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100. Reduplication

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1 Introduction

Reduplication is the phonological repetition of segmental material triggered by a morphological source. This definition captures the core aspects of this linguistic phenomenon and distinguishes it from other phenomena that cause the surface repetition of phonological material. This chapter provides a synthesis of questions about reduplication based on classic and contemporary models of reduplication. The most important questions about reduplication can be summarized as the *strong hypothesis for reduplication* (SHR).

(1) *The strong hypothesis for reduplication*

a. *Architectural modularity*
There is a morphology module that is distinct and prior to a phonology module. Both modules have internal structure.

b. *Bipartite reduplication*
The morphology module creates a reduplicated structure, but segmental copying occurs later in the phonology module.

c. *Identity is synchrony*
The source of identity effects in reduplicated forms is the fact that the repeated segments in the output are a single synchronous representation prior to copying. After copying has occurred, the repeated segments are

distinct representations and can diverge in identity on the basis of the general application of phonological rules.

The proposed answers to these questions identified by the SHR demonstrate that reduplication informs us about grammatical architecture in general, the relation between the morphology and phonology components, and phonological identity. Two important topics in reduplication are not represented in the SHR. The first is the question of global *vs.* local computation in grammar and the second is reduplicative templates. Each of these topics will be discussed, when they are raised with respect to particular models of reduplication.

This chapter is laid out as follows. First, classic models of reduplication that help define the SHR are presented in §2. Part of the discussion of each classic model is identifying the contribution that it makes to the SHR. §3 turns to contemporary models of reduplication. Fundamental differences in contemporary models can be identified by each model's orientation to the SHR. §4 identifies open questions about reduplication that deserve attention because they raise fundamental questions about what linguistic phenomena should be treated as reduplication.

2 Classic models of reduplication

Classic models of reduplication are no longer being actively pursued. The importance of knowing about them, though, resides in the contribution that each of them made to the *strong hypothesis for reduplication*.

2.1 Unusual phonology in reduplication

Wilbur (1973) marks the beginning of the formal investigation of reduplication in generative grammar. Wilbur defines R_o as "the portion of the unreduplicated form … of which a copy is made" and states: "the part which is the copy will be referred to as … R_r" (1973: 7). This nomenclature also identifies, but does not name, the region of the unreduplicated base that is not part of R_o. Using this notation a reduplicated form can be delimited into sections, as in (2b, 2c). Both R_o and R_r are separated by a dash. R_o is enclosed in square brackets and R_r is underlined. Any remaining segments are part of the unreduplicated base.

(2) *VC reduplication in Chumash* (Wilbur 1973: 7)

a.	/ʔas/ + redup ($C_1V_1C_2$-V_1C_2)	ʔas-as	'chin'
b.	suffixing reduplication	ʔ-[as]-<u>as</u>	
c.	infixing reduplication	ʔ-<u>as</u>-[as]	

Wilbur notes that in cases of total reduplication when R_o and R_r are identical, it cannot be determined whether the reduplicated structure is R_o–R_r or R_r–R_o. In cases of partial reduplication, R_r can be determined by considering the unreduplicated form that consists of R_o and the rest of the base. R_r will then be the remaining segmental material that is repeated. This parsing, when applied to (2b, 2c), identifies one of the [as] sequences as R_r, but we cannot distinguish between (2b) and (2c). One way to distinguish between these options is that the placement of R_r should not alternate among prefixing/suffixing/infixing patterns, and should match the general morphological processes of the given language. For example, if a language does not have any infixes, then R_r should not be analyzed as an infix, (2c).

Wilbur (1973) demonstrates that there are non-trivial interactions between reduplication and phonological rules, because of the **Chomsky and Halle (1968**: 236) hypothesis that all morphological rules precede all phonological rules, reduplication being a morphological rule. **Wilbur (1973)** describes three different types of interactions between reduplication and phonology.

(3) *Reduplication and phonological rule interaction* (**Wilbur 1973**)

a. *normal application*

"Forms where R_r and R_o are not identical at the surface are the result of the normal application of any phonological rule to a form which meets its structural description." (1973: 15)

b. *failure to apply*
"those forms in which either R_o or R_r meets the structural description of a phonological rule and yet has not undergone that rule." (1973: 18)

c. *overapplication*
"Overapplication of a phonological rule refers to the fact that in many reduplicated forms, the structural change applies to a form that does not meet the structural description of the rule." (1973: 26)

The terms "normal application" and "overapplication" have been retained to this day, but "failure to apply" is now normally termed "underapplication." Only normal application is accounted for if the morphology before phonology hypothesis from **Chomsky and Halle (1968)** is strictly adopted. The reason for this is that, if reduplication is a morphological rule, the copying of the segments to create R_o and R_r will occur before any phonological rule has the opportunity to apply. Consequently, all phonological rules will apply after reduplication, and thus there can only be transparent application of a phonological rule.

Over- or underapplication of a phonological rule suggests that either the morphology before phonology hypothesis, (1a) of the SHR, or some aspect of the model of reduplication must be modified. The basic ordering problem at issue is that R_r must be created at some point in the derivation. Overapplication is problematic, because this situation requires ordering a phonological rule before a morphological process. If the relevant phonological environment appears in the R_o, then ordering the phonological rule prior to reduplication will solve the problem. Underapplication is a more difficult problem, because there is no way to warrant blocking the application of a rule if a relevant structural environment appears in R_o during the derivation.

Wilbur's response to over- and underapplication phenomena was to keep the morphology before phonology hypothesis intact, but to import the concept of global rules (**Lakoff 1970**) into phonology and propose an Identity Constraint (IC) (**CHAPTER 74**: RULE ORDERING).

(4) *The Identity Constraint* (**Wilbur 1973**: 58)
There is a tendency to preserve the identity of R_o and R_r in reduplicated forms.

The IC acts as a diacritic on a phonological rule that allows the rule to over- or underapply to ensure that R_o and R_r are identical at the surface.

Wilbur presents an example from Serrano (**Hill 1967**) as a case that crucially requires the IC. The important interaction is between an optional phonological rule that inserts a homorganic high vowel between a consonant and glide sequence and an adjectival reduplication rule. **Hill (1967**: 223) notes: "the reduplication involved in [yɨ'aːyɨ'a'n] ~ [yɨ'aːiyɨ'ai'n] 'be beautiful' (< #yə'a# 'beautiful') must be introduced *at the same time as* the rule whereby an anticipatory *i* is optionally introduced before *y*" (emphasis and transcription as in original).

(5) *Ordering in Serrano*

a.	*order 1*		b.	*order 2*	
	UR	REDUP+jəˀa+ˀn		UR	REDUP+jəˀa+ˀn
	Glide insertion	*n/a*		Reduplication	jəˀaːjəˀaˀn
	Reduplication	jəˀaːjəˀaˀn		Glide insertion	jəˀaːi̲jəˀaˀn
	Other rules	jɨˀaːjɨˀaˀn		Other rules	jɨˀaːi̲jɨˀaˀn
	SR	jɨˀaːjɨˀaˀn		SR	*jɨˀaːi̲jɨˀaˀn
				???	jɨˀaːi̲jɨˀai̲ˀn

(5) demonstrates that local ordering cannot derive the data from Serrano. Order 1 (5a) causes the glide insertion rule to not apply, because the rule's structural description is not met. The surface effect is equivalent to when the glide insertion rule

optionally does not apply. Thus this ordering tells us nothing. Order 2 (5b) has the glide insertion rule apply after reduplication. The glide insertion rule inserts an [i] only between the R_r and R_o. The SR form in (5b) shows normal application of the glide insertion rule, but Hill does not list it as a possible form in Serrano. Neither of the possible rule orderings can produce the Serrano form, which shows overapplication of the glide insertion rule.

The key to understanding the importance of the type of pattern is Hill's insight that reduplication and the rule must apply "at the same time." Synchrony of reduplication and rule application is required because reduplication creates the environment that triggers the phonological rule. **McCarthy and Prince (1995**: 289) term this type of interaction *back-copying*. Back-copying interactions provide the strongest evidence for some form of global computation in phonology, such as Wilbur's IC. Wilbur's model of reduplication assumes strict local computation. This means that the rule and reduplication will each only apply once and that they must be ordered with respect to each other. (5) shows both possible orderings of the rule and reduplication; neither ordering produces the correct forms. Consequently, the data from Serrano provide strong evidence for Wilbur's IC, which explains why the glide insertion rule overapplies in (5b).

The main conclusion from Wilbur on phonology reduplication interactions is that the hypothesis that reduplication is a morphological process and all morphology precedes all phonology can be maintained if a limited amount of global computation is added to the phonological component. Global computation in the phonology is limited to the IC, which can cause phonological rules to over- or underapply to maintain identity between R_o and R_r.

2.2 Reduplication as morphology

Carrier (1979) is in essence a direct response to **Wilbur (1973)** with respect to reduplication and argues against global computation in phonology. Carrier demonstrates that global computation in phonology is not sufficient to account for reduplication patterns. **Carrier (1979)** points to the interaction between syncope and reduplication (presented as R2 in (6)) in Tagalog as a case where an IC approach is insufficient.

(6) *Syncope and reduplication interaction in Tagalog* (Carrier 1979: 174)

a.		/sunud-in/	b.		/sunud-in/
	Syncope	sund-in		R2	sunudsunud-in
	R2	sundinsundin		Syncope	*sunudsundin
				(overapplies)	*sundsundin

Carrier argues that only by ordering syncope before reduplication can the correct forms in Tagalog be produced. Carrier's R2 pattern of reduplication in (6) copies a foot's worth of phonological material (**CHAPTER 40**: THE FOOT) from the left edge of the stem. The syncope rule deletes the final vowel of a root that has been suffixed. (6a) shows that if syncope applies before reduplication, then the correct surface form is produced where the vowel of the suffix is copied. If reduplication applies before syncope, as in (6b), then there is no way to produce the correct surface form, because the vowel of the suffix is not copied. The IC can only affect whether the syncope rule over- or underapplies and cannot cause reduplication to re-copy segmental material.

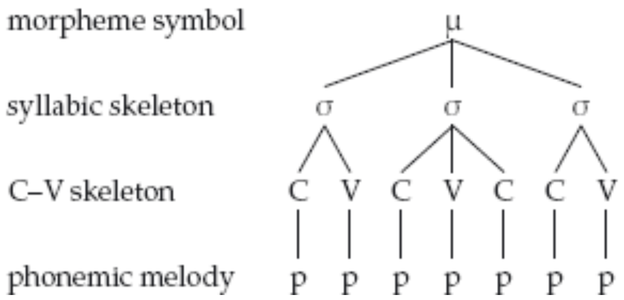
Carrier develops the implications of an analysis of Tagalog where syncope precedes reduplication. She retains the strong hypothesis that all morphology precedes all phonology and argues that reduplication is the result of a [+reduplication] feature being added as part of a word formation rule. This morphological feature triggers the application of a transformational rule that causes the copying of phonological material at the end of the morphology. The bipartite nature of reduplication in Carrier's system allows for morphological rules to apply to a stem with the [+reduplication] feature prior to reduplicative copying. An immediate benefit of the bipartite hypothesis is that it predicts morphological rules can produce over- and underapplication effects, because they will necessarily be ordered before reduplicative copying.

Carrier develops the bipartite hypothesis by arguing that the rules in Tagalog that show overapplication effects (e.g. syncope and nasal substitution) are morphological rules, not phonological. Carrier defines a morphological rule as one that cannot be specified in purely phonological terms. For example, syncope applies to some roots (e.g. /sunud/ → [sund-in]) but not others (e.g. /liːnis/ → [liːnis-liːnis-in]), and nasal substitution does not apply to all /ŋ/-final prefixes and obstruent-initial stems (**Carrier-Duncan 1984**: 274).

Carrier's contribution to our understanding of reduplication is to develop the morphological aspects of reduplication. Specifically, the hypothesis that reduplication is a bipartite process where the morphology marks a representation as reduplicated but the copying process occurs later in the derivation is extremely important. The bipartite hypothesis allows morphological rules to apply before reduplicative copying, which provides one source of explanation for over- and underapplication effects with local computation.

Marantz (1982) is a watershed for the study of reduplication. The main proposal extends ideas from **McCarthy (1981)** that propose prosodic morphology, (7).

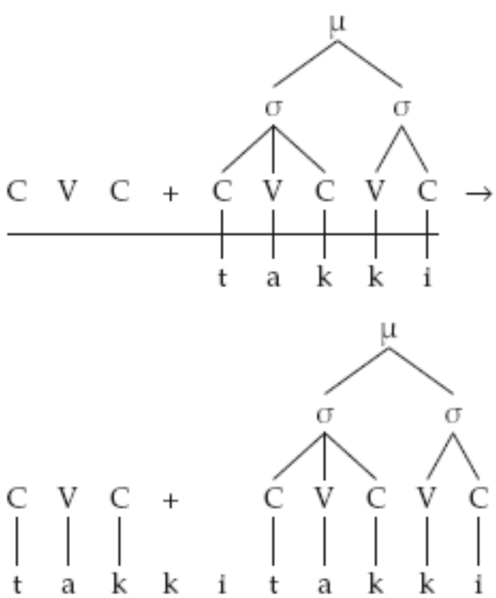
(7) *Prosodic structure of morphemes* (Marantz 1982: 454)



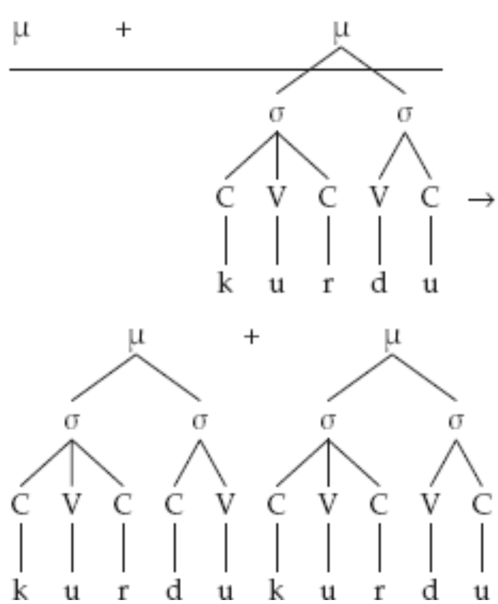
Marantz (1982) proposes that reduplicative morphemes are different from other morphemes in two ways. The first is that they are not fully specified and the second is that they trigger the copying of phonological material of the stem. The lack of specification at some level of representation allows for different patterns of reduplication to be specified by the "prosodic skeleton," which determines how much and what type of phonological material is copied. (8) presents a case of partial reduplication and total reduplication from a Marantzian perspective.

(8) *Marantzian skeletons*

a. *CVC reduplication: Agta* /takki/ → [tak-takki] (Healy 1960)



b. *total reduplication: Walpiri* /kurdu/ → [kurdu-kurdu] (Nash 1980)



Marantz focuses on expressing reduplication patterns at the C–V skeletal level due to **Moravcsik's (1978**: 307) observation that “reduplicated phonetic strings I found [are] invariably defined in reference to consonant–vowel sequence and absolute linear position.” Moravcsik's observation suggests that all of the work being done by templates is thus at the C–V level. (8a) demonstrates the affixation of a CVC prefix that accounts for one pattern of reduplication in Agta. Total reduplication can be produced by affixing a higher level of prosodic structure, the morpheme, which will cause copying of all prosodic structure under the morpheme level, (8b). Deriving different R_r shapes from general phonological representations is a major advance in the understanding of reduplication, because questions about reduplicative templates are now questions about phonological representations and processes.

The other major insight from **Marantz (1982**: 436) is the proposal that reduplication is a normal affixation process. The phonology of reduplication should mirror the phonological behavior of other affixes (**chapter 104**: root–affix asymmetries). By integrating reduplication into the general theories of phonology and morphology, Marantz argues that over- and underapplication effects are accounted for. One source of underapplication effects is the cyclic application of phonological rules to morpheme-internal environments (**chapter 85**: cyclicity). Cyclic rules do not apply in non-derived environments (**chapter 88**: derived environment effects), and if the R_r is an affix (thus a morpheme), then the effect of underapplication will be produced, because R_r will not be a derived environment. Morphological rules will also produce over- and underapplication effects, as in the Carrier bipartite hypothesis.

Marantz develops the hypothesis that phonological aspects of reduplication should be accounted for by general phonological means. Consequently, approaches to reduplication changed as phonological representations have changed. There are two important changes to phonological representations that affected the basic aspects of the Marantzian model of reduplication.

The first change is the single melody model proposed by **Mester (1986)** (**chapter 54**: the skeleton). Note that proposals in **Clements (1985)** are extremely similar to Mester's, the difference being whether melodic or templatic effects are the main focus. Clements focuses on templatic effects while Mester focuses on melodic effects. **Mester (1986**: 172–173) proposes that reduplicative morphemes are attached to the stem in a synchronous manner. This can be viewed as an extension of autosegmental representation (**Goldsmith 1976**; **chapter 14**: autosegments), where different aspects of phonological representations are not linearly ordered with respect to each other. A key aspect of the synchronous nature of reduplicative template and stem is that the melodic tier is shared between them.

Mester's (1986: 190–196) single melody analysis of the interaction of the *ruki* rule (e.g. alveolars become retroflexed after /r/, /u/, /k/, or /i/) and reduplication in Sanskrit demonstrates the advances of this model (see **chapter 119**: reduplication in sanskrit). When the root /saɲʥ/ ‘hang’ is reduplicated and affixed with a *ruki*-triggering prefix (e.g. /ab^{h}i/), then the initial /s/ in the root /sanj/ shows overapplication of the *ruki* rule because the second retroflexed *s* does not occur after a segment triggering the *ruki* rule (e.g. *[ab^{h}i–şa–saɲʥ]). Without the *ruki*-triggering prefix, no retroflexion occurs.

(9) *Overapplication of the* ruki *rule in Sanskrit reduplication*

saɲʤ	‘hang’	ab^{h}i-ṣa-ṣaɲʤ	‘cursed’	*ab^{h}i-ṣa-saɲʤ
		cf. sa-saɲʤ		

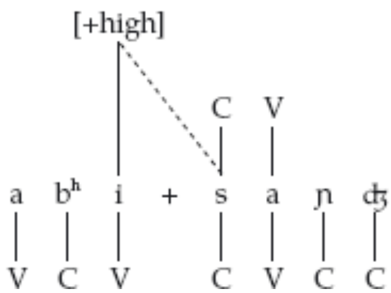
(10) demonstrates the parts of a single melody analysis for these forms. (10a) presents the unaffixed root form. The prefixing CV reduplication pattern affixes a synchronous C–V skeleton to the melodic level, (10b). (10c) shows the further affixation of the prefix /ab^{h}i/ and the application of the *ruki* rule (following **Mester's 1986**: 192 formulation).

(10) *Single melody analysis*

a. *root*

b. *root and synchronous reduplicative affix*

c. *prefixation and application of the* ruki *rule*



Understanding the representation in (10c) is the key to the advances from the single melody model. At this point in the derivation, there is only a single /s/ melody, which was retroflexed by the *ruki* rule. This /s/ is associated to two CV skeletons, one from the stem and one from the reduplicative morpheme. This is the strongest possible identity relationship between R_o and R_r, in that the melodic content of both is a single representation. Any melodic change to one must occur to the other. This is the source of explanation for overapplication effects in the single melody model. Any rule changing the melodic content of a synchronous representation can show overapplication effects. The single melody model also captures Carrier's insight about the bipartite nature of reduplication. The morphology builds a reduplicated structure that is later dealt with by the phonology. In this case, the structure produced by the morphology is one in which R_o and R_r are synchronous.

Non-linear representations like (10c) must be converted to a strictly linear representation. Tier Conflation (**McCarthy 1986**; **Mester 1986**: 176–177) converts (10c) into the fully linear representation in (11). Note that concatenation will create a relationship on the phonological skeleton between the /ab^{h}i/ prefix and the reduplicated root in (10c) that is sufficient to trigger the *ruki* rule even though full linear order may not exist between the morphemes at this point in time.

(11) *Linearization as Tier Conflation*

Tier Conflation is not a reduplication-specific device, in that it is the general device to ensure that phonological representations are strictly linear, so the phonetics component can use them. **McCarthy (1989)** argues that planar segregation is very common in phonological representation. Consequently, a process like Tier Conflation that will provide a strict linear ordering to a representation is required in phonology and will apply to both concatenative and non-concatenative morphologies. Consequently, all phonological representations must undergo some process analogous to Tier Conflation. This is a very important observation, because it accomplishes the complete naturalization of reduplication in phonology. (See also **CHAPTER 105**: TIER SEGREGATION.)

The publication of **Mester (1986)** coincided with fundamental changes in prosodic morphology. **McCarthy and Prince (1996)** drastically revise the prosodic hierarchy to eliminate the CV level of representation. This change represents the debate between the x-slot and moraic theories of the syllable (see **Kenstowicz 1994**: 425–431; **CHAPTER 54**: THE SKELETON). **McCarthy and Prince (1996)** side with the moraic model and provide analyses of reduplicative templates and other phenomena using only legitimate prosodic categories. (12) presents the proposed prosodic categories from **McCarthy and Prince (1996**: 6).

(12) *Prosodic categories*

Wd	prosodic word
F	foot
σ	syllable
σ_{μ}	light (monomoraic) syllable
$\sigma_{\mu\mu}$	heavy (bimoraic) syllable
σ_{c}	core syllable

Hayes and Abad's (1989) analysis of Ilokano heavy syllable reduplication represents the fundamental arguments for the **McCarthy and Prince (1996)** approach to reduplicative templates.

(13) *Heavy syllable reduplication for Ilokano* (Hayes and Abad 1989: 360)

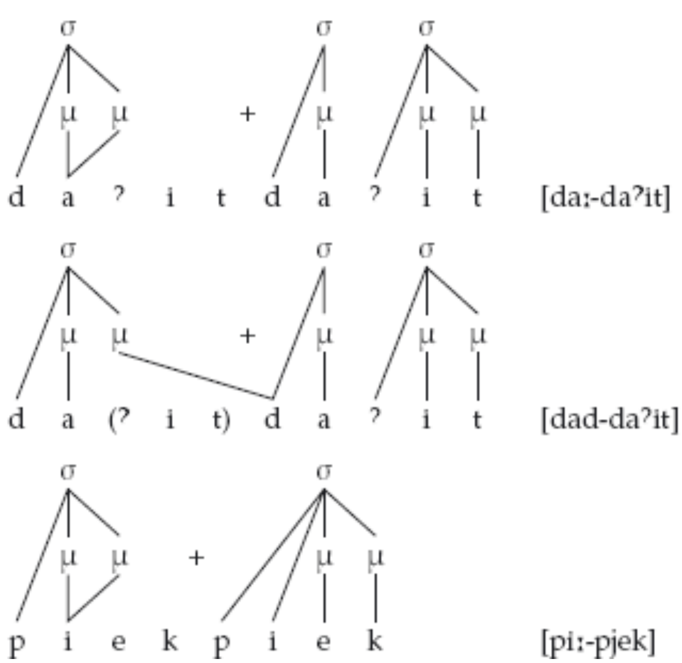
a.	tra'baho	'to work'	ʔag-trab-tra'baho	'is working'
b.	'daʔit	'to sew'	ʔag-daː-'daʔit	'is sewing'
			ʔag-dad-'daʔit	
c.	'pjek	'chick'	pjeː-'pjek	'chicks'
			piː-'pjek	

The complexity in this reduplication pattern lies in defining what satisfies the heaviness requirement. (13a) shows that a coda consonant is acceptable, and (13b, 13c) show that lengthening the first vowel copied from the R_o also satisfies the requirement. There is variation in the forms in (13b) and (13c), though. (13b) shows dialectal variation between lengthening the vowel from R_o and geminating the first consonant in the R_o in order to satisfy the branching rhyme requirement. Finally, (13c) shows that a glide in an onset from R_o can be vocalized and lengthened as a possible form of this reduplication pattern. Hayes and Abad suggest that all of these forms can be captured by specifying the reduplicative template as a bimoraic syllable.

(14) *Bimoraic syllable for Ilokano* (Hayes and Abad 1989: 360–361)

a. *heavy syllable template*

b. *examples*



(14) demonstrates that a single generalization at the syllable level can describe the forms that fall into the class of heavy syllable reduplication in Ilokano. All of the R_rs are a single syllable with a branching rhyme, but melodic association varies in the different forms for both phonological and morphological reasons. The variation seen in (13b) and (13c) is morphological in nature, because it cannot be predicted by phonological considerations.

Extending the original proposals from **Marantz (1982)** with the single melody model proposed in **Mester (1986)** and revisions to the prosodic hierarchy from **McCarthy and Prince (1996)** formalize a strong organic theory of reduplication. This theory is organic because the source of explanation for reduplication is solely from the general theory of morphology and phonology. The aspects of reduplication that make it unique are its bipartite and synchronous characteristics. Reduplication is bipartite because the morphology builds a synchronous phonological structure that is linearized later in the phonology. Reduplication is synchronous because a single phonemic melody is associated with multiple distinct prosodic structures. These two characteristics provide both morphological and phonological sources of over- and underapplication effects. Both morphological and cyclic phonological rules will apply before Tier Conflation and thus can be the source of over- and underapplication effects. Normal application effects are produced by rules that apply after Tier Conflation. **Kiparsky (1986**: 83) summarizes this situation as

> in principle, as strong a hypothesis as one could hope for. But our present picture of the articulation of phonology and morphology being as tentative as it is, [their proposals on morphology and cyclic phonology] are not easy to verify or falsify.

Although Kiparsky is cautionary, reduplication has been reduced to a unique synchronous representation and to the general question of what the nature of phonology and morphology is.

2.4 The full copy model

Steriade (1988) presages many of the themes dominating work on reduplication at the present time. **Steriade's (1988**: 146) main proposal is “that templates are not strings of concrete, fillable slots, but rather abstract conditions on prosodic weight and syllabic organization of strings.” The reflex of this is the *full copy* model of reduplication, where all reduplication patterns start with R_r consisting of a complete copy of the segmental and prosodic structure of R_o and the rest of the base. Partial reduplication patterns are then produced by eliminating structure from the R_r on the basis of different prosodic parameter settings. Steriade argues that the full copy of prosodic structure remedies inadequacies in the way syllabic transfer effects are accounted for in the Marantzian model of reduplication.

Steriade's main demonstration of the full copy model involves the analysis of two reduplication patterns from Sanskrit. The intensive reduplication pattern in Sanskrit is a prefixing CVX pattern with a prespecified /a/ as the nucleus of the R_r.

(15) *Intensive reduplication in Sanskrit*

a. *Full and zero grade forms in Sanskrit* (Steriade 1988: 108)

root	*intensive full grade*	*intensive zero grade*	
svap/sup	saː-svap-	sau-sup-	‘sleep’
		[soṣup-]	

b. *Full copy parameter settings* (Steriade 1988: 107)

parameters
- *weight parameters*
  - monosyllabic foot (heavy monosyllable)
- *syllable markedness parameters*
  - obligatory onset: unmarked setting (onset is obligatory)
  - complex onset: unmarked setting (onset may not be complex)
  - sonorant coda: unmarked setting (coda must be a sonorant)

insertion rule
- Insert /a/ in the intensive stem
- Insertion site: first syllable, rhyme

The two intensive forms in (15a) for the root /svap/ ‘sleep’ provide the background on understanding how the parameters in (15b) ensure that the R_r will end up being a CVX sequence with a prespecified /a/. Note that the difference between the full grade and zero grade forms in (15a) is based on whether the vowel *a* is deleted from the root. When the *a* is deleted in the zero grade, the *v* vocalizes to *u*. The zero grade form in brackets shows the application of other rules in Sanskrit. The weight parameter is the primary source to truncate R_r to produce patterns of partial reduplication. The particular setting in (15b), monosyllabic foot, for the Sanskrit intensive pattern will ensure that the R_r has a branching rhyme. The syllable markedness parameters provide the source of other modifications to the R_r. Banning complex onsets will cause the R_r to delete segments if there is a complex onset. The obligatory onset parameter bans the R_r from beginning with a vowel, which accounts for vowel-initial roots in Sanskrit not having a reduplicated intensive form. The sonorant coda parameter captures the observation that the R_r in intensive forms ends with either a long vowel or a sonorant consonant. Finally, there is an insertion rule that adds the prespecified /a/ vowel into the rhyme of the R_r.

(16) demonstrates how the full copy model accounts for the intensive forms for the root /svap/. To begin, the zero grade rule that deletes an unstressed /a/ in the stem occurs before full copy (**Steriade 1988**: 94–95) in the intensive forms. There are two distinct stems (i.e. one that has undergone zero grade formation and one that has not) to start the derivation of intensive forms.

(16) *Intensive reduplication in Sanskrit* (Steriade 1988: 109)

	full grade	*zero grade*
input	svap	sup
copy	svap-svap	sup-sup
/a/-insertion	*blocked* (OCP)	saup-sup
removal of unlicensed material		
complex onset	sap-svap	*n/a*
obstruent coda	sa-svap	sau-sup
prosodic weight		
rhyme lengthening	saː-svap	*n/a*
output	saː-svap	sau-sup

(16) requires only a few comments. The copy process takes as input the relevant full grade or zero grade form and the left copy is identified as R_r and thus subject to modification. The /a/-insertion rule applies first and is blocked if the R_r already contains an /a/ melody (as in the full grade form). Following this, the syllable markedness parameters remove any material that is not licensed. This causes the complex onset /sv/ to be simplified to /s/ and the non-sonorant /p/ to be deleted in R_r. Finally, the weight parameter ensures that R_r is a monosyllabic foot and lengthens the /a/ in the full grade form. The zero grade does not need this lengthening, because the diphthong /au/ satisfies this weight requirement.

The forms at the end of (16) are not the final output of the phonology. In particular, the output from reduplication of the zero grade /sau-svap/ must undergo the *ruki* rule to convert the /s/ following the R_r to a retroflex, and the /au/ diphthong must be converted to /o/. These additional changes produce the final form [soşup]. The important aspect of this is that phonological processes have another chance to apply to the reduplicated form and further obscure relationships between R_r and R_o.

Steriade (1988) does not provide an exhaustive list of parameters and insertion rules for the full copy model. This is prudent, because Steriade draws the connection between modifications to R_r in the full copy model and general morphological processes found in non-reduplicative contexts. Examples of non-reduplicative truncation in Madurese and French hypocoristics and segment insertion in English strong verbs and Kaingang verbal formation are provided as examples of processes producible by similar parameters applied in a non-reduplicative context. Thus the question of what the parameters are in the full copy model is the question as to what a possible morphological or phonological rule is.

When a full copy may occur in the derivation is an important issue, because it determines what kinds of interactions between reduplication and phonological rules can occur. **Steriade (1988**: 141), following **Kiparsky (1986)**, suggests that full copy will occur either at the lexical level or at the end of the cyclic level, with these levels being defined in **Kiparsky's (1982)** terms. Full copy in intensive reduplication in Sanskrit presumably applies at the cyclic level, which would allow zero grade formation to occur prior to reduplication, while full copy applies at the lexical level in the perfect reduplication pattern in Sanskrit, since **Steriade (1988**: 123–124) has the zero grade syncope rule apply after reduplication. This position basically echoes the claims about Tier Conflation in **Mester (1986)**, with the modification that Tier Conflation can occur at different points in the derivation.

2.5 Classic models of reduplication and the SHR

The SHR in (1) can be seen as the result of the arc of research on reduplication spanning from **Wilbur (1973)** to **Steriade (1988)**. Each of these approaches to reduplication assumes architectural modularity (1a), in that reduplication is a morphological process that interacts with phonology. **Carrier (1979)** introduces the bipartite (1b) aspect of reduplication, where a reduplicated structure created by the morphology is interpreted later by the phonology. The main gain here is that morphological rules can apply before reduplicative copying occurs, which is one source of over- and underapplication effects. Adoption of (1b) allows the "identity is synchrony" clause (1c) of the SHR to be adopted, providing a general understanding of the interaction between reduplication and phonological rules. Any morphological or phonological rule that is ordered before reduplicative copying occurs can produce over- and underapplication effects because R_o and R_r are a single representation at this point in time. Rules that apply after reduplicative copying occurs will produce normal application effects because at this point R_r and R_o are distinct. Although **Wilbur (1973)** adopted limited global computation in the Identity Constraint (4), all other classic models of reduplication favored local computation.

3 Contemporary models of reduplication

All contemporary models of reduplication are reactions to the SHR in (1). There is an interesting cyclic nature to the contemporary models, since they begin by returning to Wilbur's work on reduplication and the question of global computation in grammar.

3.1 The parallel Correspondence Theory model

McCarthy and Prince (1995) begin the contemporary era of work on reduplication by completely breaking away from the SHR in (1). The rejection of the SHR is based on the importance of parallel computation in reduplication. **McCarthy and Prince (1995**: 258) state that:

> In particular, most versions of Optimality Theory assume that constraints on all aspects of phonological structure are applied in parallel (**Prince and Smolensky 1993**). Inputs are mapped directly to outputs, in an essentially flat derivation.

Because a flat derivation is being assumed, the necessarily local and serial aspects of the SHR, such as separate morphology and phonology modules, the resulting bipartite nature of reduplication from these distinct modules, and the explanation of over- and underapplication effects due to the "before and after" aspects of the "identity is synchrony" hypothesis are all lost in a parallel computational model. Note that strict parallelism is not a necessary component of OT (e.g. Harmonic Serialism; **McCarthy 2010**), so the tenets of the SHR could be followed in OT, but **McCarthy and Prince (1995)** explicitly reject them.

As part of the rejection of the SHR and the adoption of global computation for reduplication, **McCarthy and Prince (1995)** suggest that the conclusions about reduplication should be applied to phonology in general. Correspondence Theory (CT) adopts Wilbur's IC and global computation as the core insight into reduplication and phonology. With global computation, a surface representation can be calculated from a memorized representation in a single computation, with any grammatical aspect potentially affecting the results. CT in practice eliminates all of the components of the SHR, because global computation removes the local distinctions between morphology and phonology. (17) presents the full model of reduplicative identity.

(17) *The full model of reduplicative identity* (McCarthy and Prince 1995: 273)

input	$/\mathrm{Af_{RED}} + \mathrm{Stem}/$	
IR-faithfulness	$\swarrow\!\!\nearrow \quad \updownarrow$	IB-faithfulness
output	$\mathrm{R} \rightleftarrows \mathrm{B}$	
	BR-identity	

Reduplication remains the result of the affixation of an underspecified morpheme, but the way phonological content is assigned to this affix is different. There is no copying process in CT, because a copying process operates in a computationally local way, where R_o (B in CT) can determine aspects of R_r (R in CT), but not the other way around (see **McCarthy and Prince 1995**: 292–294). Instead, reduplicative constructions have two direct correspondences and one indirect correspondence. The two direct correspondence relationships are BR-identity, which allows R_r and R_o to affect each other, and IR-faithfulness, which allows the input stem to influence the realization of R_r. The indirect correspondence for R_r is the general input-output faithfulness relationship between the stem and base. These relationships are all formally the same and operate in a global manner, which allows analyses of reduplicative phenomena unavailable to the classic models.

The bulk of **McCarthy and Prince (1995)** focuses on overapplication effects. The Malay nasal harmony example presents the strongest case for global computation in reduplication, because it is a case of back-copying.

(18) *Reduplication and vowel nasalization in Johore Malay* (Onn 1976: 180)

underlying	*stem*		*doubled stem*	
/hama/	hamə̃	'germ'	hə̃mə̃-hə̃mə̃	'germs'
/waŋi/	waŋĩ	'fragrant'	w̃ãŋĩ-w̃ãŋĩ	'fragrant (INTENS)'
/aŋan/	aŋãn	'reverie'	ãŋãn-ãŋãn	'ambition'
/aŋin/	aŋĩn	'wind'	ãŋĩn-ãŋĩn	'unconfirmed news'

Nasal harmony in Johore Malay operates in a left-to-right manner, as can be seen in the stem forms. The importance of the reduplicated forms is that the first vowel is nasalized even though it is not preceded by a nasal segment. Local computation has difficulties producing this effect because it would have to copy (/hame-hame/), have vowel nasalization apply (/hamẽ-hãmẽ/), and then re-copy to produce [hamẽ-hãmẽ]. This is clearly an unattractive scenario.

McCarthy and Prince (1995: 289–294) discuss how the Johore Malay data are naturally captured in the global computation of correspondence theory. The constraints in the tableau below are straightforward (e.g. IDENT-BR[nasal] is violated when R_o and R_r differ in the feature nasal, $*NV_{oral}$ is violated when a nasal segment is followed by an oral vowel or glide, $*V_{nasal}$ is violated when a vowel or glide is nasalized, and IDENT-IO[nasal] is violated when the input stem and output base differ in the feature nasal).

(19) *CT analysis of Johore Malay* (McCarthy and Prince 1995: 291)

/RED-waŋi/	IDENT-BR[nas]	$*NV_{oral}$	$*V_{nas}$	IDENT-IO[nas]
☞ a. $\tilde{w}\tilde{a}\eta\tilde{\imath}_R$-$\tilde{w}\tilde{a}\eta\tilde{\imath}_B$			******	***
b. $wa\eta\tilde{\imath}_R$-$wa\eta\tilde{\imath}_B$		*!	**	*
c. $wa\eta\tilde{\imath}_R$-$\tilde{w}\tilde{a}\eta\tilde{\imath}_B$	**!		****	***

Given the constraint ranking in (19), (a) is the most harmonic candidate, showing a back-copying effect where the R_r provides the environment to nasalize the initial segments of the R_o and this alternation is transferred back to R_r. The global computation allows for the transfer of any alternation from the R_o to the R_r regardless of the source of the alternation, even if the cause of the alternation is R_r itself. Notice that normal application of nasal assimilation can be produced by simply ranking IDENT-BR[nasal] below $*V_{nasal}$.

Adopting global computation increases the importance of generalizations on outputs, and this has resulted in further investigation of ideas about templates from **Steriade (1988)**. *Generalized template theory* (**McCarthy and Prince 1994a**; **Urbanczyk 2006**) proposes that the particular shapes of reduplicative templates can be derived from language-specific prosodic requirements. In other words, the parameter settings from **Steriade (1988)** should be determined by a language's phonology and morphology instead of having to be set for each reduplicative morpheme.

Urbanczyk (2006) argues that a reduplicative template's prosodic weight can be predicted by its morphological status. Where **Steriade (1988**: 83) would specify a light syllable by setting a weight parameter to "unfootable," as an idiosyncratic aspect of the particular reduplicative morpheme, Urbanczyk derives the presence or lack of a coda in R_r (producing a weight contrast) from whether the reduplicative morpheme is classed as root or affix. Roots have additional faithfulness relationships (e.g. BR-MAX(Rt)) that can support more marked phonological material. Affixes lack additional faithfulness pressures, and are thus subject to the effects of *the emergence of the unmarked* (TETU, **McCarthy and Prince 1994b**; **CHAPTER 58**: THE EMERGENCE OF THE UNMARKED).

(20) *Morphological status and reduplicative template shape in Lushootseed* (Urbanczyk 2006)

RED	*morphological status*	*reduplicated*
DIM	affix	q'i-q'ixʷ
DIST	root	saqʷ'-saqʷ'

(21) CV *vs.* CVC *status in* R_r

/DIM-q'ixʷ/	BR-MAX(Rt)	NOCODA	BR-MAX
☞ a. q'i-q'ixʷ		*	xʷ
b. q'ixʷ-q'ixʷ		**!	

/DIST-saqʷ'/	BR-MAX(Rt)	NOCODA	BR-MAX
a. sa-saqʷ'	qʷ'!	*	qʷ'
☞ b. saqʷ'-saqʷ'		**	

The diminutive reduplicative morpheme in Lushootseed is an affix, while the distributive morpheme is a root, according to Urbanczyk. The constraint ranking in (21) has a root-specific BR-faithfulness constraint, BR-MAX(Rt), dominating NOCODA, which then dominates the general BR-faithfulness constraint, BR-MAX. This is a classic TETU ranking, which produces the surface effect that the DIST morpheme can contain a coda (as in [saqʷ'-saqʷ']), while the DIM morpheme cannot (cf. [q'i-qixʷ]).

(22) demonstrates how Urbanczyk derives the monosyllabicity of all R_rs in Lushootseed. By ranking a constraint that penalizes the number of syllables in the output (*STRUCT-σ) above both BR-faithfulness constraints, R_r will be the minimal number of syllables possible (see also **Spaelti 1997**; **Hendricks 1999**). All atemplatic models assume some additional constraint that requires the reduplicative morpheme to occur in the output (see proposals by **Gafos 1998**).

(22) *Monosyllabic* R_r *without a template in Lushootseed* (Urbanczyk 2006: 202)

/DIM-hiw-il/	*STRUCT-σ	BR-MAX(Rt)	BR-MAX
☞ a. 'hi-hiwil	***		wil
b. 'hiwil-hiwil	****!		

/DIST-pastəd/	*STRUCT-σ	BR-MAX(Rt)	BR-MAX
☞ a. 'pas-pastəd	***	təd	təd
b. 'pastəd-pastəd	****!		

Each of the optimal candidates in (22) has the characteristic that the R_r contains as much phonological material (taking affix *vs.* root status into consideration, which determines whether a coda is in R_r or not; see (21)) from R_o as is needed to add only a single syllable to the output.

Although CT has had a major impact on phonology as part of the rise of Optimality Theory (**Prince and Smolensky 1993**), there has been little critical evaluation of whether it has furthered our understanding of reduplication. The crux of the matter is determining whether the empirical gains provided by global computation outweigh the results of the SHR in (1). While SHR models do not offer a natural account of back-copying effects, they do provide a general model of how phonology and reduplication interact. Once the point of copying in a derivation is determined for a reduplicative morpheme, there is a prediction about whether normal application for different types of rules (e.g. morphological, lexical, cyclic, etc.) should be the interaction between reduplication and phonology. Because CT abandons the modularity and local computation aspects of the SHR, it does not make any such predictions. The question that must be answered is whether a model with more empirical coverage but little predictive power is better than a model with less empirical coverage but great predictive power.

The proposals on reduplicative templates from CT are mostly extensions of **Steriade (1988)** because of their claimed connection to TETU effects. **Urbanczyk (2006)** presents the most restricted version, where prosodic principles are used to produce the reduplicative templates. Urbanczyk's proposals have not been evaluated cross-linguistically on languages with more than three reduplication patterns. Also, **Haugen (2008)** demonstrates the need for a syllable template to describe various reduplication patterns in Yaqui and Yapese, and work by **Hendricks (1999)** on bare consonant reduplication suggests that R_rs can be specified as a single segment, which conflicts with Prosodic Morphology (**McCarthy and Prince 2001**: 1), where reduplicative templates are to be made of authentic units of prosody (see (12)).

The role of TETU in reduplication needs to be critically evaluated, because of its widespread use as explanation in CT. **Alderete *et al.* (1999)** propose that fixed segmentism in any R_r has one of two sources: TETU or overwriting. The TETU analyses of Lushootseed, Nancowry, Yoruba, and Tübatulabal offered in Alderete *et al.* have all been shown to be inadequate: for Lushootseed, **Fitzpatrick and Nevins (2003)** demonstrate that fixed /'i/ in Lushootseed R_rs results from general considerations of the metrical system and has nothing to do with reduplication per se; for Nancowry, **Raimy (2000a**: 79–96) demonstrates that the vowel in the reduplicant is not predictable, but must be fully prespecified by the morphology; for Yoruba, **Akinlabi (2004)** demonstrates that the reduplicant must have a prespecified tone and that the prespecified vowel of the reduplicant is phonologically distinct from the phonetically identical epenthetic vowel derived by TETU; and for Tübatulabal, **Cairns (2008)** demonstrates that claimed TETU effects fall out from general phonological processes (see the original papers for the full arguments). Furthermore, the general typological claim that reduplicants/affixes will not contain any material more marked than bases/roots is questioned by the distribution of codas in Lakota (**Albright 2004**). These facts suggest that the **Steriade (1988)** position that all segmental prespecification in reduplication is carried out via insertion may be more accurate.

3.2 Precedence-based phonology

Raimy (2000a, 2000b) proposes that phonological representations consist of not only segments and prosodic structure but also precedence relations that encode the ordering of phonological elements (see **CHAPTER 34**: PRECEDENCE RELATIONS IN PHONOLOGY). These proposals change phonological representations from (23a), where order is derived from graphemic conventions (left-to-right indicates order), to (23b), where order is directly indicated by precedence relations (indicated by '→').

(23) *Precedence in phonology*

a. kæt
b. # → k → æ → t → %

Raimy (2000a, 2000b) argues that, once precedence is encoded in representations, more complicated phonological representations can be considered and investigated. Specifically, reduplication results from a phonological representation that contains a transitive symmetrical precedence relation (i.e. a "loop").

(24) presents the unreduplicated and reduplicated forms from Johore Malay that **McCarthy and Prince (1995)** present as an argument against local computation in reduplication. (24a) is the memorized form for 'fragrant' and (24b) is the reduplicated version of this form.

(24) *Precedence-based reduplication*

a. # → w → a → ŋ → i → %
b. # → w → a → ŋ → i → %
c. # → w → a → ŋ → i → w → a → ŋ → i → %

The form in (24b) contains a "loop," which is the exponence of the reduplicative morpheme. Raimy reformulates the Tier Conflation of earlier bipartite proposals as serialization; see Idsardi and Raimy (forthcoming). The surface result of serialization is the repetition of segments within the loop, producing (24c) from (24b).

Although the "loops" have no privileged status (see **Raimy 2009a**: 187, n. 4), they are the locus of much explanation of reduplication. **Raimy (2000b**: 547) points out that the precedence link needed to account for reduplication in (24b) provides the exact phonological environment required to understand the interaction of reduplication and nasal harmony in Malay in a computationally local manner.

(25) *Vowel nasalization and reduplication in Malay*

a. # → w → a → ŋ → i → %
b. # → w̃ → ã → ŋ → ĩ → %
c. # → w̃ → ã → ŋ → ĩ → w̃ → ã → ŋ → ĩ → %

Non-consonantal segments in Johore Malay are nasalized if they are preceded by a [+nasal] segment, with nasalization spreading until a non-nasal consonant is reached. (25a) shows that there is a precedence relationship where /i/ precedes /w/, and this allows nasalization to spread to /w/ and consequently to /a/, producing the representation in (25b), where all of the segments are nasalized. (25c) is the serialized form where the nasalized /w̃/ and /ã/ appear in an environment that does not include a preceding nasal segment. Serialization has eliminated the environment that allowed nasal harmony to occur. This is a classic example of opacity, which is well known to occur with local computation. The conclusion of **Raimy (2000a, 2000b)** is that global computation is not necessary to account for back-copying or any other interaction between phonology and reduplication.

Reduplicative templates are derived from how precedence links are concatenated to a stem. **Raimy (2000a, 2000b)** adopts Distributed Morphology (**Halle and Marantz 1994**) and assumes that the phonological content of a reduplicative morpheme is simply a precedence link (or links and segmental material) that forms a loop when concatenated to the base. Precedence links that are added by the morphology are defined by *anchor points* (**Raimy 2009b**; see also **CHAPTER 34**: PRECEDENCE RELATIONS IN PHONOLOGY), which consist of a limited set of positions where links can be added. Depending on how a precedence link is concatenated to a base, segments from different parts of the base will be "in the loop" and reduplicated. Anchor points develop the idea from **Moravcsik (1978**: 312) that reduplication patterns can be defined in reference to positions of consonants and vowels.

(26) *Reduplicative "templates" in precedence-based phonology*

a. *prefixing* CVC: *Agta* (Healy 1960: 7)

$\# \rightarrow l \rightarrow a \rightarrow b \rightarrow a \rightarrow n \rightarrow g \rightarrow \%$ [lab-labang] 'patches'

b. *suffixing syllable: Dakota* (Sietsema 1987: 337)

Ons Ons

$\# \rightarrow h \rightarrow \tilde{a} \rightarrow s \rightarrow k \rightarrow a \rightarrow \%$ [hãska-ska] 'are tall'

c. *discontinuous: Chukchi* (Dunn 1999: 108)

$\# \rightarrow w \rightarrow e \rightarrow n \rightarrow i \rightarrow \%$ [weni-wen] 'bell (ABS SG)'

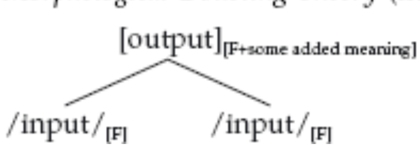
The "loop" in (26a) contains the first CVC of the stem, and these segments will be repeated when serialized. This loop can be defined by the anchor points "after the first vowel" and "first segment." Both of these anchor points are used in infixation (**Yu 2007**). (26b) presents a suffixing syllable pattern from Dakota that uses the anchor points "last segment" and "last onset." Finally, (26c) shows a discontinuous reduplication pattern from Chukchee that suffixes the first CVC sequence of the base. Discontinuous reduplication patterns that have the R_r separated from R_o in the surface string generally require two precedence links to be added. This pattern requires one precedence link for total reduplication (i.e. "last segment" precedes "first segment") and one precedence link to truncate the R_r to CVC (i.e. "after the first vowel" precedes %). Anchor points are not reduplication-specific, because they provide a general theory of how morphology creates concatenative (e.g. prefixation and suffixation) and non-concatenative (e.g. reduplication, infixation, truncation, root and template, etc.) phonological structures.

The proposals on precedence in phonology in **Raimy (2000a, 2000b)** provide a local computation solution to back-copying effects. This revitalizes the SHR in (1) as a viable model of reduplication. This makes answering the question about whether global computation in phonology is desirable or not even more important.

3.3 Morphological Doubling Theory

Inkelas and Zoll (2005) introduce Morphological Doubling Theory (MDT), which proposes that reduplication is the result of a purely morphological process where the output stem (which shows surface repetition of segments) results from two (or more) daughters that are featurally and semantically identical, as in (27).

(27) *Morphological Doubling Theory* (Inkelas and Zoll 2005: 7)



MDT denies the idea that there is phonological copying of any kind (e.g. literal derivational copying, repetition due to serialization or parallel correspondence) in reduplication. Surface repetition of segments is due to multiple independent instances of a stem. One immediate prediction that MDT makes is that total reduplication should be extremely common, since it can be produced immediately from the basic structure in (27). A more interesting prediction that MDT also makes is that a reduplication pattern can consist of two phonologically different allomorphs of a stem.

(28) *MDT basic structure examples*

a. *Warlpiri* (Inkelas and Zoll 2005: 1)
kamina 'girl'
kamina-kamina (PL)

output [kaminakamina]$_{[F+plural]}$

input /kamina/$_{[F]}$ /kamina/$_{[F]}$

b. *Sye* (Inkelas and Zoll 2005: 54)
cw-amol$_2$-omol$_1$ 'they will fall all over'
3PL.FUT-fall$_2$-fall$_1$

output [*cw-amol-omol*]$_{[F+\text{'distributed'}+3PL.FUT]}$

cw [*amol-omol*]$_{[F+\text{'distributed'}]}$

input [*amol*]$_{[F]}$ [*omol*]$_{[F]}$

(28a) presents an example of total reduplication from Walpiri that is produced by the basic structure of morphological doubling, where two semantically identical stems are inserted and produce total reduplication. (28b) shows that the same structure can produce patterns of reduplication where there is divergence between the two copies. Sye (**Inkelas and Zoll 2005**: 54, citing **Crowley 1998**: 79) presents a case where there is total reduplication but different allomorphs of the stem are inserted. /amol/ is what Crowley refers to as a "stem2" and /omol/ is a "stem1." Stem1 is the default form, and Inkelas and Zoll state that the stem2 form appears in a "collection of seemingly unrelated morphological environments" (2005: 52). The phonological difference between the two allomorphs leads to the surface appearance that total reduplication has not occurred.

MDT proposes that there is an analogous phonological side to the basic model in (27), where co-phonologies are associated with each node in the representation.

(29) *Co-phonologies in MDT* (Inkelas and Zoll 2005: 76)

Mother node
Co-phonology Z

Daughter #1 Daughter #2
Co-phonology X Co-phonology Y

/Input #1/ /Input #2/

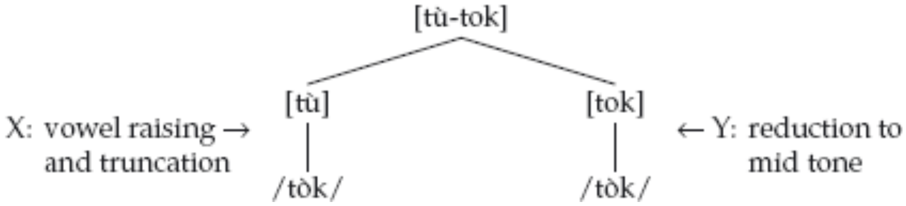
Each node in (29) has its own co-phonology associated with it. Common effects of co-phonologies are truncations that produce partial reduplication patterns. Co-phonologies X and Y will produce phonological changes that are specific to each stem. Co-phonology Z is required to produce juncture effects that hold between the stems only in reduplicative constructions.

Co-phonologies can modify both stems in different ways. Tarok presents an example of this with the reduplication pattern on monosyllabic stems.

(30) *Tarok* (Inkelas and Zoll 2005: 84)

a. ì-gìsàr ì-gìsàr-gisar 'his/her broom'
ì-tòk ì-tù-tok 'his chair'

b.



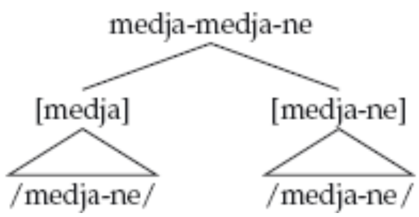
The forms in (30a) demonstrate the processes that are active in reduplicated constructions in Tarok. In all forms, the second stem (governed by co-phonology Y) has its tones reduced to mid regardless of the size of the stem. Co-phonology X must vary, depending on the size of the stem, because, if the stem is larger than a single syllable, no change to the stem occurs. However, if the stem is a single syllable, then the stem is truncated to a CV syllable and the vowel is raised. The example in (30b) lists the processes that each co-phonology is responsible for.

MDT deals with over- and underapplication of phonological processes through morphological truncation. Javanese (see **Inkelas and Zoll 2005**: 137 for the sources) has an /a/-raising process that interacts with reduplication in an opaque manner.

(31) *Javanese* (Inkelas and Zoll 2005: 136–138)

a. /medja/ medjɔ 'table'
medja-ne 'his/her table'
medjɔ-medjɔ 'tables'
medja-medja-ne 'his/her tables'

b. *Opacity by truncation*



(31) provides the basic template on how over- and underapplication effects are handled in MDT. The data in (31a) demonstrate that /a/ will raise to [ɔ] if it is the last vowel. Suffixation blocks the application of /a/-raising. By comparing the non-suffixed and suffixed reduplicated forms, the opaque interaction can be seen. Whether the first stem undergoes /a/-raising appears to be determined by whether or not the second stem is suffixed. MDT denies any phonological connection between the two stems, and instead proposes that the first stem is actually suffixed, (31b). The presence of the suffix on the first stem will block /a/-raising, and the co-phonology will then truncate the suffix. See **Raimy (2006)** for discussion of the problems MDT has with opacity in this example.

MDT is conceptually similar to **Steriade (1988)**, in that a full copy of a level of representation is made and there is no transderivational global computation across the two copies. MDT diverges from Steriade's model, though, in disconnecting from a specific model of the phonology-morphology interaction. Co-phonologies are associated with the reduplication constructions, but MDT does not develop any relationship between co-phonologies in reduplicated and non-reduplicated constructions.

Although not working within MDT, **Kiparsky (2010)** develops a stratal OT model of reduplication that has the characteristics that MDT aspires to. Kiparsky argues that the phonology that an R_r undergoes is determined by the stratal level of phonology that the copy of the stem occurs at. Although there is phonological copying, there is no transderivational identity involved in reduplication, so it is very much in the MDT spirit. The analysis of Sanskrit reduplication presented by **Kiparsky (2010)** clearly demonstrates that the phonology that the R_r undergoes is predictable from the lexical phonology of Sanskrit.

Proposals by Inkelas and Zoll and by Kiparsky demonstrate that modified versions of the SHR can be developed in OT. These models admit some global computation, but this is limited to modules defined by morphology and phonology. Reduplication is a bipartite process where R_r is created by the morphology and then subject to the general phonological derivation. Kiparsky differs from Inkelas and Zoll on the issue of identity as synchrony in reduplication. Kiparsky has a phonological version of this hypothesis in which both R_r and R_o are created from the same phonological representation via copying, while Inkelas and Zoll apply this hypothesis to the morphosyntactic level of representation, where R_r and R_o are created from different phonological representations that share a common morphosyntactic identity. Both models agree, though, that the wholesale move to global computation for reduplication in the CT model is unnecessary.

4 Conclusion and future questions

The SHR in (1) provides hypotheses as to how reduplication interacts with morphology and phonology and why reduplication appears to be a unique grammatical phenomenon. Contemporary models of reduplication have more or less followed the original arc of research that created the basis for the SHR. The wheel has not been reinvented by cycling through the evaluation of the parts of the SHR again. On the contrary, contemporary models of reduplication have increased the importance of the SHR, because each model raises more detailed questions about the validity of each component of the SHR.

Evaluation of the *identity is synchrony* clause in (1c) is currently underway in the guise of questioning what kinds of phonology reduplication interactions actually exist. Both **Inkelas and Zoll (2005)** and **Kiparsky (2010)** dispute the existence of back-copying. The argument is that the global computation of **McCarthy and Prince (1995)** and the precedence graphs of **Raimy (2000a, 2000b)** produce grammars that are more powerful than is necessary to account for reduplication. While the examples of back-copying discussed in the literature are few (e.g. Malay nasal spread, Chaha /x/-dissimilation), more cases do exist (e.g. Serrano). In order to further investigate whether back-copying exists, more examples should be included in the discussion. Obviously, the most fruitful way forward is to develop analyses of the following data in all contemporary models of reduplication to see where the differences in the models arise. Below are additional examples of back-copying that deserve more attention.

(32) *Abkhaz* (Bruening 1997: 325–326)

a. /bʧək/ [bə.ʧək] 'measure of weight'

b. /m/-*reduplication*
[əb.ʧək-m-əb.ʧək]
*[bə.ʧək-m-əb.ʧək]
*[bə.ʧək-m-ə.ʧək]

The Abkhaz data in (32) demonstrate that there is a phonological process that inserts an excrescent vowel between the /b/ and /ʧ/ in the unreduplicated form. When this form undergoes /m/-reduplication, the location of the excrescent vowel changes to precede the /b/ on the basis of the syllabification of the prespecified /m/. It is the syllabification of the prespecified /m/ and the /b/ of the base into a single syllable that places the excrescent schwa before the /b/. This placement of the excrescent schwa is transferred to the first copy (R_r), creating the /əb/ syllable in the reduplicated form. The excrescent schwa appears only in word-initial position, creating a VC syllable in reduplicated forms.

(33) *Korean* (Chung 1999: 177–178)

a.	/hilak/	→	[hirak]	'pleasure'
			[hi-hi-lak-lak] → [hi-hinaŋ-nak]	'rejoicing'
b.	/lwelak/	→	[nwe-rwenaŋ-nak]	'broadminded'
	/l/ → [n]		*[hi-hiraŋ-nak]	
			*[nwe-nwenaŋ-nak]	

The data from Korean in (33) show a complex pattern of normal and over-application of different realizations of the /l/. In (33a) we can see that in the non-reduplicated form the /l/ appears as [r] in an intervocalic environment. The reduplicated form in (33a) shows two interesting effects. First, the form undergoes an AABB reduplication pattern, based on an underlying compound structure to the word. The back-copying effect is present in the interaction between the /kl/ at the juncture between the two copies of the second syllable of the base, /lak/. There is a reciprocal influence on these segments, in that the /k/ preceding an /l/ causes the /k/ to nasalize to [ŋ]. This nasalization process then causes the following /l/ to nasalize to [n]. The nasalization of /l/ to [n] is then transferred to the /l/ of the first copy, [hihi-naŋ-nak], even though it does not follow a nasal segment. Adding to the complexity of these Korean data is the fact that the process that nasalizes the /k/ applies in a normal fashion, so the word-final /k/ is not nasalized. (33b) shows the same derivation for the second syllable /lak/, but the behavior of the /l/ in the first syllable /lwe/ is different. The /l/ in /lwe/ undergoes normal application of the [l ~ r ~ n] distribution, where the /l/ appears as [n] in word-initial position in the first repetition and as [r] intervocalically in the second repetition. The different behavior of the /l/s in the two different syllables creates a very complicated interaction between reduplication and phonology.

(34) *Paamese* (Russell 1997: 109–110)

/muni/ [munu-munu] 'drink'
*[muni-muni]
*[munu-muni]

The Paamese data in (34) are directly analogous to the Malay nasalization data already discussed in (18) and (25). In Paamese, an /i/ is backed to [u] if it is in non-final position. Reduplication causes the first copy of /muni/ to be in non-final position triggering the backing of /i/ to [u]. This alternation is then copied to the word-final /i/ in the second copy.

All three of these additional instances of back-copying provide examples of the exact base-reduplicant juncture effects that **Inkelas and Zoll (2005)** and **Kiparsky (2010)** deny exist. See the original sources for the full details of these examples. One should be cautious about interpreting arguments based on the validity of these data, though. MDT and Stratal OT can produce analyses of these types of data either through additional opaque copying for MDT or by positing special allomorphs in the relevant cases for Stratal OT. Consequently, the existence of back-copying effects (or not) is not as probative in distinguishing models of reduplication as **McCarthy and Prince (1995)**, **Inkelas and Zoll (2005)**, and **Kiparsky (2010)** suggest.

Another important question about reduplication is whether a repeated string of phonological segments is reduplication or repetition. **Gil (2005)** discusses this difference and provides examples from a naturalistic corpus of Riau Indonesian.

(35) *Repetition* vs. *reduplication in Riau Indonesian* (Gil 2005)

a. *complete arbitrary reduplication* (2005: 57)
Anton tak sini-sini a
Anton NEG RED-LOC-DEM-DEM:PROX EXCL
[commenting about his friend] 'Anton hasn't been around.'

b. *complete iconic reduplication* (2005: 54)
Naik ojek-ojek-ojek aja
go.up RED-motorbike.taxi just
[group of three persons debating whether to take a single taxi together, or separate motorbike taxis] 'Let's just ride motorbike taxis.'

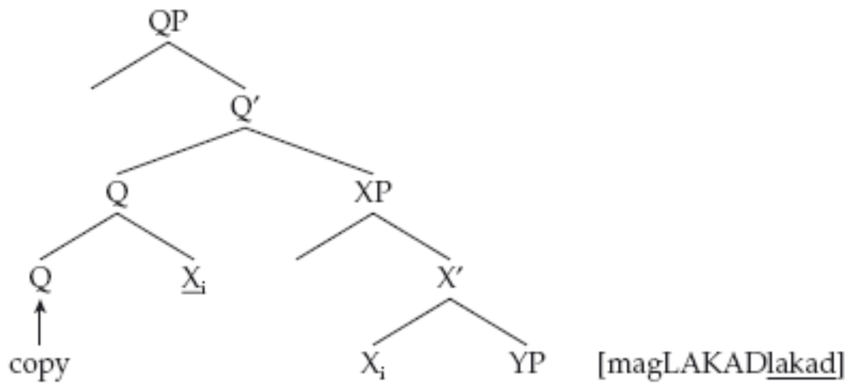
c. *ordinary language: reinforcing repetition* (2005: 43)
Masuk, masuk, masuk, masuk, ah, kelok bola
enter enter enter enter EXCL turn ball
[playing billiards on laptop computer; following the ball as it rolls]
'Go in, go in, go in, go in, damn, the ball curved.'

Gil argues that (35a) is a clear case of reduplication, because the number of repetitions is restricted to two and there is a grammatical function associated with the repetition. (35b) is iconic reduplication, where the number of repetitions of *ojek* 'motorbikes' reflects the number of motorbikes present. This is different from (35a), in that the number of repetitions is variable in (35b), while grammatically fixed in (35a). (35c) presents a case of repetition, not reduplication, because there is no grammatical function of the repetition, only a pragmatic one (i.e. it demonstrates the excitement of the player).

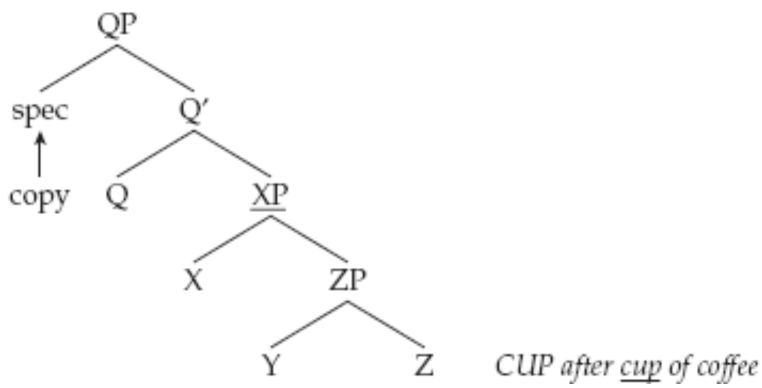
Travis (2003) provides a framework that can potentially distinguish between the examples in (35), on the basis of syntax. Because of the morphological aspects of reduplication, there is the potential for morphosyntactic considerations to play an important role in reduplication. (36) presents the syntax of two different types of reduplicative structures. Q represents a reduplicative morpheme, underlining indicates what syntactic constituent is the target of reduplication, and "copy" indicates where the repetition will occur. (36a) is an example from Tagalog of total reduplication (/lakad/ 'walk' → [mag-lakad-lakad] 'walk a little'), where the capitalized part indicates the R_r of the form. The head of the XP /lakad/ undergoes head movement to adjoin to Q, which is the reduplicative morpheme. Since the X is sister to the Q head, only the content of X is eligible to be copied in reduplication. The syntax of (36b) is different. The Q head copies material from the XP complement and places the copy in the spec position of the QP phrase.

(36) *Reduplication as syntax in Tagalog* (Travis 2003: 240)

a. *phonological*



b. *iterative*



Travis (2003) captures two important aspects of reduplication: (morpho)syntactic representations limit the amount of phonological material that can be repeated and (morpho)syntax plays a role in determining how many repetitions occur.

Morphosyntax determines the upper bound of reduplicative copying through the sisterhood relationship in syntax. Head movement raises an X to adjoin to Q in (36a). This will limit reduplication to no larger than the phonological content of X and to one copy. X category elements are generally a "word"-sized domain, so this syntactic construction aligns closely with the familiar phonological cases of reduplication. The Q element in (36b) is sister to an XP, which allows for copying of the entire XP. Because the target of copying is an XP, more than a word can be copied in this construction. Furthermore, since the copy in this construction will appear in the spec of QP, more than one repetition can occur if multiple QPs are stacked on top of each other. This accounts for the open-ended number of reduplications in … *cup after cup after cup of coffee*. These are only two of the syntactic constructions for reduplication proposed by **Travis (2003)**.

Travis's syntactic differences provide insights into distinctions among the repetition patterns discussed by Gil. (36a) is the morphosyntactic structure for common examples of reduplication such as (35a), while (36b) will account for Gil's (35b) and possibly (35c) examples. (36b) is also appropriate for phrasal reduplication examples like those in (37).

(37) *Phrasal reduplication patterns*

a. *Kannada* (Lidz 2001: 379)
nannu baagil-annu much-id-e giigilannu muchide anta heeLa-beeDa
I-NOM door-ACC close-PST-1SG RED that say-PROHIB
'Don't say that I closed the door or did related activities.'

b. *English* (Ghomeshi *et al.* 2004: 326)
Well, he didn't give-it-to-me–*give-it-to-me (he only lent it to me).*

Travis (2003) presents one view of syntactic aspects of reduplication; see **Ghomeshi *et al.* (2004)**, **Lidz (2001)**, and Idsardi and Raimy (forthcoming) for additional relevant data and different perspectives on these syntactic issues. Developing better syntactic analyses of reduplication will improve our understanding of whether there is any connection between semantics and particular reduplication patterns. If syntax plays an important role in reduplication, then there should be constraints on possible reduplication patterns and semantics pairings.

Another burgeoning question about reduplication is whether a surface repetition of segmental material is a reduplicated form or not. **Buckley (1998)** and **Zuraw (2002)** provide arguments that morphologically simplex forms can be inherently reduplicated.

(38) *Inherently reduplicated words in Manam* (Buckley 1998: 60)

a.	sa'laga	'be long'	salaga-'laga	'long (SG)'	*salaga-ga
b.	ra'gogo	'be warm'	rago'go-go	'warm'	*ragogo-gogo

Buckley (1998) argues that trimoraic forms in Manam that repeat the last two syllables, (38b) /ra'gogo/, are inherently reduplicated. One reduplication pattern in Manam is to reduplicate the final moraic foot of a form, as in (38a), /sa'laga/ → /salaga-'laga/. Forms like (38b) reduplicate only a single mora in this reduplication pattern, /ra'gogo/ → /rago'go-go/, */ragogo-'gogo/ and Buckley's idea is that if the final syllable is already reduplicated then it will "count" as bimoraic, thus producing only a single syllable for the bimoraic foot reduplication pattern.

(39) *Inherently reduplicated words in Tagalog* (Zuraw 2002: 400)

Intervocalic tapping ([ɾ] / V __ V, [d] *elsewhere*)

transparent	'du:ɾi	'loathing'
overapplies	'ɾu:ɾok	'acme'
underapplies	'de:de	'baby bottle'

Zuraw (2002) provides examples from Tagalog involving repetition of segmental material that violate general Tagalog phonotactic distribution of [d] and [ɾ]. Zuraw argues that these words can be understood as being inherently reduplicated. Once these forms are designated as reduplicated, their behavior follows documented phonology reduplication interactions such as over- or underapplication of a rule.

The common theme between Buckley and Zuraw's observations is that forms with surface repetition of segmental material that violate otherwise general patterns in a given language can be understood to be inherently reduplicated. Both Buckley and Zuraw posit an "empty" RED morpheme to provide a grammatical structure to explain the over- or underapplication of some phonological process through reduplication. **Fitzpatrick (2006)** presents an analysis of the Manam data in the **Raimy (2000a, 2000b)** model of reduplication by simply allowing "loops" to be parts of an underlying representation.

To summarize this chapter, reduplication as a natural language phenomenon provides insights into grammatical architecture and the workings of grammatical modules. There is a burgeoning consensus about the general nature of reduplication, which can be summarized as the *strong hypothesis for reduplication* in (1). With Optimality Theory turning radically derivational in the form of Harmonic Serialism (**McCarthy 2010**), it is likely that all contemporary models of reduplication will be in line with the SHR in the near future. This does not mean that there is not disagreement about formal analyses of reduplication; thus further research into reduplication is called for. Future research should refine our understanding of architecture and computation in grammar by developing more explicit analyses of reduplication in more languages. The most difficult question that faces us about reduplication is the parceling out of explanation among potential syntactic, morphological, and phonological sources. By doing this, reduplication will further show its unique status as a natural language phenomenon that involves syntax, morphology, and phonology.

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