer (2022) shows that colour is both sufficient and necessary to capture a broad spectrum of morphological tone patterns in an Indirect Reference approach.

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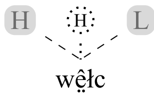
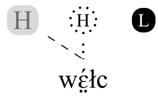
A simple example he provides is tonal overwriting in Dinka, where monomorphemic H- -L circumfixes like the applicative overwrite verb bases resulting in a falling tone (7a), whereas in a combination of a H prefix such as the centrifugal and the nonfinite L suffix, the former blocks the latter (7b). This pattern obviously requires some residual sensitivity to morphological structure since the underlying tone configurations are otherwise identical. Trommer captures it by a constraint against association of a syllable to (tones of) more than two morphological colours.

(7) a. *Dinka applicative circumfix*



b. *Dinka centrifugal prefix + non-finite suffix*



Compare this to the two other major ways to achieve Indirect Reference to morphological structure, unlabelled morpheme boundary symbols as used in SPE (Chomsky & Halle 1968) and the Prosodic Hierarchy (Nespor & Vogel 1986). Boundary symbols would fail to capture the crucial difference between (7a) and (7b). Both tone sequences would reduce to H+H+L, and the prosodic hierarchy does not link morphosyntactic structure to autosegmental features, but to bigger prosodic domains such as feet and prosodic words.

The conceptual simplicity of Coloured Containment Theory lies in the fact that colour captures not only Indirect Reference at the morphology–phonology interface, but also has the additional crucial function of distinguishing underlying (= morphological = coloured) and epenthetic (= non-underlying = colourless) material (achieved by correspondence relations in Correspondence Theory). Thus, the notation used here for the lack of morphological colour – dashed lines for colourless association lines and light grey text for colourless tones, as in (5b-iii) and (5b-iv) – directly encodes their status as epenthetic material in output representations.

2.2.2 Containment

The Containment requirement of Coloured Containment Theory states that input structure can never be literally deleted in possible outputs. The representation of deletion is achieved by diacritically marking parts of the input as phonetically invisible. Phonetic invisibility is indicated graphically here by dotted lines for invisible association lines (5b-i), and dotted circles around invisible tones (5b-ii). Crucially, there is no candidate where tones (or segments) are literally removed from possible output representations. Thus, inputs and their modifications performed by Gen are fully reconstructable from outputs, obviating input–output comparisons and indices as in Correspondence Theory. Hence, (5b) illustrates *all* possible tonal changes to the input candidate in (5a). Besides full deletion also splitting or changing a tone (say from H to L) is in principle excluded. For the analysis of Kuria, the most important restrictive aspect of the theory is that linearization can never be changed. There is no metathesis (see Zimmermann 2009 for detailed arguments) or dislocation of tone. This will be shown to result in correct empirical predictions for 'tone-shifting' systems like Kuria in §5.1.

Autosegmental Containment allows optimality-theoretic markedness constraints to still access input structure which is unrealized in the output to capture simple opacity effects. However, in the case of tone, this simply amounts to what correspondence-theoretic OT can do as long as it embraces the standard possibility of allowing floating tones in the output of an optimization cycle (see §2.2.3). Thus, in principle, the Kuria analysis developed in this article could be reimplemented in Correspondence Theory. However, as shown by Trommer (2011, 2022), Containment allows for a more principled analysis of floating features, based on the assumption that markedness constraints come generally in two versions: a phonetic and a generalized one, where the phonetic version (marked by underlining) only evaluates phonetically realized structure, and the generalized one (typographically unmarked) evaluates all structure in a candidate (whether realized or not). This predicts, for example, that in addition to the well-known constraint requiring that every phonetically realized output tone is (phonetically) associated to a mora, notated here as $\underline{\tau \rhd \mu}$ (where underlining indicates that a constraint is only sensitive to phonetically visible representations), there is also a generalized version of this constraint, $\tau \rhd \mu$ (without underlining), indicating that it is sensitive to all phonological material in an output candidate. In contrast to $\underline{\tau \rhd \mu}$, $\tau \rhd \mu$ has an inherent bias of favouring overt association of underlyingly floating material, thus deriving the content of the constraint MaxFlt, which explicitly requires floating tones to associate (Wolf 2007; see also Zoll 2003), in a way which is directly predicted by the overall design of the theory.

2.2.3 Bracket Erasure and Cyclic Locality

The notion of Bracket Erasure in stratal phonology designates its crucial mechanism to ensure Cyclic Locality: At the end of a stratum *S*, all information accessible through morphosyntactic structure building in *S* – especially hierarchical structure ('brackets') – is lost and becomes hence inaccessible to following strata. Here, I will show how this assumption is implemented in Coloured Containment Theory where the morphological information visible to phonology is already substantially restricted by Colouring, and there are no brackets. I assume that at the transition from one stratum to the next, there are two natural, but significant processes illustrated with the toy examples from (5b) in (8), assuming that the next stratum adds a new preceding morpheme, [βa]. *Clean-Up* removes all material which is marked as phonetically invisible – such as the association line in (8a) and the L in (8b) – from the representation. This means that Containment holds for the Optimality-Theoretic evaluation at a single stratum, but not globally across strata.

The equivalent of Bracket Erasure is the second process applying between strata, *Monochromisation*, which assigns a uniform colour to all material which is the result of an evaluation at a previous stratum. Thus, the two morphemes and the epenthetic L (and its association line), which can all be differentiated in their morphological status in (8d) at the output of stratum *n*, all acquire the same colour (i.e., behave representationally as a single morpheme) as the input of the next stratum *n* + 1, in contrast to [βa], which did not participate in the earlier evaluation cycle.

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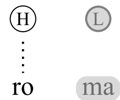
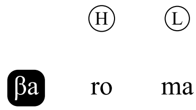
(8) *Monochromisation ('Bracket Erasure') and Clean-Up between strata*

a. *'Deleted' association line*

i. *Output of stratum n*

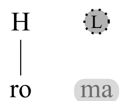


ii. *Input to stratum n + 1*

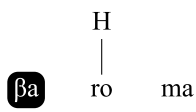


b. *'Deleted' tone*

i. *Output of stratum n*

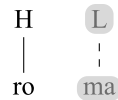


ii. *Input to stratum n + 1*

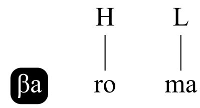


c. *Epenthetic association line*

i. *Output of stratum n*

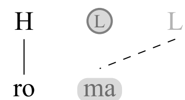


ii. *Input to stratum n + 1*

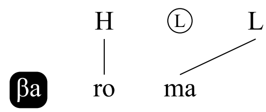


d. *Epenthetic tone*

i. *Output of stratum n*



ii. *Input to stratum n + 1*



Bracket Erasure does not affect floating tones (if they are not marked as phonetically invisible and hence subject to Clean-Up), since they are purely phonological objects. Thus, without any further stipulation, floating tones will be inherited to subsequent strata and potentially to the output of the phrase level. I will call this phenomenon, which will play a crucial role in the Kuria analysis developed below, *Floating Persistence*. Following Paschen (2018), I will call floating features that become phonologically visible in a stratum later than the one in which they are lexically inserted 'dormant features'.

It is important to note that Floating Persistence is not tied specifically to Coloured Containment. It also represents the standard approach in versions of Stratal OT based on Correspondence Theory (see, e.g., Bermúdez-Otero 2018a; Gjersøe 2019; Jaker & Kiparsky 2020) going back at least to the foundational work on tone in Lexical Phonology by Pulleyblank (1986).[2] In Pulleyblank's classic analysis of Tiv, verbal L prefixes marking tense remain floating up to the point of phonetic interpretation.

[2]Floating Persistence is incompatible with some versions of Stray Erasure (Steriade 1982), a convention deleting floating material at the end of a derivation assumed in pre-OT phonology, motivated primarily by capturing the relation of syllabification and segmental deletion. The only systematic applications of something like Stray Erasure to tone I am aware of are Clark (1990) on Igbo and Trommer (2011) on Western Nilotic, but neither of these works addresses the evidence for Floating Persistence in many other languages. Even in the area of syllabification, Stray Erasure has been controversial (Kenstowicz 1994), or formulated as allowing for systematic exceptions. Thus, the influential version of Stray Erasure by Itô (1988) allows for persistent stray segments under final extrametricality. Strikingly, this is fully parallel to the behaviour of morphological tone in Kuria, which survives just in case it is domain final (see §3.3 for a constraint-based analysis of these facts).

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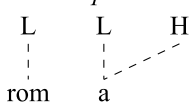
Before L roots, they block an otherwise general rule of high tone spreading, and before H-tone roots they trigger downstep. Similar evidence for floating tones persisting into the output of the phrase level has been identified in Kikuyu (Clements 1984), Gã (Paster 2003), Yala (Kenstowicz 1994), Kenyang (Odden 1988), Margi (Pulleyblank 1986) and several Grassfields Bantu languages (e.g., Kom; Hyman 2011). In fact, Kuria too exhibits two striking effects of floating-tone persistence similar to the Tiv pattern, when tone melodies are assigned to short bases in utterance-final position. If the number of tones in the melody outnumbers the mora count by exactly one tone, a rising contour emerges (the 'Contour' pattern). If the difference between tone and mora number is larger than one, the H-tone remains unpronounced, but an otherwise exceptionless process of Superlowering – further pitch lowering for a phrase-final L mora if it is preceded by another L mora – is blocked (the 'Lost-H' pattern). These options are illustrated in (9) with the remote future:

(9) *Kuria remote future 'we will …' (μ3) – short stems* (MMP: 254)

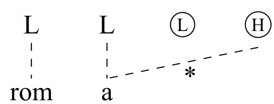
a.	*One-mora stems:*	n-to-re-[rj-a]	'eat'	Lost-H pattern
b.	*Two-mora stems:*	n-to-re-[rom-ă]	'bite'	Contour pattern
c.	*Three-mora stems:*	n-to-re-[tɛrɛk-á]	'brew'	Full realisation
d.	*Four-mora stems:*	n-to-re-[teremék-a]	'be calm'	Full realisation
		FOC-1PL-TAM-[√-FV]		

(10) shows the representation of both patterns in a tone-melody analysis using the root [rom] 'bite' (9b), which reveals the two effects of floating structure. The floating L of the remote future (10b) (i.e., the third tone of the melody) blocks association of the H to a mora already associated (by the constraint *Ⓣ introduced in (13) below, which blocks gapped association) to a L, which is otherwise possible as shown by the minimally different Remote Future form in (10a), and the floating H blocks Superlowering.[3] Thus, both effects are triggered by phonological features inherited from the lexical morphology – an interpretation also adopted in MMP's analysis of Kuria (see §5 for discussion).

(10) a. *Contour pattern*



b. *Blocked-H pattern*



3. Basic reanalysis of Kuria in Stratal OT

My reanalysis of Kuria is based on the combination of autosegmental tone melodies and stratal grammar. Tone melodies account directly for the morphologically conditioned position of Hs. In conspiracy with the stratal architecture and Floating

[3] I assume that Superlowering is part of phonetic interpretation (a phrase-final sequence of Ls is pronounced with lower pitch if at least two of them are associated), not of phonology proper, but this does not change the crucial point here that floating/unpronounced representations must be part of the outputs of phonology.

Persistence, they also naturally derive that morphological material added at a given stratum *S* may remain floating in *S*, and be associated in a later stratum *S′* to material only introduced in *S′*. Again, 'late' association of floating tones has already been proposed in the classical literature on tone in lexical phonology. Thus, Pulleyblank (1986) argues that in Margi a floating tense H is morphologically concatenated at the word level, but only associated at the phrase level. Arguments to the same effect for Bantu verbal tone are found in Hyman & Ngunga (1994) for Yao and Odden (1996) for Kimatuumbi. More recent applications in a cyclic/stratal architecture employing OT are found (in tonal and segmental phonology) in Bermúdez-Otero (2018a), Rolle (2018) on Kunama, Paschen (2018) on Fox and Seereer Sin, Jaker & Kiparsky (2020) on Tetsǫ́t'ıné and Dolatian (2022) on Armenian.

(11) shows the morpheme representations I assume for the TAM categories exemplified in (1). Stem-initial H tones as in the past (11a) are underlyingly simple H-tone affixes, whereas patterns with later H tones have morphemic tonal melodies with additional leading L tones (11b)–(11d):

(11) *Morpheme entries for inflectional tone melodies*

a.	*Past* (μ1)	↔	H
b.	*Past progressive* (μ2)	↔	L H
c.	*Remote future* (μ3)	↔	L L H
d.	*Inceptive* (μ4)	↔	L L L H

As a consequence, with verb stems of sufficient length, Hs surface on the third and fourth moras without any morpheme-specific phonology. Crucially, this account also predicts that in the case of shorter stems only Ls are associated and that the remaining tones may stay floating at the right edge of the verb. Under the assumption that the stem-level and word-level phonology preserve floating tones at the right edge, these survive to the phrase level where they may then be associated preserving their characteristic tone contour since both Ls and Hs are transferred. (12) illustrates this with a monomoraic remote future verb form and a following object.

I assume that for Kuria verbs the stem level corresponds to the macro-stem of the theoretical Bantuist literature, a constituent comprising the lexical root, any preceding object prefix, and all following suffixes, and that most inflectional tone melodies are added at this level, while tense, agreement and negation prefixes follow later at the word level, which coincides with the complete morphosyntactic word.[4] This is illustrated with the remote future (μ3) sentence [n-to-re-[rj-a] eɣé̱tɔ́ɔ́kɛ] 'we will eat a banana' (MMP: 259) in (12). The floating LLH melody is added at the stem level, where its initial tone is associated to the only available mora. At the transition to the word level the tone+stem combination undergoes Monochromisation and additional segmental prefixes are added (12b). Note that the stem [rja] actually contains two morphemes/colours, the root [rj] and the final inflectional vowel [-a], and the prefix string [ntore-] is composed of different agreement and tense prefixes, but all these different colours are only visible at the stratum where the affixes are concatenated.

[4]Following MMP, I do not discuss data with object prefixes. As pointed out by Mwita (2008: 145–146), these behave in all crucial respects like the forms without object prefixes.

The word level does not affect the floating melody tones, and thus the monochromised word enters the phrase level where it is concatenated with a following noun with empty moras, and the floating tones finally associate (12c):

(12) *Sample derivation of stratal straddling (remote future μ3)*

a. *Stem level*

L L H   L L H

rja → rja

b. *Word level*

L L H

→ n to re rja

c. *Phrase level*

L L H   L L H

nto re rja e ɣe tɔ ɔ kɛ → nto re rja e ɣe tɔ ɔ kɛ

Note that under this analysis, the TAM inflection is partially added at the stem level and partially at the word level, an assumption independently motivated for Kuria and across languages. Thus, TAM categories in Bantu more generally and also in Kuria are expressed mainly by prefixes, but also in the stem by additional suffixes, and especially by the choice of the obligatory final vowel. Both aspects may be illustrated by the μ2 past progressive, which has the additional suffix [-er], and the final vowel [-e], [n-to-oka-[rom-ér-e]] 'we have been biting' instead of [-a] as in (12) (MMP: 254). See Inkelas & Caballero (2013) for an insightful formal approach to multiple (extended) exponence in a cyclic framework and for evidence that also many other cases of multiple exponence cross-linguistically are due to word-internal stratification, where the same morphosyntactic categories are obligatorily expressed twice in different morphological strata.

In the following subsections, I will flesh out the analysis illustrated in (12) in full by specific constraint rankings in a Stratal OT grammar. In §3.1, I will introduce the basic OT constraints implementing left-to-right mapping and show how they derive different tone melodies in forms with sufficient TBUs to accommodate all morphological tones. The different types of word/phrase straddling are addressed in the subsequent sections, basically as a function of different types of mismatches between the number of tones in a melody and available TBUs (moras) in the input. If left-to-right association leaves additional empty moras, melody-final spreading applies, also across word boundaries to following objects (§3.2). §3.3 then addresses bases with fewer moras than tones in phrase-final position.

3.1 Basic left-to-right association

In the simplest case, Kuria tone association instantiates a classical case of one-by-one mora-to-tone association from left to right, as predicted by standard autosegmental association conventions (Goldsmith 1976; Pulleyblank 1986). Here, I restate these in a straightforward manner by Optimality-Theoretic constraints, which require association of tones to moras (13a) and *vice versa* (13b), and precedence constraints penalizing marked autosegmental structure preceding unmarked one (14): unassociated tones

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to the left of associated tones (14a), and unassociated moras to the left of associated ones (14b). As I will show immediately below, these constraints naturally derive left-to-right association without the formal and typological problems raised by Generalized Alignment constraints (McCarthy 2003) used by Zoll (2003) and Yip (2002). See Appendix B.1 in the Supplementary Material for a list of all constraints used in the Kuria analysis and their ranking in different strata.

(13) *Constraints triggering overall association*

a. $\tau \rhd \mu$: Assign $*$ to every tone which is not associated to a μ (≈ *Float in Yip 2002: 83)

b. $\mu \rhd \tau$: Assign $*$ to every μ which is not associated to a tone (≈ Specify in Yip 2002: 83)

(14) *Constraints triggering left-to-right association*

a. $*\underline{\textcircled{\tau}\,\tau}$: Assign $*$ to every phonetic floating tone which immediately precedes a phonetic non-floating tone

b. $*\underline{\textcircled{\mu}\,\mu}$: Assign $*$ to every phonetic unassociated mora which immediately precedes a phonetic associated mora

That association is one-by-one in the unmarked case then follows from constraints against multiply associated moras. (15a) is basically the standard constraint against contour tones restricted to rising tones (NoContour in Yip 2002), and (15b) a version of the *Twin constraint of McPherson (2016) for Ls. Kuria systematically lacks falling tones (see Mwita 2008: 11), so I assume that the complement constraint to (15a) against falling tones, $*\underline{{}_{\text{H}}\mu_{\text{L}}}$, is undominated in all strata in the language.

(15) *Constraints blocking multiply associated moras*

a. $*\underline{{}_{\text{L}}\mu_{\text{H}}}$: Assign $*$ to every μ which is phonetically associated to a L and a following H

b. $*\underline{{}_{\text{L}}\mu_{\text{L}}}$: Assign $*$ to every μ which is phonetically associated to two L tones

(16) demonstrates how these constraints derive one-by-one left-to-right association in a form with more moras than tones together with standard faithfulness constraints for tones (Max/Dep τ) and association lines (Max/Dep |; see Appendix B.1 in the Supplementary Material for definitions). This effect is mostly independent from their ranking. (I will discuss effects of $\mu \rhd \tau$ and further constraints in §3.2.) $\tau \rhd \mu$ ensures that tones should not remain unassociated (16g), Max τ blocks tone deletion (16f). $*\underline{\textcircled{\mu}\,\mu}$ derives the fact that the melody targets the first three moras in the base, and not more rightward ones (16e) (see below for evidence that this constraint is ranked relatively low), while $*\underline{{}_{\text{L}}\mu_{\text{H}}}$ and $*\underline{{}_{\text{L}}\mu_{\text{L}}}$ exclude the association of multiple tones to a single mora (as in (16c) and (16d)). At the stem and word levels, there is no spreading, since Dep | dominates $\mu \rhd \tau$ (16b), and epenthesis is excluded by undominated Dep τ (since epenthesis is systematically absent at these levels I will simply omit the constraint and epenthesis candidates from the tableaux. Max | is omitted here because it is irrelevant in the absence of underlying association lines (input forms are included among the evaluated candidates and cross-referenced in the upper left corner of tableaux):

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(16) *Remote future (μ3): Initial left-to-right mapping (stem level → (9d))*

Input: g.	*ⓣτ	$*_{L}\mu_{H}$	$*_{L}\mu_{L}$	Max τ	τ ⊳ μ	Dep |	*ⓜμ	μ ⊳ τ
☞ a. L L H te re me ka						***		*
b. L L H te re me ka						****!		
c. L L H te re me ka			*!			***		**
d. L L H te re me ka		*!				***		**
e. L L H te re me ka						***	*!	*
f. L L H te re me ka				*!**	***			****
g. L L H te re me ka					*!**			****

*ⓣτ becomes crucial in forms with more tones than moras, where it derives the effect that preferentially the leftmost tones associate, excluding candidates such as (17c), again closely emulating derivational left-to-right association:

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(17) *Remote future (µ3): More tones than moras (stem level → (2a)/(9a))*

Input: e.	*ⓣτ	*$_{\text{L}}\mu_{\text{H}}$	*$_{\text{L}}\mu_{\text{L}}$	MAX τ	τ ⊳ µ	DEP |	*ⓜµ	µ ⊳ τ
L L H ☞ a. rja					**	*		
L L H b. rja				*!*	**	*		
L L H c. rja	*!				**	*		
L L H d. rja		*!	*!			***		
L L H e. rja					*!**			*

As already shown in (12), the winning candidate of the stem-level evaluation is consequently transferred to the word level unchanged apart from undergoing Bracket Erasure via Monochromisation to serve as the input to the word-level evaluation. That the floating features of stem-level affixes remain 'dormant' until the phrase level now follows from another well-established constraint on autosegmental association, stated in (18), which requires that epenthetic association lines should not connect material belonging to the same morpheme.

(18) ALT(ERNATION): Assign ∗ to every epenthetic association line which connects two nodes of the same colour

ALTERNATION has been introduced by van Oostendorp (2007) to capture what has been traditionally called *Nonderived Environment Blocking,* for example, the fact that featural spreading is often restricted to apply across morpheme or word boundaries. In fact, a slightly more general version of ALTERNATION (labelled 'BOUND') was already proposed by Myers (1997) in one of the foundational papers on tonal phonology in OT. Trommer (2011) shows that it effectively obviates the ad hoc constraint NOTAUTOMORPHEMICDOCKING assumed in the correspondence-theoretic literature to ensure heteromorphemic association of floating features (Wolf 2007). Assuming that ALT is undominated at the word level, the tonal profile of the output of (17) remains unchanged:

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(19) *Remote future (μ3): More tones than moras (word level → (2a)/(9a))*

Input: c.	Alt	*Ⓣτ	*$_{\text{L}}\mu_{\text{H}}$	*$_{\text{L}}\mu_{\text{L}}$	τ ⊳ μ	Max τ	Max	Dep	*Ⓜμ	μ ⊳ τ
L Ⓛ H a. rja	*!	*!	*!					*		
L Ⓛ Ⓗ (dotted) b. rja					**	*!*				
L Ⓛ Ⓗ ☞ c. rja					**					

At the phrase level, the dormant floating tones are then free (and actually forced) to associate to the empty moras of a following word. This happens again one-by-one from left to right, excluding outputs such as (20b) and (20c), simply because the same constraints are still active. See §3.2 below on arguments for their ranking which slightly differs from stem- and word-level rankings (e.g., Alternation is ranked relatively low).

(20) *Remote future: More tones than moras – resolved at the phrase level (→ (2a))*

Input: a.	*Ⓣτ	*Ⓜμ	*$_{\text{L}}\mu_{\text{L}}$	τ ⊳ μ	Max τ	*$_{\text{L}}\mu_{\text{H}}$	Alt
L L H ☞ a. rja e ɣe …							
L Ⓛ H b. rja e ɣe …	*!			*			
L L H c. rja e ɣe …						*!	
L Ⓛ Ⓗ d. rja e ɣe …				*!*			

Additional support for the role of strata and Alternation in deriving left-to-right association comes from two Kuria paradigms not analysed by MMP and SJI, the hortatory imperative$_2$, and the negative remote future$_1$. The hortatory imperative$_2$ assigns a single H to the first mora of the stem for longer bases, in parallel to the past, as in (21c)–(21f). However, in forms with monomoraic stems, the H is realized on the TAM prefix instead, as in (21a) and (21b):

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(21) *Hortatory imperative$_2$ ‘do …!’* (Marlo *et al.* 2014: 288)

a.	[tá-rj-a]	‘eat’	d.	[ta-súkur-à]	‘rub’
b.	[tá-sj-a]	‘grind’	e.	[ta-káraaŋg-à]	‘fry’
c.	[ta-róm-a]	‘bite’	f.	[ta-βéreker-à]	‘call’
	[TAM-√-FV]			[TAM-√-FV]	

This follows naturally from the analysis if we assume that in contrast to other TAM markers, the TAM prefix of the hortatory imperative$_2$, [ta-], is concatenated not at the word level, but already at the stem level, together with a HL-melody, where ALTERNATION is ranked low, but above *Ⓜμ (see below for independent evidence for the trailing L). For a stem with more than two moras, ALTERNATION will then still enforce left-to-right association to the stem leaving the prefix toneless (with phrase-level insertion of default L; see below):

(22) *Hortatory Imperative$_2$ – Stem Level (→ (21c))*

Input: c.	*Ⓣτ	*$_L\mu_H$	*$_L\mu_L$	MAX τ	τ ⊳ μ	ALT	DEP |	*Ⓜμ	μ ⊳ τ
☞ a. H L ta ro ma							**	*	*
b. H L ta ro ma						*!	**		*
c. Ⓗ Ⓛ ta ro ma					*!*				***

On the other hand, for a short (monomoraic) stem, obeying ALTERNATION as in (23b) would mean that only one of the melody tones can be associated. Since τ ⊳ μ is ranked above ALTERNATION, violation of the latter is exceptionally tolerated here (23a):

(23) *Hortatory imperative$_2$ – stem level (→ (21a))*

Input: c.	*Ⓣτ	*$_L\mu_H$	*$_L\mu_L$	MAX τ	τ ⊳ μ	ALT	DEP |	*Ⓜμ	μ ⊳ τ
☞ a. H L ta rja						*	**		
b. H Ⓛ ta rja					*!		*	*	*
c. Ⓗ Ⓛ ta rja					*!*				**

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The negative remote future$_1$ also shows special effects with short bases. Like the affirmative remote future, it is characterised by a H on the third mora, as in (24d) and (24e), but in contrast to the affirmative, this H ‘disappears’ in stems which have three moras or fewer (as in (24a)–(24c)). This is true even in one-mora stems, where the negative remote future$_1$ shows final Superlowering (see §§2 and 3.3), indicating the lack of even a floating H:

(24) *Kuria (negative) remote future (μ3)* (Mwita 2008: 198)

	Stem length	*Remote future* ‘we will …’	*Negative remote future*$_1$ ‘they will not … then’	
a.	1μ	n-to-re-[rj-a]	βa-ta-re-[rj-à]	‘eat’
b.	2μ	n-to-re-[rom-ǎ̲]	βa-ta-re-[rom-à]	‘bite’
c.	3μ	n-to-re-[tɛrɛk-á̲]	βa-ta-re-[tɛrɛk-à]	‘brew’
d.	4μ	n-to-re-[teremé̲k-a]	βa-ta-re-[βereké̲r-a]	‘be calm’/‘call’
e.	5μ	n-to-re-[koondó̲kór-à]	βa-ta-re-[koondó̲kor-a]	‘uncover’
		FOC-1PL-TAM-[√-FV]	3PL-NEG-TAM-[√-FV]	

A natural explanation in the stratal analysis proposed here is that the stem-level tone morphology of this tense is identical to the pattern found in the simple μ3 remote future, introducing LLH at the stem level, but that in addition here negation is expressed by a L suffix at the word level. In fact, most tenses employing the negative prefix [ta-] also seem to exhibit the same reflexes of a final L (Mwita 2008: 187–188). The effect of ALTERNATION is shown for a stem with two moras in (25). The word-level input inherits a final floating H from the stem level (25e). Since the H has effectively become a part of the stem by Monochromisation, it is blocked from associating by ALTERNATION (25d). In contrast, the new L suffix still has a distinct colour and hence associates, to satisfy $\tau \triangleright \mu$. $*_{\mathrm{L}}\underline{\mu_{\mathrm{L}}}$ blocks overt double association to a L (25b). Deletion of melody tones is now a maybe surprising but gratuitous effect of the constraint $*\underline{\textcircled{\tau}}\,\tau$, blocking internal floating tones. This constraint was motivated above simply by ensuring one-by-one left-to-right association (see the discussion of (17)). In contrast, here, left-to-right association is thwarted by ALTERNATION, and the only way to avoid internal floating tones as in (25c) is to delete them. Note also the crucial effect of ranking $\tau \triangleright \mu$ above MAX τ at the word level, such that it is more important to maximise tone associations, as in (25a), than to preserve the tones themselves, as in the input configuration in (25e). Since, by Containment, the phonetically inert association line of the already associated L still satisfies $\tau \triangleright \mu$, this also loses to the affix L:

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(25) *Negative remote future$_1$: two-mora stem (word level → (24b))*

Input: e.	Alt	*Ⓣτ	*$_L\mu_H$	*$_L\mu_L$	τ ⊳ μ	Max τ	Max	Dep	*Ⓜμ	μ ⊳ τ
☞ a. L L H L ro ma					*	**	*	*		
b. L L H L ro ma				*!	*	*		*		
c. L L H L ro ma		*!			*	*	*	*		
d. L L H L ro ma	*!				*	*	*	*		
e. L L H L ro ma					**!					

3.2 *Melody-final spreading and morpheme-specific phrasal phonology*

Recall that melodic Hs in all the tenses analysed by MMP systematically spread up to the penultimate mora of the stem in longer bases (see (1) in §1). This raises an apparent problem for a stratal analysis. The data in (2), where spreading extends from the rightmost mora of a verb to the (phrase-)penultimate mora of a following toneless noun, show that melody-final H-spreading must be phrasal. At the same time, melody-final spreading in verbs is co-dependent on specific morphological features of the verb. Whereas the tenses in (1) exhibit right-edge spreading of Hs, there are morphological contexts where it systematically does not apply. Thus, both the remote future and the mandatory imperative impose a H on the third stem mora, but only the remote future H spreads to the penultimate position:

(26) *Morphologically contrastive spreading in μ3 tenses* (MMP: 254; Marlo *et al.* 2014: 288–289)

	Stem length	*Remote future* 'we will …'	*Mandatory imperative* '…!'	
a.	2μ	n-to-re-[rom-ă]	[rom-ă]	'bite'
b.	3μ	n-to-re-[tɛrɛk-á]	[tɛrɛk-á]	'brew'
c.	4μ	n-to-re-[karaáŋg-a]	[karaáŋg-a]	'fry'
d.	5μ	n-to-re-[koondókór-a]	[koondókor-à]	'uncover'
		FOC-1PL-TAM-[√-FV]	[√-FV]	

Lack of spreading also obtains in the two special tense paradigms we have discussed in the last section: The negative remote future$_1$, also a μ3 tense, behaves in parallel to the mandatory imperative (cf. (24)), and the hortatory imperative$_2$ also shows no H-spreading (e.g., [ta-káraaŋg-à] 'do fry' (21e)), which contrasts with the corresponding

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past forms, an otherwise similar μ1 tense which exhibits H-spreading (e.g., [n-to-o-[ka̱rááŋg-a]] 'we have fried'; see Appendix A.2 in the Supplementary Material for more data). Thus, melody-final spreading seems to lend further support to MMP's claim that word-internally conditioned phonology applies in phrasal domains, which would challenge standard stratal architectures.

Again, the solution to these problems lies in the potential of autosegmental representations to remain dormant, that is, to have effects only at a later stratum. In contrast to MMP, I interpret melody-final spreading not as a process specific to Hs, but as a more general strategy in Kuria to provide toneless moras with tonal association by spreading either Hs or Ls. The only substantial departure from the original autosegmental association conventions of Goldsmith (1976) is the assumption that, while one-to-one association of tone melodies happens at all strata in Kuria, melody-final spreading is restricted to the phrase level. In the OT implementation here, this basically follows from the fact that μ ⊳ τ is low-ranked in the lexical strata, but undominated at the phrase level, where it enforces tonal specification of all moras to tones either by spreading or by L-epenthesis. The specifics of full-mora specification are then regulated by the additional constraints in (27).

Again, most of these constraints are basically standard constraints from the OT literature. (27a) is the well-known NonFinality constraint (Yip 2002) restricted to Hs, and (27c) a parametric constraint determining the directionality of tone spreading equivalent, for example, to Anchor-Left in Myers (1997). (27b) is again a more basic OT constraint implementing one of the crucial aspects of the classical autosegmental association conventions – spreading is limited to the periphery – modulated by the crucial insight of Zoll (2003) that peripheral spreading is not a property of tones per se, but of tonal melodies (i.e., sequences of tautomorphemic affix tones). (27d) derives the standard assumption from rule-based approaches to tonal underspecification that every toneless TBU is assigned a single epenthetic default tone (Pulleyblank 1986).

(27) *Additional constraints on tone association and spreading*

a. *μ́]: Assign ∗ to every final mora which is associated with a H.

b. $*_{\mu}\tau_{\mu}\ \tau$: Assign ∗ to every multiply associated tone of colour *C* which immediately precedes another tone of colour *C*.

c. *Spread-Left: Assign ∗ to every epenthetic association line of a tone *T* which immediately precedes a non-epenthetic association line of *T*.

d. $*_{\mu}\tau_{\mu}$: Assign ∗ to every colourless tone associated to more than one mora.

For simplicity, I will omit the two undominated constraints in (27c) and (27d), and candidates violating them, from tableaux. (28) shows the phrase-level ranking of (27a) and (27b) with respect to most other constraints in the derivation of spreading in a past (μ1) form (n-to-o-[ka̱rááŋg-a] 'we have fried'; MMP: 254). Crucially, ranking Dep τ above Dep | and Alternation has the effect that spreading is in principle preferred over epenthesis as in (28c). However, this preference is reined in by higher-ranked *μ́], which blocks H-spreading up to the rightmost mora as in (28b), which instead receives a L by epenthesis (28a):

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(28) *Spreading of melody-final H to penultimate position (past μ1 – phrase level)*

Input: d.	$\mu \rhd \tau$	$*_{\mu}\tau_{\mu}\ \tau$	$*\underline{_{L}\mu_{L}}$	$*\underline{\textcircled{\mu}\mu}$	$*\underline{\textcircled{\tau}\tau}$	$\tau \rhd \mu$	$*\acute{\mu}]$	Max τ	Dep τ	$*\underline{_{L}\mu_{H}}$	Dep |	Alt	Max |
H L ☞ a. ka ra aŋ ga									*		**	**	
H b. ka ra aŋ ga							*!				***	***	
H L L L c. ka ra aŋ ga									**!*				
H d. ka ra aŋ ga	*!**												

The fact that melody-final spreading in this analysis is not specific to Hs, but is also predicted to apply to Ls when they are final in their morphological melody, provides a direct solution to the apparent morpheme-specific failure of right-edge spreading in the negative remote future$_2$ and the hortatory imperative$_2$. It follows from the assumption, already introduced for independent reasons, that these tenses are lexically assigned a final L. This is illustrated in (29) for a hortatory imperative$_2$ form, where the tonal prefix is HL, already associated at the stem level. Spreading of the H as in (29b) is blocked by $*_{\mu}\tau_{\mu}\ \tau$, since it is not final in its morphological melody. Hence, the trailing L will spread automatically to phrase-final position:

(29) *Spreading of melody-final L (hortatory imperative$_2$ – phrase level (→ (21e))*

Input: c.	$\mu \rhd \tau$	$*_{\mu}\tau_{\mu}\ \tau$	$\tau \rhd \mu$	$*\acute{\mu}]$	Dep τ	Dep |	Alt	Max |
H L ☞ a. ka ra aŋ ga						**	**	
H L b. ka ra aŋ ga		*!				***	***	*
H L c. ka ra aŋ ga	**!							

3.3 Contour formation and phrase-final floating tones

Recall from the remote future (μ3) data in (9) that under specific conditions, the final H of a verbal tone melody shows up as part of a rising contour on the last syllable of a phrase-final verb if the stem is exactly one mora too short (e.g., n-to-re-[rom-ǎ] 'we will bite', the Contour pattern. If the stem is even shorter, the H is lost without direct phonetic effect (e.g., n-to-re-[rj-a] 'we will eat', the Lost-H pattern).

Thus, the phrase level in principle allows phrase-final contours, which follows from $*\underline{_{L}\mu_{H}}$ being ranked below Max τ, and $*\underline{\mu}_{\{H,L\}}\ldots]$ (defined in (30)) above it.

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(30) $^*\underline{\mu}_{\{H,L\}}\ldots]$: Assign $*$ to every phonetic mora M associated to two different tones such that M is not phrase-final.

Let us first address the Lost-H pattern. We have already seen the stem-level and word-level derivation of a monomoraic remote future stem in (17) and (19) above in §3.1. Exactly the same evaluations apply for phrase-final verbs; the two cases only diverge at the phrase level, where the verb is combined with additional syntactic material – or not. The constraint ranking established for the phrase-internal case predicts that phrase-finally the trailing Ls and Hs should remain floating. Association of the L is blocked by $^*\underline{{}_{L}\mu_{L}}$ (31c), association of the H across the floating L by $^*\underline{ⓣ\tau}$ (31a), and deletion of the floating tones by Max τ (31b):

(31) *Lost-H pattern – phrase level (remote future/μ3 → (9a))* (MMP: 254)

Input: d.	$^*\underline{ⓣ\tau}$	$^*\underline{{}_{L}\mu_{L}}$	τ ⊳ μ	$^*\acute{\mu}]$	Max τ	$^*\underline{{}_{L}\mu_{H}}$	Alt	Dep |
a. rja (L Ⓛ H; L associated, H associated across Ⓛ)	*!		*	*		*	*	*
b. rja (L associated; L and H deleted)			**		*!*			
c. rja (L L H; all associated)		*!		*		*	**	**
☞ d. rja (L Ⓛ Ⓗ; L associated)			**					

While there is no direct pronunciation of the floating tones, they block the Superlowering process which otherwise additionally lowers L moras at phrase boundaries, as discussed in §2. If Superlowering is a phonetic implementation rule for associated phrase-final Ls, it will be correctly blocked by the persistent floating material in (31d).

The lexical evaluations for the Contour pattern are equally unremarkable. At the stem level, one-to-one left-to-right association leads to a trailing floating H (ⓁⓁⒽ +ro$_{\mu}$ma$_{\mu}$ → rò$_{\mu}$mà$_{\mu}$Ⓗ), preserved at the word level due to Alternation. Again the crucial evaluation step is in the phrasal phonology. The floating H can and must associate since final contours are possible at the phrase level – in contrast to the lexical phonology, $^*\underline{{}_{L}\mu_{H}}$ is ranked below τ ⊳ μ, and in contrast to the Lost-H pattern with an additional floating L, contour formation is not blocked by an intervening tone:

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(32) *Contour pattern – phrase level (remote future/μ3 → (9b))*

Input: e.	$*\underline{(\tau)\tau}$	$*\underline{{}_{L}\mu_{L}}$	$\tau \rhd \mu$	$*\acute{\mu}]$	MAX τ	$*\underline{{}_{L}\mu_{H}}$	ALT	DEP |
☞ a. L L H ro ma				*		*	*	*
b. L (L) H ro ma	*!			*			*	*
c. L (L) H ro ma				*	*!		*	
d. L L (H) ro ma			*!		*			
e. L L (H) ro ma			*!					

Thus, the Stratal OT account allows for deriving both phrase-final patterns transparently from the fully general constraints on tone association which also capture the basic familiar one-to-one left-to-right association of floating tones. This seems to be a substantial improvement over the analysis of MMP, who capture these configurations by three stipulative rules which apply in an opaque Duke-of-York derivation (phrase-final syllables are lengthened to allow for additional tone association and subsequently shortened to their original length; see §5).

Before we turn to the alleged problems for a representational account of Kuria across-word tone mapping, consider an important empirical limitation. The sources on Kuria provide only a handful of different nouns in postverbal contexts, most of which are arguably toneless, like [eɣetɔɔkɛ] 'banana'. In all examples of across-word association provided by Mwita (2008) and Marlo *et al.* (2012, 2014, 2015), verbal tone melodies target only toneless moras in following nouns. Therefore, I tentatively assume here that melodic association is limited to underlyingly toneless moras.

A further factor which might have an impact on the phrase-level realization of floating tones is syntactic category and constituency. Thus, association of verbal tones might be blocked (or more limited) if the word following the verb is not an object noun. Again, at this point, there are hardly any data of this type in the literature that would shed light on this question. Mwita (2008) shows that melodic Hs can also dock on postverbal locative particles and the negation morpheme [hai], which are clitics (they can also occur preverbally or attached to non-verbal lexemes). Thus, in the negative remote future$_2$, the μ3 H of a two-mora stem associates to [hai] as in [te-βá-ré[róma] <u>háí</u>] NEG-S3PL-TAM-call NEG 'they will not bite (then)' (Mwita 2008: 220).

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Dierck*s et al.* (2015: 59) further report a case of across-word association which crosses two word boundaries and affects an embedded verb across a pronoun. In (33a), the inceptive μ4 H of the initial matrix verb ('expect') shows up on the following object pronoun [wɛ]. The stem domain (delimited by square brackets) starts here with the object prefix [mo-]. In (33b), [mo-] is omitted, and the first mora of the embedded subjunctive verb ('leave') becomes the fourth mora H after the left stem boundary of the matrix verb, and consequently hosts the inceptive H. Note that in both sentences the embedded verb also has an independent morphological μ3 H, which surfaces on the final vowel of the verb (see §4.1 for more discussion). However, the status of these data is somewhat unclear since the Kuria speaker who produced them, according to Diercks *et al.* (2015), does not apply across-word association at all in other recordings.

(33) *Tone association across two syntactic words* (Diercks *et al.* 2015: 59)

a. n-da-[**mo-**gaɲ-a] wɛ́ á-tánɔr-ɛ́
S1SG-INCEP-O1-expect-FV 3SG S1SG-leave-SBJ.FV
'I expect him to leave'

b. n-da-[gaɲ-a] wɛ á-tánɔr-ɛ́
S1SG-INCEP-expect-FV 3SG S1SG-leave-SBJ.FV
'I expect him to leave'

Theoretically, the indirect-reference approach and the Stratal OT framework adopted here predict that any blocking effect for across-word association should be linked not to specific syntactic configurations, but to the general prosodic structure of Kuria. There is some evidence from tone spreading for the assumption that Kuria verbs, as in many other languages and especially in Bantu (Cheng & Downing 2012), form phonological phrases with one or more following complements (Diercks *et al.* 2015: 60). If this turns out to be correct, the Indirect Reference approach predicts that any restrictions on the association of morphological tone melodies across words should reflect the same phrase boundaries as evidenced by spreading.

4. Solving apparent problems for a tone-melody account

The tone-melody analysis developed here closely follows Cammenga's (2004) account of the Kuria infinitive. MMP reject this approach, claiming that the assumed Ls would lead to technical problems for the analysis of H spreading. In §4.1, I will show that the Stratal OT account obviates this objection. In the following sections I will address two further conceptual arguments against a tone-melody analysis raised by MMP and by the reviewers of this article based on the alleged lack of independent motivation for underlying Ls in Kuria (§4.2) and the tolerance for OCP violations in input representations (§4.3). Appendix B.3 in the Supplementary Material shows that a further set of data which MMP indicate in passing might be problematic for a tone-melody account – constructions with multiple morphological tones – follows naturally under the Stratal OT analysis proposed here.

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4.1 The spreading problem

The major empirical argument against the assumption of Ls in Kuria verb tone raised by MMP is unbounded rightwards spreading of Hs affecting the initial portions of verb stems which exhibit morphological Hs on later moras in the same stem. This pattern is found in the negative infinitive, where the negative prefix [tɔ́-] has a H which spreads up to two syllables before the μ4 H of the infinitive, and in the negative remote future$_2$, where the negative prefix [te-] carries a floating H which associates to the following agreement prefix, from where it spreads to the penultimate syllable before the μ3 H of the remote future. These two negative forms are illustrated in (34):

(34) *Spreading across prefixes and stems* (MMP: 261)

	Stem length	*Negative infinitive (μ4)* ‘to not …’	*Negative remote future$_2$ (μ3)* ‘they will not …’	
a.	4μ	o-ɣo-tɔ̱́-kó-[βéréker-á̱]	te-βá̱-ré-[βéreké̱r-á] hai	‘call’
b.	5μ	o-ɣo-tɔ̱́-kó-[kóóndokó̱r-a]	te-βá̱-ré-[kóondó̱kór-á] hai	‘uncover’
		AUG-INF-NEG-[√-FV]	NEG-3PL-TAM-[√-FV] NEG	

If the fourth-mora and third-mora patterns in these paradigms actually involved leading Ls, this would imply, according to MMP, that they should block spreading, counter to fact.

Here, I will show that no such problem obtains in a Stratal OT account. But before we turn to this point, we have to take a closer look at the interpretation of Kuria H-spreading more in general. Whereas MMP assume that there is a single general process of H-spreading deriving both melody-final spreading of Hs (see §3.2) and the pattern in (34), Mwita (2008) argues stringently that there are several spreading processes, one which applies to the last H in a verb, and a different one applying only to a H preceding another H as in (34): *Plateauing*, a process well-known from the literature on Bantu tone (see Jardine 2016 for recent discussion and references). Whereas Plateauing applies without exceptions whenever there are two Hs separated by more than one syllable (as in (34), it typically leaves one intervening L syllable intact), we have already seen in §3.2 that there are tonal melodies applying to verb stems where Hs separated from the right word/phrase edge by several L moras do not spread. Thus, H-spreading in Plateauing contexts is exceptionless, but simple melody-final H-spreading depends on the TAM category of the verb. Additional support for this conclusion comes from the fact that H-spreading from prefixes is also blocked in specific verb forms without a H (which would trigger Plateauing). Thus, in the hortatory imperative$_1$, the H of the TAM prefix [tá-] does not undergo H-spreading, in contrast to the forms in (34).

(35) *No general H-spreading from prefixes (hortatory imperative$_1$, ‘let him …’)* (Mwita 2008: 134–135)

a. *One-mora stems:* a-tá-[h-a] ‘give’

b. *Two-mora stems:* a-tá-[rom-à] ‘bite’

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c. *Three-mora stems:* a-tá-[saamb-à] 'burn'
d. *Four-mora stems:* a-tá-[βereker-à] 'call'
3SG-TAM-[√-FV]

This falls out naturally under the analysis here if the hortatory imperative$_1$ has a morphological tone melody at the stem level which lacks a H: it consists simply of a single L prefix (L+βereker-a → βèrekera). Since melody-final spreading is not restricted to Hs, this L – being the rightmost underlying tone – spreads at the phrase level to provide toneless moras with tonal association (βèrekera → a-tá-βèrèkèrà). Thus, L-spreading bleeds H-spreading in parallel to the hortatory imperative$_2$ (see (29) in §3.2). There is no Plateauing, since the H on the prefix is not followed by another H.

Kuria Plateauing involves a number of complexities depending on the position of long vowels and the exact position of the triggering Hs in the verb which are beyond the scope of this article – and are also not addressed by MMP and SJI. The core of Plateauing is a general phrasal rightwards spreading process which extends the first of two non-adjacent Hs up to the penultimate syllable before the following H,[5] which I will implement by the constraints in (36). *H…H is equivalent to the constraint *TROUGH in Yip (2002: 137), and $\text{OCP}^{\text{H}}_{\sigma}$ to the OCP constraint in Myers (1997).

(36) *Constraints capturing Plateauing (phrase level)*
a. *H…H: Assign ∗ to every mora which intervenes between two Hs.
b. $\text{OCP}^{\text{H}}_{\sigma}$: Assign ∗ to every pair of distinct Hs which are associated to adjacent syllables.

(37) shows the derivation for the negative infinitive form in (34a). While *H …H would favour full spreading to the penultimate syllable as in (37c), this is blocked by higher-ranked $\text{OCP}^{\text{H}}_{\sigma}$. *SPR-L (*SPREAD-LEFT, (27c)) ensures that the left, not the right H spreads as in (37d). Since $*\overline{\tau\,\tau}$ is ranked above MAX | and MAX τ, the delinked tones are deleted and not maintained afloat as in (37b) (in contrast to phrase-final floating tones, which do not violate $*\underline{\tau\,\tau}$):

[5] In particular contexts, Plateauing spreads further than in this statement, and in other contexts it is blocked by prosodic factors from fully arriving at the penultimate position before the following H-tone. What seems to be true without exceptions is that in H…H configurations with enough prosodic space, there is *some* rightwards spreading of the initial H.

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(37) *Spreading (negative infinitive – phrase level → (34a))*

Input: e.	OCP$^{H}_{\sigma}$	*Spr-L	*Ⓣτ	*H …H	τ ⊳ μ	*μ́]	Max τ	Max |
H (L) (L) L H ☞ a. tɔ kɔ βe re ke ra				*		*	**	**
H Ⓛ Ⓛ L H b. tɔ kɔ βe re ke ra			*!	*		*		**
H (L) (L) (L) H c. tɔ kɔ βe re ke ra	*!					*	***	***
H L (L) (L) (L) H d. tɔ kɔ βe re ke ra		*!		*		*	***	***
H L L L H e. tɔ kɔ βe re ke ra				***!		*		

Note that the differentiation of H-spreading in instances of Melody-Final Spreading and Plateauing also obviates a variant of the spreading argument against a tone-melody analysis of Kuria, raised by Rolle & Lionnet (2020). Rolle & Lionnet acknowledge the existence of morphological Ls, and argue that this is what blocks spreading in forms like the hortatory imperative$_1$ (as in the analysis provided here). Since, on the other hand, in forms like the negative remote future$_2$ (cf. (34)) there *is* spreading, they conclude that these must lack Ls. Just like MMP's criticism of tone melodies, this argument is based on the premise that there is one unified process of rightwards H-spreading. However, all examples cited by Rolle & Lionnet instantiate the configuration in (38a), not the one in (38b):

(38) a. *H-Spread blocked:* H L …] (cf. (29))
b. *H-Spread applies:* H … L H (cf. (37))

Thus, the data invoked by Rolle & Lionnet actually confirm the analysis proposed here: (38a) triggers melody-final spreading, hence L-spreading, and (38b) Plateauing.

4.2 Evidence for underlying Ls

MMP claim that the assumption of underlying Ls in Cammenga's original tone-melody approach to Kuria is problematic because the language lacks independent evidence for Ls apart from positioning Hs. This argument takes up the major line of reasoning in analyses of many Bantu languages to justify an underlying H/∅ contrast for languages with a surface H/L distinction, summarised in an influential paper by Hyman (2001a). Hyman identifies as the hallmark of a privative H/∅ language that Ls (in contrast to Hs) do not spread, trigger dissimilation or show other similar effects: they are 'inactive'. However, if the Kuria reanalysis provided here is on the right track, there

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clearly is substantial evidence for active underlying Ls in Kuria. As we have seen, the underlying Ls of tonal melodies have at least four different surface effects apart from their role in capturing the position of morphological Hs: (a) Ls spread (and prevent otherwise expected H-spreading; see the analysis of the mandatory imperative, the negative remote future$_1$ and the hortatory imperative$_2$ in §3.2); (b) they overwrite Hs (as in the negative remote future$_1$; see §3.1); (c) they surface in the formation of rising tones (in the Contour pattern; see §3.3); and (d) they intervene between Hs and their potential association targets (in the Lost-H pattern; see again §3.3).

One might interpret MMP's argument in a broader sense presupposing a parameter model which allows only strict H/L or strict H/∅ languages, thus excluding an analysis where Ls are absent in verb roots but employed as inflectional tones. But there are clear examples of languages with an underlying H/L/∅ contrast where L and ∅ neutralise on the surface – the textbook example is Margi (Pulleyblank 1986; Tranel 1992; Kenstowicz 1994), and Hyman (2001a) cites Kinande as a Bantu case in line with Mutaka (1994). Also, a substantial number of other Bantu languages which otherwise seem to be consistent with a H/∅ analysis provide evidence for underlying Ls in some minor part of their system. For example, Haya (Hyman & Byarushengo 1984) employs Ls as boundary tones postlexically. According to Hyman & Byarushengo (1984: 66–67), Ls are also exceptionally employed in the HLH melody of specific imperative forms.

In Hyman's analysis of Luganda, Ls are created by lexical rules, an analysis also argued for by Ebarb (2014) for Idakho and by Paster & Kim (2011) for Tiriki. Tiriki also provides evidence for lexically sparse underlying Ls which block H-spreading, also found in other Bantu languages such as Lumarachi (Marlo 2007). In sum, there does not seem to be strong support for a strict parametric distinction between underlying H/L *vs.* H/∅ languages. OT also provides a fundamental alternative to the parameter view, the principle of Richness of the Base in tandem with a mechanism of Lexicon Optimisation (Prince & Smolensky 1993). By Richness of the Base, grammars have to consider in principle all possible input specifications (in our case L and ∅); however, the underlying forms of specific roots and affixes are computed by a 'reverse' application of optimisation to their surface realizations.[6] As shown by Inkelas (1995) for Margi, Lexicon Optimisation predicts for tonal systems underlying underspecification for lexical material which alternates, but full specification for non-alternating patterns. This seems to fit well with the situation in Kuria: Verb roots are tonally underspecified since their tonal shape varies according to tense, whereas tone melodies such as the Remote Past LLH are reliably realized in the output and should correspond to underlying Ls.

[6]An alternative to Richness of the Base for constraint-based phonology is suggested by Clements (2001), who proposes a system where phonological features may only be activated if they are distinctive in lexical items or explicitly mentioned in an active phonological constraint. The Kuria analysis here seems in principle to satisfy both requirements. Ls are minimally contrastive (e.g., by distinguishing past H and past progressive LH or remote future LLH and mandatory imperative LLH**L**), and Ls are targeted by crucially active constraints such as $*\underline{{}_{\mathrm{L}}\mu_{\mathrm{H}}}$.

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4.3 The Obligatory Contour Principle

A further objection raised by several anonymous reviewers against a tone-melody approach is that consecutive Ls violate the original version of the Obligatory Contour Principle (OCP), the ban against adjacent identical tones.

Even before the original formulation of Autosegmental Phonology in Goldsmith (1976), the OCP was invoked by Leben (1973) as an inviolable universal morpheme structure constraint which restricts tonal melodies before they are mapped to segments. However, Goldsmith (1976) himself rejects the principle because it cannot capture lexically distinctive tone association in Etung and tone melodies with multiple Hs. Thus, in Tiv, the recent past is marked by a single H mora after the root tone of L verbs (e.g., /ngòhoro/ → [ngòhórò] 'accepted (rec.)') and H verbs (e.g., /jévese/ → [jévésè] 'fled'). In the same context, the past habitual exhibits two consecutive H moras (e.g., /ngòhoro/ → [ngòhóróǹ] 'used to accept', /jévese/ → [jévéséǹ] 'fled'; Pulleyblank 1986: 83, 87). Odden (1986), in the most thorough pre-OT study on the OCP, uncovers several hard exceptions to the predictions of the OCP from Shona, Shambala, Kikuyu, Kishambaa, Yala Ikom and Temne. Tranel (1992) notes lexical exceptions to the predictions of the OCP in Margi, and Cahill (2007) makes a detailed argument for input OCP violations of both Ls and Hs in Kɔnni. Hyman (2011) lists additional potentially problematic cases from Dioula'Odienne and Acatlán Mixtec. Representative recent OT studies providing analyses requiring the abandonment of the OCP as an input constraint on tone melodies are provided by McCarthy *et al.* (2012), McPherson (2016) and Rolle (2021).

In OT, the natural response to the exceptions to the OCP has been to reinterpret it as a *violable* constraint on *output* representations, which also solves the conceptual problem that Leben's version of the constraint violates, again, Richness of the Base (Yip 2002; McCarthy *et al.* 2012). Crucially, specific OT analyses also show that the original empirical insights behind the OCP for single languages can still be captured if it is understood as an output constraint on stems and/or words, not on single morphemes. This is demonstrated by Myers (1997) for Shona, which Kenstowicz (1994) cites as a prototypical case of evidence for the input OCP. Similarly, Tebay (2022) shows that basic Mende tone patterns – the original data set put forth by Leben (1973) as evidence for the input OCP – can be captured directly by violable output constraints in OT including an *output* version of the OCP.

Let us now turn to the specific use of the morpheme structure version of the OCP as an argument for a Construction Phonology approach. Whereas the analyses of MMP and SJI adhere to the letter of the principle, the unrestricted use of morpheme-specific rules or constraints makes its empirical predictions virtually empty. Thus, Construction Phonology can simply emulate the effect of affixal tone melodies with multiple adjacent Hs or Ls excluded by the input OCP by assuming a morpheme-specific insertion or spreading rule as in the analysis of OCP-violating morphology in Manyika by Paster (2019) (see Appendix C.1 in the Supplementary Material for a more general demonstration of this point). In sum, the cross-linguistic evidence for the tonal OCP does neither provide a compelling argument against tonal input melodies which violate it nor for a Construction Phonology account which adheres to its interpretation as an inviolable morpheme structure constraint.

5. Predictions: Stratal OT *vs.* Global Construction Phonology approaches

Up to this point, I have argued that Stratal OT is up to the challenge to capture the Kuria facts while remaining faithful to all three restrictions challenged by MMP, Phonological Locality, Cyclic Locality and Indirect Reference. The complementary argument against Global Construction Phonology approaches I will develop in this section is that Stratal OT and locality restrictions on constraint application also make more restrictive and basically correct typological predictions for possible phonological and morphological systems in general. Before we turn to this point, I will give a short overview of the frameworks and analyses used by SJI and MMP, and contrast their predictions with those of the Stratal approach in the following sections, discussing Phonological Locality in §5.1, Cyclic Locality in §5.2, and Indirect Reference in §5.3.

Kuria by morphologically sensitive ordered rules (Marlo et al. 2015)

MMP's analysis of Kuria employs ordered derivational rules as in SPE (Chomsky & Halle 1968). However, unlike SPE, these rules seem not to apply cyclically, but on complete postlexical representations where word-internal morphological and prosodic structure is still fully visible. All verbal inflectional tones are introduced by morphology as single floating Hs, whereas association and spreading are triggered by phonological rules sensitive to morphological features. Thus, the μ3 pattern of the remote future is captured by (39a), the μ4 pattern of the inceptive by (39b) and H spreading for both tenses by (39c), whereas this rule would not apply to the hortatory imperative H without H spreading (the apostrophe indicates an unassociated tone).

(39)	a. *Remote future*	b. *Inceptive*	c. *Remote future, inceptive*	
	H’	H’	H	(Iterative)
				(Domain: phrase)
	$_{\text{STEM}}$[μ μ μ	$_{\text{STEM}}$[μ μ μ μ	μ μμ’	

Rules like (39a) and (39b) show the gist of MMP's take on the morphosyntax–phonology interface: morphologically triggered rules apply in a domain whose left edge is a word-internal boundary and whose rightward extent is unlimited in the entire utterance. The full power of SPE's rule ordering mechanism is applied in MMP's analysis of contours in short stems (see §3.3 for discussion): A rule of final lengthening adds a mora to phrase-final vowels (e.g., /romaH/ → romaaH), which may then serve as the target for H-association (→ romaá) and insertion of a default L (→ romàá), feeding a further rule which removes the epenthetic mora again and reassociates the stranded H, resulting in a rising contour (→ [romǎ]).

Kuria in Cophonologies by Phase (Sande et al. 2020)

SJI reinterpret the Kuria data as evidence for the Cophonologies by Phase model (henceforth: CbP), where morphophonology is derived cyclically in Harmonic Grammar evaluations in domains defined not by stems, words and utterances, but by syntactic phases as conceived in non-lexicalist versions of Minimalist syntax. Thus, SJI posit a syntactic structure for a Kuria inceptive (μ4) sentence such as (2b) [to-ra-[rom-a] eɣ é̱tɔ́ɔ́kɛ] 'we are about to bite a banana' in which part of the morphological verb (the stem without prefixes: [rom-á]) is spelled out together in the *v*P, whereas the prefixes are only introduced in the CP and spelled out there.

In SJI's approach, construction-specific phonology is achieved by vocabulary items which as part of their idiosyncratic lexical specification contain fixed amounts of weight addition (or weight subtraction) by which they modify specific constraints. The constraint weighting of an optimization cycle in a given phase *P* is then the default general weighting of the language modified by all weight adjustments of the VIs concatenated in *P* itself (thus in the CP phase the VIs for C and Tense, but not for any material in the vP, or the subject DP, which have been introduced in earlier phases). For the general phonology of Kuria, SJI stipulate that IDENT-TONE outweighs the constraint requiring tone dislocation (in (40) so that in the default case underlying tones remain unmodified in the output (SJI: 1237):

(40) μ4: Assign one violation for each floating tone that does not surface four moras from its input location.

The inceptive VI has a floating H and weight modifications which effectively invert the default weighting by incrementing the weights of μ4 and SPREAD-(H, R), and reducing the weight of IDENT-TONE. The CP evaluation for our example clause is thus as in (41), where the inceptive H is shifted by four moras to the right:

(41) *Across-word μ4 assignment in Cophonologies by Phase* (SJI: 1238)

to-ra^{H}-[$_{\omega}$ roma] [$_{\omega}$ eɣetɔɔkɛ]	μ4 9	SPREAD(H, R) 9	IDENT-TONE 1	H
☞ a. [$_{\omega}$ to-ra-roma] [$_{\omega}$ eɣé̱tɔ́ɔ́kɛ]	0	0	1	−1
b. [$_{\omega}$ to-ra-roma] [$_{\omega}$ eɣetɔɔkɛ]	1	0	0	−9

Under this analysis, all mora-counting tone morphologies in Kuria have the same source – a single floating H as part of the tense prefix; they differ only in the constraints they promote. Thus, the remote future would add weight to a μ3 constraint, the past progressive to a μ2 constraint and so on.

The central theoretical significance SJI attribute to the Kuria data is that it discredits the standard stratal architecture of the morphology–syntax interface, in which word-internal phonology strictly precedes phrase-level phonology. SJI's argument has two components. First, they claim that delaying autosegmental material originating in word-internal morphology to associating only at the phrase level leads to technical problems ('it is unclear how to prevent morpheme-specific phonology from being realized until the post-lexical level' (SJI: 1239)). Second, they argue that even if the first problem could be solved, an analysis using dormant tones would make less restrictive predictions on locality domains than the CbP account. A major result of the Kuria reanalysis developed in §§3 and 4 is that it provides a constructive proof that SJI's first argument is unfounded. A stratal tone-melody analysis of Kuria *is* possible (see also Appendix D in the Supplementary Material for a detailed summary of technical problems in SJI's CbP analysis). In §5.2, I will show that the second argument is also empirically problematic.

5.1 Phonological Locality

The baseline for my discussion of Phonological Locality here will be a slightly extended version of the proposal by McCarthy (2003: 6), formulated in (42). The basic intuition is that every OT constraint has an obligatory *locus,* the unit which actually triggers distinct constraint violations, and optionally a left and right context specification. McCarthy considers an even tighter locality version of this principle which allows only for a single context restriction, mirroring the Locality Principle of Hewitt & Prince (1989) for derivational rules, but this is obviously too narrow. Thus, since OT constraints are generally defined negatively, binarity constraints actually require a window of three elements. For example, evaluating a constraint requiring maximally two moras in a syllable means to assign violations to syllables with *three* (or more) moras. Independently from specific OT assumptions, tone plateauing obviously cannot be captured using a single context restriction (as argued by Jardine 2016; see §4.1 for discussion). Since I am not concerned with hierarchical prosodic representations here, (42) is defined for purely autosegmental representations, where a local autosegmental object is either a single autosegmental node on tier T or a planar object, that is, an object composed of an autosegmental node N_1 on tier T_1 and a second autosegmental node N_2 on tier T_2, where T_1 and T_2 are associated (e.g., a tone associated to a mora).

(42) *Locality Principle restricting constraints on autosegmental representations*
Every OT constraint is a triple (LeftContext, Locus, RightContext), where:
a. Locus is a local autosegmental object
b. Every context specification $\in$ {LeftContext, RightContext} may refer maximally to a single local autosegmental object or a boundary

Let us see how some of the constraints used in the Kuria reanalysis fit into this template. A trivial case is Max τ ('Assign $*$ to every tone which is marked as phonetically invisible'). The locus is a single autosegmental node (on the tonal tier) without context restrictions. In $*\underline{{}_{\text{L}}\mu_{\text{L}}}$ ('Assign $*$ to every μ which is phonetically associated to two Ls'), we can interpret the initial structure μ−L as the constraint locus and the second L as the right context (or vice versa). Finally, in the constraint inducing Plateauing, *H …H ('Assign $*$ to every mora which intervenes between two Hs'), the locus is the potentially intervening mora, and both the left and the right context contain a single H each.

On the other hand, the Construction Phonology analyses of Kuria are incompatible with the Locality Principle in (42). Thus, the constraints/rules responsible for the Kuria μ2 patterns can be approximated by the formulations in (43) compatible with the three-element window imposed by the Locality Principle, but there is no way to fit in the remote future μ3 (or, *a fortiori,* μ4 inceptive), since the necessary window would comprise at least four independent objects:

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(43) *Approximating rules/constraints for the past progressive μ2 pattern*

a. MMP: Assign ∗ to every mora which follows a stem boundary and precedes a mora not associated to a H

b. SJI: Assign ∗ to every mora which follows an underlyingly unassociated H tone *H* and doesn't precede a mora associated to *H* on the surface

Thus, while the Construction Phonology accounts necessarily violate the Locality Principle, the tone-melody approach can implement the Kuria facts in accordance with (42), since the μ3 and μ4 patterns follow from morphological melodies which are not subject to categorical length restrictions. An anonymous reviewer objects that this solution just shifts the problem from phonology to morphology, since it still can capture the μ3 and μ4 'counting' patterns in Kuria. Crucially, the merit of the combined Stratal OT/Locality Principle approach is not simply that it can capture the morphological LLH and LLLH patterns in Kuria, but that it also – in contrast to the Construction Phonology approaches – makes restrictive typological predictions beyond Kuria. I will illustrate this with two phenomena which under SJI's and MMP's analyses are closely related to the Kuria data: (a) productive instances of bounded tone shifting and spreading, and (b) tonal infixation.

Bounded tone shift and spreading

For MMP and SJI, constraints as in (43) are intended as truly phonological, although morphologically restricted, constraints (rules), which implies that the processes they trigger should also be found in other languages without any restriction to morphological context as regular phonological alternations. This prediction seems to be wrong. Thus, a recent survey by Breteler (2018) on the typology of spreading and shifting in Bantu concludes that both tone shifting and spreading involve maximally two additional moras, never three or four. Similarly, there is no known language where Hs are systematically required or restricted to the third or fourth mora (or syllable) of a given prosodic or morphosyntactic domain.

Tonal infixation

Abandoning Phonological Locality further predicts that we should find genuine tonal infixation in the sense that a tonal affix is realized infixed into the tone span of its base across other distinctively specified tones which remain unaffected. Thus, consider a hypothetical language where tense is marked by a H on the third mora of the stem, but where we also have independent evidence for underlyingly specified root tones, such that different tones between the beginning of the stem and the target position of the morphological tone remain intact. For example, a MLMH base such as [tē.rè.mē.ká] would become [tē.rè.mé.ká], where the M on the third mora is overwritten by the infixal H. This could be captured in MMP's approach by a morphologically triggered rule inserting a H on the third mora as in (44a), resulting in derivations such as (44b):

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(44) *Hypothetical tone infixation in rule-based Construction Phonology*

a. TH ← ∅

$_{\text{STEM}}$[μ μ μ

b.

M	L	M	H	→	M	L	H	H
|	|	|	|		|	|	|	|
te	re	me	ka		te	re	me	ka

The possibility of inserting the tonal exponent inside the tonal base structure crucially presupposes abandoning Phonological Locality. Thus, a rule-based equivalent of (42) or the Locality Principle of Hewitt & Prince (1989) would both only allow a left context restriction of one element (here plausibly the stem boundary), hence a pattern which adds a H on the first, not the third mora (see Appendix C.2 in the Supplementary Material on the possibility of deriving tone infixation in the CbP approach of SJI).

Just as bound long-distance shifting, infixation, that is, morphologically triggered shifting of a tone affix across associated tone, seems to be unattested (Hyman 2001b). While recent surveys of tonal morphology (Rolle 2018; Trommer 2022) report tonal prefixes, suffixes and circumfixes, there do not seem to be cases comparable to (44).[7]

This generalization directly follows under the approach chosen here adopting the Four Hypothesis Program, the Locality Principle in (42) and Containment under the natural assumption that tone affixation is restricted to adding material at the edges of bases. Thus, a tonal infix cannot be generated directly by morphology due to *Morph Integrity* nor by morphologically conditioned phonology (by *Indirect Reference*), and a constraint like μ3 is excluded by the *Locality Principle*. Finally, a prefix or suffix tone cannot shift across overt tones because Containment generally excludes reordering of phonological elements.

5.2 Cyclic Locality

Since the general predictions of a lexicalist stratal architecture based on stems, words and phrases are well-known (see, e.g., Bermúdez-Otero 2018b), I will only shortly comment here on two predictions for tone.

Stratal ordering

Stratal OT predicts that the interactions between word-internal processes and processes at the phrase level are inherently ordered. Thus, if the stem-level phonology generates a suitable trigger for the phrase-level phonology, then the model predicts a feeding relationship; hence, the latter will exceptionlessly apply to the input of the former. Conversely, even when the phrase-level phonology produces a potential trigger for a stem-level process, there cannot be a feeding relation since the phrase level

[7]Note that the H involved in Mixtec 'tone perturbation' analysed as a tonal infix in Zimmermann (2016) is not a true tonal infix in the sense relevant here since it may only skip the default (mid) tone of the language (before Ls and Hs it appears in word-initial position) in parallel to Kuria, and in contrast to the hypothetical case in (44) where the tone infix skips lexically distinct (M and L) tones. See Tranel (1995) for an underspecification-based analysis of the Mixtec data which obviates the assumption of infixation.

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in Stratal OT inherently applies after stem-level phonology. On the other hand, in the construction approach of MMP, the application of phonological processes in specific domains is governed by global extrinsic rule ordering. Thus, spreading in phrasal domains could precede lexical spreading with the result that phrase-level spreading feeds word-internal spreading and the latter counterfeeds phrase-level spreading. Crucially, only the ordering patterns conforming to stratal ordering seem to be attested. A classical example is Shona (Myers 1997), where stem-level H tone spreading feeds H tone spreading at the phrase level. See Appendix C.3 in the Supplementary Material for more examples and specific pathological patterns which can be derived in Construction Phonology approaches.

No domain straddling

As a consequence of rejecting Bracket Erasure, MMP's approach allows for phrase level alternations which make reference to stem boundaries, resulting in *Domain Straddling*. An example would be an unbounded rightward-spreading process restricted to Hs at the left boundary of a stem which still crosses word boundaries, roughly a regular-alternation equivalent to something like the inceptive LLLH morphology. In contrast, the Stratal OT approach has no means to capture this. The left stem boundary is only visible at the stem and word levels, but the process itself would have to be phrase level, because it crosses word boundaries. Specific tone melodies can be inherited from stem to phrase level, but not the application of a general spreading process.

Whereas, in contrast to MMP, SJI assume a cyclic architecture with Bracket Erasure, they abandon the traditional lexicalist domains, thus allowing again for domains which are limited partially by word-internal and partially by phrasal boundaries, as long as these correspond to abstract syntactic domains such as *v*Ps. The Kuria reanalysis proposed here shows that no domain of this type is necessary since the extent of tone shifting simply falls out from the interplay of autosegmental representations and a standard lexicalist architecture.

This result is of particular importance given the lack of evidence for unambiguously phrasal domains elsewhere. Although SJI claim that effects comparable to Kuria are 'not uncommon' (p. 1238), this statement is misleading. There are a number of Bantu languages which show effects similar to Kuria, but of a much simpler type. Thus, in Ciyao (Hyman & Ngunga 1994), a single morphological H associates on a syntactically independent word if its association is blocked word-internally. Roughly, the same mechanism can explain the maybe better known case of Chimwiini where inflectional morphology such as subject agreement affects H realization at the phrase level. All these cases seem to work fully in parallel to the Kuria data discussed here modulo the complications of multitone melodies ('mora counting'). This is shown by an implementation of the basic Chimwiini facts in Appendix E.1 in the Supplementary Material. The other languages cited by SJI (in particular, Guébie, Dogon and Kalabari) lack the sensitivity of phrasal tone to word-internal structure apparently found in Kuria. The phrasal tone patterns they exhibit are triggered by specific syntactic constructions, which under a concatenative account can be captured by floating tones that constitute independent functional heads, as shown by Trommer (2022).

Thus, the Guébie phrasal Imperfective tone appears exactly in the same syntactic position occupied in other tenses by segmentally overt auxiliaries. In other words, it is in complementary distribution with independent words, not with word-internal affixes. In a stratal architecture, it then follows directly that these tones become only active in phrasal phonology and apply across words. See Trommer (2022) for an analysis of Kalabari along these lines. The absence of evidence for *v*P phases in Kuria is also in accordance with the general conclusion reached by Cheng & Downing (2012) that phrasal prosodic domains in Bantu do not directly correspond to syntactic phases.

Let us finally discuss SJI's claim that the CbP approach to Cyclic Locality is more restrictive than that of a lexicalist stratal account. They argue that under a tone-melody approach, morphological tones could show up on any phonological material following the verb, whereas the CbP approach predicts that it could only be realized on lexical items introduced in the same or a lower phase. The phase-based locality argument is at best speculative for Kuria since we (and SJI) simply lack data which would show whether the language obeys the alleged restriction to phase boundaries or not. However, cases of tonal across-word association in other languages provide evidence that morphologically triggered tone is *not* generally bound by phases. I illustrate this with the two types of phases invoked by SJI which can be identified empirically most easily, DPs and major lexical categories. Under the standard assumption that noun phrases (DPs) are phases, DP-internal material should not be able to trigger morpheme-specific tonal effects on outside material, but this prediction seems to be wrong. Thus, in Supyirie, determiners which are final in their DP trigger tone changes on following nouns, verbs or conjunctions, hence material clearly outside their DPs (e.g., cī–rēL 'tree-DEF' + páːn → cī–rē pàn 'chop a tree'; Carlson 1994: 59–60). A comparable case in Bantu is found in Kikuyu where the head noun of a DP triggers downstep on a following conjunction, preposition, or the head noun of a following independent DP (Clements 1984). Similarly, category-defining functional heads (little *n,* little *v,* etc.) establish phases (see SJI's analysis of Hebrew). Hence, roots should not be able to trigger idiosyncratic tonal effects outside of minimal stems. However, as shown in a recent survey by Rolle (2018), such effects are cross-linguistically well attested.

5.3 Indirect Reference

Under Indirect Reference, phonological constraints (or their weighting/ranking) cannot be sensitive to specific morphemes. Idiosyncratic properties of a morphological tone must be strictly due to its underlying phonological representation. Whereas this allows for capturing the Kuria facts, it still substantially limits possible systems of morpheme-specificity compared to Construction approaches. I will again discuss two specific predictions of the approach adopted here for tone: (a) *Generality of Association*: the association of tone melodies to moras is not morpheme-specific, but determined by the general constraint ranking of the relevant stratum; and (b) *Morphological Locality*: the effects of a tone melody are restricted to the tone melody itself, and hence its properties do not affect other tone melodies.

Generality of Association can be illustrated with the possibility of mirroring the processes in Kuria. Recall that for MMP the behaviour of the remote future is captured by the two morphosyntactically conditioned rules in (45a) and (45b). However, in MMP's approach, we could also imagine another morphologically conditioned tone in Kuria – let us call this the hypothetical future – which is the mirror image of the remote future: it puts a H on the third mora *before* the stem boundary by the rule in (45a′), which undergoes additional unbounded leftwards spreading by (45b′):

(45) a. *Remote future*

H'

$_{\text{STEM}}[$ μ μ μ

b. *Remote future*

H (Iterative)

(Domain: phrase)

μ μμ'

a′. *Hypothetical future*

H'

μ μ μ $_{\text{STEM}}[$

b′. *Hypothetical future*

H'(Iterative)

(Domain: phrase)

μ'μ μ

Nothing like the morpheme-specific mirroring pattern could be implemented under the Indirect Reference approach, where unbounded spreading is achieved by general constraints (and therefore has to be either leftwards or rightwards throughout the grammar), and tone melodies map uniformly. Thus, a mirror melody to the Remote Future LLH, that is, HLL, would not have the same effect as (45b), but result in association of the H to the stem-initial mora similar to the HL of the Hortatory Imperative (see §3.1).

Morphological Locality

Under Indirect Reference, morpheme-specific phonological effects are restricted to the phonological shape of the triggering morpheme itself (and its local phonological environment). Hence, morpheme-specific properties of a tone melody do not transfer to other tone melodies. However, this is exactly the situation predicted by the CbP approach of SJI, clearly demonstrable in the stacking of affix Hs in the same morphosyntactic domain in Kuria. In specific tenses, 3PL agreement also contributes a H which surfaces two moras after the segmental 3PL prefix [βa-], that is, on the stem-initial mora. Thus, in the immediate past, this H surfaces in addition to the immediate past H on the fourth stem mora as in [βa-a-[káraaŋg-ér-e]] 'they have just fried'. In the stratal approach, this can simply be captured by different tone melodies for immediate past and 3PL independently affixed at the stem and word levels (see Appendix B.3 in the Supplementary Material for a full analysis). While SJI do not analyse this combination, it is clear that under their approach 3PL [βa-] must also carry a H, which dislocates by two moras due to the constraint μ2.

Since tense and 3PL subject agreement are introduced in the same phase, they are phonologically evaluated in the same optimization cycle, and thus should behave in exactly the same way: either both shift by two moras or both shift by four moras. Thus, even though a^{H}- introduces a boost for the μ4 constraint and βa^{H}- a boost for μ2, the behaviour of the individual tones is determined globally by the overall weighting: If the resulting weight of μ4 is greater than that of μ2, we get consistent four-mora

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shift as in (46a), and if the weighting is reversed as in (46b), two-mora shift applies throughout:

(46) *2 ⊕ 4 pattern – agreement in Cophonology by Phase*

a. *Variant I: Higher weighting of μ4*

Input: d.	μ4 5	μ2 4	Id T 1	H
☞ a. βa-a-[karaáŋgére] (4-4)	0	2	2	−10
b. βa-a-[káráaŋgere] (2-2)	2	0	2	−12
☛ c. βa-a-[káraaŋgáre] (2-4)	1	1	2	−11
d. βa^{H}-a^{H}-[karaaŋgere] (0,0)	2	2	0	−18

b. *Variant II: Higher weighting of μ2*

Input: d.	μ2 5	μ4 4	Id T 1	H
a. βa-a-[karaáŋgáre] (4-4)	2	0	2	−12
☞ b. βa-a-[káráaŋgere] (2-2)	0	2	2	−10
☛ c. βa-a-[káraaŋgáre] (2-4)	1	1	2	−11
d. βa^{H}-a^{H}-[karaaŋgere] (0,0)	2	2	0	−18

The same problem is likely to be found in tone melodies attached to different verbs. Thus, recall that in the complex sentence in (33b) n-da-[gaɲ-a] wɛ á-tánɔr-ɛ́ 'I expect him to leave', the verb of the embedded clause has a μ3 pattern and the matrix clause a μ4 pattern. Crucially, this is exactly what we see. Whereas the H of the initial verb might be realized on the embedded verb, the morphological H on the latter still shows up on the third mora, and is not further dislocated (recall that μ4 pattern on a 3μ base would result in a final rise, not a final H). However, in SJI's approach, where cophonologies are a property not of morphemes or words, but of phases, including entire complex clauses, it is in principle predicted that a morphologically conditioned tone shifting process could affect all words in a clause. I will call the resulting problem the *collectivity problem*: The idiosyncratic phonological behaviour of one morpheme is predicted to generalise to other morphemes. Whereas SJI may avoid global application of shifting for the data in (33) by the stipulation that shifting constraints such as μ2 apply only to floating tones, and the assumption that all embedded Hs have been already associated in previous phases, the incorrect collectivity prediction seems to be inescapable for the 2 ⊕ 4 pattern in (46). Note also that the collectivity problem is by no means a complication specific to Kuria or to tone. It is also a problem for other CbP analyses (see the problem for Sande 2018 of restricting tonal chain shifting to a single locus in a clause), and for classical data from the pre-Phase Cophonology literature such as velar deletion in Turkish (Orgun 1996; see Appendix E.2 in the Supplementary Material).

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6. Other alternatives

An anonymous reviewer suggests that Kuria morphological tone could be understood as the result of a process-based morphological component, which would explain why it has formally different properties from genuinely phonological alternations. As pointed out by Bermúdez-Otero (2012), assuming morphological operations of this type undermines the predictiveness of phonological theory in a way analogous to morphologically sensitive phonological processes; this is the very reason for the Morph Integrity Hypothesis adopted here (see §2.1). Thus, allowing arbitrary morphological rules would lead to the same problematic predictions for possible tonal morphophonology as Construction Phonology approaches, especially for Generality of Association (§5.3) and tone infixation (§5.1).

Another alternative mentioned by MMP is the idea that Hs are attracted to prosodically prominent positions – in the case of the inceptive, a right-headed moraic colon. While this move would allow for maintaining Phonological Locality, it still would require morpheme- or construction-specific morphology to derive the fact that different TAM categories have different prosodic structures. Different prosodies could in principle also be provided by affixation, but this would mean that the affixal prosody (i.e., its moras, syllables and feet) overwrites the underlying prosody of bases, resulting in templatic effects (as assumed for other cases of prosodic affixation; see Zimmermann 2014), but Kuria does not exhibit any effect of this type.

Rolle & Lionnet (2020) therefore suggest a new theoretical construct, 'phantom structure': templatic strings of input moras associated to morphological tone (e.g., μμμμ́ for the inceptive) imposing linearization on tones through a special version of output–output correspondence even if the moras themselves do not surface because they are located on a 'phantom' tier. However, from Rolle & Lionnet's discussion, it remains unclear if this approach could provide a solution to the fact that not all morphological H tones spread (see §3.2) or to the Cyclic Locality problem posed by the Kuria data in a lexicalist stratal architecture. Since correspondence is not subject to autosegmental locality conditions, the phantom structure approach also incorrectly predicts tonal infixation across fully specified tones.

Another prosody-based alternative mentioned by MMP would be the affixation of Hs to prosodic pivots, for example, after an initial foot of the base. This would not involve morpheme-specific phonology, but a departure from a lexicalist architecture since, in contrast to tone melodies which are autosegmental objects inherited across strata, infixation would be a procedural operation applying in a given domain. Like a Construction Phonology approach, pivot affixation also incorrectly predicts the typological attestation of true tonal infixes (see §5.1).

A further question raised by an anonymous reviewer is whether the stratal tone-melody analysis could also be restated in a rule-based formalism. It is difficult to exclude this possibility because there are so many different existing (and conceivable) versions of rule-based phonology. The assumptions employed here in the tone-melody analysis – Richness of the Base, Lexicon Optimization and Indirect Reference via colours – while not necessarily incompatible with rule-based approaches, have so far only been systematically explored in an Optimality-Theoretic setting. On the other hand, MMP convincingly argue that at least under their specific theoretical assumptions about possible rule application, a tone-melody approach would cause problems for phrase-level spreading. Thus, it remains to be seen whether a rule-based approach can develop a coherent system of formal and conceptual assumptions that would allow for a similar account of the Kuria data.

7. Summary and conclusions

MMP argue that Kuria provides clear evidence against Phonological Locality, Cyclic Locality and Indirect Reference, on the grounds that conceivable alternatives to their Global Construction approach run into technical difficulties. In this article, I have shown that one of the alternatives MMP dismiss, an analysis in terms of tonal melodies, in fact provides a formally sound analysis obviating all three of these problems if embedded in Stratal Optimality. In a second step, I have evaluated the empirical predictions of the Stratal OT approach in the empirical domains which are phenomenologically closest to the Kuria patterns, tonal infixation, shifting and spreading. The comparison with the Global Construction frameworks used by MMP and SJI has shown that the Stratal OT approach makes the more restrictive and accurate typological predictions. These are summarised in (47):

(47) *Predictions of the Stratal OT approach and the Locality Principle*

- a. *Phonological Locality*
  - i. No tone infixation across associated tones
  - ii. No bounded shifting/spreading in a window exceeding three TBUs
- b. *Cyclic Locality*
  - i. No domain straddling
  - ii. Stratal ordering of shifting and spreading
- c. *Indirect Reference*
  - i. Generality of association
  - ii. Morphological Locality

Thus, the major argument of this article is one of theoretical and typological restrictiveness: The Four-Hypothesis Program of Bermúdez-Otero (2012), a modular version of stratal phonology and a general Locality Principle on possible constraints (42) can be maintained in the face of the data from Kuria tone, resulting in highly specific overall predictions for tonal morphology and phonology. That the Kuria data, especially the inceptive LLLH pattern, are still typologically unusual here follows simply from the fact that it has a morpheme of unusual shape: cross-linguistically, affixes tend to be short, and most tonal affixes (historically often derived from monosyllabic segmental affixes carrying tone) documented in the literature have only one or two tones. Three-tone melodies are much rarer, but are found, for example, in Haya (Hyman & Byarushengo 1984), Kipsigis (Trommer 2022) and Maasai (Hyman 2012). Thus, the inceptive may well be the only morphological four-tone melody documented so far. Similarly, tone melodies with adjacent identical tones are attested

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(see §4.3 for examples), but are apparently rarer than melodies with distinct tones. In sum, Kuria morphology, as far as we know it, seems to employ unusual lexical shapes, but does not require unusual formal mechanisms in its phonological grammar. Given the current limitations of empirical data from Kuria (see §3.3), a central challenge for future research will be to test whether this conclusion can be maintained against a fuller picture of its tonal morphophonology.

Supplementary material. The supplementary material provided online comprises six appendices. Appendix A gives a synopsis of the empirical facts in Kuria with a slightly extended data set. Appendix B provides a full description of the OT analysis of Kuria, including all constraint definitions and rankings. This also contains an analysis of morphological patterns which combine several morphological tone patterns in a single verb form not analysed explicitly in the main text of the article. Appendix C further substantiates problems for Construction Phonology approaches raised by the Kuria facts by elaborating on problematic typological predictions they make, and Appendix D by listing specific technical problems of the CbP analysis of Kuria provided by SJI. Appendix E contains more details on data from other languages cited in the main text. Appendix E.1 gives the sketch of an analysis for morphological tone in Chimwiini, and Appendix E.2 lays out the Collectivity Problem in Turkish velar deletion, both employed in the argumentation of §5. Additional references for the appendices are given in Appendix F. The supplementary material for this article can be found at https//doi.org/10.1017/S0952675723000180.

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