Serial Reduplication Is Empirically Adequate and Typologically Restrictive

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Wei and Walker (2020) and Zymet (2018) claim that derivational lookahead effects are attested in the interactions between reduplication and other phonological processes in Mbe and Logoori, respectively. On the basis of this evidence, they argue that reduplication in these languages cannot be modeled by Serial Template Satisfaction (McCarthy, Kimper, and Mullin 2012), a theory of reduplication set in Harmonic Serialism. This article refutes these claims and provides serial analyses for both languages. It further identifies a novel prediction of Base-Reduplicant Correspondence Theory (McCarthy and Prince 1994, 1995, 1999), a parallel theory of reduplication, that reduplicants may surface with marked structures unattested elsewhere in the language, and it demonstrates that these patterns are not replicated in serial.

Keywords: derivational lookahead, reduplication, Mbe, Logoori, Harmonic Serialism, Serial Template Satisfaction, Base-Reduplicant Correspondence Theory, the emergence of the marked

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1 Introduction

In parallel Optimality Theory (pOT; Prince and Smolensky 1993), Gen produces candidates that may be arbitrarily different from the input. In Harmonic Serialism (HS; Prince and Smolensky 1993, McCarthy 2000, 2006, 2008b, 2016), Gen only produces candidates that differ from the input by at most one operation: no operation may be applied more than once to produce a candidate, and no more than one operation may be applied to produce a candidate. Consequently, pOT can evaluate interactions between operations that HS cannot. To give a schematic example, suppose pOT maps an input /A/ onto an output [C] by making two changes. In HS, because [C] is not in the candidate set generated from /A/, the derivation must pass through an intermediate step: /A/ → B → C → [C]. However, if it is not optimal to map /A/ onto B in the first step, the derivation may converge on an output other than [C]: /A/ → X → Y → [Y]. To favor mapping /A/ onto B in anticipation of [C], the grammar would have to look ahead to future derivational steps.

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Proponents of HS argue that its restrictiveness correctly expunges unattested mappings predicted by pOT (see McCarthy 2006, 2008b, 2010, 2016 for overviews of these results). For example, outside of morphologically restricted environments, metathesis only targets adjacent segments (Buckley 2011). However, pOT predicts nonlocal metathesis as a possible repair of locally defined constraints (Heinz 2005, McCarthy 2006, 2008b). The tableau in (1) illustrates nonlocal metathesis motivated by the constraint *ORALCODA, which penalizes nonnasal segments in coda position (Walker 2000). This mapping is not possible in HS, as the candidates generated from /ant/ by making one transposition, [nat] and [atn], do not improve on *ORALCODA (McCarthy 2006, 2008b; see Takahashi 2018, 2019 for an approach to metathesis in HS). For the grammar to favor [atn] in anticipation of mapping it onto [tan], it would have to look ahead to the next derivational step. However, because HS does not look ahead, operations only apply when their application is locally optimal.

(1) Nonlocal metathesis in pOT (unattested, McCarthy 2006, 2008b)

/ant/	*ORALCODA	LINEARITY
a. ant	W 1	L
b. nat	W 1	L 1
c. atn	W 1	L 1
→ d. tan		2

There is a growing body of literature arguing that there are natural language phenomena that cannot be modeled in HS because they would require derivational lookahead (Adler 2017, Adler and Zymet 2017, 2021, Wei 2018, Wei and Walker 2018, 2020, Zymet 2018, Stanton 2020). These works draw on evidence from a diverse set of segmental processes, prosodification, and reduplication to argue that pOT is a more viable model of phonology than HS. The project of critically evaluating claims of derivational lookahead is necessarily beyond the scope of any one work and must be broken down by empirical domain. The present article focuses on reduplication and concludes that there is no evidence to support derivational lookahead.

Wei and Walker (2020) and Zymet (2018) argue that phonotactic restrictions in Mbe and Logoori, respectively, cannot be satisfied unless reduplication occurs simultaneously with other operations. Both works present analyses in Base-Reduplicant Correspondence Theory (BRCT; McCarthy and Prince 1994, 1995, 1999), a theory of reduplication set within pOT, and argue that Serial Template Satisfaction (STS; McCarthy, Kimper, and Mullin 2012), a theory of reduplication set in HS, cannot model the data without derivational lookahead.

The tableaux in (2) illustrate an unattested mapping that requires derivational lookahead (see Inkelas and Zoll 2005 for similar examples); constraints are based on Lombardi 1999, 2001. A root /galab/ is the input to the first tableau (2a–c), and it takes a reduplicative prefix /RED-galab/ in the second (2d–g). In isolation, the root-final /b/ devoices, improving on *VOICEDOBSTRUENT (2b). Devoicing the initial /g/ would fatally violate IDENTONSET(voice)-IO (2c). When the root takes a reduplicant, however, the final /b/ remains voiced (2d). Because it corresponds to the

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reduplicant-final [b], final devoicing would violate IDENT(voice)-BR (2e). The reduplicant [b] cannot devoice without violating AGREE(voice) (2f) or IDENTONSET(voice)-IO (2g). Thus, final devoicing is blocked when roots with initial voiced obstruents undergo reduplication. In all other contexts, final obstruents devoice.

(2) IDENT(voice)-BR blocks final devoicing (unattested)

/galab/, /RED-galab/	IDENT (voi)-BR	AGREE (voice)	IDONSET (voi)-IO	*VOICED OBS	IDENT (voi)-IO
a. galab				W 2	L
→ b. galap				1	1
c. kalap			W 1	L	W 2
→ d. **galab**-galab				4	
e. **galab**-galap	W 1			L 3	W 1
f. **galap**-galap		W 1		L 2	W 2
g. **kalap**-kalap			W 1	L	W 2

It is not surprising that faithfulness constraints evaluated along the base-reduplicant (BR) correspondence dimension should produce nonlocal effects such as that in (2). After all, correspondence relations hold between segments that are arbitrarily far apart. HS cannot reproduce this mapping without an analogous nonlocal constraint or derivational lookahead. If copying and devoicing must occur in separate steps, then there is no ordering that produces the surface form [**galab**-galab] (3). If copying occurs first (3a), then nonlocal blocking must be incorporated into the definition of final devoicing; otherwise, it cannot access the necessary information. If devoicing occurs first (3b), then the grammar must be equipped with derivational lookahead: devoicing applies unless it would create a disagreeing cluster later in the derivation.

(3) a. Underlying representation /RED-galab/
Copy root **galab**-galab
Final devoicing **galab**-galap
Surface representation *[**galab**-galap]
b. Underlying representation /RED-galab/
Final devoicing RED-galap
Copy root **galap**-galap
Surface representation *[**galap**-galap]

In a serial derivation, modeling mappings like (2) requires accessing information in the string that may be arbitrarily far away, or accessing information in the derivation that may be arbitrarily many steps in the future. Unless HS is equipped with these capacities, it cannot produce these mappings. This is the correct prediction, as interactions like (2) are unattested. Wei and Walker

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(2020) and Zymet (2018) argue for lookahead effects in Mbe and Logoori, respectively. Their claims of derivational lookahead are refuted by the lookahead-free STS analyses in sections 3 and 4. (STS is introduced in section 2.) Section 5 builds on (2), demonstrating unattested emergence-of-the-marked effects in BRCT: structures surface in reduplicants despite being repaired elsewhere in the language. It further argues that these predictions are unique to BRCT and that STS cannot produce the emergence-of-the-marked effects.

2 Serial Template Satisfaction

As noted above, STS is a theory of reduplication set in HS. This section provides an overview of STS; for illustrations, see Somerday 2015, Lin 2016, Anderson and Smith 2017, 2018, and Lamont 2021.

STS treats reduplicative morphemes as underlying prosodic templates, such as feet, syllables, and moras, without internal structure or segmental content. By lacking constituents, these templates violate constraints requiring prosodic heads (Selkirk 1995). Headedness constraints, shortened to HD(X), require prosodic nodes to contain nodes one level lower on the prosodic hierarchy (4). Specifically relevant to this article, HD(F) penalizes feet that do not dominate syllables, HD(σ) penalizes syllables that do not dominate moras, and HD(μ) penalizes moras that do not dominate segments.

(4) *HD(X)*
Assign one violation mark for every constituent of type X that does not contain a constituent of type X − 1 as its head. (McCarthy, Kimper, and Mullin 2012:181)

GEN has two operations that install a constituent of type X − 1 in a constituent of type X. One operation inserts an empty prosodic constituent. This trades a violation of HD(X) for one of HD(X − 1), and, following McCarthy, Kimper, and Mullin (2012:180), does not violate any faithfulness constraints. The other operation copies a contiguous string of constituents and inserts the copy into the host constituent. Copying any length string of constituents of type X violates the faithfulness constraint *COPY(X). Copying can target segments, prosodic constituents, or morphological constituents; an illustration is given in (5). The input to GEN is /bata/, which is syllabified and has been parsed into a bisyllabic foot. From this input, GEN can copy any contiguous string of segments (5a), syllables (5b), or feet (5c). GEN cannot copy discontiguous elements like the string [bt], at least not in one step.

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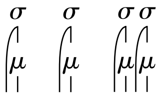
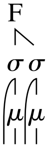
(5) *Strings* G*EN* *can copy from input* bata

a. b, a, t, ba, at, ta, bat, ata, bata



b. ba, ta, bata



c. bata

Copying cooccurs with the copy being incorporated into existing prosodic structure. If this were broken into two steps, copying would not be harmonically improving: applying the copying operation violates *COPY(X) and would fail to improve on HD(X). As an illustration, consider the example in (6), where syllable strings are copied into a foot template. Excluded from (6) are candidates where strings of segments or moras are copied into the foot template. Those candidates do not improve on HD(F), which penalizes feet that do not dominate syllables. The input to (6) contains three syllables, and any string of one (6a–c), two (6d–e), or three (6f) syllables can be copied into the foot template. In principle, arbitrarily many syllables can be copied into a foot template in one step, with markedness constraints determining the optimal amount of material. In this respect, copying is different from other structure-building operations available to GEN, which are limited in how much material they parse in one step; for example, theories of footing in HS allow at most two syllables to be footed in a single step (McCarthy 2008c, Pruitt 2010, 2012, Lamont to appear).

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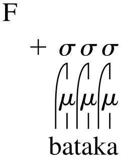
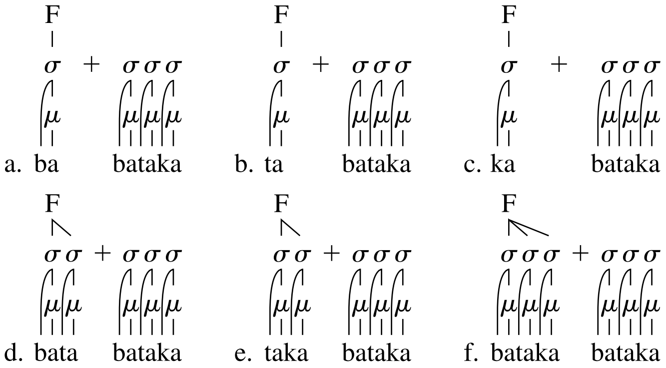


(6) *Candidates produced by copying strings of syllables from input*



The six candidates in (6) incur one violation of *COPY(σ). Additionally, there is a pressure for copies to be adjacent to their sources, formalized as the faithfulness constraint *COPY-LOCALLY(X). This constraint assigns as many violations as there are intervening constituents of type X between a copy and its source. Candidates (6b,e) each incur one violation of *COPY-LOCALLY(σ), and (6c) incurs two violations.

3 Reduplication in Mbe Does Not Require Lookahead

Reduplication expones verbal imperatives and nominal diminutives in Mbe (Benue-Congo; Bamgbọse 1966, 1967a,b,c, 1971, Walker 1998a,b, 2000). The former surfaces as a syllable-sized prefix (7a–c), and the latter surfaces as a coda on the Class 4 marker /kɛ-/ (7d–f). Reduplicant codas are limited to nasal consonants and must be homorganic to following onsets. Thus, verbs without nasal consonants take a CV imperative (7a) and verbs with nasal consonants take a CVN imperative (7b–c). Nouns without nasal consonants do not overtly realize the diminutive (7d); it surfaces as a nasal coda only with nouns that contain a nasal consonant (7e–f).

(7) *Reduplication in the Mbe imperative and diminutive*

a. **sə̂**-só.rò 'descend-IMP'
b. **g͡bə̂ŋ͡m**-g͡bé.nò 'collide-IMP'
c. **jî̃ɲ**-jîɔ.nì 'forget-IMP'
d. kà-∅-bà.rò 'liver-DIM'
e. kɛ̌-**n**-nên 'bird-DIM'
f. kɛ̌-**n**-tɔ̀.ní 'earthworm-DIM'

This phonotactic restriction applies only to reduplicants (Walker 2000:95); roots take a wider range of coda consonants word-finally (8) and at suffix boundaries (9).

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(8) *Word-final codas in Mbe* (Bamgbọse 1967a:7)
  a. tém 'bury'
  b. tén 'push'
  c. táŋ 'give in marriage'
  d. g͡bál 'run'
  e. g͡bár 'plaster'
  f. táb 'accompany'

(9) *Codas at root-suffix junctures in Mbe* (Bamgbọse 1967c:176, 181, 182)
  a. jǐɛm-kì 'be singing'
  b. lúɔm-nî 'bite all over'
  c. fùel-kî 'be blowing'
  d. tsɔ̌r-kì 'be carrying'
  e. jùab-kî 'be washing'

Wei and Walker (2018, 2020; see also Wei 2018) argue that derivational lookahead is required to model the imperative, echoing an argument by McCarthy, Kimper, and Mullin (2012:212–213). Given a CVC(V) stem, the decision to copy an open syllable **CV**-CVC(V) or a closed syllable **CVC**-CVC(V) depends on whether the copied coda will later undergo place assimilation and be licensed. Because copying cannot cooccur with assimilation, the grammar must look ahead to avoid unlicensed codas. Wei and Walker further argue that stems with initial diphthongs pose problems for analyzing the imperative as a foot, because there is no prosodic motivation to copy a coda. Given a CVVN(V) stem, copying an open syllable **CVV**-CVVN(V) satisfies FtBin, and copying a closed syllable **CVVN**-CVVN(V) is unmotivated.

This section presents an analysis of Mbe reduplication in STS that refutes the claim of lookahead.[1] The imperative is analyzed as a foot template, which prefers that reduplicants surface with codas. This is overridden by a phonotactic constraint banning nonnasal codas, deriving the difference between (7a) and (7b). Roots with initial diphthongs, such as (7c), initially provide no motivation to copy the nasal. However, copied diphthongs are obligatorily reduced, creating a headless mora in the reduplicant, which motivates copying a nasal. The same mechanism derives the diminutive, which is analyzed as an underlying mora.

3.1 The Mbe Imperative as a Foot Template

There are two verb classes in Mbe, Class I and Class II, which are distinguished by their conjugation and morphophonology (Bamgbọse 1967c). Both classes restrict reduplicant codas to nasals homorganic to following onsets and impose class-specific restrictions on reduplicant vowels.

[1] Lin (2021) has independently developed an alternative STS analysis of Mbe.

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Class I verbs are all monosyllabic (Bamgbọse 1967c); examples are given in (10). The reduplicant surfaces as an open syllable with open-syllable roots (10a,d) and roots closed by oral consonants (10b,e). With roots that end in nasals, the reduplicant surfaces with a nasal coda homorganic to the following consonant (10c,f).

(10) *Mbe Class I imperatives* (Bamgbọse 1967c:183, 184)

a.	bú	**bǔ**-bù	'grow'
b.	káb	**kǎ**-kàb	'dig'
c.	lám	**lǎn**-làm	'cook'
d.	ʃúɛ	**ʃǔɛ**-ʃùɛ	'suck'
e.	ʃíɔr	**ʃǐ**-ʃìɔr ~ **ʃíɔ**-ʃìɔr	'sneeze'
f.	túɔm	**tǔɔn**-tùɔm	'send'

Class I imperatives all take a tonal melody consisting of a rising tone on the reduplicant followed by a low tone on the root. Tonal assignment does not otherwise interact with reduplication and is not analyzed below. Reduplicant diphthongs are subject to lexical restrictions in Class I. The second element of a diphthong is lost in an open syllable if it is /e/ or /o/: for example, [**fǔ**-fùo] 'blow' (cf. (10d)). In closed syllables, diphthongs' second elements are optional, as in (10e), except when the syllable is closed by a labial, where they surface (10f).

Class II verbs are all monosyllabic or bisyllabic (Bamgbọse 1967c); examples are given in (11). The reduplicant surfaces as an open syllable with monosyllabic roots that lack codas (11a,f), monosyllabic roots with oral codas (11b,g), and bisyllabic roots with medial oral onsets (11c,h). The reduplicant surfaces with a nasal coda homorganic to the following consonant with monosyllabic roots closed by nasals (11d,i) and with bisyllabic roots with medial nasal onsets (11e,j).

(11) *Mbe Class II imperatives* (Bamgbọse 1967c:185, 186)

a.	rû	**rû**-rû	'pull'
b.	mâl	**mə̂**-mâl	'finish'
c.	só.rô	**sə̂**-só.rò	'descend'
d.	tâŋ	**tə̂n**-tâŋ	'teach'
e.	g͡bé.nô	**g͡bə̂ŋ͡m**-g͡bé.nò	'collide'
f.	tʃûe	**tʃû**-tʃûe	'bore (hole)'
g.	fûel	**fû**-fûel	'blow'
h.	kúɛ.lô	**kû**-kúɛ.lò	'nibble at'
i.	dzûɔŋ	**dzûn**-dzûɔŋ	'be higher'
j.	jíɔ.nî	**jîɲ**-jîɔ.nì	'forget'

Class II imperatives all take a falling tone on the reduplicant and a falling tone on the root. As with Class I verbs, the tones are not analyzed below. Reduplicant vowels are subject to very stringent restrictions in Class II. High vowels are copied faithfully (11a), and all other monophthongs are reduced to [ə] (11b–e). Diphthongs are all reduced to their initial element (11f–j), which, because Mbe only has falling diphthongs (Bamgbọse 1967a), results in a simple high vowel.

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Class II verbs provide evidence that the imperative is an underlying foot. The reduplicant surfaces with a coda with CV(V)NV roots, and there must be some motivation for it, formalized as FtBin (12). In addition to their different tonal contours and restrictions on vowels, Classes I and II differ in how they fill in the foot template (see Lamont 2021 for the same lexical split in another language). In Class I, the root syllable is copied and then nonnasal codas are deleted. In Class II, an empty syllable is inserted and then a string of segments is copied to head it.

(12) *FtBin*
Assign one violation to every foot that dominates fewer than two syllables and fewer than two moras.

In addition to the Hd(X) and *Copy(X) constraints introduced in section 2, constraints are needed to model the vowel alternations in Class II verbs. Because diphthong reduction in Class I is optional and does not feed other phonological processes, it is not discussed in the analysis. The constraints in (13) motivate reduction.

(13) *Mid/Low ≫ *Schwa ≫ *High

Vowel reduction is modeled by an operation that maps full vowels onto schwa. Applying this operation violates the faithfulness constraint Max(V-place). Following McCarthy (2019), Gen can delete schwa but not full vowels, and so vowel deletion is gradual: for example, /a/ → ə → Ø, /u/ → ə → Ø. The analysis diverges from McCarthy's in that mid and low vowels map directly onto schwa without first raising.

Similarly, following McCarthy (2007, 2008a, 2016), consonantal deletion and place assimilation are analyzed as gradual processes, both of which begin by deleting a segment's place features. Gen can only delete placeless consonants and spread place features onto placeless consonants. Place deletion violates the faithfulness constraint Max(C-place), and the resulting placeless consonant violates the markedness constraint HavePlace. CodaCond motivates debuccalization (14), feeding consonantal deletion and place assimilation. Note that, as defined, this constraint penalizes superficially homorganic clusters, requiring assimilation: for example, an.ta → aN.ta → an͡.ta.

(14) *CodaCond*
Assign one violation to every consonantal place feature not associated to an onset. (McCarthy 2008a:279)

The differences between Class I verbs and Class II verbs are modeled with lexically indexed constraints (Pater 2007, 2010). For example, the ranking Max(V-place)$_{I}$ ≫ *Mid/Low ≫ Max(V-place) derives the fact that low vowels surface faithfully in Class I reduplicants (10b) but reduce to schwa in Class II reduplicants (11b).

The analysis of the Mbe imperative is presented in detail in sections 3.1.1 and 3.1.2; the full set of tableaux is available in the online appendix (https://doi.org/10.1162/ling_a_00452). The diminutive is discussed in section 3.2. Because they are irrelevant to the overall analysis, differences between the reduplicant and the root are not discussed. They may plausibly be analyzed as faithfulness to roots or affix-specific markedness. Accordingly, only violations incurred by

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reduplicants are shown in tableaux. Pairwise relations between constraints reflect the overall ranking. A Hasse diagram for Mbe is given at the end of the section (see figure 1).

3.1.1 Class I Imperatives Copy Syllables The restrictions on reduplicant codas are enforced via deletion in Class I. The root syllable is copied, and then any place features in the coda are deleted. If the coda is an oral consonant, it is then deleted entirely, and if it is a nasal consonant, it is place-linked to the following onset. Thus, only place-linked nasal codas surface.

3.1.1.1 Copied Oral Codas Are Deleted The tableau in (15) shows the copying step of the derivation mapping /F-káb/ onto [**kǎ**-kàb] 'dig'. The root is syllabified, which implies earlier derivational steps, assuming gradual syllabification (Elfner 2009, Pater 2012, Torres-Tamarit 2012, 2016, Moore-Cantwell 2016). The foot template is unfilled in the faithful candidate (15a), which fatally violates HD(F). Copying the root syllable into the template (15c) is preferred to inserting an empty syllable (15b), because HD(σ) dominates *COPY(σ). Other logically possible candidates do not improve on HD(F).

(15) /F-káb$_I$/ → [**kǎ**-kàb$_I$], Step 1 (Mbe)

F + σ μμ kâb Class I	HD(F)	HD(σ)	*COPY(σ)	*MID/LOW	*ORALCODA	FTBIN	CODACOND
a. F + σ μμ kâb	W 1		L	L	L	W 1	L
b. F σ + σ μμ kâb		W 1	L	L	L	W 1	L
→ c. F σ + σ μμ μμ kâb kâb			1	1	1		1

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In the next two steps of the derivation (16), the coda /b/ is deleted. First, its labial place feature is deleted (16b); the exterior arrow indicates that this candidate is the input to the next step (16d–f). The diacritic distinguishes debuccalized stops derived from voiced obstruents, ʔ̬, from those derived from voiceless obstruents, ʔ. Copying a vowel into the reduplicant does not improve on *ORALCODA or CODACOND, because the labial-vowel string cannot be resyllabified as a CV syllable in one step. *MID/LOW cannot motivate vowel reduction because the lexically indexed constraint MAX(V-place)$_I$ is dominant (16c). The placeless coda is then deleted in the third step (16d–f), satisfying HAVEPLACE and *ORALCODA (16e). Place assimilation also satisfies HAVEPLACE, but fails to improve on *ORALCODA (16f). Deleting the coda violates HD(μ) because the second reduplicant mora no longer dominates any segments.

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(16) /F-káb$_I$/ → [**kǎ**-kàb$_I$], Steps 2–3 (Mbe)

F / σ + σ / μμ μμ / kâb kâb Class I	MAX(V-Pl)$_I$	*MID/LOW	MAX(V-Pl)	*SCHWA	*ORALCODA	HD(μ)	*CODACOND	MAX(C-Pl)	HAVEPLACE	*LINK(place)	MAX
a. kâb kâb		1			1		W 1	L	L		
→ b. kâʔ̬ kâb		1			1			1	1		
c. kə̂b kâb	W 1	L	W 1	W 1	1		W 1	L	L		
d. kâʔ̬ kâb		1			W 1	L			W 1		L
→ e. kâ kâb		1				1					1
f. kâg kâb		1			W 1	L				W 1	L

The headless mora is deleted in the fourth step (17e), as it cannot be retained without violating higher-ranked constraints. Linking the mora to the reduplicant vowel fatally violates *LONGVOWEL (17b), copying a stop to head the mora fatally violates *ORALCODA (17c), and copying a vowel to head the mora introduces an additional violation of *MID/LOW (17d). The derivation converges in the next step (17f–h). The faithful candidate violates both FTBIN and *MID/LOW (17f), but neither constraint can optimally motivate an operation to apply. Inserting an empty syllable (17g) and copying a syllable into the reduplicant (17h) both create a binary foot, but violate constraints that dominate FTBIN.

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(17) /F-káb$_I$/ → [**kǎ**-kàb$_I$], Step 4 and convergence (Mbe)

F / σ + σ / μμ μμ / kâ kâb Class I	HD(σ)	*COPY(σ)	*MID/LOW	*ORALCODA	HD(μ)	*LONGV	MAX(μ)	*COPY(seg)	FTBIN	CODACOND
a. F / σ + σ / μμ μμ / kâ kâb			1		W 1		L		L	
b. F / σ + σ / μμ μμ / kâ kâb			1			W 1	L		L	
c. F / σ + σ / μμ μμ / kâk kâb			1	W 1			L	W 1	L	W 1
d. F / σ + σ / μμ μμ / kââ kâb			W 2				L	W 1	L	
→ e. F / σ + σ / μ μμ / kâ kâb			1				1		1	
→ f. F / σ + σ / μ μμ / kâ kâb			1						1	
g. F / σ σ + σ / μ μμ / kâ kâb	W 1		1						L	
h. F / σ σ + σ / μ μ μμ / kâ kâ kâb		W 1	W 2						L	

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3.1.1.2 Copied Nasal Codas Are Assimilated Nasal-final verbs like [túɔm] 'send' follow the same first two steps, copying the root syllable and deleting the coda's place features. In the third step, the coda undergoes place assimilation instead of being deleted, as the tableau in (18) illustrates. Deletion violates HD(μ) (18b) and, because the nasal does not violate *ORALCODA, is dispreferred to assimilation (18c). As with [**kǎ**-kàb] *[**kǝ̌**-kàb] 'dig', MAX(V-place)$_I$ prevents the reduction of the diphthong to [əɔ] or [uə]. The derivation converges in the next step on [**tǔɔn**-tùɔm].

(18) /F-túɔm$_I$/ → [**tǔɔn**-túɔm$_I$], Step 3 (Mbe)

F; σ + σ; μμμ μμμ; túɔN túɔm Class I	*MID/LOW	HD(μ)	*HIGH	HAVEPLACE	*LINK(place)	MAX
F; σ + σ; μμμ μμμ; a. túɔN túɔm	1		1	W 1	L	
F; σ + σ; μμμ μμμ; b. túɔ túɔm	1	W 1	1		L	W 1
F; σ + σ; μμμ μμμ; → c. túɔn túɔm	1		1		1	

3.1.2 Class II Imperatives Copy Segments Class II imperatives enforce the restrictions on reduplicant codas by only copying nasals into coda position. A nasal coda can be copied early in the derivation, along with other segmental material copied to head the syllable. A nasal coda can also be copied later in the derivation to head a mora whose constituent vowel was deleted. Once copied, nasal codas are debuccalized and place-linked to the following segment.

3.1.2.1 Oral Consonants Are Not Copied as Codas In Class II, the foot template is headed by inserting an empty syllable. The tableau in (19) illustrates this step of the derivation mapping /F-só.rô/ onto [**sǝ̂**-só.rô] 'descend'. As before, the syllabified root implies earlier derivational

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steps. The faithful candidate fatally violates HD(F) (19a) and loses to a candidate with an inserted syllable (19b). Copying the root syllables into the foot template is preferred by HD(σ) and FTBIN, but is ruled out by the lexically indexed faithfulness constraint *COPY(σ)$_{II}$ (19c).

(19) /F-só.rô/ → [**sə̂**-só.rô], Step 1 (Mbe)

F + $\sigma\sigma$ ($\mu\mu$) sórô Class II	HD(F)	*COPY(σ)$_{II}$	HD(σ)	*COPY(σ)	*MID/LOW	FTBIN
a. F + $\sigma\sigma$ ($\mu\mu$) sórô	W 1		L			1
→ b. F–σ + $\sigma\sigma$ ($\mu\mu$) sórô			1			1
c. F–$\sigma\sigma$ ($\mu\mu$) sórô + $\sigma\sigma$ ($\mu\mu$) sórô		W 1	L	W 1	W 2	L

The rest of the derivation is illustrated in the tableaux in (20). A string of segments is copied to head the syllable in the second step of the derivation (20b).

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(20) /F-só.rô/ → [s**ə̂**-só.rô], Steps 2–4 (Mbe)

F σ + σσ μ μ sórô Class II	Hd(σ)	*Mid/Low	MaxHdμ	Max(V-Pl)	*Schwa	*OralCoda	Hd(μ)	*Copy(seg)	FtBin	CodaCond	Max
a. F σ + σσ sórô	W 1	L						L	1		
→ b. só sórô		1						1	1		
c. sór sórô		1				W 1		1	L	W 1	
→ d. só sórô		W 1		L	L				1		
→ e. sə́ sórô				1	1				1		
→ f. sə́ sórô					1				1		
g. s sórô			W 1		L		W 1		1		W 1

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Copying the string [sór] with a coda is preferred by FtBin, but fatally violates the higher-ranked *OralCoda (20c). In the third step (20d–e), the reduplicant vowel is reduced to [ə], trading a violation of *Mid/Low for a violation of *Schwa (20e). Finally, the derivation converges on [**sə̂**-só.rô] (20f–g). The reduplicant schwa is marked, but it is protected by MaxHdμ, a positional faithfulness constraint that protects dependents of the head mora of a syllable ((21); Alderete 1995). In this example, the schwa is dominated by the syllable's only mora, which is its head mora. Throughout this analysis, the leftmost mora of a syllable is assumed to be the head. Thus, MaxHdμ protects vowels in CVC syllables and protects the high vowels in diphthongs. Note that Hd(σ) is inactive here; as defined, Hd(σ) penalizes moraless syllables, not syllables without moraic segments.

(21) *MaxHd*μ

Assign one violation to every application of the operation that deletes a segment dominated by the head mora of a syllable.

3.1.2.2 Nasal Consonants Are Copied as Codas Derivations of nasal-final Class II verbs like [tâŋ] 'teach' also begin by inserting an empty syllable to head the foot template. Thereafter, a CVN string is copied to head the syllable. The tableau in (22) illustrates this step. Because the reduplicant is a monosyllabic foot, FtBin prefers it to have a coda (22c) and dominates Coda-Cond, the only constraint that disprefers the coda.

After this copying step, the reduplicant vowel is reduced to [ə]. As in (20f–g), the schwa cannot be deleted because it is dominated by the head mora. The nasal then loses its place feature and assimilates to the coronal stop: **tə̂ŋ**-tâŋ → **tə̂N**-tâŋ → [**tə̂n**-tâŋ].

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(22) /F-tâŋ/ → [**tân**-tâŋ], Step 2 (Mbe)

F | σ + σ μμ tâŋ Class II	Hd(σ)	*Mid/Low	*Copy(seg)	FtBin	CodaCond
F | σ + σ μμ a. tâŋ	W 1	L	L	W 1	L
F | σ + σ μ μμ b. tâ tâŋ		1	1	W 1	L
F | σ + σ μμ μμ → c. tâŋ tâŋ		1	1		1

3.1.2.3 Vowel Deletion Feeds Nonlocal Nasal Copying When Hd(σ) motivates copying, nasal codas are only copied to satisfy FtBin—that is, when the root vowel is monomoraic. When the initial root vowel is a diphthong, and thus bimoraic, there is no motivation to copy a coda in this step. This is illustrated in the tableau in (23a–c) with [jíɔ.nî] 'forget'; by assumption, Gen cannot copy only part of the diphthong. Because the copied diphthong satisfies FtBin (23b), no constraint prefers copying a coda. Doing so needlessly violates CodaCond (23c), even if the resulting cluster is homorganic: place features in coda position are not licensed until they are linked to an onset, which takes a step. While FtBin does not motivate nasal copying in this step, Hd(μ) motivates it later in the derivation. All diphthongs in Mbe begin with a high vowel and fall into a low or mid vowel (Bamgbọse 1967a). In Class II imperatives, these second vowels reduce to schwa (23f) and then, because their mora is not the head mora, are deleted (23h), leaving their moras headless.

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(23) /F-jíɔ.nî/ → [**jîɲ**-jîɔ.nì], Steps 2–4 (Mbe)

F-σ + σ σ jíɔ.nî Class II	HD(σ)	*MID/LOW	*SCHWA	MAX(V-Pl)	HD(μ)	*HIGH	*COPY(seg)	FTBIN	CODACOND	MAX
a. jíɔ.nî	W 1	L				L	L	W 1		
→ b. jíɔ jíɔ.nî		1				1	1			
c. jíɔn jíɔ.nî		1				1	1		W 1	
d. jíɔ jíɔ.nî		W 1	L	L		1				
e. jə́ɔ jíɔ.nî		W 1	1	1		L				
→ f. jíə jíɔ.nî			1	1		1				
g. jíə jíɔ.nî			W 1		L	1				L
→ h. jí jíɔ.nî					1	1				1

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The headless mora motivates a second round of segmental copying (24). To satisfy HD(μ), a segment can be copied in as its head (24b–c), or the mora can be deleted (24d). When there is no suitable segment to copy (as in (17a–e)), the latter is preferred. But, when a nasal is available, it is copied (24c). Notably, this instance of copying is nonlocal—three segments separate the original nasal from its copy. Copying the reduplicant [i] (24b) or the root [j] satisfies *COPY-LOC(seg), but fatally violates *HIGH or *ORALCODA, respectively.

(24) /F-jíɔ.nî/ → [**jîɲ**-jîɔ.nì], Step 5 (Mbe)

F / σ + σ σ / μμ μμ μ / jí jíɔ.nî Class II	*HIGH	HD(μ)	MAX(μ)	*COPY-LOC(seg)	*COPY(seg)	FTBIN	CODACOND
F / σ + σ σ / μμ μμ μ / a. jí jíɔ.nî	1	W 1		L	L		L
F / σ + σ σ / μμ μμ μ / b. jíí jíɔ.nî	W 2			L	1		L
F / σ + σ σ / μμ μμ μ / → c. jín jíɔ.nî	1			3	1		1
F / σ + σ σ / μ μμ μ / d. jí jíɔ.nî	1		W 1	L	L	W 1	L

Before the derivation converges, the copied nasal is debuccalized and then assimilates to the onset: **jín**-jíɔ.nî → **jíN**-jíɔ.nî → [**jîɲ**-jîɔ.nì].

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In Class II imperatives, nonlocal copying only occurs with roots of the shape CVVN(V). It must be fed by diphthong reduction, and is motivated to preserve the second mora of the reduplicant (see Kawu 2000, Zuraw 2002, and Elfner and Kimper 2008 for other cases of phonologically driven nonlocal copying). It is crucial that this second round of copying is motivated by HD(μ) and not by FTBIN. Otherwise, verbs of the shape NVC would be incorrectly predicted to take nasal-final reduplicants. Consider the tableau in (25), which illustrates such a case with [mâl] 'finish'. The derivation converges on [**mə̂**-mâl] (25a), with a monomoraic reduplicant. Copying the root-initial nasal into the reduplicant satisfies FTBIN, but fatally violates *COPY(seg). Thus, as in (17f–h), FTBIN is ranked too low to motivate operations to apply that do not improve on another markedness constraint.

(25) /F-mâl/ → [**mə̂**-mâl], convergence (Mbe)

F | σ + σ μ $\mu\mu$ mə̂ mâl Class II	*SCHWA	*COPY(seg)	FTBIN	CODACOND
F | σ + σ μ $\mu\mu$ → a. mə̂ mâl	1		1	
F | σ + σ $\mu\mu$ $\mu\mu$ b. mə̂m mâl	1	W 1	L	W 1

3.1.3 Summary of Mbe Imperatives Class I and II imperatives differ in the structures they copy and therefore how they enforce the phonotactic restrictions on reduplicant codas. In Class I, the root syllable is copied, and then oral consonants are deleted from the coda. In Class II, codas are only copied to fulfill a prosodic need, either as part of a larger segmental string to head an empty syllable or nonlocally to head a mora. Both lexical classes effectively filter out nonnasal segments from coda position. Nasals are preserved in codas, where they debuccalize and undergo place assimilation.

This section has demonstrated that, despite their differences, Class I and II imperatives are modeled with the same grammar. Lexically indexed constraints are necessary to derive the differences in vowel reduction and whether syllables or segments are copied, but otherwise the constraint set is identical. The next section illustrates that this grammar also models diminutives.

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3.2 The Mbe Diminutive as a Mora Template

Diminutives take the Class 4 marker /kɛ-/ (Bamgbọse 1966), but their primary exponent is a nasal coda homorganic to a following consonant (Walker 1998a, 2000); examples are given in (26). The nasal coda only surfaces with nouns that contain nasals (26d–f); it is unrealized with nouns that do not (26a–c). This indicates that the nasal is copied from the root and is not present underlyingly.

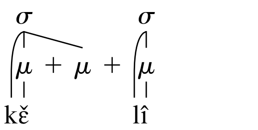
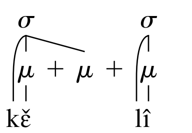
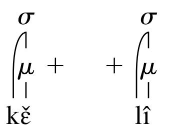
(26) *Mbe diminutives* (Bamgbọse 1966:48, 49, 50)

a.	lí	kɛ̆-lî	'eye'
b.	bɛ̀l	kɛ̆-bɛ́l	'wives'
c.	lè-bà.rò	kà-bà.rò	'liver'
d.	bù-mù	kɛ̀-**m**-mù	'story'
e.	kɛ̀-nén	kɛ̆-**n**-nên	'bird'
f.	bù-tɔ̀.ní	kɛ̆-**n**-tɔ̀.ní	'earthworm'

Because it surfaces as a single segment in coda position, the diminutive can be analyzed as an underlying mora. Like Class II imperatives, this headless mora motivates (nonlocal) nasal copying. When no nasal segment is available, the mora is deleted. This is illustrated in the tableaux in (27)–(28) with the same constraint ranking as for the imperative. As before, tableaux only show violations incurred by the reduplicant.

The tableau in (27) illustrates the derivation of [kɛ̆-lî] 'eye'. As in (17), there is no suitable segment that can be copied, and the mora deletes (27b). When a nasal is available, it is copied to head the mora. This is illustrated in the tableau in (28) with [kɛ̆-**n**-tɔ̀.ní] 'earthworm'. Deleting the mora satisfies Hᴅ(μ) (28c), but, because segment copying is preferred, the root-internal nasal is copied as its head (28b). As in (24), copying is nonlocal: the copy surfaces two segments away from its source.

(27) /kɛ-μ-lí/ → [kɛ̆-lî], Step 1 (Mbe)

	Hᴅ(μ)	Mᴀx(μ)
a. 	W 1	L
→ b. 		1

(28) /kɛ-μ-tɔ̀.ní/ → [kɛ̌-**n**-tɔ̀.ní], Step 1 (Mbe)

σ σ σ μ + μ + μ μ kɛ̌ tɔ́ní	HD(μ)	MAX(μ)	*COPY-LOC(seg)	*COPY(seg)	CODACOND
a. σ σ σ μ + μ + μ μ kɛ̌ tɔ́ní	W 1		L	L	L
→ b. σ σ σ μ + μ + μ μ kɛ̌ n tɔ́ní			2	1	1
c. σ σ σ μ + + μ μ kɛ̌ tɔ́ní		W 1	L	L	L

Before the derivation converges, the copied nasal's coronal place feature deletes, and the onset's coronal place feature spreads: kɛ̌-**n**-tɔ̀.ní → kɛ̌-**N**-tɔ̀.ní → [kɛ̌-**n**-tɔ̀.ní].

As an underlying mora, the diminutive behaves exactly like headless moras created in the derivation of imperatives. In the absence of a nasal consonant, the mora is deleted, as with oral-consonant-final Class I verbs. Otherwise, nasal consonants are copied in as heads, as with Class II verbs with initial diphthongs.

3.3 Summary

Mbe limits reduplicant codas to nasals homorganic to following consonants. This phonotactic restriction applies to imperative verbs in both lexical classes and to diminutive nouns. Wei and Walker (2020) argue that by requiring codas to be place-linked, Mbe cannot be modeled without derivational lookahead. However, as this section has demonstrated, banning nonnasal segments from coda position suffices. Oral segments are either deleted from coda position, as with Class I imperatives, or are never copied into coda position, as with Class II imperatives and diminutives. This leaves only nasals in coda position, which undergo place assimilation. Wei and Walker (2020) also argue that a serial analysis cannot model imperatives of the form **CVN**-CVVN(V), because there is no motivation to copy the nasal coda. This is true early in the derivation, but reducing the diphthong to a single vowel creates a headless mora and, with it, the motivation for a second round of segmental copying. The constraint ranking for Mbe is represented in the Hasse diagram in figure 1; dashed lines represent disjunctive rankings.

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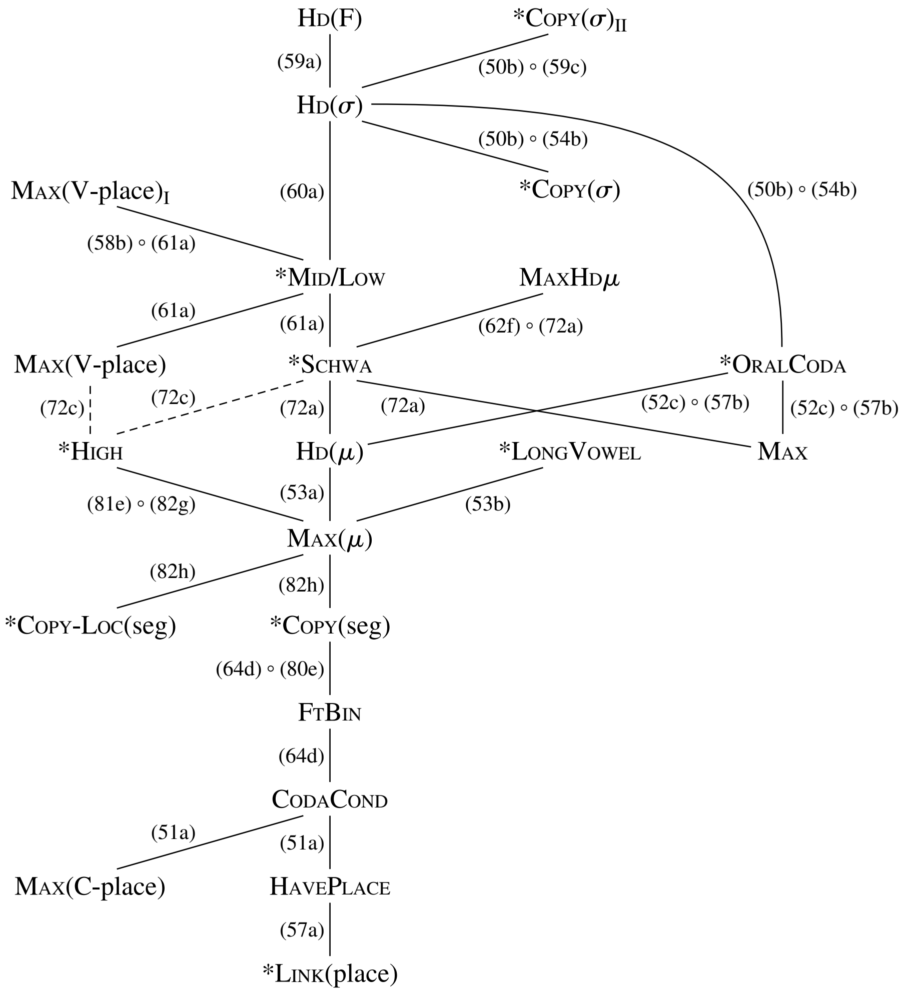

Figure 1
Hasse diagram for Mbe; referenced tableaux are in the online appendix

4 Reduplication in Logoori Does Not Require Lookahead

Logoori (also known as Maragoli; Bantu; Leung 1991, Glewwe and Aly 2016, Adler and Zymet 2017, 2021, Zymet 2018, Odden n.d.) does not permit vowels to surface in hiatus, and underlying vowel clusters are subject to a number of different processes (see Glewwe 2016, Zymet 2018, and Odden n.d. for discussion of hiatus resolution outside reduplication). Mid and high vowels surface as glides, and trigger compensatory lengthening word-medially, but not word-finally: /vi-a/ → [vja] *[vjaː] ‘of-CL.8’ (Zymet 2018:304). These processes are active in the formation of second and third person singular possessives, which concatenate a (C)V noun class marker

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with a suffix vowel, /-ɔ/ in the second person and /-ɛ/ in the third person. These possessives also take a syllable-sized reduplicative prefix that shows similar, but distinct effects. Reduplicants surface with a glide except when it would be adjacent to a homorganic high [+ATR] vowel: [**gùː**-gw-ɔ́] *[**gwùː**-gw-ɔ́] (29e).

(29) *Logoori singular possessives* (Leung 1991:24, Zymet 2018:309)

	1.sg /-angɛ/	2.sg /-ɔ/	3.sg /-ɛ/	Noun class
/o-/	a. w-aːŋgɛ	b. **wɔ̀ː**-v-ɔ́	c. **wɛ̀ː**-v-ɛ́	1
/go-/	d. gw-aːŋgɛ	e. **gùː**-gw-ɔ́	f. **gwìː**-gw-ɛ́	3
/e-/	g. j-aːŋgɛ	h. **jɔ̀ː**-j-ɔ́	i. **jɛ̀ː**-j-ɛ́	9
/ke-/	j. tʃj-aːŋgɛ	k. **tʃìː**-tʃj-ɔ́	l. **tʃìː**-tʃj-ɛ́	7
	'my'	'your (sg.)'	'his/her'	

The phonotactic restriction on homorganic glides is not specific to reduplication. For example, the indefinite future prefix /ri-/ surfaces as [rj-] before vowel-initial verbs (30a–c) and as [r-] before those beginning with [i] (30d). There is no independent evidence for the avoidance of [wu].

(30) *[j] does not surface before [i]* (Odden n.d.:chap. 3, 130)

a. /va-ri-ata/	[varjaːtá]	'they may perform surgery'
b. /a-ri-erema/	[arjeːrémá]	'he may float'
c. /a-ri-ɪmba/	[arjɪːmbá]	'he may sing'
d. /va-ri-ita/	[váríːtá]	'they may kill'

Zymet (2018; see also Adler and Zymet 2017, 2021) argues that derivational lookahead is required to model the possessive. The order between hiatus resolution and reduplication depends on the shape of the stem. With /V-V/ stems, glide formation precedes copying, resulting in two CV syllables: /V-V/ → V̯-V → [**V̯V**-V̯-V]. With /CV-V/ stems, however, that order would create an illicit complex onset when the resulting vowel is high: /CV-V/ → CV̯-V → *[**CV̯V**-CV̯-V], and reduplication must precede hiatus resolution: /CV-V/ → **CV**-CV-V → [**CV**-CV̯-V]. The order between hiatus resolution and reduplication thus requires looking ahead to avoid glides from surfacing before homorganic high vowels.

This section presents an analysis of Logoori reduplication in STS that does not require lookahead. The noun class marker and suffix vowel are parsed into a single syllable, which is copied. Glides are then formed independently in the reduplicant and in the stem. If, after raising and tensing of the reduplicant vowel, the glide-vowel sequence is homorganic, the glide is deleted. Thus, Logoori reduplication does not provide evidence for lookahead.

4.1 The Logoori Possessive as a Foot Template

Before arguing for the underlying form of the reduplicant, it is important to establish exactly what is copied. The stem is transparently composed of a noun class marker and a suffix vowel: /(C)V-V/. In order to derive the differences between the reduplicant and the stem, this entire structure must be copied: /(C)V-V/ → **(C)VV**-(C)V-V. Hiatus resolution then proceeds indepen-

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dently in the reduplicant and in the stem. This is necessary to derive the length and quality of the reduplicant vowel.

Underlying high vowels surface as vowels in the reduplicant and as glides in the stem. The surface form of the stem is exactly what is expected from hiatus resolution: /ɾi-ɔ/ surfaces as [ɾj-ɔ] with a complex onset and not as *[ɾi-w] with a coda (31c). The form of the reduplicant results from its preference to surface with a high [+ATR] vowel. The copied high vowel in /ɾiɔ/ is thus preserved at the expense of the mid vowel, resulting in an intermediate form with a coda [ɾiw]. As Logoori does not allow consonants to surface in coda position, this glide is deleted.

(31) *Noun class markers with high vowels* (Zymet 2018:309)

	2.sg /-ɔ/	3.sg /-ɛ/	Noun class
/dʒi-/	a. **dʒìː**-dʒj-ɔ́	b. **dʒìː**-dʒj-ɛ́	4
/ɾi-/	c. **ɾìː**-ɾj-ɔ́	d. **ɾìː**-ɾj-ɛ́	5
/vi-/	e. **vìː**-vj-ɔ́	f. **vìː**-vj-ɛ́	8
/zi-/	g. **zìː**-zj-ɔ́	h. **zìː**-zj-ɛ́	10
/mu-/	i. **mùː**-mw-ɔ́	j. **mwìː**-mw-ɛ́	18
	'your (sg.)'	'his/her'	

The preference for high vowels to surface in the reduplicant triggers copied mid vowels to raise and tense (32). In the third person, the reduplicant is exactly like the stem, except that the copied suffix vowel /ɛ/ raises to [i] (32b,d,f,h,j). In the second person, raising the copied suffix vowel /ɔ/ to [u] creates a homorganic glide-vowel sequence, and the glide is deleted: /goɔ/ → gwɔ → gwu → [gu] (32a). Just as in Class I imperatives in Mbe (section 3.1.1), some segments that are copied are later deleted.

(32) *Noun class markers with mid vowels* (Zymet 2018:309)

	2.sg /-ɔ/	3.sg /-ɛ/	Noun class
/go-/	a. **gùː**-gw-ɔ́	b. **gwìː**-gw-ɛ́	3
/ɾo-/	c. **ɾùː**-ɾw-ɔ́	d. **ɾwìː**-ɾw-ɛ́	11
/to-/	e. **tùː**-tw-ɔ́	f. **twìː**-tw-ɛ́	13
/vo-/	g. **vùː**-vw-ɔ́	h. **vwìː**-vw-ɛ́	14
/ko-/	i. **kùː**-kw-ɔ́	j. **kwìː**-kw-ɛ́	15
	'your (sg.)'	'his/her'	

The only exception to the pattern in (32) is the Class 7 marker, which Zymet (2018) analyzes with an underlying mid vowel /ke-/. Its reduplicant always surfaces with [i]: [**tʃì**-tʃj-ɔ́] *[**tʃjù**-tʃj-ɔ́] (Zymet 2018:309). Leung (1991) and Odden (n.d.) analyze this morpheme as having an underlying high vowel /kɪ-/, which is consistent with its patterning with other high vowel noun class markers (31).

Vowel raising does not occur when the stem syllable has a simple onset, as with noun class markers of the shape /Ca/ (33). Low vowels delete in hiatus contexts and do not leave behind a glide: /ga-etu/ → [g-eːtu] 'our-CL.6' (Zymet 2018:305). Stems that are underlyingly /Ca-V/ thus surface as /CV/, and the reduplicant vowel does not raise: [**vɔ̀ː**-v-ɔ́] *[**vùː**-v-ɔ́] (33a).

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(33) *Noun class markers with low vowels* (Zymet 2018:309)

	2.sg /-ɔ/	3.sg /-ɛ/	Noun class
/va-/	a. **vɔ̀ː**-v-ɔ́	b. **vɛ̀ː**-v-ɛ́	2
/ga-/	c. **gɔ̀ː**-g-ɔ́	d. **gɛ̀ː**-g-ɛ́	6
/ka-/	e. **kɔ̀ː**-k-ɔ́	f. **kɛ̀ː**-k-ɛ́	12
/ha-/	g. **hɔ̀ː**-h-ɔ́	h. **hɛ̀ː**-h-ɛ́	16
	'your (sg.)'	'his/her'	

The same is true of onsetless noun class markers, which surface as glides (34). There is no consonant with which to form a complex onset in the stem, and the reduplicant surfaces with a mid vowel: [**jɔ̀ː**-j-ɔ́] *[**jùː**-j-ɔ́] (34a).

(34) *Noun class markers without onsets* (Zymet 2018:309)

	2.sg /-ɔ/	3.sg /-ɛ/	Noun class
/e-/	a. **jɔ̀ː**-j-ɔ́	b. **jɛ̀ː**-j-ɛ́	9
/o-/	c. **wɔ̀ː**-v-ɔ́	d. **wɛ̀ː**-v-ɛ́	1
	'your (sg.)'	'his/her'	

Simple onsets block vowel raising because they are transparent to height harmony. High [−ATR] vowels lower to mid when the next syllable contains a mid vowel (35a–b). Harmony is blocked by, among other things, consonant-glide clusters (35c–d). Because there is a general pressure to avoid high-mid vowel sequences unless a complex onset intervenes, reduplicant vowels raise only when the stem has a simple onset. Raising in words like [**jɔ̀ː**-j-ɔ́] *[**jùː**-j-ɔ́] (34a) would create a disharmonic high-mid sequence.

(35) *Regressive [−ATR] vowel lowering* (Odden 2019, n.d.:chap. 3, 93, 141)

a.	/ɪ-kɪ-dete/	[e-ke-déte]	'finger'
b.	/ɪ-kɪ-deːnde/	[e-ke-deːnde]	'swamp'
c.	/ʊ-kɪ-vo-eɲa/	[ʊkɪvweːɲá]	'you are still wanting it'
d.	/a-kɪ-vo-onogɲa/	[akɪvwoːnógóɲá]	'he is still messing it up'

In order to model Logoori reduplication, the noun class marker and the suffix vowel must be present in both the stem and the reduplicant. There are a handful of underlying forms consistent with this analysis: an underlying syllable filled by copying the morphological stem, an underlying foot filled by inserting a syllable and then copying a string of segments, and an underlying foot filled by copying a syllable. Without evidence to favor any analysis in particular, the latter is chosen for its simplicity of presentation: the stem is syllabified into a .(C)VV. syllable, which is copied into an underlying foot template. It is also possible to adopt a template-free analysis that requires some overt realization of the reduplicant, as Anderson and Smith (2017, 2018) propose for Tohono O'odham.

The analysis does not require a constraint on vowel hiatus per se. Instead, syllables that dominate multiple vowels violate *NonHeadVowel ((36); roughly equivalent to de Lacy's (2002, 2006) $*{-}\Delta_{\sigma} \geq$ɨ). Adjacent underlying vowels are syllabified together to minimize violations of Onset; see the tableaux in the online appendix.

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(36) **NonHeadVowel*
Assign one violation to every syllable that dominates more than one vowel.

To improve on *NonHeadVowel, Gen has an operation that maps vowels onto glides by delinking their moras (cf. Jacobs 2019, where gliding is analyzed as mora deletion in HS). This operation is posited primarily for analytical ease, but is consistent with the hypothesis that vowels and glides differ in terms of weight and no other features (Rosenthall 1994). Two assumptions with respect to glides are made for expository ease. First, vowels map directly onto the glides [j,w]. This avoids intermediate raising steps like /e/ → e̯ → [j]. Second, Gen deletes glides in one step rather than first deleting their place features, suppressing unnecessary tableaux.

Vowel raising is motivated by the constraint *Mid/Low$_{RED}$ (37). The domain of this constraint must be specified as the reduplicant, because vowel raising is otherwise unattested in the language. Raising a vowel violates the faithfulness constraint Ident(high). For expository ease, Gen raises and tenses vowels in one step.

(37) **Mid/Low$_{RED}$*
Assign one violation for every mid vowel and every low vowel in the reduplicant.

The pressure for vowel harmony is simplified as the constraint *HighMid (38). This constraint suffices for the purposes of analyzing reduplication, but it may be stated too generally for the language, as [+ATR] vowels are not subject to lowering: /ɪ-vi-dete/ → [ɪ-vi-déte] *[e-ve-déte] 'finger-cl.8' (cf. (35a)). Whatever mechanism is responsible for this distinction between /i/ and /ɪ/ is beyond the scope of the article.

(38) **HighMid*
Assign one violation for every high vowel followed by a mid vowel unless separated by another vowel or a complex onset.

The analysis of Logoori reduplication is presented in detail in section 4.1.1. As in previous analyses, tableaux represent pairwise relations between constraints that reflect the overall ranking. That ranking is represented in the Hasse diagram in figure 2.

4.1.1 Logoori Possessives Copy Syllables The noun class marker and suffix vowel are syllabified together and then copied into a foot template (see the online appendix for the syllabification steps). Hiatus resolution proceeds independently in the two syllables, and produces different outcomes to satisfy constraints on reduplicant vowels.

4.1.1.1 High Vowels Surface Faithfully in Reduplicants, as Glides in Stems The tableau in (39) shows the first step after the stem has been syllabified, where the syllable is copied into the foot template (39c). Inserting an empty syllable violates the higher-ranked Hd(σ) and Onset (39b). No other candidate improves on Hd(F) (39a,d–e).

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(39) /F-vi-ɔ/ → [**vìː**-vj-ɔ́], Step 1 (Logoori)

F + σ (μμ) viɔ	HD(F)	HD(σ)	ONSET	*COPY(σ)	*NONHEADV	HD(μ)	*HIGHMID	*MID/LOW$_{RED}$	*CODA
a. F + σ (μμ) viɔ	W 1			L	L 1		L 1	L	
b. F – σ + σ (μμ) viɔ		W 1	W 1	L	L 1		L 1	L	
→ c. F – σ (μμ) viɔ + σ (μμ) viɔ				1	2		2	1	
d. F + σ (μμ) vjɔ	W 1			L	L	W 1	L	L	
e. F + σ (μμ) viw	W 1			L	L	W 1	L	L	W 1

The input to the second step (40) contains two syllables that each dominate two vowels. Forming a glide from any of the four vowels improves on *NONHEADVOWEL (40b–e), but only targeting the mid vowel in the reduplicant satisfies *MID/LOW$_{RED}$ (40c). Raising the reduplicant vowel to [u] has the same effect, but fails to improve on *NONHEADVOWEL (40f).

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The high vowel of the stem becomes a glide in the next step (41), satisfying *NonHeadVowel (41b). Because there is no pressure for the stem to surface with a high vowel, a complex onset is preferred to a coda (41c). This step illustrates why hiatus resolution must proceed independently in the two syllables: if hiatus resolution had preceded copying, the reduplicant would also have a complex onset.

(40) /F-vi-ɔ/ → [**vìː**-vj-ɔ́], Step 2 (Logoori)

F σ + σ μμ μμ viɔ viɔ	*NonHeadV	Hd(μ)	*HighMid	*Mid/Low$_{RED}$	Ident(high)	*Coda
a. viɔ viɔ	W 2	L	W 2	W 1		L
b. vjɔ viɔ	1	1	1	W 1		L
→ c. viw viɔ	1	1	1			1
d. viɔ vjɔ	1	1	1	W 1		L
e. viɔ viw	1	1	1	W 1		1
f. viu viɔ	W 2	L	1		W 1	L

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(41) /F-vi-ɔ/ → [**vìː**-vj-ɔ́], Step 3 (Logoori)

F σ + σ viw viɔ	*NonHeadV	Hd(μ)	Max(μ)	*Link(μ)	*HighMid	*Coda	Max
a. viw viɔ	W 1	L 1			W 1	1	
→ b. viw vjɔ		2				1	
c. viw viw		2				W 2	
d. viw viɔ	W 1	L	W 1		W 1	1	
e. viw viɔ	W 1	L		W 1	W 1	1	
f. vi viɔ	W 1	L 1			W 1	L	W 1

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(42) /F-vi-ɔ/ → [**vìː**-vj-ɔ́], Step 4 (Logoori)

F σ + σ μμ μμ viw vjɔ	HD(μ)	*FINALLONGV	MAX(μ)	*LINK(μ)	*CODA	MAX
F σ + σ μμ μμ a. viw vjɔ	W 2			L	1	
F σ + σ μ μμ b. viw vjɔ	1		W 1	L	1	
F σ + σ μμ μμ → c. viw vjɔ	1			1	1	
F σ + σ μμ μ d. viw vjɔ	1		W 1	L	1	
F σ + σ μμ μμ e. viw vjɔ	1	W 1		1	1	
F σ + σ μμ μμ f. vi vjɔ	W 2			L	L	W 1

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(43) /F-vi-ɔ/ → [**vìː**-vj-ɔ́], Steps 5–6 (Logoori)

F σ + σ μμ μμ viw vjɔ	Hd(μ)	Max(μ)	*Coda	Max
F σ + σ μμ μμ a. viw vjɔ	W 1	L	1	
F σ + σ μμ μ → b. viw vjɔ		1	1	
F σ + σ μμ μμ c. vi vjɔ	W 1	L	L	W 1
F σ + σ μμ μ d. viw vjɔ			W 1	L
F σ + σ μμ μ → e. vi vjɔ				1

Two vowels having been delinked from their moras, the input to the fourth step contains two headless moras (42). Because Max(μ) dominates *Link(μ), deleting moras (42b,d) is generally dispreferred to relinking them to vowels (42c,e). The reduplicant vowel is lengthened in this step (42c). Linking to the stem vowel would create a word-final long vowel, in violation of *FinalLongVowel (42c).

In the next step, *FinalLongVowel prevents the stem mora from relinking at all. It is deleted, satisfying Hd(μ) (43b). In the next step, the reduplicant glide is deleted from coda position, satisfying *Coda (43e).

The derivation converges in the next step on [**vìː**-vj-ɔ́], as its input does not violate any active markedness constraints.

4.1.1.2 Mid Vowel Raising Feeds Homorganic Glide Deletion *Mid/Low$_{RED}$ dictates which reduplicant vowel is targeted in hiatus contexts if one is high. When no constraint prefers a .CVV̯.

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syllable, as when both reduplicant vowels are mid, *CODA chooses a .CV̯V. syllable. The resulting complex onset is opaque to height harmony, and vowel raising is not blocked. This is illustrated in the tableau in (44a–b), the sixth step mapping /F-vo-ɔ/ onto [**vùː**-vw-ɔ́] 'your (sg.)'. Raising the reduplicant vowel to [u] satisfies *MID/LOW$_{\text{RED}}$ and creates a homorganic glide-vowel cluster, violating *ji/wu (44b). The violation of *ji/wu is removed in the next step (44c–d) by deleting the glide (44d).

(44) /F-vo-ɔ/ → [**vùː**-vw-ɔ́], Steps 6–7 (Logoori)

F σ + σ μμ μ vwɔ vwɔ	*MID/LOW$_{\text{RED}}$	IDENT(high)	*ji/wu	MAX
a. vwɔ vwɔ	W 1	L	L	
→ b. vwu vwɔ		1	1	
c. vwu vwɔ			W 1	L
→ d. vu vwɔ				1

The derivation converges in the next step on [**vùː**-vw-ɔ́].

4.1.1.3 Simple Onsets Block Mid Vowel Raising Because the stem vowel is always mid, it is only possible to raise the reduplicant vowel when the stem has a complex onset. Thus, raising is

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blocked when the noun class marker vowel is low and deletes without leaving behind a glide, or when the noun class marker does not have an onset. The latter is illustrated with the tableau in (45), the convergent step of the derivation mapping /F-o-ɔ/ onto [**wɔ̀ː**-v-ɔ́] 'your', ignoring the intervocalic hardening of /w/ to [v]. Because the stem onset is simple and therefore transparent to height harmony, the reduplicant mid vowel cannot raise without creating a disharmonic vowel sequence and violating *HIGHMID (45b).

(45) /F-o-ɔ/ → [**wɔ̀ː**-v-ɔ́], convergence (Logoori)

F σ + σ μμ μ wɔ wɔ	*HIGHMID	*MID/LOW$_{RED}$	IDENT(high)	*ji/wu
F σ + σ μμ μ → a. wɔ wɔ		1		
F σ + σ μμ μ b. wu wɔ	W 1	L	W 1	W 1

4.1.2 Summary of Logoori Possessives Whether glides surface in the reduplicant depends on how the reduplicant resolves hiatus, which is independent of how the stem resolves hiatus. Because there is a preference for the reduplicant vowel to be high, high vowels surface as vowels, and no glide surfaces. The preference for high vowels compels mid vowels to raise, which can suppress glides from surfacing to avoid homorganic glide-vowel sequences.

4.2 Summary

Logoori bans glides from surfacing before homorganic high vowels. Zymet (2018) argues that this restriction cannot be satisfied in reduplication contexts without derivational lookahead. However, as this section has demonstrated, this is not the case. Copied high vowels never surface as glides in the reduplicant, satisfying their preference for high vowels. The same pressure motivates mid vowel raising. Derived high vowels surface with heterorganic glides, but force homorganic glides to delete. Thus, Logoori reduplication does not pose a challenge to STS. The constraint ranking for Logoori is represented in the Hasse diagram in figure 2; dashed lines represent disjunctive rankings.

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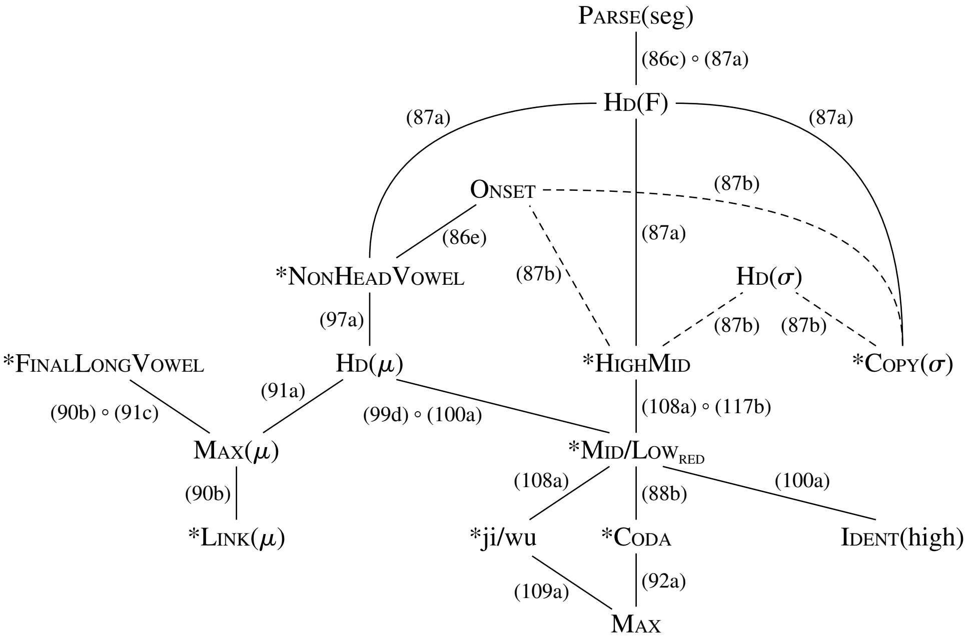

Figure 2
Hasse diagram for Logoori; referenced tableaux are in the online appendix

5 The Emergence of the Marked in Parallel, but Not Serial, Reduplication

Wei and Walker (2020) and Zymet (2018) argue that BRCT is superior to STS on empirical grounds. By arguing that reduplication in Mbe and Logoori, respectively, cannot be modeled without derivational lookahead, they claim that STS is not expressive enough to model the attested typology. As sections 3 and 4 have demonstrated, however, neither language evidences derivational lookahead, and STS is empirically adequate. This section identifies a novel class of unattested patterns, the emergence of the marked, predicted by BRCT that cannot be replicated by STS. On the basis of this evidence, STS is argued to be more typologically restrictive than BRCT.

It is not uncommon for reduplicants to admit only a strict subset of the marked structures that surface elsewhere in a language (McCarthy and Prince 1994; see Becker and Flack Potts 2011 for an overview). In such cases, unmarked structures that are generally dispreferred to faithful, marked structures emerge in restricted environments such as reduplicants. The converse pattern, the emergence of the marked, where structures that are repaired elsewhere in the language surface in reduplicants in order to satisfy faithfulness constraints, is unattested.[2] There are mecha-

[2] The term *the emergence of the marked* has also been used in other contexts such as children idiosyncratically deleting onsets (Velleman and Vihman 2002) or marked tones associating to reduplicants (Downing 2005). Blevins (2003, 2005) discusses cases of intervocalic consonant deletion and vowel syncope that create violations of ONSET and *CODA, respectively, which only target reduplicants. However, as these processes conspire to eliminate phonologically predictable material (Blevins 2005), they can be analyzed as satisfying a markedness constraint, distinguishing them from the cases in this section.

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nisms that have been shown to generate these effects, such as constraints that penalize the lowest end of a markedness hierarchy (Gouskova 2003) and constraints that penalize structures in roots specifically (Albright 2004), but BRCT has been argued to avoid them (Spaelti 1997). This section, however, dispels that: not only does BR-faithfulness prevent the elimination of marked structures, it creates them.

Consider the tableaux in (46), identical to those in section 1, but with a suffixal reduplicant; this pattern too is unattested. Voiced obstruents that surface word-finally are generally devoiced (46a–c). However, final voiced obstruents surface in the reduplicant whenever stems begin with voiced obstruents (46d). The constraint IDENT(voice)-BR is crucial in preventing obstruents in the reduplicant from devoicing (46e,g); with this constraint set, no markedness constraint prefers the winner (46d) over these candidates.

(46) IDENT(voice)-BR blocks final devoicing (unattested)

/galab/, /galab-RED/	IDENT (voi)-BR	AGREE (voice)	IDONSET (voi)-IO	*VOICED OBS	IDENT (voi)-IO
a. galab				W 2	L
→ b. galap				1	1
c. kalap			W 1	L	W 2
→ d. galab-**galab**				4	
e. galab-**galap**	W 1			L 3	
f. galap-**galap**		W 1		L 2	W 1
g. galap-**kalap**	W 1			L 1	W 1
h. kalap-**kalap**			W 1	L	W 2

These tableaux demonstrate that a core component of BRCT can force marked structures to surface faithfully that would otherwise be repaired. As argued in section 1, this cannot be replicated in STS without introducing derivational lookahead or bizarre nonlocal constraints.

While IDENT-BR constraints can force marked structures to surface faithfully in the reduplicant, MAX-BR can create them, as the tableaux in (47) demonstrate with another unattested pattern. In this example, consonants generally delete rather than surfacing in coda position (47a–b). However, prefixal reduplicants not only surface with codas, but surface with arbitrarily complex codas (47c–h). The base in this example is bisyllabic, and the constraint RED=σ forces the reduplicant to be a single syllable (47c). This specific constraint is used for ease of presentation; the analysis is consistent with multiple theories of CON. For example, if the base were footed, then ALLFT-L would have the same minimizing effect. The optimal candidate satisfies MAX(C)-BR by copying the stem's onset cluster into the reduplicant coda (47d). Omitting one or more consonants fatally violates MAX(C)-BR (47e–f). The only way to maintain perfect correspondence between the reduplicant and the base without violating *CODA is to delete consonants from the

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base (47g–h). However, the available options either create onsetless syllables (47g) or delete a vowel (47h), violating higher-ranked constraints. As in the previous example, MAX(C)-BR is crucial in ruling out candidates (47e–f), which are not dispreferred by any markedness constraints.

(47) MAX(C)-BR creates arbitrarily complex codas (unattested)

/pakl/, /RED-pakla/	RED=σ	MAX (C)-BR	ONSET	MAX (V)-IO	*CODA	MAX (C)-IO
a. pakl					W 1	L
→ b. pa						2
c. **pa.kla**-pa.kla	W 1				L	
→ d. **pakl**-pa.kla					1	
e. **pak**-pa.kla		W 1			1	
f. **pa**-pa.kla		W 2			L	
g. **pa**-pa.a			W 1		L	W 2
h. **pa**-pa				W 1	L	W 2

The combined effect of the minimizing constraint RED=σ and the maximizing constraint MAX(C)-BR is to pack as many consonants into the reduplicant as possible. Notably, the reduplicant is closed not to satisfy a prosodic requirement, but to be arbitrarily large. For every base CV.C^{n}V, MAX(C)-BR prefers the candidate **CVC^n**-CV.C^{n}V over every candidate **CVC^{n-1}**-CV.C^{n}V.

Because there is no mechanism in STS or HS generally that motivates arbitrary maximization, STS cannot produce this mapping without significant modification. Segment copying cannot close a syllable unless doing so satisfies a prosodic requirement like FTBIN. These constraints can only motivate a fixed number of consonants to surface in the coda; FTBIN, for example, is satisfied by a single coda consonant. In the example above, however, no such threshold can be set; MAX(C)-BR always prefers copying n consonants instead of $n-1$ consonants. Because the CVCC string is not a prosodic unit, it also cannot be copied directly as a string of prosodic constituents. Further, if the two syllables of the stem were copied, the onset cluster would have to be resyllabified. But, because this language parses underlying /VCCV/ as [V.CCV] and not as *[VC.CV] or *[VCC.V], complex onsets are generally preferred to codas, and without reranking the constraints, resyllabification would not be optimal. Copying a phonologically defined string is therefore infeasible, but so is copying a morphological unit. In HS, reduplicants are not a distinguished class of affixes, and differences in behavior reflect root-affix asymmetries, not base-reduplicant asymmetries (see Zukoff 2017 for discussion of a prediction of STS along these lines). Thus, even if the CVCC string were a morpheme and copied into the reduplicant, it would be expected to behave like affixes of the same shape, and delete the final consonants.

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In summary, the core components of BRCT, faithfulness constraints that regulate identity between the reduplicant and its base, predict that marked structures should surface in the reduplicant, even if they do not surface elsewhere in the language. These unattested patterns, the emergence of the marked, are not predicted by STS and represent a major difference in the typological predictions between the two frameworks.

6 Conclusion

The limitations HS imposes on Gen restrict the interactions between operations it is able to evaluate. Parallel Optimality Theory assumes no such restrictions and accesses a strict superset of candidates at evaluation. Arguments favoring pOT over HS must identify mappings whose outputs are inaccessible to HS. This article begins a project aimed at critically evaluating such claims recently made in the literature, focusing on reduplication. Wei and Walker (2020) and Zymet (2018) argue that phonotactic restrictions in Mbe and Logoori, respectively, cannot be obeyed unless copying occurs simultaneously with other operations. Both works argue that BRCT (McCarthy and Prince 1994, 1995, 1999), a theory of reduplication in pOT, is therefore superior to STS (McCarthy, Kimper, and Mullin 2012), a theory of reduplication in HS. This article has rebutted their arguments, providing serial analyses of the reduplication mappings in question. Further, it has identified a class of unattested mappings, the emergence of the marked, that are predicted only by BRCT. Therefore, not only is STS empirically adequate, it is appropriately typologically restrictive.

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