2012

Reduplication in Harmonic Serialism

John J. McCarthy, *University of Massachusetts - Amherst*
Wendell Kimper, *University of Manchester*
Kevin Mullin, *University of Massachusetts - Amherst*

Reduplication in Harmonic Serialism

John J. McCarthy   Wendell Kimper   Kevin Mullin

Abstract In standard Optimality Theory, faithfulness constraints are defined in terms of an input-output correspondence relation, and similar constraints are applied to the correspondence relation between a stem and its reduplicative copy. In Harmonic Serialism, a derivational version of Optimality Theory, there is no input-output correspondence relation, and instead faithfulness violations are based on which operations the candidate-generating GEN component has applied.

This article presents a novel theory of reduplication, situated within Harmonic Serialism, called Serial Template Satisfaction. Reduplicative correspondence constraints are replaced by operations that copy strings of constituents. Depending on the constraint ranking, phonological processes may precede or follow copying, with different effects. Serial Template Satisfaction and reduplicative correspondence theory make different predictions about partial reduplication, prosodic constituent copying, skipping effects, and reduplication-phonology interactions. The predictions of Serial Template Satisfaction are argued to be superior.

Keywords Reduplication, Optimality Theory, Harmonic Serialism, template, derivation.

J. J. McCarthy (corresponding author), K. Mullin
Department of Linguistics
University of Massachusetts Amherst
Amherst, Massachusetts 01003 USA
Email: jmccarthy@linguist.umass.edu

W. Kimper
Department of Linguistics
University of California, Santa Cruz
Santa Cruz, California 95064 USA

1. Introduction

Harmonic Serialism (HS) is a derivational version of Optimality Theory. In HS, the candidate-generating GEN component is limited to making one change at a time, so all output candidates differ minimally from the input. The grammar selects the optimal one, which then becomes a new input to GEN. This process continues until no further changes are possible.

A good deal of evidence in support of HS has been amassed (see section 2), but reduplication presents clear challenges. Perhaps the most obvious comes from limiting GEN to making one change at a time. A natural hypothesis is that the one-change reduplicative operation is copying of a single segment. But then, it is by no means clear how to get from, say, *tᶡilparku* to *tᶡilpa-tᶡilparku* 'bird species' in Diyari. Does the derivation go *tᶡilparku* → *tᶡ-tᶡilparku* → *tᶡi-tᶡilparku* → …, or does it take some other route? How can *tᶡ-tᶡilparku* beat all other single-segment copies as well as the candidate with no copying at all? These questions are perhaps not unanswerable, but neither are they trivial to answer.

Reduplication also challenges another aspect of HS's agenda: the elimination of correspondence relations. In standard OT, correspondence relations encode the various similarities and differences between input and output or base and reduplicant (McCarthy & Prince 1995a, 1999). In HS, input-output correspondence is superfluous because each candidate differs in at most a single way from the input, so it is possible to link the operations in GEN – deletion, insertion, feature change, and so on – directly to the faithfulness violations. The obvious question is whether, having dispensed with input-output correspondence, HS still needs base-reduplicant correspondence. A related question is whether the traditional derivational analysis of overapplication of phonological processes in reduplication can be revived in HS.

These and other considerations discussed later suggest that it is appropriate to develop an approach to reduplication in HS and explore its consequences. In this article, we propose a theory of reduplicative copying in HS called Serial Template Satisfaction (STS). In STS, a reduplicative template of type X can be satisfied in one of two competing ways. It can be satisfied by copying a string of one or more constituents of type X–1 from the adjoining stem. Or, it can be satisfied by populating the template with empty constituents of type X–1 (which themselves must be satisfied as the derivation continues). The choice between these two ways of satisfying a template is determined by constraint ranking. Ranking also determines how the copying operation interacts with phonological processes.

This article begins (section 2) with a brief overview of HS and some of its main results to date. Section 2 also explains HS's treatment of faithfulness. The article then continues (section 3) by laying out and exemplifying the basic principles of STS. This is followed in section 4 by a discussion of cases where the copied constituents are segments. This section includes three main empirical results that distinguish STS from base-reduplicant correspondence theory: an explanation for why prefixed disyllabic reduplicants are normally vowel-final; an explanation for why they nonetheless normally retain a coda in the first syllable; and an explanation for the non-existence of the so-called simple-syllable reduplicative pattern.

Section 5 shows how prosodic-constituent copying reduplication is obtained in STS, with examples of syllable copying from Yidiny and mora copying from Yaqui. This account of constituent copying is argued to be superior to an alternative that uses base-reduplicant correspondence constraints requiring faithfulness to prosodic constituent edges.

Section 6 treats the interaction of phonology and reduplication in STS. This topic encompasses a wide range of phenomena, from overapplication (6.2) to skipping effects (6.6). We argue that there is no solid evidence of phonology-reduplication interactions that require parallel phonological and copying operations (6.2, 6.3, 6.5), and thus that there is no good case to be made for the parallel model of base-reduplicant correspondence and against the serial model of STS. Another empirical finding in this section is the nonexistence of overapplying allophonic processes (6.2), contrary to a prediction of base-reduplicant correspondence theory but not STS. This section also includes a proposal about the analysis of skipping effects in STS (6.6), leading in section 7 to an explanation for why there are no skipping effects in total reduplication. Section 8 summarizes the predictions of STS that are discussed in this article, and finally section 9 concludes.

2. Background: Harmonic Serialism

The dominant version of Optimality Theory in Prince and Smolensky (1993/2004) can be called Parallel OT (P-OT). In P-OT, the mapping from underlying to surface representation is direct, with no intermediate stages. P-OT is "parallel" in the sense that GEN can change the underlying form in multiple ways at once.

Prince and Smolensky briefly discuss a version of OT called Harmonic Serialism (HS), but it was not much noticed in later work. The case for HS was reopened in McCarthy (2000, 2002: 159-163, 2007b), where some general consequences of this theory are identified and discussed.[1] HS differs from P-OT in two respects, *gradualness* and the existence of a *GEN→EVAL loop*.

Gradualness refers to a property of HS's GEN component: it can make only one change at a time. Since "one change" is too vague a notion to be useful for analysis, HS requires a precise definition of the operations in GEN that each constitute a single change. One goal of this article is to define the operations in GEN that are important in reduplication.

In P-OT, a derivation consists of a single pass through GEN and EVAL. In HS, the output of EVAL is submitted as a new input to GEN, in a GEN→EVAL loop. This loop continues until it reaches *convergence*, when EVAL chooses as winner a candidate that is identical to the most recent input. That winner is the final output of the grammar.

An important consequence of HS's basic architecture is that derivations must show monotonic harmonic improvement until convergence. That is, in every HS derivation …. → *X* → *Y* → … produced by the grammar G, the highest-ranking constraint in G that distinguishes between *X* and *Y* must be a constraint that favors *Y* over *X*. The effects of this architectural imperative of HS are ubiquitous, as will be apparent throughout this article.

HS can be briefly illustrated with an analysis of initial epenthesis in Arabic. When an initial consonant cluster occurs in underlying representation, glottal stop and a high vowel are preposed: /fʕal/ → *ʔifʕal* 'do!'. Under the assumption that GEN can insert only one segment at a time, two steps are required before convergence: /fʕal/ → *ifʕal* → *ʔifʕal*. At step 1, the input to GEN is the underlying form /fʕal/, and the candidate set includes faithful *fʕal* as well as all of the ways of making a single change in it: *ifʕal*, *ʕal*, *fal*, *fʕil*, *fril*, etc. These candidates are evaluated (see tableau (1)), and the optimal one, *ifʕal*, becomes the new input to GEN at step 2.[2]

[1] See McCarthy (2010b, 2010c) for a fuller introduction to HS and more extensive references.

[2] Tableaux are in the comparative format introduced by Prince (2002). The number of violations is indicated by an integer. In loser rows, a cell may contain **W**, **L**, or neither depending on whether the constraint favors the winner, the loser, or neither. Because every loser-favoring constraint must be dominated by some winner-favoring constraint, in a properly ranked tableau every **L** is preceded in the same row by a **W** across a solid line.

(1) Step 1 of /fʕal/ → *ʔifʕal*

/fʕal/	*COMPLEX-ONSET	MAX	ONSET	DEP
a. → ifʕal			1	1
b. fʕal	1 W		L	L
c. fal		1 W	L	L

The ultimate output form *ʔifʕal* is not in the candidate set at step 1 because it is two insertions away from the input.

The candidate set at step 2 includes the step-1 output *ifʕal* as well as *ʔifʕal*, *ifʕali*, *fʕal* (with deletion of the previously epenthesized vowel), etc. Tableau (2) shows that the grammar chooses *ʔifʕal*, which becomes the new input to GEN at step 3:

(2) Step 2 of /fʕal/ → *ʔifʕal*

ifʕal	*COMPLEX-ONSET	MAX	ONSET	DEP
a. → ʔifʕal				1
b. ifʕal			1 W	L
c. fʕal	1 W	1 W		L

Observe that *ʔifʕal* incurs only one violation of DEP at step 2. That is because it differs by only a single insertion from the step-2 input *ifʕal*. Observe too that *fʕal* violates MAX at step 2, even though it is identical with the lexical form. That is because it is the result of a deletion operation applied to the step-2 input.

At step 3 (shown in tableau (3)), the input and optimum are both *ʔifʕal*. The derivation has therefore converged on *ʔifʕal* as the final output of the grammar:

(3) Step 3 of /fʕal/ → *ʔifʕal*

ʔifʕal	*COMPLEX-ONSET	MAX	ONSET	DEP
a. → ʔifʕal				
b. ifʕal		1 W	1 W	
c. ʔifʕali				1 W

The derivation in (1)–(3) exemplifies two general properties of this theory:

(i) Surface-unviolated constraints may be violated in the course of a derivation. The winning candidate in (1), *ifʕal*, trades a violation of *COMPLEX-ONSET for a violation of ONSET, which is surface-unviolated in Arabic. This is hardly surprising; constraint violation is a fact of life in OT, and HS is no different. Where HS differs from P-OT is that the surface forms are only a subset of the outputs of EVAL, so there can be outputs of EVAL which violate constraints that surface forms obey.

(ii) Claims about GEN are empirical hypotheses that must be worked out in tandem with claims about the constraint component CON. General techniques for doing this are described in McCarthy (2009), but a simple hypothetical example can make the point. Imagine a theory of CON in which *COMPLEX-ONSET and ONSET are not distinct constraints, and instead there is a constraint ONSET=1 that is violated by any syllable that does not have exactly one onset consonant. If that were true, then the facts of Arabic would be incompatible with the hypothesis that GEN is limited to epenthesizing one segment at a time. The reason is that the derivation /fʕal/ → *ifʕal* → *ʔifʕal* is not harmonically improving under this conception of CON:

(4) Effect of ONSET = 1 with single-segment epenthesis

	/fʕal/	MAX	ONSET = 1	DEP
a.	ifʕal		1	1 W
b. →	fʕal		1	
c.	fal	1 W	L	

If it were somehow desirable to have ONSET = 1 instead of the constraints it replaces, then GEN would have to include an operation that epenthesizes strings of segments and not just individual segments.

The consequences of interaction between GEN and CON figure prominently in many of the arguments that HS is superior to P-OT. Does a given CON yield a language in which underlying /A/ maps to surface *B?* In P-OT, the answer is yes if and only if there exists a ranking of CON under which *B* is more harmonic than *A* and every other candidate derived from /A/. In HS, there must also be a harmonically improving path of winning intermediate steps from /A/ to *B*. Sometimes, there is no such path. In that case, P-OT and HS may make different typological predictions, and in work to date those predictions seem to favor HS. This work includes analyses of cluster simplification (McCarthy 2008a), stress assignment (Pruitt 2010; Staubs to appear), autosegmental spreading (McCarthy 2007b, 2010a), and apocope and metathesis (McCarthy 2007b).[3] The OT-Help program (Staubs et al. 2010) assists analysts in determining the typological predictions in HS of a given set of constraints, operations, and lexical items.

Another body of evidence in support of HS comes from cases where intermediate levels of representation are necessary. For example, syncope of unstressed vowels cannot be satisfactorily analyzed in P-OT because the dependency is strictly unidirectional: syncope depends on where stress is assigned, but where stress is assigned does not depend on syncope. This interaction proves to be unproblematic in HS: stress is (necessarily) assigned before syncope (McCarthy 2008b). Other results along these lines include an explanation for opaque interaction of stress and epenthesis (Elfner to appear), a solution to a well-known conundrum in positional faithfulness (Jesney to appear), an account of how and when a process can vary in applicability within an utterance (Kimper 2011), and the resolution to a problem with the P-Map (McCarthy 2011).

We will conclude this brief overview of HS by returning to a point made in the introduction: input-output correspondence is superfluous in HS. In Correspondence Theory (McCarthy & Prince 1995a, 1999), the candidate set for input /I/ consists, at a minimum, of all the strings over some alphabet and all of the ways of coindexing each of those strings with /I/. Thus, $d_1a_2g_3$ is a member of the candidate set for /$k_1æ_2t_3$/, as are $d_1a_3g_2$, d_1a_2g, and so on. Correspondence Theory's faithfulness constraints are defined in terms of these indices: the *d* of d_1a_2g is coindexed with /k/, so it violates IDENT(place) and IDENT(voice); the *g* of d_1a_2g has no index, so it violates DEP, and so on. Because the input and the output candidates can differ in unlimited ways in P-OT, correspondence is needed simply to keep track of these differences and to assign faithfulness violations correctly.

Although HS retains Correspondence Theory's *names* for the faithfulness constraints, the *definitions* of these constraints are quite different. In (1), for example, *ifʕal* was produced from input *fʕal* by applying an insertion operation. It is the application of this insertion operation that incurs the violation of DEP, just as the application of a deletion operation incurs the violation of MAX in *ʕal* and *fal*. This is precisely how faithfulness is implemented in OT-Help: each faithfulness constraint is associated with some operation(s) in GEN. Applying an operation

[3] Walker (2010) has argued that HS cannot account for certain harmony processes. Kimper (to appear) offers a rejoinder.

incurs violations of its associated faithfulness constraint(s). McCarthy (2007a) proposes that the operations performed by GEN are defined in terms of faithfulness – a single change is defined as a single violation of some basic faithfulness constraint. The current proposal reverses that relationship; GEN is able to perform some set of operations, and faithfulness constraints are defined with respect to those operations. Discovering that inventory of operations – the set of single changes that GEN is able to perform – constitutes a core component of the HS research program, and redefined faithfulness constraints follow from the inventory of operations.

All well-established faithfulness constraints are amenable to being redefined in this way. DEP and MAX have already been mentioned: their violations are keyed to segment insertion and deletion operations. Applying insertion or deletion medially violates CONTIGUITY; applying these options peripherally violates ANCHOR. An operation that transposes adjacent segments is responsible for LINEARITY violations (McCarthy 2007b). The operations on distinctive features may involve changing feature values, thereby violating IDENT, or deleting and inserting featural elements, thereby violating DEP(feature) and MAX(feature) (see McCarthy 2008a for discussion). Coalescence and breaking, which violate the correspondence constraints UNIFORMITY and INTEGRITY, have not yet been examined from an HS perspective. An HS approach to positional faithfulness is the topic of Jesney (to appear).

Defining faithfulness in this way eliminates the need for Input-Output and Base-Reduplicant correspondence relations, since in both cases non-identity can only arise as the result of a phonological operation. This is not necessarily the case for other types of correspondence – Output-Output correspondence (Benua 1997) and Agreement by Correspondence (Hansson 2001; Rose & Walker 2004) operate at a level of representation where non-identity may not be attributable to the application of operations in GEN. The scope of the proposal in this paper is limited to eliminating BR-correspondence, but these other forms of correspondence present a challenge that a broader endeavor to redefine faithfulness relations will need to contend with.

3. Serial Template Satisfaction

3.1. The theory

We follow Marantz (1982) in assuming that reduplicative affixes are templates.[4] We follow McCarthy & Prince (1986/1996, 1995b) in also assuming the basic premises of the theory of prosodic morphology: in partial reduplication, the template is a prosodic constituent syllable (σ) or foot (*ft*); and constraints on these constituents determine how templates are satisfied. To simplify the discussion, we temporarily set aside the role of moras in reduplication, returning to this matter in section 5.

As we noted in section 2, any analysis in HS requires an explicit hypothesis about those aspects of GEN that are relevant to the phenomenon under discussion. Two aspects are particularly relevant to reduplication: the operations that build prosodic structure and the copying operation. We describe each in turn.

Prosodic structure is built by an operation Insert(X) that inserts a prosodic constituent node of type X and integrates it into existing structure. X can be integrated into prosodic structure in two ways. It can be parsed as a dependent of a constituent of type W (W > X): $[\ ]_W \rightarrow [X]_W$, such as $[\ ]_{ft} \rightarrow [\sigma]_{ft}$ by Insert(σ). Or, X can parse as its dependents one or more pre-existing constituents of type Y (X > Y): $Y_1Y_2Y_3 \rightarrow [Y_1Y_2Y_3]_X$, such as *pa* → $[pa]_\sigma$. We will refer to these two modes of applying Insert(X) as top-down and bottom-up, respectively.

[4] On the program of eliminating reduplicative templates initiated in McCarthy & Prince (1994a, 1994b), see section 6.3.

GEN also includes an operation Copy(X) that creates a copy of a string of constituents of type X (with their contents), places that copy anywhere, and integrates it into pre-existing prosodic structure. From the requirement that a string be copied, it follows that the constituents copied in any single application of GEN must be contiguous and of the same type. For example, syllable copying applied to *pat.ka* gives candidates like *pat-pat.ka* and *pat.ka-pat.ka*, copying one or two entire syllables. Syllable copying will not yield *pa-pat.ka*, which can only be obtained by segment copying.

As we also noted in section 2, violations of faithfulness constraints in HS are associated with the application of operations in GEN. Each application of Copy(X) incurs a violation of the constraint *COPY(X). (Applications of Insert(X) may also incur faithfulness violations, but that will not be important in our proposal.) Because Copy(X) is defined to copy strings of elements of type X, a single application of Copy(X) brings a single violation of *COPY(X), no matter how many Xs are copied at the same time. Thus, *COPY(σ) is violated equally by *pat-pat.ka* and *pat.ka-pat.ka*.[5]

Although our main focus here is on cases where the X of Copy(X) is a string of segments or prosodic constituents, total reduplication of roots, stems, or morphosyntactic words suggests that X can be a grammatical constituent as well. This matter is taken up in section 7.

STS does not include base-reduplicant (BR) correspondence, nor does it recognize “base” or “reduplicant” as category labels in phonological representation.[6] We may still use these words as convenient abbreviations for “portion of the representation not associated with the reduplicative template” and “portion of the representation associated with the reduplicative template”, but it should be remembered that they have no theoretical status in STS.

Without BR correspondence, STS must give an alternative account of how reduplicative identity is obtained and when it is imperfect. The Copy(X) operation is the sole source of reduplicative identity in STS. Copy(X) is limited to copying some whole number of *X*s exactly. Surface differences between base and reduplicant are the result of copying fewer *X*s than the base contains (e.g., because of a template), or they are the effect of processes applying after copying (see section 6.6). Some other recent theories of reduplication, such as Inkelas and Zoll (2005) or Raimy (2000), reject BR correspondence as well, but they differ from STS in other respects. Explicit comparison of STS with BR correspondence can be found throughout this article.

Prefixing reduplication in Diyari proceeds by copying the beginning rather than the end of the stem: *tʲilpa-tʲilparku*, not **parku-tʲilparku*. This is a reflection of the generalization, due to Marantz (1982), that copying normally proceeds edge-in: from left to right in prefixes and in the opposite direction in suffixes. In P-OT with BR correspondence, this generalization is attributed to two violable constraints. One, ANCHOR$_{BR}$, requires the first (with prefixes) or last (with suffixes) segment in the base to have a correspondent that is first/last in the reduplicant. The other, CONTIGUITY$_{BR}$, is violated by any segment in the base that is preceded and followed by segments with correspondents but has no correspondent itself. The effects of these constraints can be seen in tableau (5). For explicitness, the correspondence relation is shown by coindexation.

---

[5] An anonymous reviewer has suggested that this way of counting *COPY(X) violations is counterintuitive — shouldn't there be one violation for each X copied? This is a case where intuitions formed by experience with Correspondence Theory are unreliable in an HS context. The Copy(X) operation is defined to copy a string of *X*s. Applying this operation once incurs one violation of *COPY(X). For this constraint to measure the length of the string of *X*s in order to reckon its violations, its definition would have to be made more complicated — needlessly, in our view.

[6] STS also lacks input-reduplicant (IR) correspondence, as expected of a theory that denies BR and IO correspondence as well.

(5) ANCHOR$_{BR}$ and CONTIGUITY$_{BR}$ at work

	ANCHOR$_{BR}$	CONTIG$_{BR}$
a. → $t^j_1 i_2 l_3 p_4 a_5$-$t^j_1 i_2 l_3 p_4 a_5 r_6 k_7 u_8$		
b. $t^j_1 i_2 l_3 k_7 u_8$-$t^j_1 i_2 l_3 p_4 a_5 r_6 k_7 u_8$		3 **W**
c. $p_4 a_5 r_6 k_7 u_8$-$t^j_1 i_2 l_3 p_4 a_5 r_6 k_7 u_8$	1 **W**	

ANCHOR$_{BR}$ is problematic and controversial, even within correspondence theory, and more recent work in that framework has rejected ANCHOR$_{BR}$ in favor of locality constraints requiring the original and its copy to be adjacent (Lunden 2006; Nelson 2003, 2005; Riggle 2004). Any constraint with this effect will correctly favor (5)a over (5)c and render ANCHOR$_{BR}$ largely superfluous.

Correspondence is not essential to defining this sort of adjacency constraint. Its effects can also be obtained within STS's operational approach. An operation that copies a string and places the copy adjacent to the original is more faithful than one that places the copy further away. Just as an application of the operation Copy(X) automatically produces a violation of *COPY(X), so too it may produce a violation of the following constraint:

(6) COPY-LOCALLY(X) (COPY-LOC)

To a candidate produced by Copy(X), assign as many violations as there are *X*s intervening between the original X string and its copy.

Some of the details of this definition are speculative and may be modified with further research, but it will suffice for now.

COPY-LOCALLY does exactly what is required with candidates (5)a and (5)c. When Copy(seg) produces *t^jilpa-t^jilparku*, the original segmental string and copy are adjacent. When it produces *parku-t^jilparku*, the original and its copy are separated by three segments, so COPY-LOCALLY is violated three times. The remaining candidate, (5)b, cannot be produced with a single application of Copy(seg) because *t^jilku* is not a string in *t^jilparku*. (More will be said about this and other contiguity effects in STS in sections 4 and 6.6.)

As in Prosodic Morphology generally, the contents of a template are controlled by markedness constraints. These constraints may include FOOT-BINARITY, for the *ft* template, or ONSET, for the σ template. There is also a family of HEADEDNESS constraints, which are applicable to any prosodic category:

(7) HEADEDNESS(X) (HD(ft), HD(σ)) (Selkirk 1995)

Assign a violation mark for every constituent of type X that does not contain a constituent of type X–1 as its head.

Templates enter the derivation as empty constituents. Thus, a template of type X violates HEADEDNESS(X) and possibly some category-specific constraints on X, such as FOOT-BINARITY if *X* is of type *ft*. As the highly schematized derivation in (8) shows, applying Insert(X–1) in the top-down mode removes the HEADEDNESS(X) violation, but at the expense of introducing a violation of HEADEDNESS(X–1). Insert(X–2) can fix that (third column in (8)), but introduces a HEADEDNESS(X–2) violation. This top-down, template-satisfying derivation can be terminated at any point X–n by applying Copy(X–n–1). When the bottom of the prosodic hierarchy is reached, it can also be terminated by segmental epenthesis. Satisfying a template means reaching the bottom of the hierarchy by one means or another, so every layer of constituent structure has a head and meets other active constraints on its form.

(8) Role of HEADEDNESS

X	→	$[X{-}1]_X$	→	$[[X{-}2]_{X-1}]_X$
*HD(X)		✓HD(X)		✓HD(X)
		*HD(X–1)		✓HD(X–1)
				*HD(X–2)
e.g.,				
ft	→	$[\sigma]_{ft}$	→	$[[\text{ə}]_\sigma]_{ft}$
*HD(ft)		✓HD(ft)		✓HD(ft)
		*HD(σ)		✓HD(σ)

As we will show in sections 4 and 5, the tension between satisfying HEADEDNESS by Insert(X) or Copy(X) is responsible for a split in the typology of reduplication with a *ft* template.

3.2. Exemplification

In the Austronesian language Manam, the reduplicative template is the metrical foot *ft* (Buckley 1997, 1998; Lichtenberk 1983; McCarthy & Prince 1986/1996):[7]

(9) Reduplication in Manam

salaga	'be long'	salaga-laga	'long (sg.)'
moita	'knife'	moita-ita	'cone shell'
dara	'blood'	dara-dara	'red'
malaboŋ	'flying fox'	malabom-boŋ	'flying fox sp.'
ʔulan-	'desire (v.)'	ʔulan-laŋ	'desirable'
ziŋ	'black ashes'	zin-ziŋ	'black'

The foot is a bimoraic trochee in Manam, with stress falling on the syllable containing the penultimate mora: *sa'laga*, *mala'boŋ*. In words like *moita*, where stress would be expected to fall on an onsetless penult, it is shifted backward to the antepenult: *'moita*. The fact that this word reduplicates as *moita-ita* and not **moita-moita* shows that the reduplicant, though foot-sized, does not literally copy the main-stress foot of the stem. Rather, as we will show, it copies syllables.

The relevant part of the HS derivation begins with the *ft* template suffixed to the fully prosodified stem, as shown in the input cell in the upper left of tableau (10).[8] This input also appears as candidate (10)b, which violates both FOOT-BINARITY and HEADEDNESS(ft). All of the other candidates are the result of a single application of Insert or Copy. Insert(σ) is responsible for candidate (10)c. The inserted syllable provides the *ft* template with a head, but still leaves it non-binary. Furthermore, the inserted syllable brings its own HEADEDNESS violation. Candidates (10)a, (10)d, and (10)e, on the other hand, were produced by Copy(σ), which copies a string of one or more syllables and parses them into the empty *ft* node. Of these three candidates, the most harmonic is (10)a, because although all violate *COPY(σ) equally, (10)d leaves the template with a FOOT-BINARITY violation and (10)e violates COPY-LOCALLY because Copy(σ) displaced the syllable string when it copied it.

[7] Throughout, the transcription used in the original source is preserved, unless it would cause confusion (e.g., because it uses digraphs for single segments).

[8] The assumption that reduplicative templates are affixed to fully prosodified stems is, of course, just the traditional assumption that prosodic structure is assigned cyclically (e.g., Ito 1986; Kiparsky 1979). In STS, it means that the constraints favoring bottom-up parsing (PARSE-SEGMENT, PARSE-SYLLABLE) dominate the constraints that favor filling the template, top-down. Indeed, it is hard to see how it could be otherwise: it is not possible to concatenate a template consisting solely of prosodic structure with a stem that lacks prosodic structure. For further discussion, see section 6.2. Also see Wolf (2008) for a general theory of cyclicity in an HS-like system.

(10) Step 1 of Manam *salaga-laga*

ft + ft △ σ σ sa.la.ga	FT-BIN	HD (ft)	HD (σ)	COPY-LOC	*COPY (σ)
a. → ft + ft △ △ σ σ σ σ σ sa.la.ga la.ga					1
b. ft + ft △ σ σ sa.la.ga	1 **W**	1 **W**			**L**
c. ft + ft △ | σ σ σ sa.la.ga	1 **W**		1 **W**		**L**
d. ft + ft △ | σ σ σ σ sa.la.ga ga	1 **W**				1
e. ft + ft △ △ σ σ σ σ σ sa.la.ga sa.la				1 **W**	1

Although the number of candidates that can be produced by a single application of Insert or Copy is finite, it is somewhat larger than the set included in (10). A quick review of these additional candidates shows that none vies for optimality with (10)a. The Insert operation could insert structure of a different type or in a different place – e.g., inserting another *ft* node or inserting a σ node initially. Within the set of constraints in (10), these candidates are all harmonically bounded by (10)c, because they do nothing to improve on the *ft* template's violations of FOOT-BINARITY and HEADEDNESS, and they introduce additional violations of these constraints. The Copy operation can also be applied in various ways. For example, it can copy syllables into locations that are not accessible from the template, such as *sala-salaga*. These are harmonically bounded by (10)a because they too do nothing to improve on the *ft* template's constraint violations. The same goes for applications of Copy(seg), which at this stage of the derivation would produce candidates with free-floating segments that cannot be parsed directly into the *ft* node, thereby violating PARSE(segment). To be perfectly clear, the candidate set does not include *salaga-saga*, because no single application of the Copy operation will duplicate non-contiguous segments or syllables. This is what it means for Copy(X) to copy a *string* of *X*s.

Although (10)a is the desired output form, the derivation is not yet complete. HS requires a final convergence step, where the most harmonic candidate is identical to the input. In the case at hand, convergence can be demonstrated by showing that further applications of Insert or Copy degrade harmony rather than improve it:

(11) Step 2 of Manam *salaga-laga*

ft + ft σ σ σ σ σ sa.la.ga la.ga	FT-BIN	HD (ft)	HD (σ)	COPY-LOC	*COPY (σ)
a. → ft + ft σ σ σ σ σ sa.la.ga la.ga					
b. ft + ft ft σ σ σ σ σ sa.la.ga la.ga	1 **W**	1 **W**			
c. ft + ft σ σ σ σ σ σ sa.la.ga la.ga ga					1 **W**

Form (11)c also adds a violation of PARSE(syllable).

Words ending in a heavy syllable, such as *malaboŋ*, undergo similar derivations, except that copying just one syllable is sufficient to ensure that the *ft* template satisfies FOOT-BINARITY. The derivation does not converge immediately after that, however: after *malaboŋ-boŋ* is produced at step 1, a further step is required for nasal place assimilation to produce *malabom-boŋ*.

This analysis of Manam illustrates how the competition to satisfy a *ft* template by Copy or Insert can be made to favor Copy at step 1. Reduplication in Balangao exemplifies the other possibility. Balangao has a prefixed *ft* template that reproduces the initial syllable followed by the onset and nucleus (but not the coda) of the second syllable:

(12) Reduplication in Balangao (McCarthy & Prince 1994a; Shetler 1976)

ʔuma	ka-ʔuma-ʔuma	'always making fields'
ʔabulot	ka-ʔabu-ʔabulot	'believers of everything'
taynan	ma-tayna-taynan	'repeatedly be left behind'
tagtag	ma-nagta-tagta-tagtag	'running everywhere/repeatedly'

Unlike Manam, reduplication in Balangao cannot be attributed to an application of Copy(σ) because the reduplicants *tayna* and *tagta* are not the result of copying a whole number of syllables in the following stem. Instead, the *ft* template is populated by applications of Insert(σ) at steps 1 and 2, shown in tableaux (13) and (14). The choice in (13) is between providing the *ft* template with a head by inserting a syllable, as in (13)a, or providing it with structure by copying one or more syllables from the stem, as in (13)c. Although the markedness constraints FOOT-BINARITY and HEADEDNESS(σ) favor (13)c, the higher-ranking faithfulness constraint *COPY(σ) casts the deciding vote for (13)a.

(13) Step 1 of Balangao *tayna-taynan*

ft + ft σ σ tay.nan	*COPY (σ)	HD (ft)	FT-BIN	HD (σ)	*COPY (seg)
a. → ft + ft σ σ σ tay.nan			1	1	
b. ft + ft σ σ tay.nan		1 **W**	1	**L**	
c. ft + ft σ σ σ σ tay.nan tay.nan	1 **W**		**L**	**L**	

At step 2, there are additional copying options, but again none is optimal. In (14)c, the empty σ node inherited from step 1 has been provided with a head by copying segments from the stem. This is dispreferred to inserting another σ node because FOOT-BINARITY dominates HEADEDNESS(σ). In (14)d, FOOT-BINARITY is satisfied by copying a syllable into the *ft* template, but top-ranked *COPY(σ) is violated.

(14) Step 2 of Balangao *tayna-taynan*

ft + ft σ σ σ tay.nan	*COPY (σ)	HD (ft)	FT-BIN	HD (σ)	*COPY (seg)
a. → ft + ft σ σ σ σ tay.nan				2	
b. ft + ft σ σ σ tay.nan			1 **W**	1 **L**	
c. ft + ft σ σ σ ta tay.nan			1 **W**	**L**	1 **W**
d. ft + ft σ σ σ σ tay tay.nan	1 **W**			1 **L**	

At step 3, segment copying fills the two empty syllables of the template. Copying less than two syllables worth of segments, as in (15)c, leaves an unresolved violation of HEADEDNESS(σ).

(15) Step 3 of Balangao *tayna-taynan*

ft + ft △ △ σ σ σ σ tay.nan	*COPY (σ)	HD (ft)	FT-BIN	HD (σ)	*COPY (seg)
a. → ft + ft △ △ σ σ σ σ tay.na tay.nan					1
b. ft + ft △ △ σ σ σ σ tay.nan				2 **W**	**L**
c. ft + ft △ △ σ σ σ σ ta tay.nan				1 **W**	1

This derivation then converges at step 4: the *ft* template is headed and binary, and the syllables it contains are also headed.

Copy(seg) can apply in other ways, producing candidates other than those in (15), though none is more harmonic than (15)a. One is *ayna-taynan*, which shares (15)a's *COPY(seg) violation mark but also incurs violations of COPY-LOCALLY and ONSET. Another is *taynan-taynan*, which also shares (15)a's *COPY(seg) violation mark but additionally violates NO-CODA. On the other hand, *tana-taynan*, with a codaless reduplicant, is not a possible candidate at step 3 because *tana* is not a contiguous string of segments in the stem and a single application of Copy(seg) cannot copy a discontinuous sequence. In the next section, we will show how these observations about codas in the Balangao reduplicant are related to some general typological results.

4. Segment-copying reduplication

Balangao is an example of segment-copying reduplication: the operation that produces reduplication is Copy(seg). In this section, we explore the typology of segment-copying reduplication when the reduplicant is disyllabic. We present a new typological observation about disyllabic prefixing reduplication and use it as the basis of an argument for STS over BR correspondence theory. We conclude the section by extending this result to a type of monosyllabic reduplication.

Disyllabic reduplication with a prefixed *ft* template is found in many Australian and Austronesian languages. Besides the Austronesian language Balangao, a few additional examples are given in (16)–(19), the first two Australian and the second two Austronesian:

(16) Verb reduplication in Waalubal (Bandjalang) (Crowley 1978)

buma-ni	buma-buma-ni	'hit about'
galga	galga-galga	'chop'
yarbi	yarbi-yarbi-le:-la	'is singing'
bala:ya-ni	bala-bala:ya-ni	'has died'
yaru:ma	yaru-yaru:ma	'swim'
baramga:-la	bara-baramga:-la	'are jumping'

(17) Verb reduplication in Dyirbal (Dixon 1972)

baniɲu	bani-baniɲu	‘come’
balgan	balga-balgan	‘hit’
miɖun	miɖu-miɖun	‘having to wait [for someone]’
miyandaɲu	miya-miyandaɲu	‘laugh’
banagaɲu	bana-banagaɲu	‘return’
gulgiɽibin	gulgi-gulgiɽibin	‘become prettily painted’

(18) Reduplication in Buol (Zobel 2005)

undu-undu	‘carrying/being carried on the head’
dovu-dovu	‘falling’
litu-litu	‘sitting’
kio-kiom	‘smiling’
pota-potaan	‘carrying/being carried on the shoulder’
polo-poloŋ	‘sleeping’
lobu-lobuŋ	‘lie buried’
digu-digum	‘holding/being held in hand’

(19) Reduplication in Tomini-Tolitoli (Himmelmann 2001)

na-ale-alenda	‘rather long’
me-ito-itong	‘rather black’
‘e-inu-inung	‘drink indiscriminately’
lonsi-lonsing	‘rather round’
me-ogo-ogob-an	‘brood for each other’

The examples in (16)–(19) follow a consistent pattern: a disyllabic foot template is satisfied by copying the first syllable of the stem and the initial CV of the second syllable – σCV for short. This means that the first syllable of the reduplicant will have a coda if the first syllable of the stem does, but the second syllable of the reduplicant never has a coda: Waalubal *bara-baramga:-la*, **baram-baramga:-la*; Dyirbal *gulgi-gulgiɽibin*, **gulgiɽ-gulgiɽibin*. The absence of a coda from the second syllable can in a few cases be attributed to phonotactic requirements. In Diyari, for example, the reduplicant is a separate phonological word, and all phonological words are vowel-final in this language (Austin 1981; McCarthy & Prince 1994a; Poser 1989). No such explanation is available, however, for the ill-formedness of **baram-baramga:-la* or **gulgiɽ-gulgiɽibin* – Waalubal allows final *m* and medial *mb*, and Dyirbal allows final *ɽ* and medial *ɽg*.

Are these languages typical? Is the disyllabic foot template always realized as σCV? We conducted a typological survey to answer this question. Because the *ft* reduplicant is particularly common in Australian and Austronesian languages, we examined all of the languages in two sources about these language groups. For Australia, we consulted the original sources for the languages reported to have disyllabic reduplication in Fabricius’s (1998) survey.[9] For Austronesian, we looked at the descriptions in Adelaar & Himmelmann (eds.) (2005). We also did a search of the Graz Database on Reduplication (Hurch 2005 et seq.).[10]

---

[9] We did not use Fabricius’s brief descriptions because we found them to be unreliable. Instead, we always went to the original sources.

[10] The search parameters for the Graz Database were:
Reduplication pattern: partial
Reduplicant form: σσ.
Position: initial.

Besides Waalubal, Dyirbal, and Diyari, other Australian languages with the σCV pattern include Djapu (Morphy 1983), Mara (Heath 1981), and Ngiyambaa (Donaldson 1980). Some variations on the theme are also reported: in Dyirbal, the σCV reduplicant optionally becomes σCVC if this allows a disyllabic root to be copied exactly; in Djapu, the σCV reduplicant has an optional *ʔ* at the end; reduplicant-final *ʔ* is obligatory with the σCV reduplicant in Mangarayi (Harvey 1991; Merlan 1982) and Ritharngu (Heath 1980).

The Austronesian situation is similar. Speaking of Austronesian disyllabic reduplication in general, Himmelmann (2005: 123) writes, "The second syllable is usually open, regardless of the shape of the second syllable of the base." The languages for which σCV reduplication has been described include, besides Balangao and Tomini-Tolitoli, Buol (Zobel 2005), Ilokano (Rubino 2005), Kambera (Klamer 2005), Nias (Brown 2005), and Tetun (Klinken 1999; Van Engelenhoven & Williams-van Klinken 2005), Tukang Besi (Donohue 1999), and Yami (Rau & Dong 2005). Makassarese has σCV*ʔ* with roots longer than two syllables (Aronoff et al. 1987): *baraʔ-barambaŋ* 'sort of chest'. Tagalog is similar, except that a σCVː reduplicant is used with longer roots.

Our survey did not turn up any examples of languages with CVCV reduplication, where a disyllabic reduplicant disallows codas in both syllables even though the language allows codas generally:[11]

(20) Hypothetical case of CVCV reduplication

mele	mele-mele
kalan	kala-kalan
paltiru	pati-paltiru
mikartu	mika-mikartu
nampalu	napa-nampalu

Hereafter, when we refer to CVCV reduplication, we mean a *pattern* of reduplication that conforms to (20) (and not a language that happens to have CVCV reduplicants with CVCV… words).

At first blush, Seediq looks like a case of CVCV reduplication. For example, the *w* of *ˈdawras* is missing in the reduplicant *dərə*:

(21) Reduplication in Seediq (Tsukida 2005)

ˈdawras	dərə-ˈdawras	'cliff/pl.'
ˈrudan	rədə-ˈrudan	'old man/pl.'
ˈsəʔdiq	sədə-ˈsəʔdiq	'person/pl.'

In fact, this is not CVCV reduplication but rather general phonological reduction of pretonic syllables. Seediq has penult stress, and syllables that precede the penult are always C*ə*, like the syllables of the reduplicant (Tsukida 2005: 292). The changes seen in the reduplicant – reduction to *ə* and deletion of codas – are also found in the ordinary phonology. See section 6.6 for further discussion.

Nor did our survey turn up any examples of languages with σCVC reduplication in the sense of (22):

The results of the search added Gooniyandi and Tukang Besi to our examples.

[11] Suzanne Urbanczyk (pers. comm.) first drew our attention to the importance of this typological gap.

(22) Hypothetical case of σCVC reduplication

mele	mele-mele
kalan	kalan-kalan
paltiru	paltir-paltiru
mikartu	mikar-mikartu
nampalu	nampal-nampalu

Hereafter, when we refer to σCVC reduplication, we mean a *pattern* of reduplication that conforms to (22) (and not, say, a language with total reduplication that happens to have some σCVC roots).

Lardil is a well-known but, as it turns out, only apparent counterexample to the claim that σCVC reduplication does not exist. Based on examples like those in (23)a, Lardil has been described as following the σCVC pattern (McCarthy & Prince 1986/1996, 1990; Wilkinson 1986, 1988). This description overlooks examples like (23)b, with a longer root and consequently longer reduplicant.

(23) Lardil verb reduplication

a. paɾel-paɾeli	'to gather'
maɽbaɾ-maɽbaɾa	'be cramped'
b. wuɽuwal-wuɽuwala	'go around'

This is actually total root reduplication, with the illusion of partial reduplication created by Lardil's famous apocope process applying in the prefixed reduplicant but not in the following verb stem.[12]

We are left, then, with a reasonably secure typological observation about disyllabic reduplication: it is σCV in the sense of (24) and never CVCV or σCVC in the senses of (25) and (26), respectively. The missing CVCV and σCVC patterns are unlikely to be an accidental gap, because the σCV pattern is remarkably well attested. Nor can this difference be explained historically or areally: two different language families are involved (Pama-Nyungan and Austronesian), and the distance between the most widely separated languages with σCV reduplication is over 5000 km.

The non-existence of CVCV and σCVC reduplication, in the senses of (20) and (22), is unexpected in BR correspondence theory. By permuting the ranking of $\text{M}\textsc{ax}_{\text{BR}}$, $\text{C}\textsc{ontiguity}_{\text{BR}}$, and No-Coda, we can obtain all three ways of realizing a disyllabic reduplicant, well-attested σCV (24) and unattested CVCV (25) and σCVC (26). (These tableaux presuppose that other constraints limit the reduplicant to exactly two syllables.)

---

[12] Final vowels are apocopated in Lardil nouns that contain at least three moras (Hale 1973; Klokeid 1976; Prince & Smolensky 1993/2004; Wilkinson 1986, 1988): /majaɾa/ → [majaɾ] 'rainbow'. It has also been argued that verb stems are protected from apocope by an underlying suffix /-t̪/ (Klokeid 1976: 84-85): /waɾnawu-t̪/ → *waɾnawu* 'cook (uninflected non-future)'; cf. *waɾnawu-t̪-uɽ* 'cook (future)'. There is also solid evidence that compounds in Lardil consist of two prosodic words (Klokeid 1976: 66-68). Combining these three observations, we can analyze Lardil as a case of root reduplication where the reduplicant and base are in separate prosodic words (see section 7). The reduplicant is consonant-final because of apocope, not because of the template:

(i) Lardil as root reduplication

$[\text{pareli}]_{\text{PWd}}$ $[\text{pareli-t̪}]_{\text{PWd}}$	Total root reduplication
$[\text{parel}]_{\text{PWd}}$ $[\text{pareli-t̪}]_{\text{PWd}}$	Apocope of PWd-final vowels
$[\text{parel}]_{\text{PWd}}$ $[\text{pareli}]_{\text{PWd}}$	Deletion of non-apical codas

(24) σCV reduplicant in BR correspondence theory

/RED + paltiru/	CONTIG$_{BR}$	NO-CODA	MAX$_{BR}$
a. → palti-paltiru		2	2
b. pati-paltiru	1 **W**	1 **L**	3 **W**
c. paltir-paltiru		3 **W**	1 **L**

(25) CVCV reduplicant in BR correspondence theory

/RED + paltiru/	NO-CODA	CONTIG$_{BR}$	MAX$_{BR}$
a. palti-paltiru	2 **W**	**L**	2 **L**
b. → pati-paltiru	1	1	3
c. paltir-paltiru	3 **W**	**L**	1 **L**

(26) σCVC reduplicant in BR correspondence theory

/RED + paltiru/	CONTIG$_{BR}$	MAX$_{BR}$	NO-CODA
a. palti-paltiru		2 **W**	2 **L**
b. pati-paltiru	1 **W**	3 **W**	1 **L**
c. → paltir-paltiru		1	3

The ranking in tableau (24) is exactly McCarthy & Prince's (1994a) analysis of the Balangao example discussed in section 3.2. Tableaux (25) and (26) are the rest of the factorial typology over these constraints and candidates.

In contrast, the STS analysis of Balangao in section 3.2 does not produce the unattested CVCV and σCVC patterns under ranking permutation. The key insight is this: in a language that allows codas at all, HEADEDNESS(σ) has to dominate NO-CODA. With the opposite ranking, potential codas would be avoided by parsing them as the onsets of headless syllables:

(27) No codas if NO-CODA dominates HEADEDNESS(σ)

/pat/	NO-CODA	HD(σ)
a. → pa.tΔ		1
b. pat	1 **W**	**L**

If we take the STS ranking in tableau (15) and add NO-CODA in the only place where it can go, below HEADEDNESS(σ), it becomes clear why σCV is possible but the unattested CVCV and σCVC patterns are not:

(28) Step 3 of hypothetical *palti-paltiru*

ft + ft σ σ σ σ σ pal. ti. ru	*COPY (σ)	HD (ft)	FT-BIN	HD (σ)	NO-CODA	*COPY (seg)	
a. → ft + ft σ σ σ σ σ pal.ti pal. ti. ru					2	1	σCV reduplication
b. ft + ft σ σ σ σ σ pal. ti. ru				2 **W**	1 **L**	**L**	
c. ft + ft σ σ σ σ σ pa pal. ti. ru				1 **W**	1 **L**	1	CVCV reduplication
d. ft + ft σ σ σ σ σ pal.tir pal. ti. ru					3 **W**	1	σCVC reduplication

Because a single application of Copy(seg) cannot copy a discontinuous string of segments, CVCV reduplication of a CVCCV… stem has to be done in two steps. The first of those steps, shown in (28)c, violates HEADEDNESS(σ), which the winner satisfies. True, (28)c better satisfies NO-CODA than the winner, but to no avail: as we saw in (27), any language with codas has to rank HEADEDNESS(σ) above NO-CODA. So (28)c is not a possible intermediate winner under any ranking of these constraints, and hence CVCV reduplication is not a possible final result.

σCVC reduplication, shown in candidate (28)d, is harmonically bounded by the winner within this constraint set and, therefore, can win under no ranking of these constraints. It is harmonically bounded because of the NO-CODA violation incurred by the final consonant of the σCVC reduplicant. This same candidate is not harmonically bounded in the BR correspondence analysis (26) because the constraint MAX_{BR} favors maximal satisfaction of the template. STS has no equivalent to MAX_{BR} and so it does not produce this unwelcome prediction.

Typological results in OT (and equally HS) are highly dependent on assumptions about CON. We have shown that STS will not produce CVCV or σCVC reduplication with the constraint set in (28). Are there any other constraints that might limit the force of this claim?

The Seediq example in (21) shows that CVCV reduplication is possible when the reduplicant is affected by a general coda-deletion process. Absent such a process, CVCV reduplication could in principle be possible if there were a NO-CODA constraint specific to the reduplicative morpheme. The question of whether there are such constraints is not one that we can answer here, but we note that it intersects with the much broader question of how exceptions are treated in OT grammars: with morpheme-specific constraints, morpheme-specific rankings, or lexical listing. For discussion, see among others Becker (2008), Flack (2007), Gouskova (2007), Inkelas et al. (1997), Kager (2009), and Pater (2008).

σCVC reduplication could in principle be possible in a language where the reduplicant is in a separate phonological word from the stem, like Diyari, and all phonological words must end in a consonant because of the constraint FINAL-C (Gafos 1998; McCarthy 1993; McCarthy & Prince 1994a; Wiese 2001). Something close to this is found in Makassarese, which was mentioned earlier. When the reduplicant is not an exact copy of a disyllabic root, it is σCVʔ. Final ʔ also appears in all words that would otherwise end in an epenthetic vowel, indicating that there is a general process of ʔ epenthesis to satisfy FINAL-C (McCarthy & Prince 1994a): /botol/ → *botoloʔ* ‘bottle’.

These typological results about disyllabic reduplicants are related to another typological result about monosyllabic reduplicants. In their survey of reduplicative patterns, McCarthy and Prince (1986/1996) identify a pattern that they call the “simple syllable”. It is simple because the template is just σ, with no weight specification. In the simple-syllable pattern, the reduplicant is a CV syllable unless the base begins with a CVC… sequence, in which case the reduplicant is a CVC syllable.

(29) The simple syllable reduplicative pattern

a. CV- with CV or CV.V… stem

pa	*pa*-pa
pu.a	*pu*-pu.a

b. CVC- with CVC… stem

pa.ta	*pat*-pa.ta
pat.ka	*pat*-pat.ka

McCarthy and Prince’s example of the simple syllable reduplicative pattern was Ilokano, but it was based on a source that failed to indicate vowel length. In real Ilokano (Hayes & Abad 1989), words like those in (29)a lengthen the vowel of the reduplicant so it is consistently heavy: *puː-pu.a* (see (36)). No better examples of the simple syllable reduplicative pattern have emerged subsequently, and a search of the Graz Database did not turn up any examples either. Evidently, it does not exist, as Steriade (1988: 80) first proposed.

BR correspondence theory predicts the existence of this unattested pattern, for much the same reason that it predicts the unattested σCVC pattern. If the reduplicant is subject to no prosodic requirements except monosyllabicity, then the presence or absence of a coda in the reduplicant with CVC… stems will be determined by the ranking of MAX_{BR} with respect to NO-CODA:

(30) Simple syllable with BR correspondence

	MAX_{BR}	NO-CODA
a. → *pat*-pa.ta	1	1
b. *pa*-pa.ta	2 **W**	**L**

When there is no consonant available for copying, then the reduplicant has no coda, and it defaults to a light CV syllable, as in (29)a.

The point is that BR correspondence theory has two ways of getting a CVC reduplicant. One way is to require the reduplicant to be a heavy syllable. In that case, the reduplicant is CVC with CVC… stems and CVː with CV and CV.V… stems. Ilokano is an example. The other way of getting a CVC reduplicant is to require the reduplicant to be a syllable, *tout court*, and to impose the ranking in (30), with MAX_{BR} acting as an additional size/weight requirement on the reduplicant (cf. (26)). In that case, the reduplicant is CVC with CVC… stems and CV with CV and CV.V… stems, as in (29). This does not seem to occur.

STS has no MAX_{BR} constraint or the equivalent, and so it is unable to produce the unattested pattern. In STS, if the reduplicative template is a syllable of unspecified weight (and if no prosodic constraints require it to be heavy), then it will be realized as CV no matter where NO-CODA is ranked (see (35) for an example).

(31) σ template in STS (step 1)

σ + σ σ pa.ta	HD(σ)	*COPY(seg)	NO-CODA
a. → σ + σ σ pa pa.ta		1	
b. σ + σ σ pa.ta	1 **W**	**L**	
c. σ + σ σ pat pa.ta		1	1 **W**

In general, STS satisfies the σ template in the least marked way consistent with the requirements discussed in section 3.1: a single application of GEN is limited to copying contiguous segments, and the reduplicant and original are normally adjacent. The least marked way of satisfying a σ template is often with a copy of CV, as in (31), though there are circumstances (e.g., if STRESS-TO-WEIGHT is active) when copying more than that is optimal.[13]

In this section, we introduced and defended three new typological claims: the non-existence of CVCV reduplication in the sense of (20), σCVC reduplication in the sense of (22), and simple syllable reduplication in the sense of (29). We showed that all three patterns are predicted to exist in BR correspondence theory, but none is predicted to exist in STS. The main points of difference are these: STS's Copy(seg) operation can only copy strings of adjacent segments; and STS does not have MAX_{BR} or its equivalent. These two points are related, as we explained in section 3.1: the Copy operation itself is the sole way of imposing BR identity, and it does so in ways that are limited intrinsically (only strings can be copied) and extrinsically (the copied material must be parsed by the template).

In the next section, we show how STS analyzes reduplicative patterns that involve copying syllables and moras.

---

[13] The simple-syllable pattern could in principle be possible in STS in a language that independently ruled out lengthening, gemination, coda epenthesis, or other ways of giving weight to the CV reduplicant. As described by Kennedy (2005: 147-148), Kusaiean is such a language: it lacks vowel length etc., and it has CV reduplication alternating with CVC, as in (29).

Kennedy's (2005: 152-153) claim that Kusaiean lacks vowel length is questionable, however. He cites Lee (1975: 16-17, 30-31) in support of this claim. In fact, though, Lee (p. 16) says that "The length of the vowels serves to differentiate one word from another", and he goes on (pp. 30-31) to show that vowel length is contrastive in non-final syllables. The actual Kusaiean reduplicative pattern, as described by Lee (1975: 215ff.), is this:

(i) Reduplication in Kusaiean

CVːC- with CVCV… stem	kuːl-kuluːs	'to peel bit by bit'
CVːC- with CVːCV… stem	faːl-faːlɨːs	'to mend again and again'
CVː- with CVːC stem	soː-soːk	'to get jealous'
CV- with CVː.V… stem	fo-foː.uːl	'to emit smell'

Except for the last example, this looks like an instance of the *ft* template, with vowel length required in the reduplicant just as it is required in word-final (stressed?) syllables. Resistance to copying word-final consonants, as in *soː-soːk*, is also observed in Ilokano (see (36)).

5. Copying prosodic constituents

The σCV reduplicative pattern is not the only kind of disyllabic prefixing reduplication. There is another, evidently rarer type, of which Yidiny is the most secure example:[14]

(32) Yidiny reduplication (Dixon 1977; Marantz 1982; McCarthy & Prince 1990; Nash 1980)

buɲa	buɲa-buɲa	'woman/pl.'
ŋalal	ŋalal-ŋalal	'big/lots of big [ones]'
mulari	mula-mulari	'initiated man/pl.'
/dʲimuru/	dʲimu-dʲimur	'house/pl.'
dʲugarba-n	dʲugar-dʲugarba-n	'have an unsettled mind/for a long time'
gindalba	gindal-gindalba	'lizard sp. /pl.'
/guɲdʲilbay/	guɲdʲil-guɲdʲiːlbay	'tiger snake/pl.'
galambaraː	gala-galambaraː	'march fly/pl.'

Yidiny copies the first two syllables of the stem, reduplicating σCV if the second stem syllable is open and σCVC if it is closed: *mula-mulari*, **mular-mulari*; *dʲugar-dʲugarba-n*, **dʲuga-dʲugarba-n*. In Dixon's analysis, reduplication precedes processes of apocope (cf. 'house') and vowel lengthening (cf. 'tiger snake'). If the coda of the stem's second syllable is a nasal followed by a homorganic consonant, it is not copied, perhaps because its place feature is licensed in onset position.

In STS terms, Yidiny has the same *ft* template as Balangao and the other languages discussed in section 4, but it satisfies this template earlier in the derivation, with the Copy(σ) operation rather than the Copy(seg) operation. As tableaux (33) and (34) show, this result is obtained by ranking FOOT-BINARITY and HEADEDNESS(σ) above rather than below *COPY(σ). In consequence, the *ft* template is satisfied immediately, by copying syllables, rather than waiting until the template has enough structure to allow segment copying, as in Balangao.

[14] Nash (1980) analyzes Warlpiri in the same way as Yidiny, though unfortunately crucial examples of the *dʲugar-dʲugarba-n* type are scarce. Gooniyandi (Kennedy 2008; McGregor 1990) might also be a case, if the unique example of that type is representative: *jaddan-jaddandi* 'twigs'.

(33) Step 1 of Yiddiny *mula-mulari*

	ft + ft △ σ σ σ mu.la.ri	HD (ft)	FT-BIN	HD (σ)	*COPY (σ)
a. →	ft + ft △ △ σ σ σ σ σ mu.la mu.la.ri				1
b.	ft + ft △ σ σ σ mu.la.ri	1 **W**	1 **W**		**L**
c.	ft + ft │ △ σ σ σ σ mu mu.la.ri		1 **W**		1
d.	ft + ft │ △ σ σ σ σ mu.la.ri		1 **W**	1 **W**	**L**

(34) Step 1 of Yidiny *d^{j}ugar-d^{j}ugarba-n*

	ft + ft △ σ σ σ d^{j}u.gar.ban	HD (ft)	FT-BIN	HD (σ)	*COPY (σ)
a. →	ft + ft △ △ σ σ σ σ σ d^{j}u.gar d^{j}u.gar.ban				1
b.	ft + ft △ σ σ σ d^{j}u.gar.ban	1 **W**	1 **W**		**L**
c.	ft + ft │ △ σ σ σ σ d^{j}u d^{j}u.gar.ban		1 **W**		1
d.	ft + ft │ △ σ σ σ σ d^{j}u.gar.ban		1 **W**	1 **W**	**L**

Note the resemblance between Yidiny and Manam in (9)–(11), another language that satisfies a *ft* template by copying syllables.

Yidiny and Balangao have the same *ft* template, but different grammars determine how to satisfy it. Whenever there is a *ft* template, there is a grammar-determined choice between satisfying it immediately with syllable copying or waiting until segment copying is possible. When the template is of type σ, however, it cannot be satisfied by syllable copying – a copied syllable cannot be parsed inside of the template syllable. There is, however, a similar grammar-determined choice between copying moras and copying segments.[15] To demonstrate this, we will compare the various ways of realizing a σ template.

One realization of a σ template is as a CV syllable. Many examples can be found in the literature, such as the following:

(35) CV reduplication in Ilokano (Hayes & Abad 1989)

liŋʔet	si-li-liŋʔet	'perspiration/covered with'
buneŋ	si-bu-buneŋ	'machete/carrying a'
pandiliŋ	si-pa-pandiliŋ	'skirt/wearing a'
ǰyanitor	ʔagin-ǰya-ǰyanitor	'janitor/pretend to be a'
tugaw	ʔag-tu-tugaw	'to sit/sits restfully'

As we saw in (31), a CV reduplicant is the normal realization of the σ template in STS. Because no constraint like $\textsc{Max}_{BR}$ favors copying more segments, the reduplicant is no bigger than it needs to be to make a well-formed syllable and thereby satisfy the template. (On the treatment of onset clusters with the σ template, see section 6.6.)

Another realization of a σ template is as a heavy syllable. Again, many examples can be found in the literature, such as the following:

(36) Heavy syllable reduplication in Ilokano (Hayes & Abad 1989)

pusa	pus-pusa	'cat/pl.'
kaldiŋ	kal-kaldiŋ	'goat/pl.'
ǰyanitor	ǰyan-ǰyanitor	'janitor/pl.'
trabaho	ʔag-trab-trabaho	'to work/is working'
na-ʔalsem	naka-ʔal-ʔalsem	'sour/very'
daʔit	ʔag-daː-daʔit	'to sew/is sewing'
roʔot	roː-roʔot	'leaves, litter/pl.'
trak	traː-trak	'truck/pl.'

In Ilokano, the reduplicant is always a heavy syllable. It is usually a CVC syllable, but CVː occurs instead in two situations where CVC is ruled out: when CVC copying would put a glottal stop into coda position, where it is banned; and when the stem is monosyllabic.

STS offers no new insight into the question of how the heaviness of the reduplicant is stipulated, whether in the template itself (Marantz 1982; McCarthy & Prince 1986/1996; Thurgood 1997), by a constraint on the template (Blevins 1996; Crowhurst 2004; McCarthy & Prince 1993), or by constraint interaction (Kennedy 2003; McCarthy & Prince 1994b; Spaelti 1995, 1997). But, if a heaviness requirement of some sort is assumed, then the form of the reduplicant can be accounted for readily:

[15] A *ft* template could also be satisfied by mora copying after application of Insert(σ). The effect does not seem to be different from syllable copying.

(37) Step 1 of Ilokano heavy syllable reduplication

σ + σ σ pu.sa	HD(σ)	NO-V:	*COPY(seg)	NO-CODA
a. → σ + σ σ pus pu.sa			1	1
b. σ + σ σ pu.sa	1 **W**		**L**	**L**
c. σ + σ σ puː pu.sa		1 **W**	1	**L**

Eliminating candidate (37)b requires that HEADEDNESS(σ) dominate *COPY(seg) and NO-CODA. (As we showed in (27), HEADEDNESS(σ) must in any case dominate NO-CODA in any language with codas.) Candidate (37)c requires the markedness constraint against long vowels, NO-Vː, to dominate NO-CODA as well. Reversing this ranking while holding all else equal produces CVː reduplication across the board, as in Tagalog (Carrier-Duncan 1984: 262). Even if NO-Vː dominates NO-CODA, CVː reduplication is possible if NO-Vː is itself crucially dominated by a third constraint. The constraint against glottal stop in coda position has that role in Ilokano.[16]

A third type of monosyllabic prefixing reduplication appears to copy the initial syllable of the stem: a CV reduplicant with CVCV… stems and a CVC reduplicant with CVC.CV… stems. This is not as common as the first two types, and has even been claimed not to exist (Marantz 1982; McCarthy & Prince 1990; Moravcsik 1978). The most convincing case comes from Yaqui (Haugen 2003, 2008):

(38) Monosyllabic habitual reduplication in Yaqui

a. CV reduplicant with initial open syllable

vusa	vu-vusa	'awaken'
chike	chi-chike	'comb one's hair'
hewite	he-hewite	'agree'
ko'arek	ko-ko'arek	'wear a skirt'

b. CVC reduplicant with initial closed syllable

vamse	vam-vamse	'hurry'
chepta	chep-chepta	'jump over'
chukta	chuk-chukta	'cut with a knife'
hitta	hit-hitta	'make a fire'
bwalkote	bwal-bwalkote	'soften, smoothe'

There are significant complications (Haugen 2003), but the generalization that CVC reduplicants are limited to stems with initial closed syllables seems secure. Another case that has been reported, Yapese, is less persuasive: only two examples of the crucial (38)b type are cited by Ballantyne (1999), and data inconsistent with syllable copying can be found in another source, Jensen (1977: 111).

Demers et al. (1999: 47) propose that reduplication in Yaqui copies the first mora of the stem, a proposal that we adopt here. This analysis presupposes, following Fraenkel (1959), that codas in Yaqui are non-moraic, so an initial closed syllable is a single mora. Fraenkel's evidence comes from the stress pattern. Adjacent syllables can be stressed, but not adjacent

[16] Tableau (37) presupposes that the vowel *u* can be parsed into both moras of the heavy syllable template at the same derivational step when copying occurs. If it is instead assumed that copying requires an additional step, then (37)c will not even be a candidate at step 1.

moras, and a coda does not count as a mora for this purpose.[17] It also requires, following Hyman (1985), Ito (1986, 1989), and others, that all segments in a syllable, including onset consonants, be immediate constituents of μ nodes.

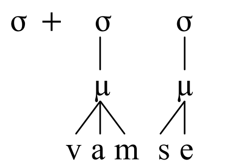
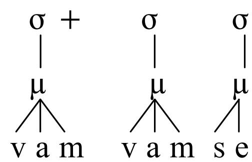
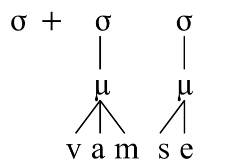
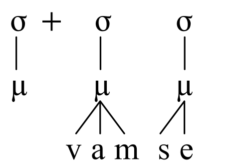
In STS, if the template is of type σ, then there is a tension between supplying it with a head (and meeting any weight requirements) by applying Insert(μ) or Copy(μ). In segment-copying reduplication, such as (37), Insert(μ) takes precedence because *COPY(μ) dominates HEADEDNESS(μ). In mora-copying reduplication, however, the opposite ranking of these constraints allows Copy(μ) to take precedence:

(39) Step 1 of Yaqui mora-copying reduplication – CV.CV… stem

σ + σ σ μ μ v u s a	HD(σ)	HD(μ)	*COPY(μ)
a. → σ + σ σ μ μ μ v u v u s a			1
b. σ + σ σ μ μ v u s a	1 **W**		**L**
c. σ + σ σ μ μ μ v u s a		1 **W**	**L**

[17] Fraenkel gives a list of clusters, all ending in *h* or *č*, that do make a mora, but only irregularly, forcing him to employ a special juncture symbol.

(40) Step 1 of Yaqui mora-copying reduplication – CVC.CV… stem

	HD(σ)	HD(μ)	*COPY(μ)
			
a. → 			1
b. 	1 **W**		**L**
c. 		1 **W**	**L**

Both derivations converge immediately after this.

Yidiny and Yaqui exemplify prosodic constituent copying in STS. We explained in section 3.1 how a template of type X can be satisfied by inserting empty constituents of type X – 1 or by copying constituents of type X – 1. The choice between these two modes of satisfaction is determined not by the template itself but by the grammar. Satisfaction of the template is demanded by HEADEDNESS(X) and any other active constraints on X's form, such as FOOT-BINARITY when X is of type *ft*. If *COPY(X – 1) dominates HEADEDNESS(X – 1), then X will be satisfied by inserting one or more elements of type X – 1. If HEADEDNESS(X – 1) dominates *COPY(X – 1), however, elements of type X – 1 will be copied to fill the template. If a previous Insert(X – 1) operation has already supplied the X template with dependents of type X – 1, then the same choice is made, recursively, between inserting or copying constituents of type X – 2.

This account of prosodic constituent copying requires nothing more than certain operations and constraints that STS needs anyway – Insert, Copy, HEADEDNESS, and *COPY – and the standard OT assumption that languages differ in constraint ranking. In contrast, treatments of constituent copying within BR correspondence theory have required additional apparatus that is not as well motivated on other grounds. Here we discuss two such proposals.

McCarthy & Prince (1995a) introduce a constraint called STROLE that prevents an onset from being copied as a coda (***mular-mulari*) while allowing a coda to be copied as a coda (*gindal-gindalba*):

(41) STROLE_{BR} (McCarthy & Prince 1994a)

Corresponding segments in base and reduplicant must have identical syllabic roles.

The problem is not with STROLE_{BR} itself, but rather with its input-output counterpart STROLE_{IO}. It is a fundamental premise of correspondence theory that input-output faithfulness and base-reduplicant identity are enforced by identical constraints on different correspondence relations, so the existence of STROLE_{BR} entails the existence of STROLE_{IO}. But, STROLE_{IO} predicts the existence of languages with a contrast between tautomorpheme *pa.ta* and *pat.a*, a contrast that can be obtained simply by ranking STROLE_{IO} above ONSET and NO-CODA. No such language is known to exist (Blevins 1995: 221; Clements 1986: 318; Hayes 1989: 260; McCarthy 2003: 60–62), so STROLE$_{IO}$ is clearly making a wrong prediction.

Another approach to constituent copying elaborates on the notion "base". According to McCarthy & Prince (1995a, 1999), the base of base-reduplicant correspondence is the entire string to which the reduplicative morpheme is prefixed or suffixed. Shaw (2005) and Haugen (2009) propose a different theory of the base: it is the constituent to which the reduplicative morpheme is aligned by an ANCHOR$_{BR}$ constraint. For instance, in Yidiny ANCHOR$_{BR}$-L(RED, head foot) ensures that the reduplicative morpheme is prefixed to the initial foot. By hypothesis, as an automatic consequence, the base for reduplicative correspondence in Yidiny is that same foot, and so only material in that foot is available for copying. In Balangao, on the other hand, the reduplicative morpheme is subject to ANCHOR$_{BR}$-L(RED, stem), so the entire stem is in the domain of the correspondence relation. This proposal is called the Constituent Base Hypothesis (CBH).

Although the CBH is implemented within standard OT, it is not in fact possible to reconcile the assumptions of CBH with those of standard OT. CBH defines the reduplicative base by reference to the ranking (or existence) of ANCHOR$_{BR}$ constraints on reduplicative morphemes. Base-reduplicant correspondence relations are established by GEN. CBH therefore requires that GEN have access to the constraint hierarch H. This is a very significant departure from the assumptions of standard OT, whose modular structure does not allow for information to flow from H to GEN (Prince & Smolensky 1993/2004: 5). To be sure, HS is also a very significant departure from the assumptions of standard OT, but one whose broader consequences have been studied and found independent support (see section 2).

In this section, we have shown how prosodic constituent copying can be analyzed in STS, and once again, we have argued that it is superior to BR correspondence theory. In the next section, we look at the interaction of phonological processes with reduplication – an area that might seem to offer the greatest potential for demonstrating any advantages that BR correspondence has over STS.

6. The interaction of reduplication with phonology

6.1. Introduction

In standard parallel OT with BR correspondence (hereafter just P-OT), the effects of reduplication and all phonological processes are evaluated together, in parallel. The markedness constraints that trigger phonological processes are deployed in a constraint hierarchy that also includes input-output faithfulness constraints and base-reduplicant identity constraints. Permuting the ranking of these three types of constraints predicts a range of ways in which phonology and reduplication can interact (McCarthy & Prince 1995a, 1999).

In STS, GEN includes a family of Copy operations and other families of operations that insert, delete, and spread phonological elements. Copying is usually triggered by a Headedness constraint, and the ranking of the triggering Headedness constraint relative to other constraints determines when in the derivation copying will occur. A markedness constraint that is ranked high enough may favor a phonological process that precedes copying; other constraints may have to wait until after copying to be satisfied.

The first half of this section is organized around the three types of phonology-reduplication interaction discussed by McCarthy & Prince (1995a, 1999): ordinary overapplication in 6.2, back-copying overapplication in 6.3, and underapplication in 6.4. The second half deals two other kinds of phonology-reduplication interaction that have special relevance to STS: lookahead effects, in which the amount that is copied appears to depend on post-copying phonology (section 6.5), and skipping effects, which STS attributes to post-copying deletion processes (section 6.6).

6.2. Overapplication

The difference between P-OT and STS has obvious relevance to one of the central issues in reduplication-phonology interaction: overapplication. A phonological process is said to overapply if its effects on one member of the reduplicant/base pair are duplicated in the other member. For example, in Chumash (42), prefixal *k* fuses with an initial laryngeal; fusion is said to overapply because both reduplicant and base show the effects of this process. In Javanese (43), intervocalic *h* deletes. This process is said to overapply in *bəda-bədae* because the first *h* is deleted even though it is preconsonantal.

(42) C + laryngeal coalescence in Chumash (Applegate 1976; McCarthy & Prince 1995a: 313ff.; Mester 1986)

ʔaniš	$k^ʔ$an-$k^ʔ$aniš	'my paternal uncles'
hawaʔ	k^haw-k^hawaʔ	'my maternal aunts'

(43) *h* deletion in Javanese (Dudas 1976; Horne 1990; McCarthy & Prince 1995a: 285ff.)

bəɖah	bəɖae	bəɖah-bəɖah	bəɖa-bəɖae	'broken'
ɖajɔh	ɖajɔe	ɖajɔh-ɖajɔh	ɖajɔ-ɖajɔe	'guest'

In P-OT, following an earlier proposal by Wilbur (1973a), overapplication is attributed to activity by BR correspondence constraints, such as IDENT_{BR}(Place) in Chumash or DEP_{BR} in Javanese. In the Chumash example *$k^ʔ$an-$k^ʔ$aniš*, for instance, the *$k^ʔ$*s in the reduplicant and the base are BR correspondents. Because they are both velar, they satisfy IDENT_{BR}(Place). So-called normal application of coalescence violates this constraint: /k-σ-ʔaniš/ → **$k^ʔ$an-ʔaniš*. In this way, the effects of coalescence and copying are evaluated together, in parallel.

In STS, the effects of coalescence and copying in Chumash are evaluated serially. In this respect, STS is in agreement with a long tradition of analyzing overapplication by ordering the phonological process – here, coalescence – before copying (Anderson 1975; Bloomfield 1933: 222; Inkelas & Zoll 2005; Kiparsky 1986, 2010; Mester 1986; Munro & Benson 1973; Odden & Odden 1985; Wilbur 1973a, 1973b). In STS, as in HS generally, order of application can be controlled by the ranking of markedness constraints. If the markedness constraint favoring some phonological process is ranked higher than any constraint demanding template satisfaction, then that process will occur before copying.

Chumash will serve to illustrate. The underlying representation is /k-σ-ʔaniš/ ('my' + plural + 'paternal uncle'), where σ is a heavy syllable. At the first step (44), the choices are to coalesce the segmentally adjacent /k/ and /ʔ/, or to copy /ʔan/ into the template. By ranking the markedness constraint that compels coalescence, *Cʔ, above the constraint that compels template satisfaction, HEADEDNESS(σ), we get coalescence to happen first.

(44) Step 1 of Chumash *k'ʔan-k'ʔaniš*

σ + σ σ k+ ʔa.niš	*Cʔ	Hd(σ)	No-Coalescence	*Copy(seg)
a. → σ + σ σ kˀa.niš		1	1	
b. σ + σ σ k+ ʔa.niš	1 **W**	1	**L**	
c. σ + σ σ k ʔan ʔa.niš	1 **W**	**L**	**L**	1 **L**

At step 2 (45), *Cʔ has already been satisfied, so lower-ranking Headedness(σ) comes into play, and *kˀan* is copied into the template. Coalescence of /k/ and /ʔ/ has "overapplied" because it applied prior to copying.

(45) Step 2 of Chumash *kˀan-kˀaniš*

σ + σ σ kˀa.niš	*Cʔ	Hd(σ)	No-Coalescence	*Copy(seg)
a. → σ + σ σ kˀan kˀa.niš				1
b. σ + σ σ kˀa.niš		1 **W**		**L**

The derivation converges at the next step.

In the literature on reduplication, the principal argument against the ordering theory of overapplication comes from a variety of Malay reported by Onn (1980: 114) and discussed also by Kenstowicz (1981) and McCarthy & Prince (1995a, 1999). Since this is a case of total reduplication, we will arbitrarily assume that the reduplicant is prefixed. According to Onn, rightward spreading of nasality from the end of the reduplicant onto the beginning of the base is replicated at the beginning of the reduplicant:

(46) Overapplication of nasal harmony in Malay

/hamə/	hamə̃	<u>h̃ã</u>mə̃-h̃ãmə̃
/waŋi/	waŋĩ	<u>w̃ã</u>ŋĩ-w̃ãŋĩ

As McCarthy & Prince show, no ordering theory of overapplication could account for nasalization in the underlined segments in (46). The problem is that the overapplying process isn't applicable until reduplication has already occurred. In general, ordering theories of reduplication-phonology interaction are incompatible with overapplication of processes that apply at reduplicant-base juncture.

The Malay example is not very reliable, however. It is not introduced until the penultimate page of Onn (1980), immediately after a concession that evidence previously discussed does not definitively argue against the ordering theory. Other sources on Malay do not mention this behavior (Inkelas & Zoll 2005: 221n.), and Kiparsky (2010) could not verify it with four native speakers of the appropriate dialect. Unless better evidence is brought forth in the future, we have to conclude that (46) is spurious and hence no counterexample to ordering theories of overapplication like STS.

Another of McCarthy & Prince's examples of overapplication of a process applying at reduplicant-base juncture comes from Axininca Campa (McCarthy & Prince 1993; Payne 1981;

Spring 1990). Consonant-initial suffixes require the preceding stem to be prosodically closed in the sense of having the prosody characteristic of a free-standing phonological word: it must end in a vowel and it must contain at least two moras. Deficiencies are remedied by epenthesizing *a* or *ta* as needed (epenthetic segments and their copies are underlined):

(47) Effects of suffixation

a. Consonant-final stem with consonant-initial suffix

/kow/ noŋ-kowa-wai-ti[18] ‘I will search for it more and more’

b. Monomoraic stem with consonant-initial suffix

/na/ nata-wai-taːnts^{h}i ‘to carry continually’

c. Compare with vowel-initial suffix

/kow/ kow-aːnts^{h}i ‘to search’

/na/ na-taːnts^{h}i ‘to carry’

The reduplicative morpheme is a suffix in Axininca, and the stem to which it is suffixed also has to be prosodically closed. Segments epenthesized to satisfy this requirement are copied along with the rest of the stem:

(48) Overapplication in Axininca Campa

a. Base is vowel-final

/kow/ noŋ-kowa-kowa-tiro ‘I will search for it more and more’

b. Base is minimally bimoraic

/na/ nata-nata-wai-tak-i ‘has continued to carry it more and more’

Because the reduplicant is always consonant-initial in the relevant examples, it can be seen as the trigger of epenthesis, just like the non-reduplicative consonant-initial suffix *-wai* in (47). On this view, the reduplicant is both triggering epenthesis and copying its result.

This interpretation of the Axininca facts is incompatible with STS or other derivational approaches to overapplication, but there is an alternative analysis that remains strictly within the limits of STS. Prosodic closure of the stem to which a reduplicative affix is attached has been assumed throughout this article, starting with the Manam example in section 3.2. As we observed in footnote 8, it is hard to see how it could be otherwise. If reduplicative affixes enter the derivation as empty prosodic structure – that is, as templates – then the stem to which they are affixed must already have prosodic structure of the same type, because otherwise there would be nothing to concatenate the affix with. Thus, it is expected that the epenthetic segments are present prior to reduplication.

An anonymous reviewer has drawn our attention to a third possible case of overapplication of a process that applies at reduplicant-base juncture. Russell (1997) analyzes some data from Paamese (Crowley 1982) in these terms. The observation is that, when *CuCi* words reduplicate, both *i*s change into *u*s:

(49) Reduplication in Paamese

muni	munu-munu	‘drink’
luhi	luhu-luhu	‘plant’
uhi	uhu-uhu	‘blow’

For convenience, we will refer to the two parts of *munu-munu* as $munu_1$ and $munu_2$. In Russell’s analysis, the final vowel of $munu_1$ is *u* and not *i* because it has assimilated to the initial vowel of $munu_2$ (informally, $i \rightarrow u$ /_C*u*). The final vowel of $munu_2$ is *u* rather than *i* as a result of base-reduplicant identity. In this interpretation, $i \rightarrow u$ assimilation is an overapplying process that occurs at reduplicant-base juncture.[19]

[18] The consonant *t* is epenthesized to relieve hiatus.

[19] If it could be shown that $munu_1$ is the reduplicant and $munu_2$ is the base, Paamese would also be an example of back-copying (section 6.3).

The process *i* → *u* /_C*u* is by no means secure, however. Crowley and Russell note that it is not applicable in words with disyllabic suffixing reduplication: *tukuli-kuli, *tukulu-kuli, *tukulu-kulu* 'creep (of a vine)'. Nor is it applicable with other suffixes: *levi-ku*, **levu-ku* 'my trunk (of body)'. Nor is it applicable root-internally: *hilu* 'cough', *ninu* 'spirit', *sinu* 'dressed'. In light of this complete lack of generality of the supposed *i* → *u* process, we might as well say "C*u*C*i* roots become C*u*C*u* when reduplicated". There is no good case here for overapplication of a phonological process because there is no good case for a phonological process.

Finally, Korean has been offered as an example of overapplication of a process applying at reduplicant-base juncture (Chung 1999; Raimy 2011: 2407). Korean has a pair of processes that change /VklV/ into *VŋnV*. The /l/ → *n* process is said to overapply in reduplication of Sino-Korean compounds, but not the /k/ → *ŋ* process. These compounds reduplicate by copying each part separately: /si-pi/ → *si-si-pi-pi* 'judgement'. Overapplication occurs when the second part of the compound has the shape /lVk/:

(50) Overapplication in Sino-Korean compounds

Simple	Reduplicated	
hi-lak	hi-hi-<u>n</u>aŋ-na<u>k</u>	'rejoicing'
yu-lak	yu-yu-<u>n</u>aŋ-na<u>k</u>	'quite willingly'

According to Chung, the single-underlined segments are *n* rather than *l* as a result of overapplication of the /l/ → *n* process, but for some reason the /k/ → *ŋ* process does not overapply to the doubly-underlined segments. Chung accounts for this difference by proposing an onset-specific version of IDENT$_{BR}$(nasal). A much simpler solution is possible, however. Suppose the reduplicated compounds have an internal phonological word boundary, as proposed by Ahn (1998: 325): [*hi-hi*]$_{PWd}$-[*<u>n</u>aŋ-nak*]$_{PWd}$. Then the singly-underlined *n* is simply the usual realization of initial /l/ in Sino-Korean words (cf. Chung 2003: 125fn.).

We conclude, then, that there are no solid cases of overapplication of a process conditioned at reduplicant-base juncture, and thus no good evidence from overapplication for BR correspondence theory over STS.

There is another important difference between STS and BR correspondence: overapplication of allophonic processes. BR correspondence theory can account for a language where two sounds are in perfect complementary distribution except when base-reduplicant identity is at stake. STS cannot. We will explain with a hypothetical example.

Imagine a language where oral and nasalized vowels are in complementary distribution: vowels are nasalized before a nasal consonant and oral otherwise. Following McCarthy & Prince (1995a, 1999), we analyze this with the constraints in (51), ranked as in (52). Under this ranking, any input oral vowel in the nasalizing environment must become nasal, and any input nasal vowel outside the nasalizing environment must become oral.

(51) Constraints for anticipatory nasalization

a. *V_{oral}N

Assign a violation mark for every sequence of an oral vowel followed by a nasal consonant.

b. *V_{nasal}

Assign a violation mark for every nasalized vowel.

c. IDENT$_{IO}$(nasal)

For every input segment *i* with output correspondent *o*, assign a violation mark if *i* and *o* have different values for [nasal].

(52) Ranking for allophonic anticipatory nasalization

a. Nasalization before a nasal

	/pani/	*V$_{oral}$N	*V$_{nasal}$	Id$_{IO}$(nas)
a. →	pãni		1	1
b.	pani	1 **W**	**L**	**L**

b. Denasalization elsewhere

	/kãti/	*V$_{oral}$N	*V$_{nasal}$	Id$_{IO}$(nas)
a. →	kati			1
b.	kãti		1 **W**	**L**

Now, imagine that this hypothetical language has CV prefixing reduplication and that Ident$_{BR}$(nasal) is ranked above *V$_{nasal}$. In that case, the vowel of the reduplicant will be nasalized to match nasalization in the vowel of the base:

(53) Ranking for overapplication of anticipatory nasalization (BR correspondence)

	/RED + pani/	Id$_{BR}$(nas)	*V$_{oral}$N	*V$_{nasal}$	Id$_{IO}$(nas)
a. →	pã-pãni			2	1
b.	pa-pãni	1 **W**		1 **L**	1
c.	pa-pani		1 **W**	**L**	**L**

In this hypothetical language, nasalization of vowels is completely predictable from the phonological context except in reduplicants, where a vowel may be nasalized outside the nasalizing context to match nasalization in the base.

This language is not analyzable in STS. By ranking *V$_{oral}$N above Headedness(σ), STS can nasalize the vowel of /pani/ before copying it: /pani/ → *pãni* → *pã-pãni*. This is shown in tableaux (54) and (55).

(54) Step 1 of hypothetical language

	σ + σ σ pa.ni	*V$_{oral}$N	Hd(σ)	*V$_{nasal}$	Id(nas)
a. →	σ + σ σ pã.ni		1	1	1
b.	σ + σ σ pa.ni	1 **W**	1	**L**	**L**
c.	σ + σ σ pa pa.ni	1 **W**	**L**	**L**	**L**

(55) Step 2 of hypothetical language

σ + σ σ pã.ni	*V$_{oral}$N	HD(σ)	*V$_{nasal}$	ID(nas)
a. → σ + σ σ pã pã.ni			2	
b. σ + σ σ pã.ni		1 **W**	1 **L**	

At the next step, though, the vowel of the reduplicant denasalizes because *V$_{nasal}$ disfavors *pã-* and no higher-ranking constraint – specifically, *V$_{oral}$N – favors it:

(56) Step 3 of hypothetical language

σ + σ σ pã pã.ni	*V$_{oral}$N	HD(σ)	*V$_{nasal}$	ID(nas)
a. → σ + σ σ pa pã.ni			1	1
b. σ + σ σ pã pã.ni			2 **W**	**L**

The derivation then converges at step 4, yielding *pa-pãni*.

In general, STS predicts that allophonic processes will not overapply, even when the allophonic process precedes copying, as it does in (54)–(56). This prediction follows from the basic theory of allophony in OT – constraints and rankings like those in (51) and (52) – and the fact that STS has no BR correspondence mechanism for enforcing base-reduplicant identity after copying has occurred. In a truly allophonic system like this one, there is a ranking that eliminates the marked allophone in all phonological contexts, except for those specific phonological contexts where the marked allophone is required. That is why *V$_{nasal}$ dominates IDENT(nasal) in (52), and that is why the STS derivation converges on *pa-pãni*.

Suppose instead that our hypothetical language had contrastive vowel nasalization that is neutralized before a nasal consonant: /pani/ → *pãni*, /kãti/ → *kãti*, and /sapi/ → *sapi*. In that case, IDENT(nasal) would dominate *V$_{nasal}$. Under that ranking, the derivation that begins in (54) would converge after step 2, and there would be no denasalization step 3 because IDENT(nasal) is ranked higher.

These hypothetical examples show that STS allows overapplication of neutralizing, morphophonemic processes, but it does not allow overapplication of non-neutralizing, allophonic processes. BR correspondence theory allows overapplication of processes of both types. This is a testable prediction.

McCarthy & Prince (1995a) mention, sometimes quite briefly, a total of eleven languages that are said to have overapplying, underapplying, or back-copying allophonc processes. Here we discuss the eight languages with overapplying processes, leaving the underapplying and back-copying ones for later sections.

In four of the eight languages, the putatively allophonic processes turn out to be neutralizing under strict scrutiny:

(57) Processes incorrectly identified as allophonic in McCarthy & Prince (1995a: Appendix B)

Language	Process	Original Source	Evidence
Javanese	medial *a* ~ final ɔ high V laxing	Dudas (1976)	*a/ɔ* have overlapping distribution: Final *a*s in loans and two native words (Poedjosoedarmo 1969: 167). Tense high V in elatives (1976: chapter 5)
Luiseño	*č* ~ *š*	Munro & Benson (1973)	Distribution is actually overlapping (Davis 1976: 202; Kiparsky 1986: 92ff.; Marantz 1982: 462).
Madurese	nasal harmony [ATR] harmony	Stevens (1968)	Distribution of [ATR] is clearly overlapping, [nasal] marginally so (Stevens 1968: 18-20, 22-23, 41-45).
Malay	nasal harmony medial *a* ~ final *ə*	Onn (1980), Kenstowicz (1981)	Overlapping distribution: Loans with final *a* (Teoh 1988: 27); phonemic vowel nasalization in Arabic loans (Teoh 1988: 136-137); /a/ → *ə* counterfed by *r* deletion (Onn 1980: 91),

In three other languages, the process that is said to overapply is actually applying independently in the reduplicant and the stem, because the conditions that make it applicable obtain in both. In Sesotho, stress assignment in the stem appears to overapply in the reduplicant. According to McNally (1990: 345), however, the reduplicant receives its own stress because it is a separate phonological word from the stem. In Yapese, an *a* umlaut process seems to overapply in the reduplicant (Jensen 1977: 112), but there is no good evidence that this is overapplication instead of a process whose structural description is met in reduplicant and stem independently (Kiparsky 1986: 101-102). The same can be said for umlaut and vowel raising processes in Rotuman (Churchward 1940).

The last of the eight examples is Squamish. Wilbur (1973b) proposes that vowel lowering by a following uvular variably overapplies and underapplies in reduplicated forms. The problem is that Wilbur's source, Kuipers (1967), gives only one example, a word that is lexically listed in reduplicated form (i.e., its unreduplicated form does not occur). At best, this case should be judged as not proven.

In this subsection, we have identified two ways in which STS's predictions about overapplication differ from those of BR correspondence theory. BR correspondence, but not STS, predicts the possibility of overapplication of processes that are conditioned at reduplicant + base juncture, and BR correspondence, but not STS, predicts the possibility of overapplication of allophonic processes. In their argument for BR correspondence, McCarthy & Prince (1995a, 1999) cite various examples of both phenomena, but we and others have discovered weaknesses in this evidence. Unless better examples are found, the nonexistence of these two types of overapplication supports STS over BR correspondence.

6.3. Back-copying

McCarthy & Prince also argue for P-OT and against serial approaches on the basis of a phenomenon they call *back-copying*. In back-copying, a phonological process whose structural description is met in the reduplicant overapplies to the base. Imagine, for example, a language in which place assimilation affects the final consonant in a CVC reduplicant and through it affects its correspondent in onset position in the base: /RED + panit/ → *pam-pamit*.[20] Back-copying is only analyzable with BR correspondence or a similar mechanism that links the segment in the reduplicant back to the segment that it copied:

(58) Back-copying with BR correspondence in hypothetical /RED + panit/ → *pam-pamit*

/RED + panit/	AGREE(place)	ID_{BR}(place)	ID_{IO}(place)
a. → $p_1a_2m_3\text{-}p_1a_2m_3i_4t_5$			1
b. $p_1a_2m_3\text{-}p_1a_2n_3i_4t_5$		1 **W**	**L**
c. $p_1a_2n_3\text{-}p_1a_2n_3i_4t_5$	1 **W**		**L**

STS has nothing like BR correspondence: once the Copy operation has taken place, there are no more ties between the segments in the reduplicant and their originals. Back-copying, if it exists, is a serious challenge for STS.

The *pam-pamit* example is hypothetical and seems implausible, as McCarthy & Prince (1995a: 326) concede. The examples of back-copying that they cite include two cases of coalescence "across" the reduplicative template, Chumash (42) and Tagalog. As we showed in (44) and (45), there is a straightforward analysis of these in STS that does not involve back-copying. Another of their examples is reduction and deletion in Klamath, but it has been reanalyzed by Zoll (2002). The last of McCarthy & Prince's examples is an allophonic alternation between *w* and *ŋʷ* in Southern Paiute, but Gurevich (2000) has shown that it is spurious. Kenstowicz & Banksira (1999) present a back-copying analysis of some data in Chaha, but Inkelas & Zoll (2005: 177-178) make a convincing case that this as a phonological assimilation process that has nothing to do with reduplication. In sum, there are no cases of back-copying of a phonological process that would challenge STS and support BR correspondence theory.

McCarthy & Prince's (1995a, 1999) discussion of back-copying is to a great extent focused on avoiding a bad prediction of BR correspondence theory known eponymously as the Kager-Hamilton Conundrum (KHC). The KHC is the observation that BR correspondence theory predicts that reduplicative templates can be back-copied to their bases under some rankings. The result is that partial reduplication is made total by deleting those segments in the base that are not in BR correspondence:

[20] Usually, only cases of partial reduplication can be identified as potential instances of back-copying. When reduplication is total, as in the Malay and Korean examples discussed in section 6.2, it is often impossible to say which copy is the base and which is the reduplicant. That makes it impossible to say whether a process is applying normally to the base and overapplying to the reduplicant, or applying normally to the reduplicant and overapplying (back-copying) to the base.

(59) Kager-Hamilton Conundrum

/RED + patak/	RED = σ	MAX$_{BR}$	MAX$_{IO}$
a. → $p_1a_2t_3$-$p_1a_2t_3$			2
b. $p_1a_2t_3a_4k_5$-$p_1a_2t_3a_4k_5$	1 **W**		**L**
c. $p_1a_2t_3$-$p_1a_2t_3a_4k_5$		1 **W**	**L**

The conundrum is that such cases were believed not to occur.

McCarthy & Prince's solution to the KHC relies on two assumptions, one of which is directly relevant to our concerns here: there are no templates. Specifically, the claim is that there are no templatic constraints like RED = σ in (59), nor are there any templates consisting of empty prosodic constituents, as in STS. Part of this claim is surely right. Templates do not need to stipulate basic markedness requirements on the reduplicant, such as simplification of onset clusters, when markedness constraints are already available to do that (McCarthy & Prince 1986/1996, 1994a; Steriade 1988). This fundamental idea of prosodic morphology carries over to STS, albeit in a different form, as we show in section 6.6. The elimination of templates that express basic shape requirements – e.g., this reduplicative morpheme is a syllable, this other one is a foot – has proven to be more challenging (though see Urbanczyk 2006 for recent discussion). Basic shape requirements are all that STS's templates express.

Some recent work questions whether the KHC is actually a conundrum, pointing to cases that look like back-copying of a template (Caballero 2006; Downing 2000; Gouskova 2007). If these examples hold up, then we will truly have a conundrum: templates can be back-copied, but phonological processes cannot. Neither BR correspondence theory nor STS is in a position to explain this observation, which suggests that there is something about templates that we do not yet fully grasp.

6.4. Underapplication

Another type of reduplication-phonology interaction is known as *underapplication*. Hypothetical underapplication of *h* deletion in Javanese would produce *bəɖah-bəɖahe*: even though the second *h* is in the intervocalic context of the deletion process, it does not in fact delete because its twin, the first *h*, does not meet those conditions.

McCarthy & Prince (1995a) show that P-OT allows underapplication only under very limited conditions, when some BR identity constraint is ranked high but overapplication is ruled out by some other constraint. One of their examples is an allophonic alternation between initial *g* and medial *ŋ* in Tokyo Japanese: *geta* 'clogs' versus *oriŋami* 'origami'. In the reduplicated mimetic *gara-gara* 'rattling', the medial consonant is *g* rather than *ŋ*, which they attribute to underapplication under the following ranking:

(60) Underapplication in Tokyo Japanese with BR correspondence

RED + gara	ID$_{BR}$(nas)	*[$_{PWd}$ŋ	*g	ID$_{IO}$(nas)
a. → gara-gara			2	
b. gara-ŋara	1 **W**		1 **L**	1 **W**
c. ŋara-ŋara		1 **W**	**L**	1 **W**

In (60)c, the process has overapplied, changing both instances of *g* into *ŋ*. Overapplication is ruled out by an undominated constraint against initial *ŋ*. Because the demands of undominated IDENT$_{BR}$(nasal) also have to be met, the candidate with underapplication wins instead.

Because it has no BR identity constraints, STS cannot reproduce this analysis. At it turns out, this seeming failure of STS is no liability, because the analysis is wrong. Ito & Mester (2003) (see also Silverman (2002)) point out that the two *gara* forms are separate phonological words, each with its own accent: $[ga'ra]_{PWd}$-$[ga'ra]_{PWd}$. Word-initially, *g* rather than *ŋ* is expected anyway, so there is no evidence here of allophonic under- or overapplication.

McCarthy & Prince's other main example of underapplication is palatalization in Akan. In native Akan roots, velars are prohibited before front vowels, where palatals are found instead: *tɕɛ*, **kɛ* 'divide'. Under certain conditions, the vowel of the reduplicative prefix is front even when the vowel of the stem is back: *kɪ-kaʔ* 'bite'. Observe that the *k* in of the reduplicant in *kɪ-kaʔ* has not palatalized even though it is followed by a front vowel: **tɕɪ-kaʔ*. McCarthy & Prince attribute this case of underapplication to the joint effects of a BR identity constraint and an OCP constraint that rules out backf-copying overapplication, as in **tɕɪ-tɕaʔ*.

Silverman (2002) proposes an alternative account of this phenomenon. The prohibition on velars before front vowels is a static property of roots, with no support from alternations. Its productivity is therefore questionable. Loan words gathered from Adomako (2008) show no tendency toward palatalization of velars before *i*/*ɪ*: *tɪnkɪ* 'think', *kipi* 'keep', *kiki* 'kick', *gɪrasɪ* 'glass', etc. The absence of palatalization in *kɪ-kaʔ* is not a case of underapplication. Rather, it is the expected failure of a process that is no longer productive.

Ablaut in Dakota has received more attention in the literature than any other case of underapplication (Kiparsky 1986; Marantz 1982; McCarthy & Prince 1995a; Shaw 1980; Sietsema 1988; Wilbur 1973a). Ablaut of /a/ to *e* applies at the end of certain lexically specified stems before clitics like *-šni:* $ap^há$ 'to strike', $ap^h\underline{é}$*-šni* 'he didn't strike it'; but *niyá* 'to breathe', *niy$\underline{á}$-šni* 'he is not breathing' with ap^ha (but not *niya*) in the class of ablaut-undergoers and *-šni* in the class of ablaut-triggers. There is no ablaut in the reduplicated form $ap^há$-p^ha-*šni* 'he didn't strike it repeatedly', and this has been analyzed as underapplication.

Calling $ap^há$-p^ha-*šni* a case of underapplication presupposes that it would be $ap^há$-$p^h\underline{e}$-*šni* if reduplication and ablaut interacted "normally", with neither over- nor underapplication. This presupposition is not reasonable, however. Just because /ap^ha/ is in the lexical class of ablaut-undergoers, it does not follow that its partial copy p^ha in the reduplicant also belongs to that lexical class. Lexical class membership is a property of morphemes, not segments. The propensity of the reduplicant to undergo ablaut is determined by the lexical class membership of the reduplicative morpheme, not that of the stem that is being copied. The reduplicative morpheme in Dakota is evidently not in the class of ablaut-undergoes, and no more needs to be said.

McCarthy & Prince discuss one other case of underapplication: a coda deletion process does not affect the reduplicant in Chumash because it would create a light syllable where the template requires a heavy one. In this example, they show, BR identity does no crucial work. It is therefore irrelevant to our program of comparing STS with BR correspondence theory. A similar account can be given for underapplication of syncope in Tonkawa reduplicated words (Gouskova 2007): *to-topoʔs*, **to-t.poʔs* 'I cut it (repetitive)' because the reduplicative template is a light syllable.

In sum, like overapplication and back-copying, underapplication provides no crucial support for BR correspondence over STS, once the evidence is regarded with a more skeptical eye.

6.5. Lookahead

Although overapplication and back-copying fail to support P-OT over STS, there is one more phenomenon to consider. We will use the term *lookahead* to refer to situations where copying seems to look ahead to the results of a subsequent phonological process. Imagine a language that allows a coda only if it is a nasal followed by a homorganic consonant. (This common pattern is usually attributed to the constraint CODA-COND (Goldsmith 1990; Ito 1989).) Could this language have a reduplicative affix that looks like (61), where the reduplicant is CV unless CVC is possible by copying a nasal and assimilating it? The paradox is that the nasal obviously cannot assimilate until it has been copied, but it cannot be copied until it has assimilated.

(61) Assimilation-dependent copying

pa.ta	*pa*-pa.ta
pa.na	*pam*-pa.na

This hypothetical language presents no difficulty for P-OT. The effects of assimilation and copying are evaluated together, in parallel. Copying can depend on assimilation and assimilation can depend on copying. Tableau (62) illustrates.

(62) Assimilation-dependent copying in P-OT

	CODA-COND	MAX_{BR}	IDENT_{BR}(Place)
a. → *pa*-pa.ta		2	
b. *pat*-pa.ta	1 **W**	1 **L**	
c. → *pam*-pa.na		1	1
d. *pan*-pa.na	1 **W**	1	**L**
e. *pa*-pa.na		2 **W**	**L**

Assimilation-dependent copying in the sense of (61), if it exists, would present a serious problem for serial evaluation; at the time of copying, the derivation cannot look ahead to see if the segment copied into coda position will be able to assimilate subsequently. There is, then, no way to distinguish segments that can copy as codas from segments that cannot.

McCarthy (2002: 144-145) bases an argument for P-OT on a supposed real-life instance of (61), Southern Paiute (Sapir 1930).[21] The contrast between examples with CV reduplication like *ma-ma.qa* 'to give' and examples with CVC reduplication and an assimilated nasal like [*pim*-pin.ti] 'to hang onto' looks like (61). We will show that these examples are misleading, however. In reality, Southern Paiute does not have a CODA-COND-conditioned alternation between CVC and CV reduplication, as in (62). Rather, it has two distinct reduplicative affix allomorphs, CVC and CV. (Later, we will propose that they are *ft* and σ templates, respectively.) The CVC allomorph, we will argue, is derived by first copying CVC and then making subsequent changes to the coda to satisfy markedness requirements.

The choice between the CVC and CV allomorphs is entirely unpredictable, but within each allomorph, the realization is fully predictable from the phonology. There are three realizations of CVC. In the geminating pattern (63)a, the coda of the reduplicant surfaces as a fully assimilated obstruent, resulting in a geminate. This occurs when the potential coda is not a nasal and the initial consonant is not a glide. In the nasalizing pattern (63)b, the coda of the reduplicant surfaces as a nasal that shares place with a following obstruent. This occurs when the potential coda is a nasal and the base does not begin with a glide. Finally, in the debuccalizing pattern (63)c, the reduplicant coda surfaces as a glottal stop before a base-initial glide.

[21] Although they are based on the same language, this argument for BR correspondence is unrelated to the back-copying argument in section 6.3.

(63) CVC Reduplication[22]

a. Geminating

patsi	pap-patsi	'older sister'
qati	qaq-qati	'to sit'

b. Nasalizing

pannaqa	pam-pannaqa	'several returned'
pinti	pim-pinti	'to hang onto'

c. Debuccalizing

yaqqa	yaʔ-yaqqa	'to cry'
waʔani`	waʔ-waʔani	'to yell'

With the CV allomorph, a base-initial obstruent stop is spirantized:

(64) CV Reduplication

a. Spirantizing

pai	pa-vai	'to call'
pinwa	pi-vinwa	'wife'

b. Non-Spirantizing

maqa	ma-maqa	'to give'
wanwi	wa-wanwi	'to stand'

The predictable phonological behavior of reduplicants represents a set of phonological generalizations that hold true for the language as a whole – the only permissible codas in Southern Paiute are geminates, assimilated nasals, and glottal stop, and intervocalic spirantization occurs with obstruent stops. McDonough (1987) points out a set of mutations triggered by non-reduplicative prefixes which parallel many of the above patterns. This suggests that the phonological processes at work apply generally in the language and are not reduplicant-specific.

It is not, however, predictable whether a given root will reduplicate as CVC or CV. This is no less true when the conditions for nasalizing reduplication are met, as shown by the near minimal pair in (65). In (65)a, we see a spirantizing CV reduplicant, and in (65)b we see a nasalizing CVC reduplicant. In both examples, the second consonant of the base is a nasal and the base-initial consonant is an obstruent that the nasal could assimilate to. If CV reduplicants were the result of failure to assimilate, we would expect (65)a to be *[*pim*-pinwa].

(65) Unpredictability of CVC vs. CV reduplication

a. pinwa	*pi*-vinwa	'wife'
b. pinti	*pim*-pinti	'to hang onto'

This evidence is sufficient to show that Southern Paiute is not actually an instance of the hypothetical pattern in (61) that requires the P-OT analysis in (62). The point of (62) is that CODA-COND can cause both assimilation of a coda in (62)c and non-copying of a coda in (62)a because the effects of assimilation and copying are evaluated together, in parallel. The reality of Southern Paiute is that copying or non-copying of a coda has nothing to do with CODA-COND. There are two lexically determined allomorphs of the reduplicative affix. One has a σ

22 These data and most of the classification of them come from McDonough (1987), which includes a collection of all reduplicated forms in Sapir (1931).

template, and it is satisfied by copying CV in accordance with the result shown in (31). The other allomorph has a *ft* template. It is always CVC, for reasons that we will now explain.

When the template is of type *ft*, the ranking in (66) and (67) will cause it to expand into a single syllable before copying a heavy syllable's worth of segments. Observe that the winning candidate at Step 2, [*qat*-qa.ti], violates Coda-Cond to satisfy Foot-Binarity, which rules out *[*qa*-qa.ti].[23]

(66) Step 1 of [*qaq*-qati]

ft + ft σ σ qa ti	*Copy(σ)	Hd(ft)	Hd(σ)	Ft-Bin	Coda-Cond	*Copy(seg)
a. → ft + ft σ σ σ qa ti			1	1		
b. ft + ft σ σ qa ti		1 **W**	**L**	1		
c. ft + ft σ σ σ σ qa ti qa ti	1 **W**		**L**	**L**		

[23] Here we assume the definition of Foot-Binarity in McCarthy and Prince (1986/1996): feet are binary under syllabic or moraic analysis. It is therefore satisfied by any foot consisting of at least two syllables or one heavy syllable.

(67) Step 2 of [*qaq*-qati]

ft + ft σ σ σ qa ti	*COPY(σ)	HD(ft)	HD(σ)	FT-BIN	CODA-COND	*COPY(SEG)
a. → ft + ft σ σ σ qat qa ti					1	1
b. ft + ft σ σ σ qa ti			1 **W**	1 **W**	**L**	**L**
c. ft + ft σ σ σ σ qa ti			2 **W**		**L**	**L**
d. ft + ft σ σ σ qa qa ti				1 **W**	**L**	1

At this point, the high-ranking prosodic constraints have been satisfied, and low-ranking CODA-COND can begin to have effects on the course of the derivation. We assume McCarthy's (2008a) analysis of CODA-COND effects in HS, which has connections with earlier work in rule-based phonology (Cho 1990; Kiparsky 1993; Mascaró 1987; Poser 1982). CODA-COND first causes debuccalization, which violates the faithfulness constraint *DELETE(Place) and the markedness constraint HAVE-PLACE. Satisfaction of HAVE-PLACE is then achieved by spreading a place feature from the following onset.[24] The following tableaux illustrate the last two steps of the derivation before convergence (Irrelevant constraints and structure have been omitted to keep the size of the tableaux manageable.)

(68) Step 3 of [*qaq*-qati]

qat.qa.ti	CODA-COND	*DELETE(Place)	HAVE-PLACE	*SPREAD(Place)
a. → qaʔ.qa.ti		1	1	
b. qat.qa.ti	1 **W**	**L**	**L**	

(69) Step 4 of [*qaq*-qati]

qaʔ.qa.ti	CODA-COND	*DELETE(Place)	HAVE-PLACE	*SPREAD(Place)
a. → qaq.qa.ti				1
b. qaʔ.qa.ti			1 **W**	**L**

[24] CODA-COND says that syllable coda position does not license place of articulation specifications (Goldsmith 1990; Ito 1989). A place feature that has spread from onset to coda is licensed by its association with the onset, so it does not violate this constraint.

The derivation of [*pim*-pinti] is identical except that the output of step 3 has the placeless nasal [N] rather than [ʔ]: [*piN*-pinti]. The debuccalizing type of reduplicant is the result of a constraint against geminate glides that dominates HAVE-PLACE: [*yaʔ*-yaqqa], *[*yay*-yaqqa].

The same processes – CVC copying, debuccalization, and (attempted) assimilation – occur for all three of the heavy-syllable reduplicant types. Crucially, the phonological processes that occur subsequent to copying have no impact on the size of the reduplicant. A pattern like that in (61), where the amount of phonological material copied in reduplication depends crucially on the ability of the copied material to undergo some subsequent phonological change, would pose a serious problem for a theory of phonology like HS, in which derivational look-ahead is impossible. In this section, however, we have shown that this prediction of HS/STS is in fact correct – the language claimed to exhibit the pattern in (61), Southern Paiute, in fact has a different sort of alternation. In Southern Paiute, the choice between CVC and CV reduplicants is lexically idiosyncratic: the phonologically predictable alternations do not alter the weight of the reduplicant. The amount of material copied is determined by the interaction of the prosodic template of the reduplicant and emergent markedness constraints, and can be evaluated entirely on the basis of phonological properties that are accessible at the time of copying. There is no need for derivational look-ahead or parallel evaluation.

In a back-handed way, Southern Paiute argues for STS and against BR correspondence. The McCarthy (2002: 144-145) analysis of Southern Paiute highlights a prediction of BR correspondence theory in P-OT. Our demonstration that Southern Paiute is not an example of that prediction turns an argument for parallelism into a problem: P-OT can analyze this now-hypothetical interaction, but STS cannot. Unless other, more persuasive instantiations of this prediction are forthcoming, this constitutes an argument for STS.

6.6. Skipping effects

We will use the pretheoretical term *skipping* to refer to situations where the surface form of the reduplicant matches a non-contiguous sequence of segments in the stem. Sanskrit is one of the best-known examples of this type:

(70) Skipping in Sanskrit perfect reduplication

du-druv	‘run’
ja-jña	‘know’
si-ṣmi	‘smile’
pa-psaː	‘devour’

In P-OT with base-reduplicant correspondence, skipping effects are attributed to crucial domination of CONTIGUITY$_{BR}$ by some markedness constraint(s). In Sanskrit, CONTIGUITY$_{BR}$ is dominated by *COMPLEX-ONSET, which rules out *dru-druv*, and by the Margin hierarchy (Prince & Smolensky 1993/2004), which favors low-sonority onsets and thereby rules out **ru-druv*. Tableau (71) shows this interaction:

(71) Sanskrit with BR correspondence

RED-druv	*COMP-ONS	*MAR/LIQ	*MAR/NAS	*MAR/FRIC	CONTIG$_{BR}$
a. → du-druv		1			1
b. dru-druv	1 **W**	2 **W**			**L**
c. ru-druv		2 **W**			**L**

When the first consonant is higher in sonority than the second one, then the Margin hierarchy favors preservation of the second and skipping is not necessary: *tu-ṣtu* ‘praise’, **su-ṣtu* because of *MARGIN/FRICATIVE.

As we explained in section 3.1, Copy(X) in STS is by hypothesis limited to copying strings of Xs. This means that skipping effects can never be produced in a single step of a derivation – *du-druv* is not among the candidates that GEN produces from input σ-*druv*. Skipping can only be obtained in a multi-step derivation, either by copying piecemeal, as in σ-*druv* → *u-druv* → *du-druv*, or by copying and then deleting, as in σ-*druv* → *dru-druv* → *du-druv*. As it turns out, only the latter option is viable.

We showed in (28) that piecemeal copying to satisfy NO-CODA is not viable with disyllabic reduplication: for a language to have codas at all, the template-filling imperative HEADEDNESS(σ) must dominate NO-CODA, which is therefore unable to force partial coping in [*σσ*]$_{\text{ft}}$-*paltiru* → *palti-paltiru*, *[*paσ*]$_{\text{ft}}$-*paltiru*. Piecemeal copying is not viable with Sanskrit's monosyllabic reduplication either. Ranking HEADEDNESS(σ) and *COMPLEX-ONSET above ONSET and COPY-LOCALLY would give σ-*druv* → *u-druv*. This derivation would converge on **u-druv* because Sanskrit has no general process for eliminating word-initial onsetless syllables, and in particular it does not have consonant-copying epenthesis that would yield *du-druv*.

Sanskrit must therefore be analyzed as copying + deletion, with derivations like σ-*druv* → *dru-druv* → *du-druv*. The crucial analytic move is to rank COPY-LOCALLY above *COMPLEX-ONSET, so adjacency of the copy to the string it has copied trumps syllable markedness:[25]

(72) Sanskrit in STS, step 1

σ-druv	HD(σ)	COPY-LOC	*COMP-ONS
a. → dru-druv			2
b. σ-druv	1 **W**		1 **L**
c. ru-druv		1 **W**	1 **L**
d. d-druv	1 **W**		1 **L**

At step 2, the cluster in the prefix simplifies by deleting its more sonorous member. This simplification occurs because *COMPLEX-ONSET dominates MAX$_{\text{affix}}$, though not MAX$_{\text{root}}$ (McCarthy & Prince 1995a):

(73) Sanskrit in STS, step 2

dru-druv	HD(σ)	COPY-LOC	MAX$_{\text{root}}$	*COMP-ONS	MAX$_{\text{affix}}$	*MAR/LIQ	*MAR/NAS	*MAR/FRIC
a. → du-druv				1	1	1		
b. dru-druv				2 **W**	**L**	2 **W**		
c. ru-druv				1	1	2 **W**		
d. dru-duv			1 **W**	1	**L**	1		

Cluster simplification in the reduplicant arguably reflects a general phonological process of the language, as the analysis in (73) entails. In Sanskrit, prefixes never have complex onsets, except for prefixes that are more word-like (cf. Janda & Joseph 2002). That is why all four Sanskrit reduplicative prefixes simplify onsets in exactly the same way as the perfect prefix.

The treatment of Sanskrit's complex onsets in the STS copy + deletion analysis resembles the analysis in Steriade (1988). The two analyses share another trait: they are both able to account for the syllable transfer effect in intensive reduplication, which proves to be problematic for BR correspondence theory. According to Steriade, the intensive has (at some

[25] The representation of syllable structure in (72) and (73) has been flattened to save space.

intermediate stage of the derivation) a $[\text{C}a\text{C}]_\sigma$ reduplicant if the second C is a sonorant: *mar-mard* 'rub, crush (full grade)'. The vowel of the reduplicant is always *a*, whatever the vowel of the root: *mar-mr̥d* 'id. (zero grade)'. The so-called syllable transfer effect arises when the root proffers two sonorant consonants, one of which is in a complex onset. The empirical finding is that the onset sonorant is never parsed as a coda in the reduplicant:

(74) Syllable transfer in the Sanskrit intensive[26]

kan-krand	kan-kr̥n̥d	'cry out (full/zero grade)'
*kar-krand	*kar-kr̥n̥d	
b^han-b^hranç	b^han-b^hr̥n̥ç	'fall (full/zero grade)'
*b^har-b^hranç	*b^har-b^hr̥n̥ç	

In STS and Steriade's full-copy theory, the complex onset is copied intact and then simplified: *σ-krand → kran-krand → kan-krand*. Thus, the sonorant has no opportunity to be parsed as a coda. But in BR correspondence theory, *kan-krand* and **kar-krand* tie on all the standard faithfulness constraints:

(75) Tie between *kan-krand* and **kar-krand* in BR correspondence theory

RED-krand	Max_{BR}	Dep_{BR}	$\text{Contig}_{\text{BR}}$	Anchor-L_{BR}	$\text{Linearity}_{\text{BR}}$
a. → $\text{k}_1\text{an}_4\text{-k}_1\text{r}_2\text{a}_3\text{n}_4\text{d}_5$	3	1	1		
b. $\text{k}_1\text{ar}_2\text{-k}_1\text{r}_2\text{a}_3\text{n}_4\text{d}_5$	3	1	1		

Recall that the intensive has a fixed *a* vowel, not a copy vowel. That is why Dep_{BR} is violated.

Resolving this tie in BR correspondence theory requires the constraint $\text{StRole}_{\text{BR}}$ in (41). The losing candidate (75)b violates StRole because the corresponding *r* segments in the reduplicant and the base have different syllabic roles: the one in the base is an onset and the one in the reduplicant is a coda. Candidate (75)b does not have this deficiency (though something more would have to be said about why the language allows alternations a nucleus to copy as a coda, as in the zero-grade forms).

The objection to StRole has already been explained in section 5: by the basic assumptions of Correspondence Theory, the existence of $\text{StRole}_{\text{BR}}$ entails the existence of $\text{StRole}_{\text{IO}}$. But $\text{StRole}_{\text{IO}}$ predicts unattested and presumably impossible contrasts in syllable structure, such as tautomorpheme *tab.la* contrasting with tautomorpheme *ta.bla*. In OT, the notion "possible contrast" is intimately connected with assumptions about the faithfulness component of Con. When those assumptions go astray, as they do with $\text{StRole}_{\text{IO}}$, then so do the predictions about contrast.

Intensive reduplication in Sanskrit supplies one argument that STS's copy + deletion approach to skipping is superior to the treatment of skipping in P-OT. Another argument was presented in section 4, in the discussion of disyllabic reduplication. P-OT predicts a type of skipping behavior that we called CVCV reduplication: /RED-paltiru/ → *pati-paltiru*. It predicts this under a hierarchy where No-Coda is ranked below Max_{IO} and above Max_{BR} and $\text{Contig}_{\text{BR}}$, as shown in (25). STS does not in general predict CVCV reduplication, however. In STS, the imperative to fill the disyllabic template is Headedness(σ), and Headedness(σ) has to dominate No-Coda in any language that has codas. As (27) shows, this means that piecemeal copying is not an option with a disyllabic template: there is no way to get *paσ-paltiru* to beat *palti-paltiru*.

[26] The ultimate surface forms of *kan-krand* and *kan-kr̥n̥d* are *kanikrand* and *kanikrad*, respectively. The ultimate surface forms of *b^han-b^hranç* and *b^han-b^hr̥n̥ç* are *bani:b^hranç* and *bani:b^hraç*, respectively. See Steriade (1988) for discussion.

In section 4, however, we also noted that the surface appearance of CVCV reduplication is possible if the reduplicant is subject to a later deletion process: … → *σσ-paltiru* → *palti-paltiru* → *pati-paltiru*. A near example of this behavior is Seediq, shown in (76) (repeated from (21)):

(76) Reduplication in Seediq (Tsukida 2005)

ˈrudan	rədə-ˈrudan	'old man/pl.'
ˈdawras	dərə-ˈdawras	'cliff/pl.'
ˈsəʔdiq	sədə-ˈsəʔdiq	'person/pl.'

Seediq has total reduplication of disyllabic roots (for which see section 7),[27] but the first copy is subject to reductive processes affecting pretonic syllables, which are always of the form C*ə*: /baytaq-an/ → *bəˈtaqan* 'to spear (goal voice 2)'.[28]

To account for the observation that pretonic syllables are always C*ə*, we will assume the ad hoc constraints NO-CODA$_{\text{preton}}$ and *PERIPH$_{\text{preton}}$. (The latter is violated by peripheral, non-*ə* vowels. In a P-OT analysis, these markedness constraints must dominate MAX$_{\text{IO}}$ and IDENT$_{\text{IO}}$(V-Place) to account for pretonic reduction in non-reduplicated words:

(77) Pretonic reduction in Seediq in P-OT, I

baytaq-an	NO-CODA$_{\text{preton}}$	*PERIPH$_{\text{preton}}$	MAX$_{\text{IO}}$	IDENT$_{\text{IO}}$(V-Place)
a. → bəˈtaqan			1	1
b. bayˈtaqan	1 **W**	1 **W**	**L**	**L**

To account for pretonic reduction in reduplicated words, these same markedness constraints must also dominate the BR counterparts of the faithfulness constraints in (77):

(78) Pretonic reduction in Seediq in P-OT, II

RED-dawras	NO-CODA$_{\text{preton}}$	*PERIPH$_{\text{preton}}$	MAX$_{\text{BR}}$	IDENT$_{\text{BR}}$(V-Place)
a. → dərə-ˈdawras			2	2
b. dawras-ˈdawras	2 **W**	2 **W**	**L**	**L**

The problem with this P-OT analysis is that it has no good explanation for why the reduplicant always preserves the second consonant of the medial cluster (i.e., *r* rather than *w* in *dərə-ˈdawras*). Because this is prefixing reduplication, we expect the usual bias for left-to-right association to assert itself (Marantz 1982), yielding **dəwə-ˈdawras*. Perhaps a story could be told about this particular example – *rə* is a better syllable than *wə* under the Margin hierarchy – but what is needed is a general account of why the second consonant is preserved in every case, and why the same is true in input-output mappings like /baytaq-an/ → *bəˈtaqan*.

This is part of a broader problem: cross-linguistically, why do consonant clusters simplify by deleting the first member and not the second? Extant proposals for solving this problem require a level of representation where both members of the cluster are present and syllabified as coda and onset (McCarthy 2008a, 2011; Steriade 2001/2008; Wilson 2000, 2001). STS has such a level of representation: it is the immediate output of the Copy(root) operation:

[27] Longer roots have a σ template: [*bə*-bəˈrigan] 'stores'

[28] Tsukida makes it clear that pretonic syllables are always of the form C*ə*, but /baytaq-an/ → *bəˈtaqan* is the only example cited of pretonic coda deletion in a non-reduplicated form. We assume that this process is general.

(79) Seediq step 2 in STS

ft + ft △ △ σ σ σ σ daw.ras	HD(σ)	NO-CODA$_{preton}$	*PERIPH$_{preton}$	*COPY (root)	MAX	ID(V-PLACE)
a. → ft + ft △ △ σ σ σ σ daw.ras daw.ras		2	2	1		
b. ft + ft △ △ σ σ σ σ daw.ras	2 **W**	**L**	**L**	**L**		

The derivation continues at steps 3 and 4 with deletion of the codas in pretonic syllables, thereby improving performance on NO-CODA$_{preton}$:

(80) Seediq step 3 in STS

ft + ft △ △ σ σ σ σ daw.ras daw.ras	HD(σ)	NO-CODA$_{preton}$	*PERIPH$_{preton}$	*COPY (root)	MAX	ID(V-PLACE)
a. → ft + ft △ △ σ σ σ σ da .ras daw.ras		1	2		1	
b. ft + ft △ △ σ σ σ σ daw.ras daw.ras		2 **W**	2		**L**	

The choice of which pretonic coda to delete first is arbitrary, as is the ranking of NO-CODA$_{preton}$ and *PERIPH$_{preton}$. In any case, the derivation continues with deletion of the other pretonic coda at step 4 and elimination of peripheral vowels in the same context at steps 5 and 6. It converges at step 7.

Can all cases of reduplicative skipping be reanalyzed as post-copying deletion processes? The answer to this question is complex because it turns on two difficult questions, one empirical and the other theoretical. The empirical question is whether there are languages where the reduplicant is subject to a deletion process that is demonstrably inapplicable to other morphemes of the same class. Sanskrit is not such a language because no prefix has a complex onset except for the preverbs *pra* 'forward' and *prati* 'back to', which are in separate, more word-like class from the reduplicative prefixes. The theoretical question, which was previously mentioned in section 4, is whether there can be markedness or faithfulness constraints specific to individual morphemes. We are not yet in a position to offer definitive answers to either of these questions, though at least the stakes for STS are now reasonably clear.

7. Copying grammatical constituents

Ghomeshi *et al.* (2004) and Kimper (2008) provide evidence that reduplication above the level of the word depends on syntactic, rather than prosodic, constituency (cf. Fitzpatrick-Cole 1996). There is, then, no reason to exclude the possibility that grammatical constituents can be targeted for copying at or below the level of the word as well. The obvious candidates for

Copy(X) treatment are root, stem, and morphosyntactic word. Copying of these grammatical constituents is controlled by *COPY(X) constraints, like copying of segments or prosodic constituents. We have already seen hints of this in discussions of Lardil (23) and Seediq (79). This section will provide a more systematic treatment.

Consider the simplest case, prosodically unrestricted copying of an entire stem, as in Indonesian:

(81) Indonesian plural reduplication (Cohn 1989)

hak	ˈhak-ˈhak	'right/pl.'
buku	ˈbuku-ˈbuku	'book/pl.'
wanita	waˈnita-waˈnita	'woman/pl.'
ˌmaʃaˈrakat	ˌmaʃaˈrakat-ˌmaʃaˈrakat	'society/pl.'
miˈnum-an	miˈnuman-miˈnuman	'drink/pl.'
kə-ˌmaʃaraˈkat-an	kəˌmaʃaraˈkatan-kəˌmaʃaraˈkatan	'society (abstract)/pl.'

This can be analyzed as satisfaction of a phonological word template by copying a stem, including its prosodic structure (Cohn 1989: 185), under the ranking in (82):

(82) Step 1 of Indonesian plural reduplication

PWd + PWd ft ft [maʃarakat]$_{stem}$	HD(PWd)	HD(ft)	*COPY(ft)	*COPY(stem)
a. → PWd (ft ft) maʃarakat + PWd (ft ft) [maʃarakat]$_{stem}$				1
b. PWd + PWd (ft ft) [maʃarakat]$_{stem}$	1 **W**			**L**
c. PWd (ft) + PWd (ft ft) [maʃarakat]$_{stem}$		1 **W**		**L**
d. PWd (ft) maʃa + PWd (ft ft) [maʃarakat]$_{stem}$			1 **W**	**L**

The high-ranking constraints rule out leaving the template unfilled (82)b, filling it gradually in top-down mode (82)c, and filling it by copying a foot rather than a stem (82)d.

Dyirbal is another example, this time of root copying. In Dyirbal, it will be recalled, the reduplicative pattern is normally σCV, but it is optionally σCVC just in case this will allow a disyllabic root to be copied entirely: *baɽa-baɽal* ~ *baɽal-baɽal* 'punch'. The basic ranking for σCV reduplication (in Balangao) was given in (13)–(15). The variation in Dyirbal can be accommodated by variable ranking of *COPY(seg) and *COPY(root) at the bottom of the hierarchy:

(83) Step 3 of Dyirbal *baɽa-baɽal* ~ *baɽal-baɽal*

ft + ft σ σ σ σ ba .ɽal	*COPY (σ)	HD (ft)	FT-BIN	HD (σ)	*COPY (seg)	*COPY (root)
a. → ft + ft σ σ σ σ ba .ɽa [ba .ɽal]$_{root}$					1	
b. → ft + ft σ σ σ σ ba .ɽal [ba .ɽal]$_{root}$						1

When the root is longer than two syllables, it cannot fit the disyllabic template, and so the root-copying option is foreclosed.

This view of total reduplication, when combined with the conception of skipping effects in section 6.6, has the potential to address an unwanted prediction of BR correspondence theory.[29] Skipping and other effects of markedness are not usually observed in total reduplication – we do not expect to find a variety of Indonesian where *bromocorah-bromocorah* 'criminals' becomes *bomocorah-bromocorah*, simplifying the onset cluster in the (presumed prefixed) reduplicant.[30] Yet BR correspondence theory predicts exactly this, if *COMPLEX-ONSET dominates MAX$_{BR}$. In STS, on the other hand, Copy(X) can only produce an exact copy of X: PWd + *bomocorah* → *bromocorah-bromocorah*. Any ranking of *COMPLEX-ONSET that would produce cluster simplification in the first stem copy would also be expected to produce cluster simplification in the second copy, and in the unreduplicated word as well. In any language that permits complex onsets, *COMPLEX-ONSET is ranked too low to affect the results of total reduplication.

8. Summary of Results

Throughout this article, we have identified various consequences of STS that differ from the predictions of BR correspondence theory. This section brings those results together in a single place, sharpening up the contrast between these two theories. The various types of reduplication that are predicted in STS are discussed first, followed by reduplication/phonology interactions, and finally a list of arguably unattested phenomena that STS does not predict but BR correspondence theory does. For clarity, we illustrate our points with schematic reduplicated examples in which the reduplicant is always prefixal and has been underlined for easy identification.

Syllable insertion with ft *template (section 4).* This top-down operation is only possible when the template is a *ft*. It is always followed by the segmental copy operation (after mora insertion), which fills the empty syllable nodes. Reduplicants formed in this way are disyllabic: *pa.ti-pa.ti.ku.* If the language generally allows word-medial codas, then these codas will always

[29] We are grateful to an anonymous reviewer for pointing out the relevance of this prediction.

[30] Steriade (1988: 81) attributes this observation to a personal communication from Diana Archangeli.

be possible in reduplicants : *pal.ti-pal.ti.ku.* Prefixed reduplicants end in an open syllable, regardless of whether the base's second syllable is closed: *pa.ti-pa.ti.ku, pa.ti-pa.tir.ku.*

Syllable copying with ft *template (section 5).* Other reduplicants are formed by bottom-up copying operations. Syllable copying is only possible with *ft* templates. Descriptively, the result of syllable copying is that the second syllable of the prefixed disyllabic reduplicant is closed if and only if the second syllable of the stem is closed: *pa.ti-pa.ti.ku, pal.ti-pal.ti.ku, pal.tir-pal.tir.ku.*

Segment copying with σ *template (section 4).* The other main type of reduplication involves *σ* templates and bottom-up segment copying into the syllabic template. If no weight requirement is imposed on the reduplicant, syllable markedness will limit it to a light syllable: *pa-pa.ti, pa-pal.ti.* If the reduplicant is required to be heavy, it will be CVC or CVː, depending on details of the syllable markedness ranking: *pat-pa.ti, pal-pal.ti* or *paː-pa.ti, paː-pal.ti.*

Mora copying with σ *template (section 5).* This is the type of reduplication found in Yaqui. The template is a *σ,* which is filled from the bottom-up with copied moras. Codas in Yaqui lack moras, leading to this pattern: *pa-pa.ta, pal-pal.ti.*

Total reduplication with PWd *template.* In full reduplication, the template is of type *PWd* and the copying operation targets a morphosyntactic constituent such as stem or word.

Interaction with phonological processes (section 6). STS claims that all instances of overapplication of neutralizing morphophonemic processes are analyzable serially, with the phonological process preceding the copying operation.

Skipping (section 6.6). Skipping effects (discontiguous reduplication) are derived serially via an initial copying operation followed by deletion at subsequent steps of the derivation. The deletion process should be applicable to all affixes of the same type as the reduplicant, if any exist.

The STS typology just sketched does not include any of the following patterns, all of which are predicted by BR correspondence theory under standard assumptions. We have argued that none of these patterns exists, and that their non-existence follows from STS.

a) Coda-skipping reduplication without a general coda deletion process (section 4): **pa.ti-pal.tir.ku.*
b) Disyllabic reduplication with obligate final coda (unless FINAL-C is active) (section 4): **pa.tik-pa.ti.ku, *pal.tir-pal.tir.ku.*
c) Simple syllable reduplication – that is, a variably weighted syllable with a consonant copied for the coda when possible (section 4): **pa-pa, *pat-pa.ti*
d) Contrastive syllabification, which is predicted by the STROLE correspondence constraint (section 5): **pa.ta* vs. **pat.a.*
e) Overapplication of processes occurring at base-reduplicant juncture (section 6.2).
f) Overapplication of non-neutralizing, allophonic processes (section 6.2).
g) Backcopying (section 6.3).
h) Underapplication (section 6.4).
i) Derivational lookahead affecting reduplicative copying (section 6.5).

If we are right that these alleged phenomena do not in fact exist, then the case for STS is very compelling indeed.

9. Conclusion

This article has presented Serial Template Satisfaction, a theory of reduplication embedded in Harmonic Serialism, which is a derivational version of Optimality Theory. The main premises of STS include a particular characterization of GEN's Copy operation, a competing Insert operation, and a constraint *COPY that under some circumstances allows Insert to beat Copy. In STS, template satisfaction can be and often is a gradual process that plays out over the course of a derivation. The derivation is also crucial to understanding STS's predictions about reduplication-phonology interactions and skipping effects.

In this article, we have taken pains to identify cases where STS and base-reduplicant correspondence theory in parallel OT make different predictions. We have argued that the predictions of STS are largely borne out, often to the disadvantage of BR correspondence theory. We have not yet essayed the more difficult task of comparing STS with more distant theories (Frampton 2009; Inkelas & Zoll 2005; Kiparsky 2010; Marantz 1982; Raimy 2000; Steriade 1988). That will have to be left for another time.

Acknowledgments This research was supported by grant BCS-0813829 from the National Science Foundation to the University of Massachusetts Amherst. We are grateful for the helpful, constructive comments received from the editor, Adam Albright, and the anonymous reviewers. We also happily acknowledge the assistance of the members of the McCarthy-Pater grant group, especially Joe Pater.

References

Adelaar, K. A., & Himmelmann, N. (Eds.). (2005). *The Austronesian languages of Asia and Madagascar*. London ; New York: Routledge.

Adomako, K. (2008). *Vowel epenthesis and consonant deletion in loanwords: A study of Akan*. Master's thesis, University of Tromso, Tromso, Norway.

Ahn, S.-C. (1998). *An Introduction to Korean Phonology*. Seoul: Hanshin Publishing Company.

Anderson, S. R. (1975). On the interaction of phonological rules of various types. *Journal of Linguistics, 11*, 39-62.

Applegate, R. B. (1976). Reduplication in Chumash. In M. Langdon, & S. Silver (Eds.), *Hokan Studies* (pp. 271-283). The Hague: Mouton.

Aronoff, M., Arsyad, A., Basri, H., & Broselow, E. (1987). Tier configuration in Makassarese reduplication. In A. Bosch, E. Schiller, & B. Need (Eds.), *CLS 23: Parasession on Autosegmental and Metrical Phonology* (pp. 1-15). Chicago: Chicago Linguistic Society.

Austin, P. (1981). *A Grammar of Diyari, South Australia*. Cambridge: Cambridge University Press.

Ballantyne, K. (1999). Reduplication in Yapese: A case of syllable copying. In C. Kitto, & C. Smallwood (Eds.), *Proceedings of AFLA VI* (pp. 17-24). Toronto: Toronto Working Papers in Linguistics.

Becker, M. (2008). *Phonological Trends in the Lexicon: The Role of Constraints*. Doctoral dissertation, University of Massachusetts Amherst, Amherst, MA.

Benua, L. (1997). *Transderivational Identity: Phonological Relations Between Words*. Doctoral dissertation, University of Massachusetts Amherst, Amherst, MA.

Blevins, J. (1995). The syllable in phonological theory. In J. A. Goldsmith (Ed.), *The Handbook of Phonological Theory* (pp. 206-244). Cambridge, MA, and Oxford, UK: Blackwell.

Blevins, J. (1996). Mokilese reduplication. *Linguistic Inquiry, 27*(3), 523-530.

Bloomfield, L. (1933). *Language*. New York: Holt, Rinehart & Winston.

Brown, L. (2005). Nias. In K. A. Adelaar, & N. Himmelmann (Eds.), *The Austronesian languages of Asia and Madagascar* (pp. 562-589). London ; New York: Routledge.

Buckley, E. (1997). Integrity and Correspondence in Manam Double Reduplication. *Proceedings of NELS 28*, 59-67.

Buckley, E. (1998). Alignment in Manam stress. *Linguistic Inquiry, 29*, 475-496.

Caballero, G. (2006). 'Templatic backcopying' in Guarijio abbreviated reduplication. *Morphology, 16*(2), 273-289, doi:10.1007/s11525-007-9108-8.

Carrier-Duncan, J. (1984). Some problems with prosodic accounts of reduplication. In M. Aronoff, & R. T. Oehrle (Eds.), *Language Sound Structure* (pp. 260-286). Cambridge, MA: MIT Press.

Cho, Y.-M. Y. (1990). *Parameters of Consonantal Assimilation*. Doctoral dissertation, Stanford University,

Chung, C. W. (1999). *Reduplication in Korean*. Doctoral dissertation, Indiana University, Bloomington, IN.

Chung, C. W. (2003). An Optimality-Theoretic approach to full reduplication in Korean. *The Linguistic Association of Korea Journal, 11*(2), 109-133.

Churchward, C. M. (1940). *Rotuman Grammar and Dictionary*. Sydney: Australasia Medical Publishing Co. [Repr. 1978, AMS Press, New York.].

Clements, G. N. (1986). Syllabification and epenthesis in the Barra dialect of Gaelic. In K. Bogers, H. van der Hulst, & M. Mous (Eds.), *The Phonological Representation of Suprasegmentals* (pp. 317-336). Dordrecht: Foris.

Cohn, A. (1989). Stress in Indonesian and bracketing paradoxes. *Natural Language & Linguistic Theory, 7*, 167-216.

Crowhurst, M. (2004). Mora Alignment. *Natural Language & Linguistic Theory, 22*(1), 127-177.

Crowley, T. (1978). *The Middle Clarence Dialects of Bandjalang*. Canberra: Australian Institute of Aboriginal Studies.

Crowley, T. (1982). *The Paamese Language of Vanuatu*. Canberra: Research School of Pacific Studies, the Australian National University.

Davis, J. F. (1976). Some notes on Luiseño phonology. *International Journal of American Linguistics, 42*(3), 192-216.

Demers, R. A., Escalante, F., & Jelinek, E. (1999). Prominence in Yaqui words. *International Journal of American Linguistics, 65*(1), 40-55.

Dixon, R. M. W. (1972). *The Dyirbal language of North Queensland*. Cambridge: Cambridge University Press.

Dixon, R. M. W. (1977). *A Grammar of Yidiny*. Cambridge: Cambridge University Press.

Donaldson, T. (1980). *Ngiyambaa: The Language of the Wangaaybuwan*. Cambridge: Cambridge University Press.

Donohue, M. (1999). *A Grammar of Tukang Besi*. Berlin and New York: Mouton de Gruyter.

Downing, L. (2000). Morhological and prosodic constraints on Kinande verbal reduplication. *Phonology, 17*, 1-38.

Dudas, K. (1976). *The Phonology and Morphology of Modern Javanese*. Doctoral dissertation, University of Illinois, Urbana-Champaign, Urbana, IL.

Elfner, E. (to appear). Stress-epenthesis interactions in Harmonic Serialism. In J. J. McCarthy, & J. Pater (Eds.), *Harmonic Grammar and Harmonic Serialism*. London: Equinox Publishing.

Fabricius, A. H. (1998). *A comparative survey of reduplication in Australian languages*. München: Lincom Europa.

Fitzpatrick-Cole, J. (1996). Reduplication meets the phonological phrase in Bengali. [doi: 10.1515/tlir.1996.13.3-4.305]. *The Linguistic Review, 13*(3-4), 305-356, doi:10.1515/tlir.1996.13.3-4.305.

Flack, K. (2007). Templatic morphology and indexed markedness constraints. *Linguistic Inquiry, 38*, 749-758.

Fraenkel, G. (1959). Yaqui phonemics. *Anthropological Linguistics, 1*(5), 7-18.

Frampton, J. (2009). *Distributed reduplication*. Cambridge, Mass.: MIT Press.

Gafos, A. (1998). Eliminating long-distance consonantal spreading. *Natural Language & Linguistic Theory, 16*, 223-278.

Ghomeshi, J., Jackendoff, R., Rosen, N., & Russell, K. (2004). Contrastive Focus Reduplication in English (The Salad-Salad Paper). *Natural Language & Linguistic Theory, 22*(2), 307-357.

Goldsmith, J. (1990). *Autosegmental and Metrical Phonology*. Oxford and Cambridge, MA: Blackwell.

Gouskova, M. (2007). The reduplicative template in Tonkawa. *Phonology, 24*, 367-396.

Gurevich, N. (2000). Reduplication in Southern Paiute and correspondence theory. In R. Billerey, & B. D. Lillehaugen (Eds.), *Proceedings of the 19th West Coast Conference on Formal Linguistics* (pp. 167-177). Somerville, MA: Cascadilla Press.

Hale, K. (1973). Deep-surface canonical disparities in relation to analysis and change: An Australian example. In T. Sebeok (Ed.), *Current Trends in Linguistics* (Vol. 9: Diachronic, Areal and Typological Linguistics, pp. 401-458). The Hague: Mouton.

Hansson, G. Ó. (2001). *Theoretical and Typological Issues in Consonant Harmony*. Doctoral dissertation, University of California, Berkeley, CA.

Harvey, M. (1991). Glottal stop, underspecification and syllable structure among the Top End languages. *Australian Journal of Linguistics, 11*, 67-105.

Haugen, J. D. (2003). Allomorphy in Yaqui reduplication. In L. M. Barragan, & J. D. Haugen (Eds.), *MIT Working Papers on Endangered and Less Familiar Languages 5* (pp. 75-103). Cambridge, MA: MIT Working Papers in Linguistics.

Haugen, J. D. (2008). *Morphology at the interfaces: Reduplication and noun incorporation in Uto-Aztecan*. Amsterdam; Philadelphia: John Benjamins Pub.

Haugen, J. D. (2009). What is the base for reduplication? *Linguistic Inquiry, 40*(3), 505-514.

Hayes, B. (1989). Compensatory lengthening in moraic phonology. *Linguistic Inquiry, 20*, 253-306.

Hayes, B., & Abad, M. (1989). Reduplication and syllabification in Ilokano. *Lingua, 77*, 331-374.

Heath, J. (1980). *Basic Materials in Ritharngu: Grammar, Texts, and Dictionary* (Pacific linguistics). Canberra: Dept. of Linguistics, Research School of Pacific Studies, Australian National University.

Heath, J. (1981). *Basic Materials in Mara: Grammar, Texts, and Dictionary* (Pacific linguistics, no. 60). [Canberra]: Dept. of Linguistics, Research School of Pacific Studies, Australian National University.

Himmelmann, N. (2001). *Sourcebook on Tomini-Tolitoli languages : general information and word lists* (Pacific linguistics, 511). Canberra: Pacific Linguistics, Research School of Pacific and Asian Studies, the Australian National University.

Himmelmann, N. (2005). The Austronesian languages of Asia and Madagascar: Typological characteristics. In K. A. Adelaar, & N. Himmelmann (Eds.), *The Austronesian languages of Asia and Madagascar* (pp. 110-181). London ; New York: Routledge.

Horne, E. C. (1990). *Beginning Javanese / by Elinor C. Horne* (Yale linguistic series, 3). New Haven: Yale University Press.

Hurch, B. (2005 et seq.). Graz Database on Reduplication.

Hyman, L. (1985). *A Theory of Phonological Weight*. Dordrecht: Foris.

Inkelas, S., Orgun, O., & Zoll, C. (1997). The implications of lexical exceptions for the nature of grammar. In I. Roca (Ed.), *Derivations and Constraints in Phonology* (pp. 393-418). Oxford: Oxford University Press.

Inkelas, S., & Zoll, C. (2005). *Reduplication: Doubling in Morphology*. Cambridge ; New York: Cambridge University Press.

Ito, J. (1986). *Syllable Theory in Prosodic Phonology*. Doctoral dissertation, University of Massachusetts Amherst,

Ito, J. (1989). A prosodic theory of epenthesis. *Natural Language & Linguistic Theory, 7*, 217-259.

Ito, J., & Mester, A. (2003). Lexical and postlexical phonology in Optimality Theory: Evidence from Japanese. *Linguistische Berichte, 11*, 183-207.

Janda, R. D., & Joseph, B. D. (2002). Sanskrit as She has been Misanalyzed Prosodically. In R. Singh (Ed.), *The Yearbook of South Asian Languages and Linguistics* (pp. 59-90). New Delhi: Sage.

Jensen, J. T. (1977). *Yapese Reference Grammar*. Honolulu: University Press of Hawaii.

Jesney, K. (to appear). Positional faithfulness, non-locality, and the Harmonic Serialism solution. In S. Lima, K. Mullin, & B. Smith (Eds.), *Proceedings of the 39th Annual Meeting of the North East Linguistic Society*. Amherst, MA: GLSA Publications.

Kager, R. (2009). Lexical irregularity and the typology of contrast. In K. Hanson, & S. Inkelas (Eds.), *The nature of the word: Studies in honor of Paul Kiparsky* (pp. 397-432). Cambridge, MA: MIT Press.

Kennedy, R. (2003). *Confluence in Phonology: Evidence from Micronesian Reduplication*. Doctoral dissertation, University of Arizona, Tucson, AZ.

Kennedy, R. (2005). The binarity effect in Kosraean reduplication. *Phonology, 22*, 145-168.

Kennedy, R. (2008). Evidence for Morphoprosodic Alignment in Reduplication. *Linguistic Inquiry, 39*(4), 589-614, doi:doi:10.1162/ling.2008.39.4.589.

Kenstowicz, M. (1981). Functional explanations in generative phonology. In D. L. Goyvaerts (Ed.), *Phonology in the 1980's* (pp. 431-444). Ghent: E. Story-Scientia.

Kenstowicz, M., & Banksira, D. P. (1999). Reduplicative Identity in Chaha. *Linguistic Inquiry, 30*(4), 573-585.

Kimper, W. (2008). Syntactic reduplication and the spellout of movement chains. Amherst, MA: University of Massachusetts Amherst.

Kimper, W. (2011). Locality and globality in phonological variation. *Natural Language & Linguistic Theory, 29*(2), 423-465.

Kimper, W. (to appear). Harmony is myopic. *Linguistic Inquiry*.

Kiparsky, P. (1979). Metrical structure assignment is cyclic. *Linguistic Inquiry, 10*, 421-441.

Kiparsky, P. (1986). The phonology of reduplication. Stanford, CA: Stanford University.

Kiparsky, P. (1993). Blocking in non-derived environments. In S. Hargus, & E. Kaisse (Eds.), *Studies in Lexical Phonology* (pp. 277-313). San Diego: Academic Press.

Kiparsky, P. (2010). Reduplication in Stratal OT. In L. Uyechi, & L. H. Wee (Eds.), *Reality Exploration and Discovery: Pattern Interaction in Language & Life* (pp. 125-142). Stanford, CA: CSLI Publications.

Klamer, M. (2005). Kambera. In K. A. Adelaar, & N. Himmelmann (Eds.), *The Austronesian languages of Asia and Madagascar* (pp. 709-734). London ; New York: Routledge.

Klinken, C. L. v. (1999). *A grammar of the Fehan dialect of Tetun, an Austronesian language of West Timor* (Pacific linguistics, v. 155). Canberra: Research School of Pacific and Asian Studies, the Australian National University.

Klokeid, T. (1976). *Topics in Lardil Grammar*. Doctoral dissertation, MIT, Cambridge, MA.

Kuipers, A. H. (1967). *The Squamish language, Grammar, texts, dictionary: 2 parts*. The Hague: Mouton.

Lee, K.-D. (1975). *Kusaiean Reference Grammar*. Honolulu: University of Hawaii Press.

Lichtenberk, F. (1983). *A Grammar of Manam*. Honolulu: University of Hawaii Press.

Lunden, S. L. A. (2006). Reduplicant placement, anchoring, and locality. Williamsburg, VA: College of William and Mary.

Marantz, A. (1982). Re Reduplication. *Linguistic Inquiry, 13*, 483-545.

Mascaró, J. (1987). A reduction and spreading theory of voicing and other sound effects. Barcelona: Universitat Autònoma de Barcelona.

McCarthy, J. J. (1993). A case of surface constraint violation. *Canadian Journal of Linguistics, 38*, 169-195.

McCarthy, J. J. (2000). Harmonic serialism and parallelism. In M. Hirotani (Ed.), *Proceedings of the North East Linguistics Society 30* (pp. 501-524). Amherst, MA: GLSA Publications.

McCarthy, J. J. (2002). *A Thematic Guide to Optimality Theory* (Research Surveys in Linguistics). Cambridge: Cambridge University Press.

McCarthy, J. J. (2003). Sympathy, cumulativity, and the Duke-of-York gambit. In C. Féry, & R. v. d. Vijver (Eds.), *The Syllable in Optimality Theory* (pp. 23-76). Cambridge: Cambridge University Press.

McCarthy, J. J. (2007a). *Hidden Generalizations: Phonological Opacity in Optimality Theory*. London: Equinox Publishing.

McCarthy, J. J. (2007b). Restraint of analysis. In S. Blaho, P. Bye, & M. Krämer (Eds.), *Freedom of Analysis* (pp. 203-231, Studies in Generative Grammar, Vol. 95). Berlin and New York: Mouton de Gruyter.

McCarthy, J. J. (2008a). The gradual path to cluster simplification. *Phonology, 25*, 271-319.

McCarthy, J. J. (2008b). The serial interaction of stress and syncope. *Natural Language & Linguistic Theory, 26*, 499-546.

McCarthy, J. J. (2009). Studying Gen. *Journal of the Phonetic Society of Japan, 13*(2), 3-12.

McCarthy, J. J. (2010a). Autosegmental spreading in Optimality Theory. In J. Goldsmith, E. Hume, & L. Wetzels (Eds.), *Tones and Features* (pp. 195-222). Berlin and New York: Mouton de Gruyter.

McCarthy, J. J. (2010b). *Doing Optimality Theory* supplement on Harmonic Serialism. Amherst, MA: University of Massachusetts Amherst.

McCarthy, J. J. (2010c). An introduction to Harmonic Serialism. *Language and Linguistics Compass, 4*(10), 1001-1018, doi:10.1111/j.1749-818x.2010.00240.x.

McCarthy, J. J. (2011). Perceptually grounded faithfulness in Harmonic Serialism. *Linguistic Inquiry, 42*(1).

McCarthy, J. J., & Prince, A. (1986/1996). Prosodic Morphology 1986. New Brunswick, NJ: Rutgers University Center for Cognitive Science.

McCarthy, J. J., & Prince, A. (1990). Foot and word in prosodic morphology: The Arabic broken plural. *Natural Language & Linguistic Theory, 8*, 209-283.

McCarthy, J. J., & Prince, A. (1993). Prosodic Morphology: Constraint Interaction and Satisfaction. New Brunswick, NJ: Rutgers University Center for Cognitive Science.

McCarthy, J. J., & Prince, A. (1994a). The emergence of the unmarked: Optimality in prosodic morphology. In M. Gonzàlez (Ed.), *Proceedings of the North East Linguistic Society 24* (pp. 333-379). Amherst, MA: GLSA Publications.

McCarthy, J. J., & Prince, A. (1994b). Two lectures on Prosodic Morphology (Utrecht, 1994). Part I: Template form in Prosodic Morphology. Part II: Faithfulness and reduplicative identity. Amherst, MA and New Brunswick, NJ: University of Massachusetts Amherst and Rutgers University.

McCarthy, J. J., & Prince, A. (1995a). Faithfulness and reduplicative identity. In J. Beckman, L. Walsh Dickey, & S. Urbanczyk (Eds.), *University of Massachusetts Occasional Papers in Linguistics 18* (pp. 249-384). Amherst, MA: GLSA Publications.

McCarthy, J. J., & Prince, A. (1995b). Prosodic morphology. In J. A. Goldsmith (Ed.), *The Handbook of Phonological Theory* (pp. 318-366). Cambridge, MA, and Oxford, UK: Blackwell.

McCarthy, J. J., & Prince, A. (1999). Faithfulness and identity in Prosodic Morphology. In R. Kager, H. van der Hulst, & W. Zonneveld (Eds.), *The Prosody-Morphology Interface* (pp. 218-309). Cambridge: Cambridge University Press.

McDonough, J. (1987). Concerning the nature of certain consonants in Southern Paiute, ... Amherst, MA: University of Massachusetts.

McGregor, W. (1990). *A Functional Grammar of Gooniyandi*. Amsterdam: John Benjamins.

McNally, L. (1990). Multiplanar reduplication: Evidence from Sesotho. In A. Halpern (Ed.), *The Proceedings of the West Coast Conference on Formal Linguistics 9* (pp. 331-346). Stanford: Stanford Linguistic Association.

Merlan, F. (1982). *Mangarayi* (Lingua Descriptive Series). Amsterdam: North Holland.

Mester, A. (1986). *Studies in Tier Structure*. Doctoral dissertation, University of Massachusetts Amherst,

Moravcsik, E. (1978). Reduplicative constructions. In J. Greenberg (Ed.), *Universals of Human Language* (pp. 297-334 (vol. 293)). Stanford: Stanford University Press.

Morphy, F. (1983). Djapu, a Yolngu dialect. In R. M. W. Dixon, & B. J. Blake (Eds.), *Handbook of Australian Languages, Volume III* (pp. 1-188). Amsterdam: John Benjamins.

Munro, P., & Benson, P. (1973). Reduplication and rule ordering in Luiseño. *International Journal of American Linguistics, 39*, 15-21.

Nash, D. (1980). *Topics in Warlpiri Grammar*. Doctoral dissertation, MIT, Cambridge, MA.

Nelson, N. (2003). *Asymmetric Anchoring*. Doctoral dissertation, Rutgers University, New Brunswick, NJ.

Nelson, N. (2005). Wrong side reduplication is epiphenomenal: evidence from Yoruba. In B. Hurch (Ed.), *Studies on Reduplication* (pp. 135-160). Berlin: Walter de Gruyter.

Odden, D., & Odden, M. (1985). Ordered reduplication in Kihehe. *Linguistic Inquiry, 16*, 497-503.

Onn, F. M. (1980). *Aspects of Malay Phonology and Morphology: A Generative Approach*. Kuala Lumpur: Universiti Kebangsaan Malaysia.

Pater, J. (2008). Morpheme-specific phonology: Constraint indexation and inconsistency resolution. In S. Parker (Ed.), *Phonological Argumentation: Essays on Evidence and Motivation*. London: Equinox Publishing.

Payne, D. (1981). *The Phonology and Morphology of Axininca Campa*. Arlington, TX: The Summer Institute of Linguistics and University of Texas at Arlington.

Poedjosoedarmo, S. (1969). Wordlist of Javanese non-Ngoko vocabularies. *Indonesia, 7*, 65-169.

Poser, W. J. (1982). Phonological representations and action-at-a-distance. In H. van der Hulst, & N. Smith (Eds.), *The Structure of Phonological Representations* (Vol. 2, pp. 121-158). Dordrecht: Foris.

Poser, W. J. (1989). The metrical foot in Diyari. *Phonology, 6*, 117-148.

Prince, A. (2002). Arguing optimality. In A. Carpenter, A. Coetzee, & P. de Lacy (Eds.), *University of Massachusetts Occasional Papers in Linguistics 26: Papers in Optimality Theory II* (pp. 269-304). Amherst, MA: GLSA.

Prince, A., & Smolensky, P. (1993/2004). *Optimality Theory: Constraint Interaction in Generative Grammar*. Malden, MA, and Oxford, UK: Blackwell.

Pruitt, K. (2010). Serialism and locality in constraint-based metrical parsing. *Phonology, 27*, 481-526.

Raimy, E. (2000). *The phonology and morphology of reduplication* (Studies in generative grammar, 52). Berlin; New York: Mouton de Gruyter.

Raimy, E. (2011). Reduplication. In M. van Oostendorp, C. Ewen, E. Hume, & K. Rice (Eds.), *The Blackwell Companion to Phonology* (pp. 2383-2413). Malden, MA, and Oxford, UK: Blackwell.

Rau, D. V., & Dong, M.-N. (2005). Yami reduplication. *Concentric: Studies in Linguistics, 31*(2), 57-87.

Riggle, J. (2004). Nonlocal reduplication. *Proceedings of NELS 34*, 485-496.

Rose, S., & Walker, R. (2004). A typology of consonant agreement as correspondence. *Language, 80*, 475-531.

Rubino, C. (2005). Iloko. In K. A. Adelaar, & N. Himmelmann (Eds.), *The Austronesian languages of Asia and Madagascar* (pp. 326-349). London ; New York: Routledge.

Russell, K. (1997). Optimality Theory and morphology. In D. Archangeli, & D. T. Langendoen (Eds.), *Optimality Theory: An Overview* (pp. 102-133). Oxford: Blackwell.

Sapir, E. (1930). Southern Paiute, a Shoshonean Language. *Proceedings of the American Academy of Arts and Sciences, 65*, nos. 1-3.

Sapir, E. (1931). Southern Paiute Dictionary. *Proceedings of the American Academy of Arts and Sciences, 65*(3), 537.

Selkirk, E. (1995). The prosodic structure of function words. In J. Beckman, L. Walsh Dickey, & S. Urbanczyk (Eds.), *University of Massachusetts Occasional Papers in Linguistics 18: Papers in Optimality Theory* (pp. 439-470, University of Massachusetts Occasional Papers 18). Amherst, MA: GLSA Publications.

Shaw, P. (1980). *Dakota Phonology and Morphology*. New York: Garland.

Shaw, P. (2005). Non-adjacency in reduplication. In B. Hurch (Ed.), *Studies on Reduplication* (pp. 161-210). Berlin and New York: Mouton de Gruyter.

Shetler, J. (1976). *Notes on Balangao grammar* (Language data : Asian-Pacific series, no. 9). Huntington Beach, Calif.: Summer Institute of Linguistics.

Sietsema, B. (1988). Reduplication in Dakota. In G. L. L. McCleod, & D. Brentari (Eds.), *CLS 24: Papers from the 24th Annual Regional Meeting of the Chicago Linguistic Society. Part One: The General Session* (pp. 337-352). Chicago: Chicago Linguistic Society.

Silverman, D. (2002). Dynamic versus static phonotactic conditions in prosodic morphology. *Linguistics, 40*(1), 29-59.

Spaelti, P. (1995). A constraint-based theory of reduplication patterns. In J. Camacho, L. Choueiri, & M. Watanabe (Eds.), *Proceedings of the Fourteenth West Coast Conference on Formal Linguistics* (pp. 477-492). Stanford, CA: CSLI Publications.

Spaelti, P. (1997). *Dimensions of Variation in Multi-Pattern Reduplication*. Doctoral dissertation, University of California, Santa Cruz,

Spring, C. (1990). *Implications of Axininca Campa for Prosodic Morphology and Reduplication*. Doctoral dissertation, University of Arizona, Tucson, AZ.

Staubs, R. (to appear). Pathologies of feature-driven stress. In *Proceedings of NELS 41*. Amherst, MA: GLSA Publications.

Staubs, R., Becker, M., Potts, C., Pratt, P., McCarthy, J. J., & Pater, J. (2010). OT-Help 2.0 [computer program]. Amherst, MA: University of Massachusetts Amherst.

Steriade, D. (1988). Reduplication and syllable transfer in Sanskrit and elsewhere. *Phonology, 5*, 73-155.

Steriade, D. (2001/2008). The phonology of perceptibility effects: The P-map and its consequences for constraint organization. In K. Hanson, & S. Inkelas (Eds.), *The Nature of the Word: Studies in Honor of Paul Kiparsky* (pp. 151-180). Cambridge, MA: MIT Press.

Stevens, A. M. (1968). *Madurese Phonology and Morphology*. New Haven, CT: American Oriental Society (American Oriental Series 52).

Teoh, B. S. (1988). *Aspects of Malay Phonology Revisited -- A Non-linear Approach*. Doctoral dissertation, University of Illinois at Urbana-Champaign, Urbana, IL.

Thurgood, E. (1997). Bontok Reduplication and Prosodic Templates. *Oceanic Linguistics, 36*(1), 135-148.

Tsukida, N. (2005). Seediq. In K. A. Adelaar, & N. Himmelmann (Eds.), *The Austronesian languages of Asia and Madagascar* (pp. 291-325). London ; New York: Routledge.

Urbanczyk, S. (2006). Reduplicative form and the root-affix asymmetry. *Natural Language & Linguistic Theory, 24*, 179-240.

Van Engelenhoven, A., & Williams-van Klinken, C. (2005). Tetun and Leti. In K. A. Adelaar, & N. Himmelmann (Eds.), *The Austronesian languages of Asia and Madagascar* (pp. 735-768). London ; New York: Routledge.

Walker, R. (2010). Nonmyopic harmony and the nature of derivations. *Linguistic Inquiry, 41*, 169-179.

Wiese, R. (2001). The structure of the German vocabulary: Edge marking of categories and functional considerations. *Linguistics, 39*, 95-115.

Wilbur, R. (1973a). *The Phonology of Reduplication*. Doctoral dissertation, University of Illinois,

Wilbur, R. (1973b). Reduplication and rule ordering. In *CLS 9* (pp. 679-687). Chicago: Chicago Linguistic Society.

Wilkinson, K. (1986). Prosodic structure and Lardil phonology. Amherst, MA: University of Massachusetts Amherst.

Wilkinson, K. (1988). Prosodic structure and Lardil phonology. *Linguistic Inquiry, 19*, 325-334.

Wilson, C. (2000). *Targeted Constraints: An Approach to Contextual Neutralization in Optimality Theory*. Doctoral dissertation, Johns Hopkins University, Baltimore, MD.

Wilson, C. (2001). Consonant cluster neutralization and targeted constraints. *Phonology, 18*, 147-197.

Wolf, M. (2008). *Optimal Interleaving: Serial Phonology-Morphology Interaction in a Constraint-Based Model*. Doctoral dissertation, University of Massachusetts Amherst, Amherst, MA.

Zobel, E. (2005). Buol. In K. A. Adelaar, & N. Himmelmann (Eds.), *The Austronesian languages of Asia and Madagascar* (pp. 625-648). London ; New York: Routledge.

Zoll, C. (2002). Vowel Reduction and Reduplication in Klamath. *Linguistic Inquiry, 33*(3), 520-527.