REPRESENTING REDUPLICATION

by

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ABSTRACT

This dissertation argues for a new representational approach to reduplication. It argues that reduplication is best understood as resulting from complicated underlying representations that have a looping structure. The looping nature of these structures result in what is recognized as reduplication.

After a brief introduction, Chapter 2 outlines the issues that previous approaches to reduplication have addressed. These issues include the interaction between reduplication and phonological rules, what the formal nature of reduplication is, and what the nature of reduplicative templates is. The success and failure of previous models in providing adequate solutions to these issues is used as a guideline for the development of the proposals in this dissertation.

Chapter 3 investigates the interaction between phonological rules and reduplication. Explicit precedence relations are introduced to phonological representation and their benefits are demonstrated. The main conclusion from this chapter is that a representational approach to reduplication based on explicit precedence relationships can account for the interaction between phonology and reduplication within a serial and modular model of phonology and morphology.

Chapter 4 discusses the implications for morphology that the representations proposed in Chapter 3 present. The nature of reduplication as a readjustment rule is discussed along with prespecification in reduplication and

the general process of morpheme concatenation. A linearization algorithm is presented that transforms the looping underlying structures into a linear string which shows overt repetition of segmental material that is recognized as reduplication. Finally, the production of reduplicative template patterns from the underlying prosodic structure of forms is demonstrated.

Chapter 5 summarizes the findings of the previous chapters and discusses the ramifications of this approach. The important findings in this thesis are that data from reduplication are orthogonal to issues of computation in phonology. Thus, arguments in favor of Optimality Theory (Prince and Smolensky 1993, McCarthy and Prince 1995) based on reduplication are no longer valid. Furthermore, the issues of opacity, predictive power and the goals of Prosodic Morphology (McCarthy and Prince 1986, 1993b) all argue in favor of the model of phonology proposed in this thesis over OT models.

Chapter 1

INTRODUCTION

Reduplication has become the focus of much research in generative phonology. The outcome of this intense interest in reduplication has been arguments of a general nature about how we should view phonology (Prince and Smolensky 1993, McCarthy and Prince 1986, 1993ab, 1994ab, 1995). These arguments claim reduplication and associated phenomena cannot be accounted for within a strictly derivational model of phonology (Chomsky and Halle 1968). Thus, it is argued, reduplication presents evidence in favor of models of phonology that are crucially non-derivational in nature.

This dissertation will argue for an enrichment in phonological representation that will allow a strictly derivational model of phonology to account for reduplication. As with most representational issues, this representational enrichment is theoretically neutral to the extent that it can be implemented in either a derivational or parallel model of phonology. In order to present an explicit model that can be thoroughly tested and evaluated, this new approach will be presented within a derivational model of phonology. The assumption of a fully derivational model of phonology will present the strongest

argument against the view that reduplication requires parallel computation in phonology. Once the final analysis of reduplication is presented it will become apparent that reduplication does not provide any direct evidence on the nature of computation in phonology.

The arguments used to support this new approach to reduplication will be primarily empirical, but other arguments based on metatheoretical ideals will also be presented. In particular I will argue that the proposed approach to reduplication is more constrained than all previous approaches (Carrier 1979, Marantz 1982, McCarthy and Prince 1995, and others) and that reduplicative and concatenative morphology can now be accounted for with the same basic machinery. In addition to these arguments, extensions of the basic proposal will be presented to show that the representational enrichment is advantageous for all of phonology and not just for reduplication.

This thesis will consist of outlining a new approach to reduplication based on making explicit the precedence relationships inherent in phonological representations. Chapter 2 recounts a history of the approaches to reduplication within generative grammar. This summary provides perspective on the relevance of the present proposals.

Chapter 3 presents a discussion of how precedence in phonology should be formally encoded. The basic proposal in this chapter is that precedence should be explicitly encoded in phonological representations through precedence relations ($\rightarrow$). This move replaces the present situation of deriving precedence in phonological forms from typographic left-to-right ordering. The introduction of

explicit precedence relationships allows novel complex phonological representations to be built. These new representations directly address the issues of the formal nature of reduplication and the interaction between morphology and phonology. The results of this chapter will show that a derivational, rule based approach to reduplication is able to account for all aspects of the interaction between phonological rules and morphology. This result indicates that accounting for reduplication phenomenon in phonology is mostly orthogonal to computational issues. More subtle empirical evidence will be required if reduplication is to bear on the nature of computation in phonology.

Chapter 4 will discuss the formal aspects of the morphology involved in reduplication. One key aspect that will be discussed is the nature of a linearization algorithm that is required by the complex phonological representations proposed in Chapter 3. The formal characteristics of these representations and the linearization algorithm will be shown to not only account for why reduplication occurs but to also produce the attested reduplicative templates. This approach to reduplicative templates is more constrained than all previous proposals have been. These results are due to the representations that are posited in Chapter 3 and provide support for their adoption.

Finally, Chapter 5 provides a summary of the basic arguments in favor for the proposed representational changes to phonological theory. Additionally, there is a discussion of the implications of the proposals in this thesis beyond reduplication.

Chapter 2

A SHORT HISTORY OF REDUPLICATION

2.1 Introduction

This chapter presents a summary and overview of research on reduplication in generative grammar over the last 30 years. This research has continually bettered our understanding of the specifics of reduplication and phonology in general. In order to fully understand the merit of the proposals in this dissertation, we must comprehend how reduplication has been understood in previous work. The commonness of reduplication in the world's languages presents a vast amount of data that can be consulted. Early studies of reduplication consisted of a vast amount of descriptive work cataloging the relevant phenomena. With the advent of generative phonology, the theoretical importance of reduplication began to be investigated. I begin discussion of theoretical accounts of reduplication from this point.

2.2 Rule based models of reduplication

The investigation of reduplication as a morphological and phonological process can be divided into three broad categories: the formal representation of reduplication, the interaction of reduplication and phonological rules, and reduplicative templates. These three facets of reduplication have not developed at the same pace nor have all theories of reduplication addressed them with the same care. The assets and liabilities of each previous approach to reduplication provide a guide to the development of the proposal of this dissertation.

2.2.1 Early models of reduplication

Chomsky and Halle 1968 (SPE) will be the beginning point of the discussion of the development of a generative account of reduplication. SPE does not discuss reduplication but it lays the groundwork for a generative approach to reduplication. Interestingly, it took quite a bit of time before reduplication was formally treated as a generative process. Early descriptive accounts of reduplication imply that reduplication is some sort of grammatical process that repeats phonological material (Haeberlin 1918) but the idea of a generative grammar was not formulated at this time. Voegelin and Voegelin 1967 come very close to formalizing reduplication as a generative process through their discussion of Hopi and the relationship between Chomsky's transformations and descriptive adequacy. The passage where Voegelin and

Voegelin state (1967:280), "The noun for *sore* (ʔiya) marks plural by reduplication (ʔiʔiya). The reduplicated noun is the base for the passive verb..." implies that Voegelin and Voegelin were thinking of reduplication in a generative framework but they do not formally spell this thought out. Reduplication is thought of as a generative process here because Voeglin and Voeglin claim that the unreduplicated form (noun) is the base for a transformation that produces the reduplicated form (passive verb).

The next close pass to a fully specified generative account of reduplication is Luelsdorff 1968 where a rule of the form '$\varphi \rightarrow \varphi\ (\varphi)$' is proposed in order to produce repetition. This rule provides a generative account of repetition but its connection to reduplication is not made until Moyne and Carden 1974. Moyne and Carden discuss the syntax involved in subject reduplication in Persian and provide the following rule.

(1) Subject Reduplication (Moyne and Carden 1974:209)

$X\ [\ NP_1\ VP\ ]_S\ Y \Rightarrow X\ [\ NP_1\ NP_1\ VP\ ]_S\ Y$

This rule appears to be the first formal treatment of reduplication as a generative process. Ironically, this proposal is made in a syntax paper.

Preceding this technical formulation, reduplication was understood as a morphological transformation using the same mechanism of transformational rules as in syntax (Chomsky 1955). Following the outline of SPE, reduplication was treated as a morphological rule and thus would precede all phonological rules. Many of the assumptions in SPE are empirical questions and can be

refuted by appropriate data. The uncovering of new empirical data began the development of a generative approach to reduplication.

Wilbur 1973 investigates the interaction between reduplication and phonological rules. According to the assumptions in SPE, we should expect little to no interaction. The only interaction should be phonological rules acting on the output of reduplication since all morphology precedes phonology. The main conclusion of Wilbur 1973 is that this conception of reduplication is not tenable due to certain interactions between reduplication and phonological rules.

Wilbur 1973 shows that two types of interaction between reduplication and phonological rules create ordering paradoxes. These ordering paradoxes result from the assumption that all of morphology precedes phonology (Chomsky and Halle 1968). One paradox is created solely on this assumed ordering between morphology and phonology, and it will be called the morphological paradox. The other paradox will be called the phonological paradox and is due to the mechanism of rule ordering. Wilbur 1973 argues that both of these ordering paradoxes result from the *overapplication* and/or *underapplication* of phonological rules.

Overapplication (or *underapplication*) of a phonological rule is when it appears that a phonological rule has applied (or appears to have failed to apply in the case of *underapplication*) before reduplication occurs. This has the effect of making an application of a phonological rule appear unconditioned (or the lack of application an exception) that can be analyzed as phonological opacity (Kiparsky 1971). The problem that arises for a SPE type phonological framework

is that these particular cases of opacity cannot be accounted for due to assumptions made about the relationship between morphology, phonology and rule ordering.

Overapplication of a phonological rule creates a morphological paradox through the requirement that the phonological rule must apply before reduplication does in order to account for overapplication. Wilbur 1973 presents the following example from Chumash. (The phenomena below will be later referred to as coalescence, section 4.4.2.2. This term is more correct in describing the phonological process in question. Wilbur refers to it as aspiration though.)

(2) Coalescence in Chumash (Wilbur 1973: 26)

$$\begin{bmatrix} C_1 \\ +\text{cons} \\ -\text{voice} \end{bmatrix} \rightarrow [+\text{aspiration}] \; / \; \_\_ \; \begin{Bmatrix} h \\ C_1 \end{Bmatrix}$$

Base	/s-soyin/	/ma-k-hatinet/
Reduplication	s-soy-soyin	ma-k-hat-hatinet
Expected	*s^{h}oy-soyin	*mak^{h}at-hatinet
Actual	s^{h}oy-s^{h}oyin	mak^{h}at-k^{h}atinet
Gloss	'it is very black'	'my joints'

This example from Chumash shows that in the actual occurring form, the word internal copy of the consonant that undergoes coalescence (s^{h}oys^{h}oyin, mak^{h}atk^{h}atinet) does not appear in an environment that triggers this rule. If reduplication occurs before the coalescence rule, which it should if the assumption about all morphology precedes phonology is true, then this

application of coalescence is unconditioned and unexplained. If we allow the rule to apply before reduplication, though, the occurring forms are no longer exceptional.

(3) Rule ordering and the morphological paradox

Morphology before Phonology		*Phonology before Morphology*	
Base	/s-soyin/	Base	/s-soyin/
Reduplication	s-soysoyin	Coalescence	s^{h}oyin
Coalescence	s^{h}oysoyin	Reduplication	$s^{h}oys^{h}$oyin
Output	*s^{h}oysoyin	Output	$s^{h}oys^{h}$oyin

As can be seen in the different rule orderings in (3), in order to account for *overapplication* of some phonological rules, a phonological rule must be allowed to apply before overt reduplication occurs. If this possibility is granted, then the phonological opacity that *overapplication* represents is explained by the copying aspect of reduplication which copies part (or all) of the word and places it into an environment that is different from the other copy. Under this solution, reduplication occurs after coalescence and opacity results from rule ordering, which is the normal source of opacity. To sum up here, one way of accounting for *overapplication* of phonological rules is to allow some phonological rules to precede some morphological rules (as in Lexical Phonology, Kiparsky 1982).

While abandoning the assumption that all morphology precedes phonology allows a solution to the morphological paradox to be found, the

phonological paradox is not as easily overcome. Wilbur 1973 presents the following example of this type of *overapplication*.

(4) Chuckchee (Bogoras 1922, Wilbur 1973: 76)

y → d / n_

[yɪn]+[Redup.] → dɪndɪn 'fire'

The importance of this example is that Bogoras 1922 claims that /d/ does not occur in Chuckchee except as the output of the above rule. The main point here is that the word initial /d/ is not mandated by any rule in Chuckchee and therefore rule ordering is not a viable solution to this problem. (5) shows that rule ordering cannot account for this type of form.

(5) The inadequacy of rule ordering in Chuckchee

Base	[yɪn]	Base	[yɪn]
Reduplication	yɪn-yɪn	y → d	-----
y → d	yɪn-dɪn	Reduplication	yɪn-yɪn
Output	*yɪn-dɪn	Output	*yɪn-yɪn

Neither ordering of the rule and reduplication correctly derives the occurring form. The crux of the problem is that the environment that triggers the application of the rule in question results from reduplication. McCarthy and Prince 1995 refer to this situation as 'B[ase] copies R[eduplicant]' (also referred to as *backcopying*). It is thus impossible to have the rule apply before reduplication

occurs and this prevents the phonological paradox from being accounted for in a SPE type framework.

An interesting aspect of the inability of rule ordering to account for this type of phonology/reduplication interaction is that *underapplication* can be accounted for. The ordering where the phonological rule applies before reduplication does create a form that shows *underapplication*. Even more interesting is that this situation is reversed in the previous example from Chumash. In (3), neither ordering produces *underapplication*. There is no reason for the aspiration rule to not apply in (3) because the triggering environment is present in the unreduplicated form.

There appears to be a relationship between whether rule ordering will account for *overapplication* or *underapplication* of a phonological rule and where or how the triggering environment of the rule occurs. If the environment occurs fully within the unreduplicated form then *underapplication* is troublesome. If the environment results from the segmental material added through reduplication then *overapplication* is troublesome for a rule based analysis.

The main conclusion that Wilbur 1973 draws is that a strictly derivational model of phonology cannot account for reduplication. The whole of Wilber 1973 investigates all of the technical possibilities that were proposed in SPE that could possibly account for *overapplication* and *underapplication* effects. Rule ordering, rule exception marking, and special boundary symbols are all unable to account for the interaction between reduplication and phonological rules. Wilbur's solution to this problem is to introduce the Identity Constraint that allows a

transderivational identity relationship to be created between the base and the reduplicant.

(6) *The Identity Constraint* (Wilbur 1973: 58)

> There is a tendency to preserve the identity of Ro [base] and Rr [reduplicant] in reduplicated forms.

(6) will allow the phonological opacity that appears as *overapplication* and *underapplication* of phonological rules to result from the theoretically separate tendency of the base and reduplicant to be identical. This approach will account for reduplication effects but does not add any insight into this phenomena, as it just stipulates that base and reduplicant should be identical in some instances without providing any ideas as to why, or criteria as to when, this should be the case. The Identity Constraint also adds a great amount of power to phonological rules if transderivational identity is now a possible characteristic of individual rules. The solution to reduplication specific effects as the result of an Identity Constraint is the basis of the OT approach to reduplication (McCarthy and Prince 1993b, 1994ab, 1995) and it will be shown that the arguments (unconstrainedness and overgeneration) that can be made against Wilbur's proposal apply with equal force to the OT approach to reduplication.

In summary, Wilbur 1973 presents evidence that reduplication provides data that cannot be accounted for by the phonological theory presented in SPE. The two types of data that are the basis of this conclusion are the *overapplication* and *underapplication* of phonological rules. Wilbur's solution to this problem is to propose an Identity Constraint that creates a transderivational relationship

between base and reduplicant. By establishing the Identity Constraint, Wilbur 1973 claims that the SPE view of the relationship of morphology preceding phonology can be maintained.

The next major work on reduplication is Carrier 1979. The main contribution made by this work is the claim that reduplication is a purely morphological process and best characterized by transformational rules. These claims solidify the formal nature of reduplication at this time. Additionally, Carrier argues against Wilbur's Identity Constraint by presenting data from Tagalog that cannot be accounted for via this machinery.

Carrier's main argument against Wilbur 1973 is the interaction of a syncope rule and reduplication in Tagalog. Wilbur 1973 reiterates that reduplication is a morphological rule and that all morphological rules should precede all phonological rules. Carrier's argument against the Identity Constraint is based on this assumption. The following example shows that Tagalog requires a syncope rule to apply before reduplication does. This particular example of reduplication from Tagalog (R2 in Carrier's terms) copies the first foot of the stem. (IC = Identity Constraint and GR = Global Rules).

(7) Interaction of syncope and reduplication in Tagalog (Carrier 1979)

Base	/sunud-in/	
Reduplication	sunud-sunud-in	
Syncope	sunud-sund-in	
IC+GR	sund-sund-in	
Output	*sund-sundin	[sundin-sundin]

Carrier notes that the syncope rule must be ordered before reduplication or the proper form cannot be derived. In the above derivation, *overapplication* has occurred due to the Identity Constraint and Global Rules (IC+GR) that Wilbur posits and this produces the wrong output. Having the syncope rule *underapply* does not solve the problem because the incorrect **sundun-sundun-in* would result. Normal application also does not derive the correct form because this application of syncope would produce **sundun-sund-in*. Carrier argues that only by placing syncope before reduplication can these forms be correctly accounted for. Thus, this type of interaction between reduplication and syncope in Tagalog provides an argument against the Wilbur 1973 model of reduplication.

Although examples like (7) appear to require some phonological rules to apply before morphological rules, Carrier proposes a different solution. Carrier proposes that phonological rules that act exceptionally are not actually phonological rules, instead, these rules are morphological rules (cf. Leiber's allomorphic relations). Carrier presents two types of evidence in favor of this conception of exceptional rule application. The first argument is based on exceptions to the phonological rules that appear to apply before reduplication. Carrier shows that the processes of syncope and nasal substitution all have exceptions to their applications. The morpheme /maN-/ in the nasal substitution examples is a Subject Topic marker (Carrier 1979).

(8) Exceptional rules in Tagalog (Carrier 1979)

Syncope		
sunud-in	sundin-sundin	'obey/obey somewhat'
Compare:		
linis-in	linis-linis-in	'clean/clean a little'
Nasal Substitution		
maN-putul	mamutol	'cut'
maN-bilih	mamilih	'shop'
Compare:		
maN-basah	mambasah	'read'

Carrier presents these two rules to show that they are not fully productive in the phonology of Tagalog. In fact, whether these rules apply or not appear to be determined on a form by form basis. Thus, according to Carrier, *sundun* is marked to undergo syncope while *linis* is marked to not undergo this rule. Similarly, the root *bilih* is marked to undergo nasal substitution while *basah* is marked to not undergo this process. The unpredictable nature of these rules is reason enough for Carrier to relegate them to the lexicon and make them morphological rules. The reasoning is that the lexicon should only contain information about forms that needs to be memorized and since whether or not a form undergoes syncope or nasal substitution is unpredictable, this information should reside in the lexicon.

The other explanation Carrier presents for the exceptional nature of some rules is that reduplication is a unique operation in the lexicon. Carrier supports this view of reduplication with two arguments. The first argument is based on the morphological sensitivity of some reduplication rules. The reduplicative processes that Carrier investigates in Tagalog are sensitive to morphological information in an asymmetrical fashion. Reconsider the some examples from (8) (below as (9)).

(9) Morphological edges in reduplication

sunud-in	sundin-sundin	'obey/obey somewhat'
linis-in	linis-linis-in	'clean/clean a little'
mag-linis	mag-linis-linis	'clean/clean a little'

These examples show that reduplication in Tagalog is sensitive to morphological information at the 'left side' of a form but not on the 'right side'. Accordingly reduplicative copying begins at the left edge of the stem but will continue into suffixes if a particular shape is required. The necessity of including morphological information and structural information (to ensure the proper amount of copying) in the reduplication rule is the main reason Carrier proposes that reduplication is a transformational rule. To be explicit, Carrier's R2 reduplication rule follows.

(10) R2 Reduplication (Carrier 1979)

W	$[_{STEM}$	$C_0V_1C_0$ (+)	V_2	C(+)	X	>>>	12	3	42345
1		2	3	4	5		[+lg]		

Carrier argues that reduplication processes require the ability to explicitly refer to morphological information that a transformational rule provides. In order to indicate what reduplicates in R2 reduplication, the rule must specify that reduplication begins from the left edge of the stem and continues until a consonant that follows the second vowel is reached. In addition to this segmental aspect to R2 reduplication, the fact that the second vowel in the reduplicant lengthens must also be specified in this rule. Carrier argues that using the CV notation posited in SPE is unable to characterize reduplication not only due to the massively complex formulation of the above rule in an SPE type framework but also due to total reduplication.

Total reduplication presents the situation where the copying command is to copy everything regardless of the actual structural configurations of Cs and Vs. If a reduplication rule only uses Cs and Vs to describe the changes that must occur, the variable nature of total reduplication presents an insurmountable problem because each form can have different arrangements of Cs and Vs. Different arrangements of Cs and Vs in total reduplication would require different formulations of the reduplication rule and this would prevent a generalization from being made (this argument is repeated in McCarthy and Prince 1986 against a Marantz 1982 model of reduplication). In summary, due to the notational complexity and unique information that reduplication rules require, Carrier argues that reduplication is best characterized as a transformational rule.

With this move, Carrier 1979 claims that reduplication appears in a special place in the lexicon. This claim allows Carrier to propose a novel solution to the exceptional interaction of rules with reduplication. Carrier's solution is that *overapplication* and *underapplication* are actually cases of allomorphy. The relationship where morphology precedes phonology can now be reinstated because the exceptional nature of some rules is accounted for totally within the lexicon. This approach posits a special allomorph that is only used when there is a reduplicative morpheme present. Thus, reduplication triggers the choice of a different allomorph[1] that contains the phonological change in question and this appears as a phonological rule acting exceptionally. Since all of these changes are occurring in the morphological component, the separation between phonology and morphology is maintained.

Invoking allomorphy as an explanation as to why there are *overapplication* and *underapplication* effects makes the claim that these processes are not morphophonological in nature. This is an empirical claim that can and must be tested. This claim is true in some cases but false in others. Cases where there is an unpredictable nature to the interaction between reduplication and a rule are perhaps best handled by allomorphy type approaches. Other cases where the nature of the interaction between reduplication and a rule (even if this nature is *overapplication* or *underapplication*) is predictable should not be treated as allomorphy since predictable and regular (in a relative sense) rule interactions should be accounted for within the phonological component and not the morphological component.

A major drawback to the transformational approach to reduplication is the generative power of transformational rules. The string rewrite mechanism that is the root of transformational rules does not have any inherent constraints on its application. This will allow this mechanism to account for all known types of reduplication but it also predicts that other unattested patterns to be produced. Thus, this mechanism overgenerates pathological reduplication patterns as easily as attested patterns. Consider the following transformations.

(11) Possible transformational reduplication patterns

String Reversal	12345 → 54321-12345
Scrambling	12345 → 24315-12345
Doubling	12345 → 1122334455

All of the patterns in (11) are easily created by a transformational rule (and are equally complex, "marked", in this notation) but are not attested in human language nor do they appear to be natural linguistic possibilities. The basic problem with this formal mechanism is that it is just as easy to produce the non-occurring patterns in (11) as it is to produce the R2 rule posited by Carrier 1979 (this is (10)). Both rules in (10) and (11) require five 'numbers' to be used but there is no way of predicting if the ordering of the numbers in the output is a reasonable process. The mechanism of transformational rule requires additional ad hoc constraints imposed on its application in order to insightfully account for reduplicative phenomena. Otherwise, this mechanism overgenerates and does not make any predictions about the shape of possible reduplicants. The issue of

overgeneration plagues all present proposals on reduplication (Stemberger 1996). In fact, overgeneration will always be a problem without a theory of simplicity and learning (SPE, Chomsky 1955). This point will be one of the major advantages to the proposals in Chapters 3 and 4.

In summary, Carrier 1979 presents a formal approach to reduplication in the guise of a transformational rule. In support of this approach, Carrier provides evidence that shows the morphologically dependent nature of reduplication in Tagalog. The morphological nature of reduplication is indicated by its special interaction with phonological rules and the special requirements on its application and output. Carrier 1979 represents the pinnacle of understanding of reduplication in a non-autosegmental framework of generative phonology. The main drawback of this approach is massive overgeneration of possible reduplicative forms, which prevents this proposal from making any predictions about natural or unnatural reduplication patterns.

2.2.2 The affix and copy approach

Marantz 1982, building on proposals by Goldsmith 1976 and McCarthy 1979, proposes a novel way of understanding reduplication. Marantz's key insight is that reduplication is just a special type of affixation. This view argues against the Carrier transformational account of reduplication and instead presents a principled and constrained view of reduplication as a special case of affixation.

According to Marantz reduplication is different from normal affixation because a bare CV skeleton is attached to the stem, instead of a fully phonologically specified one. This bare CV skeleton is then filled with melodic content from a copy of the base melody, triggered by the morphological aspect of reduplication, through the principles of autosegmental spreading and templatic phonology (Goldsmith 1976, McCarthy 1979, 1981).

The Marantzian approach to reduplication is based in a derivational system of phonology. As seen in (12), reduplication begins with the affixation of a bare CV skeleton. After this CV skeleton is added, the melody from the base is copied and then associated to the CV skeleton. Finally, all non-associated melodic elements are deleted and the reduplicated form is complete.

(12) Agta Initial CVC Reduplication (Marantz 1982, p.446)

CV Affixation		Copy +Association			
t a k k i		t a k k i	t a k k i		
| | | | |	→	| | |	| | | | |	=	taktakki
CVC+CVCCV		CVC+	CVCCV		

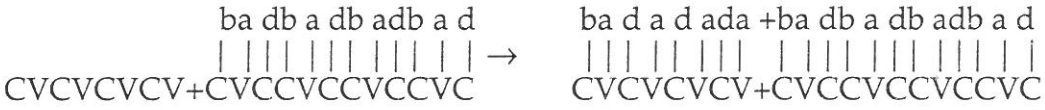
Viewing reduplication in this way produces a much more constrained apparatus for reduplication than Carrier 1979 but it does not add anything further to the understanding of the interaction between morphology and phonology. The constraints placed on this technology based on the principles of autosegmental spreading and templatic phonology do not prevent all overgeneralization though. The issue of exactly how melody/template association proceeded was a very active issue in the literature following Marantz 1982. Marantz proposed and argued for a template driven type of association,

which proposed that the template was primary in the association process. Others proposed different positions on this topic though. Kitagawa 1987, Mester 1986, Clements 1985, and Cowper and Rice 1985 among others all present different views on this topic. See these authors for their arguments for their particular positions.

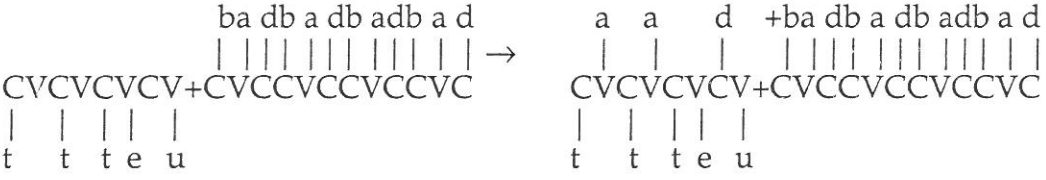
The examples of string reversal, scrambling and doubling found in (11) are not easily produced in a Marantzian framework but the following examples of pathological deletion and prespecification are.

(13) Overgeneralization in a Marantzian framework

No Coda badbadbadbad → <u>badadada</u>-badbadbadbad



Radical Prespecification badbadbadbad → <u>tatatedu</u>+badbadbadbad



The examples in (13) show that the Marantzian copy and associate technology also requires ad hoc constraints to limit the production of unnatural reduplicative patterns.

The issue of the interaction of phonological rules and reduplication is not inherently addressed by the proposals in Marantz 1982. In fact, Marantz adopts the same allomorph based solution to most cases of *overapplication* as proposed

by Carrier, modified only by the adoption of some then current proposals for morphological theory (esp. Lieber 1980).

Prosodic Morphology (McCarthy and Prince 1986) was developed in direct response to these issues of overgeneration of possible reduplication patterns. Prosodic Morphology claims that the CV skeleta used in Marantz 1982 are not actually bare CV skeleta but rather are the units of structure that are legitimate prosodic categories. Reduplicative templates are restricted to Wd 'prosodic word', F 'foot', σ 'syllable', σ_{μ} 'light (monomoraic) syllable, $\sigma_{\mu\mu}$ 'heavy (bimoraic) syllable' and finally σ_{c} 'core syllable' (McCarthy and Prince 1986:6). This proposal limits the power of the copy and association model of reduplication through well-motivated stipulation, using an independently necessary component of phonological theory --prosodic categories. The fact that common reduplicative templates are evidenced throughout the languages of the world while other patterns are not does need to be explained but there is very little insight to this situation provided by a structural stipulation.

Even with the stipulation that only legitimate templates can be used as reduplicative ones, the technology in Prosodic Morphology can still produce unattested reduplication patterns. In particular, there are no restrictions on how many or what combinations of legitimate templates can be added to a form to produce reduplication. (14) gives examples of some unattested reduplication patterns that can be produced with Prosodic Morphology.

(14) Pathological reduplication in Prosodic Morphology

No Coda badbadbadbad → <u>bada</u>-badbadbadbad

```
        ba db a db adb a d        ba da        +ba db a db adb a d
        | | | | | | | | | | | _   \| \|          | | | | | | | | | | |
σc σc   +CVCCVCCVCCVC             σc  σc         +CVCCVCCVCCVC
```

Radical Prespecification badbadbadbad → raka+badbadbadbad

```
        ba db a db adb a d        a  a  + ba db a db adb a d
        | | | | | | | | | | | _   |  |    | | | | | | | | | | |
σc σc   +CVCCVCCVCCVC             σc σc  +CVCCVCCVCCVC
| |                               |  |
r k                               r  k
```

Neither of the examples in (14) is as dramatic as the ones provided in (13) but the basic problematic characteristics remain. The formal mechanism that is used to produce the derivations in (14) makes the incorrect predictions that codas can be deleted word internally in reduplication with the same amount of ease as they can be retained. If the position that core syllables (σ_c) are less marked than other syllables (this claim is made in present OT models through the positing of ONSET, NO CODA and *COMPLEX constraints), then the mechanisms in Prosodic Morphology actually predict that medial coda omission in reduplication is less marked than other patterns. This is an incorrect prediction.

The problem of constraining prespecification is also not addressed by the mechanisms in Prosodic Morphology either. This is also shown in (14). It must be noted that there is a hint of some kind of markedness metric in this approach to reduplicative templates that could be elaborated to possibly limit radical

prespecification effects. This potential aspect of Prosodic Morphology has not been developed though so it is not clear how it would affect this model.

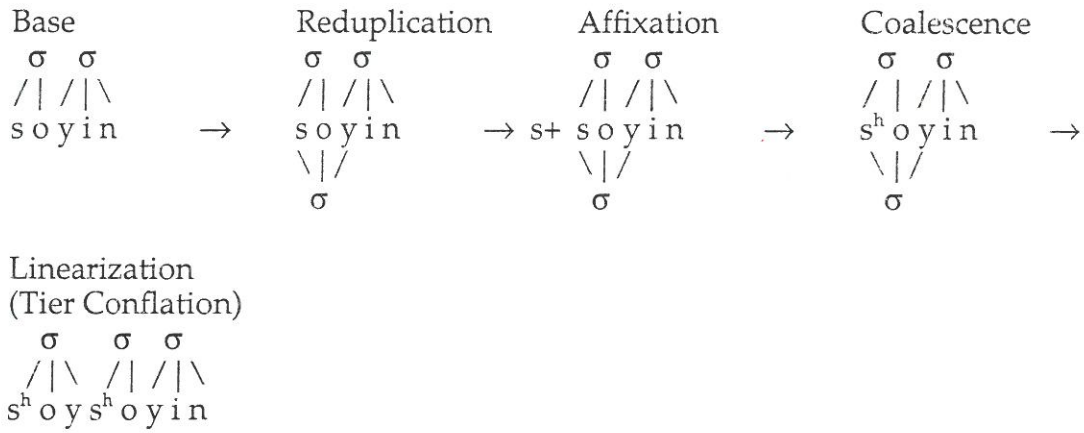
To summarize this section, Marantz 1982 argues that reduplication is a special type of affixation. Reduplication is a unique type of affix because it only specifies CV information and not melodic information. Additionally, there is morphological information that triggers the copying and association of the base melody to give melodic content to reduplicative morphology. This understanding of reduplication is attractive primarily due to the claim that reduplication is just a type of affixation. Also, since this proposal is based on previous proposals about templates (McCarthy 1979,1981) and autosegmental phonology (Goldsmith 1976) it is more constrained than the mechanisms proposed in Carrier 1979. Prosodic Morphology (McCarthy and Prince 1986) provides further constraints on the possible types of reduplicative templates. One must note that these constraints on reduplicative templates are ad hoc in nature and do not prevent the overgeneration of pathological reduplication patterns.

2.2.3 Single melody models

The most significant insight into reduplication in a rule-based framework is the proposals for single melody approaches to reduplication made by Clements 1985 and Mester 1986. These proposals differ from the Marantzian copy and associate model by denying the copying aspect of reduplication.

Instead, reduplication is the association/affixation of a prosodic category onto the melody of the base. This results in a structure that has multiple prosodic categories associated with a single melody. This model posits two separate planes of prosodic structure rather than two separate planes of melody. This situation is later remedied by a linearization process that places the reduplicant prosodic category in some linear relation to the base. This type of approach to reduplication provides an elegant analysis of the *overapplication* of coalescence in Chumash discussed in (2). Below is a sketch of the analysis provided by Mester 1986 for this data.

(15) Single melody analysis of Chumash coalescence (Mester 1986)



According to this analysis, *overapplication* occurs because when aspiration applies, this process affects the single melody of the base. The reduplicant is also associated with this base so when the later process of linearization occurs and places the reduplicant at the beginning of the word, the aspirated word initial segment of the base becomes word internal. As previously mentioned, this chain of events is simply a case of phonological opacity in that linearization obscures

the fact that both surface aspirated segments were at one time in the derivation word initial and a single segment.

The idea that the surface reduplicant and surface base are actually a single object for a period of time during a phonological derivation is a crucial insight into the nature of reduplication. A highly explanatory reason for the *overapplication* and *underapplication* of phonological rules is provided by this notion. This position is the strongest interpretation of the Identity Constraint proposed by Wilbur. Base and reduplicant have a tendency in some cases to preserve identity because *they are the same entity* until linearization occurs. This view of reduplication is retained by the proposals made in this thesis.

The proposal that base and reduplicant are the same entity during a part of the phonological derivation does not solve all of the problems of a rule based approach to reduplication though. In particular, a Chuckchee (example (4)) type case of *overapplication* cannot be accounted for without resorting to an allomorphy-based solution as seen in Carrier 1979 and Marantz 1982. Consider an updated Mester 1986 analysis of the possible derivations for this Chuckchee example.

(16) Continuing inadequacy of rule ordering in Chuckchee

Possible Ordering 1

Base →	Redup. →	/y → d/ →	Linearization
σ	σ		σ σ
/|\	/|\		/|\ /|\
yɪn	yɪn	---------	yɪnyɪn
	|/		
	σ	Output	*yɪn-yɪn

Possible Ordering 2

Base →	Redup. →	Linearization →	/y → d/
σ	σ	σ σ	
/|\	/|\	/|\ /|\	
yɪn	yɪn	yɪnyɪn	yɪn-dɪn
	|/		
	σ	Output	*yɪn-dɪn

This particular type of interaction is problematic for the single melody model because there is no way for reduplication to create the environment for a rule that *overapplies*. In particular, the triggering environment for the /y → d/ rule is not met until after linearization has split the single base/reduplicant melody into two separate independent ones. Once this split has occurred, there should be no Identity effects. This type of situation is exactly how *normal application* of phonological rules is accounted for in Mester 1986.

In summary, Mester 1986 provides the crucial insight that identity effects in reduplication result from the base and reduplicant being the same entity during a period of the phonological derivation. Following this proposal, a linearization operation (based on McCarthy 1979) separates the base/reduplicant entity into two separate entities at the point of phonological derivation between

the cyclic and post-cyclic rule blocks. This leads to a typology of phonological rules that predicts that only cyclic rules should show *overapplication* and *underapplication* effects while post-cyclic rules should only show *normal application*.

2.2.4 Full copy model

The final rule based model of reduplication that needs to be discussed is the full copy model proposed by Steriade 1988. Steriade claims that reduplication copies the entire structure of a form and then deletes aspects of this structure according to the setting of certain parameters. These parameters, according to Steriade, encode markedness effects in that simplification of the copied structure results from the parameters removing marked structure.

This approach has the advantage that full reduplication is easily accounted for and its commonness is predicted by the nature of Steriade's proposal. Since full reduplication is accomplished by simply copying the whole structure and doing nothing else, it is predicted to be the default case of reduplication. This fact is supported by the prevalence of total reduplication in the world's languages. The parameters can eliminate only marked structure in that they have the options of what type of structures that they can license. Thus, one parameter can be set to 'core syllable' and this will eliminate all structure but a CV syllable in the reduplicant. Other parameters will simplify complex onsets,

remove codas, etc. All of these types of processes are viewed to eliminate marked structures and are the result of parameters in Steriade's view.

The parameters proposed by Steriade are not constrained in their application though. The full copy model, like all previous models, predicts that unattested reduplication patterns should be more common than some attested ones. The reasoning behind this claim is due to how total reduplication is handled in this model. Full reduplication is predicted to be the most common pattern because no additional constraints are required by this pattern. Only the full copy process is required. Following this point, patterns of reduplication that require less parameters should be more common that patterns requiring more parameters. This prediction is problematic for the following reason. CV reduplication results from three constraints: weight parameter, complex onset parameter, and a coda parameter. The troublesome prediction that is present here is that the reduplication pattern that results from the omission of one of these parameters should be more common than CV reduplication. Omitting either of the two syllable parameters (complex onset and coda) is not problematic but omission of the weight parameter is. Consider the example in (17).

(17) Overgeneration in Full Copy Model

Parameter: complex onset
Setting: unmarked (=complex onsets not allowed)
Matching procedure: Eliminate from the base a unit disallowed by the template.

Parameter: obstruent codas
Setting: unmarked (=obstruent codas disallowed)
Matching procedure: Eliminate from the base a unit disallowed by the template.

Base: bradbradbradbrad
Full Copy: bradbradbradbrad-bradbradbradbrad
Onset Cons.: badbadbadbad-bradbradbradbrad
Coda Cons.: <u>babababa</u>-bradbradbradbrad

The derivation in (17) shows that there must be some additional ad hoc constraints placed on the relationship between parameters. One constraint would be that onset and coda requirements can only be active if there is a weight requirement. An additional problem to this approach is that to produce 'unmarked' patterns, formally marked structures (additional parameters) are posited. This situation is contradictory in nature and indicates that the formal system underlying the full copy model of reduplication is inherently flawed.

The proposals made by Steriade are similar to previous ones for reduplication in that only certain aspects of reduplication are addressed. Steriade's successes advance our understanding of base transfer effects in reduplication (first pointed out by Clements 1985) and the tendency for reduplication to result in simpler structures than in the base. Unfortunately, these proposals do not address the *overapplication* and *underapplication* of

phonological rules nor do they provide deeper explanations for the stipulations on reduplicative templates made by McCarthy and Prince 1986.

In summary, Steriade 1988 advances our understanding of some aspects of reduplication but also leaves other areas unchanged. The most important contribution made by Steriade 1988 is the discussion of simplifying structure in reduplicants. This idea will reemerge as a basic tenet in OT analyses of reduplication. The questions that are not addressed by Steriade are the ones dealing with the interaction between reduplication and phonological rules.

2.2.5 Summary

Research on reduplication has focused on three main aspects of this phenomenon. The first aspect of reduplication is the interaction between morphology and phonological rules. This question can be distilled to asking what type of information flow between morphology and phonology is necessary in order to account for reduplication. From the work discussed in the previous sections, it appears that there can be a one way flow of information from morphology to phonology if certain *overapplication* and *underapplication* effects are analyzed as the result of allomorphy rules. This position can be made stronger if the single melody approach to reduplication is adopted because only certain type of *overapplication* and *underapplication* effects must be relegated to the morphology while other cases can be dealt with directly in the phonology.

The summary of recent work on reduplication shows that no consensus has been reached as to the formal nature of reduplication. This dichotomy is also present in the OT literature and will be discussed in the next section.

Finally, limits on overgeneration via different reduplicative templates are stipulated in all present theories of reduplication. There have been advances that have limited some types of overgeneration of reduplicative templates but the present technology still requires ad hoc constraints on its uses. This is a continuing problem in OT analyses of reduplication.

2.3 Optimality Theory

Optimality Theory (OT, Prince and Smolensky 1993, McCarthy and Prince 1993ab, 1994ab, 1995, etc.) presents a radical departure from the assumptions that have driven previous research on reduplication. This section will present an overview of the differences between OT approaches to reduplication and previous views and outline the advances in OT research on reduplication. I will only refer to specific OT machinery when it is pertinent to the discussion at hand.

OT approaches to reduplication are drastically different than previous rule based approaches not only due to the switch from rules to violable constraints but also due to the abandonment of the guiding assumptions that framed the rule based investigation into reduplication. Fundamental assumptions that have been a part of generative grammar have been changed by the theoretical shift to OT. The changes in theoretical positions, both

representational and computational, made by OT relevant to the issues investigated in this thesis are discussed in the following sections.

2.3.1 Prosodic Morphology

A division of labor between morphology and phonology has been an issue in all rule-based analyses of reduplication. Wilbur, Carrier, Marantz, Mester and Steriade all argue for a view of morphology that precedes phonology with a definite division between the two modules. OT (and Prosodic Morphology) abandons this view and proposes instead a non-modular morphology and phonology with representations that contain all morphological and phonological information simultaneously. This shift is exemplified by Generalized Alignment (McCarthy and Prince 1993a) which proposes a schema that arranges phonological and morphological categories in relation to each other. Given that OT evaluates output candidates, the implementation of Generalized Alignment constraints requires morphological information throughout the entire phonological computation (the doctrine of Consistency of Exponence, McCarthy and Prince 1993b:20-21). This position makes the issue of whether morphological processes occur before or after phonological processes totally irrelevant since all information required by either of these types of processes is present.

It is interesting to note that if this position is adopted in a rule based framework, all cases of *overapplication* and *underapplication* can be dealt with via allomorphy type rules interspersed in the phonological component. This point is

often overlooked and once it is realized, the arguments that McCarthy and Prince make against serial models of phonology are severely weakened. The issue of information flow between morphology and phonology is completely orthogonal to the issues of computation in phonology and rules vs. constraints.

Abandoning the division between morphology and phonology leads to the first empirical success of OT. Since morphology and phonology freely interact, the morphological paradox discovered by Wilbur 1973 is easily circumvented because there is no longer an expectation that morphological processes should precede phonological ones. This solution to the morphological paradox is not a solution though. It is actually an admission of defeat in that no insight has been added to linguistic theory but instead our theory has only become less constrained. Less constrained theories make it easier to account for data but harder to provide explanatory accounts.

A subsidiary issue in OT that is related to the relation between morphology and phonology is the claim of parallel computation that is the center of many proposals by McCarthy and Prince (1993b, 1994b, 1995). The status of parallel computation in OT is an interesting one. There seems to be a hedging on a full commitment to parallel computation while at the same time an agenda promoting this position. Prince and Smolensky 1993 point out that there are plausible versions of OT that are serially based but these alternatives have not been seriously investigated. McCarthy and Prince take a stronger position on parallelism stating that it is a principle of OT (1993b:2,5) and making it a central

factor in their analysis of reduplication. The importance of parallelism to McCarthy and Prince is represented in the following quote.

> "A further significant property of Correspondence Theory emerges from parallelism of constraint evaluation. The base and the reduplicant are evaluated symmetrically and simultaneously with respect to the language's constraint hierarchy. The base does not have serial priority over the reduplicant, and reduplication is not, in fact, the copying or replication of previously fixed base. Instead, both base and reduplicant can give way, as it were, to achieve the best possible satisfaction of the entire constraint set." McCarthy and Prince 1995:254.

It is interesting to note that while there may not be any serial priority to the base in Correspondence Theory there is a morphological one. McCarthy and Prince 1995:364 argue that Input/Reduplicant Faithfulness will never dominate Input/Base Faithfulness due to a metaranking Root-Faithfulness >> Affix-Faithfulness that is stipulated in McCarthy and Prince 1994b. This creates the conceptual priority of base over reduplicant. Unfortunately, this argument is not congruent with other work on reduplication in OT. Urbanczyk 1996 argues that reduplicative templates are partially derived from the status of the reduplicant being either affix or root. Urbanczyk claims that root reduplicants are ones that are larger than a syllable. If this position is granted then IR Faithfulness can be freely ranked over IB Faithfulness and this situation will allow and predict, according to the factorial typology present in OT, that there should be an emergence of the *marked* in some cases of reduplication. As McCarthy and Prince 1995:364 state, "This type of behavior is also unattested and seems quite impossible".

Parallel computation is a particular way of implementing the combination of information from morphology and phonology. We must note that what McCarthy and Prince mean by parallel computation is the free flow of information throughout a *flat* phonological derivation. In essence, this claim of parallelism is actually the removal of all constraints on phonological processes that have been previously proposed. All phonological processes should have full access to information from any other phonological process. This type of free flow of information in a derivation leads to a vastly unconstrained theory that has little to no predictive power.

Another problematic aspect of the claims of parallelism made by McCarthy and Prince is the direct input-output mapping of phonological processes. This position denies the presence of intermediate forms in phonological processes. Idsardi 1997, 1998ab and Noyer 1997a (among others) show that intermediate forms are necessary in order to account for opaque (Kiparsky 1971) phonological processes. Idsardi 1997, 1998a specifically points out that recent proposals made by McCarthy 1997b,1998 to account for opacity effects in OT either result in a derivational model of OT or empirical failure.

In summary, OT adopts a model of phonology with a much less constrained flow of information within a derivation. This is a liability to OT because the advances in empirical coverage (back copying effects in reduplication) do not outweigh the overgeneration problems that arise from unconstrained theories.

2.3.2 Transderivational identity

The adoption of general transderivational identity throughout phonology is another source of empirical success for OT (potentially at the cost of an overly powerful theory). McCarthy and Prince 1995 propose that Correspondence is the basic phonological notion that conditions phonological processes. According to this proposal, Correspondence subsumes the Containment model of Prince and Smolensky 1993. This entails a change in Faithfulness constraints from PARSE and FILL to MAX and DEP. The arguments for this change in theory are due solely to data from reduplication. In particular, McCarthy and Prince adopt and expand on Wilbur's basic finding of the Identity Constraint. Correspondence Theory can be viewed as the wholesale adoption and formalization of the Identity Constraint (Wilbur 1973) across all phonological processes and not just reduplicative copy.

McCarthy and Prince 1995 generalize Correspondence to cover all aspects of identity in phonology (base-reduplicant, input-output, reduplicant-input). Once again, we must ask if the empirical gains made by adding transderivational information to phonology justify the change in paradigm. The proposals in Chapter 3 and 4 of this thesis will show that the adoption of transderivational identity in order to account for reduplication is unnecessary, and therefore undesirable.

The issue of whether transderivational identity and global rules in phonology is a desirable thing has been broached once before due to Lakoff 1970.

The result of this earlier discussion was the rejection of global rules in phonology. While this debate can not be directly used in present times, there are some lessons that can be learned. In the earlier debate, Baker and Brame 1972:51 state,

> "The difference between a model of linguistic description which allows global constraints and one which does not is, in one important respect, parallel to the difference between the original transformational model and a pure phrase-structure model. In both cases, the newer model has the effect of widening the range of grammars consistent with a given finite body of preliminary data. Consequently, in both cases, the burden of proof falls upon the proponent of the more powerful of the two models..."

This idea is directly on point in respect to the present state of phonological theory. Optimality Theory is the more powerful model of phonology and thus it is required of OT proponents to provide arguments in favor of this model. McCarthy and Prince make most of their arguments based on data from reduplication and the main result of this thesis will show that these arguments are no longer valid. Thus, if there are not conclusive arguments in favor of OT, the less powerful model of generative phonology (Chomsky and Halle 1968, Leben 1973, Goldsmith 1976) should be retained.

2.3.3 Reduplicative templates

There has been little advance made by OT in the problem of overgenerating reduplicative templates over previous models of reduplication. Stemberger 1996 shows that all problems of overgeneration that plague prior models of reduplication (Carrier 1979, Marantz 1982) also affect present OT

proposals. In fact, Stemberger shows that OT can do string reversal and this indicates that OT is less constrained than all of the copy and associate (Marantz 1982, Mester 1986, Steriade 1988) models of reduplication. This is one concrete ill effect of the addition of parallel computation and transderivational information to phonology. This also supports the view that OT is the more powerful theory of phonology and thus has the burden to argue for its adoption.

There has been a conscious effort within OT to remove templates as independent phonologically real entities from phonological theory (McCarthy and Prince 1994b, Urbanczyk 1996, Spaelti 1997, Hendricks 1998, Gafos 1998a). These approaches all fall short of eliminating all structural information from reduplication processes. This project is actually orthogonal to accounting for reduplication as a phonological process though.

One inherent aspect of all reduplicative morphemes is some sort of structural information that specifies the shape of the reduplicant. Pre-OT, this information has been thought of in terms of templates (McCarthy 1979). Templates as independent objects cannot exist within a Correspondence model of OT due to what is referred to as the Kager-Hamilton problem. The Kager-Hamilton problem is actually a type of potential 'Reduplicant affects Base' (backcopying) type of interaction where a templatic requirement on the reduplicant can and should cause truncation in the base. This possibility is recognized by McCarthy and Prince (1997:29-31) as indicating a potential flaw within their system.

The root of the Kager-Hamilton problem is that Correspondence Theory accounts for and predicts backcopying effects (where the realization of the reduplicant affects the realization of the base) should exist in reduplication. This is the correct result for many segmental processes but this system runs contrary to the fact that templatic requirements on a reduplicant never backcopy onto the base. Here is the hypothetical interaction that McCarthy and Prince 1997 want to rule out.

(18) Kager-Hamilton Problem (McCarthy and Prince 1997:30)

	/RED+t'ilparku/	RED=MinWd	MAX-BR	MAX-IO
☞	t'ilpa-t'ilpa			*
	t'ilpa-t'ilparku		*!	
	t'ilparku-t'ilparku	*!		

The tableau in (18) shows that if a templatic constraint and MAX-BR are ranked above MAX-IO, a backcopying effect based on the template can be produced. This type of effect is unknown in human language and thus is a problem.

The potential templatic backcopying effect is the impetus behind the desire to eliminate reduplicative templates and it is completely theory internal to OT. No other model of reduplication, past or present, has this potential problem of templatic backcopying. Other arguments based on parsimony of resources within the phonology are presented as the basis for the desire to remove reduplicative templates but these arguments are misconceived. This parsimony argument goes as follows. Reduplicative templates are mechanisms that are specific to only reduplicative forms. A theory that can account for the same empirical facts without a process specific mechanism is to be preferred; therefore

the process specific reduplicative template should be removed from phonological theory.

The problem with this argument is two fold. The first one is that OT still retains a process specific mechanism that accounts for reduplication and this is RED[2]. The core models of reduplication within OT (McCarthy and Prince 1993, 1994ab, 1995, Urbanczyk 1996, Spaelti 1997) rely on the assumption of RED and there is no program to remove this process specific element. The other problem is that the goal of eliminating templates is actually designed to remove inherent structural information in RED. This is an inappropriate idea though, and McCarthy and Prince 1995 acknowledge this fact. McCarthy and Prince 1995:265 state that there can be multiple and different REDs within a single language. This point is empirically required in languages that have multiple patterns of reduplication. Tagalog (Carrier 1979) presents an example of this due to the presence of both foot reduplication (*sundin-sundin*) and CV reduplication (*memimilih*). OT chooses to encode the structural difference between these two types of reduplication in morpheme specific constraints. Thus, foot reduplication will be produced by constraints that specify this structural requirement for RED_1. CV reduplication is produced by a different set of constraints that refer to RED_2 and put CV structural requirements on it. The elimination of templates in OT consists of changing the constraints that were originally used to derive the shape of reduplicants, e.g. RED=σ (McCarthy and Prince 1993), with either multiple constraints that specify whether RED is a root or affix and then what structural requirements are placed on roots or affixes

(Urbanczyk 1996) or Generalized Alignment constraints that require RED to align with a particular prosodic structure (McCarthy and Prince 1994b, Spaelti 1997). There is no change in the structural information that is applied in order to derive the shape of the reduplicant only the surface appearance of how this information is encoded in a grammar.

One question that has not been asked of Generalized Template Theory (McCarthy and Prince 1994b) is what affect this program has on root and template morphology. McCarthy 1979 claims that the idea of template is crucial to the understanding of these types of morphological systems. It appears that the position on root and template morphology that claims the necessity of templates as independent objects is in conflict with the position of Generalized Template theory that denies the existence of templatic constraints within UG (McCarthy and Prince 1997:31). In order to fully support the removal of templatic constraints from OT (and thus nullify the Kager-Hamilton problem), an analysis of root and template morphology must be provided that is not based on the templatic proposals of McCarthy 1979. This atemplatic analysis of root and template morphology has not been produced in OT yet and recent OT proposals that do address issues in languages with root and template morphology assume full-blown templates (Gafos 1998b, Kenstowicz and Petros 1999). McCarthy (1997a) presents reanalyses of previous templatic effects in Rotuman (McCarthy 1996) and Cupeño (McCarthy 1979, McCarthy and Prince 1990) but does not present full analyses on how to achieve the templatic effects atemplatically. McCarthy only provides suggestions as to what constraints could be used in a

Generalized Template framework to produce the templatic effects without presenting full working analyses. Sketches do not make arguments. This work also discusses Arabic broken plurals and provides an analysis of this phenomenon atemplatically through the insertion of moras. The question that remains is how the rest of Semitic/Arabic root and template morphology is to be accounted for in OT without templates.

The success of Generalized Template Theory can not be evaluated until it achieves the same empirical coverage as previous rule based accounts in the literature. If Generalized Template Theory is adopted as a general tenet of OT then all pre-existing OT analyses that are based on the explicit or implicit assumption of a template are no longer valid and must be recapitulated in the Generalized Template Theory framework. It will only be through the complete elimination of templates that the Kager-Hamilton problem can be removed from OT. If templates are required at all in OT, only pure stipulation will allow the exclusion of templates in UG for the purposes of reduplication while at the same time allowing templates for other purposes. Until this contradiction in theoretical underpinnings of what types of constraints are in UG is resolved no proposals on templates within OT can be fully accepted.

All theories of reduplication will have to account not only for the reduplicative patterns that do occur and others that do not, but also for why a particular pattern appears in a particular language. The second requirement is independent from the actual machinery used to produce the possible reduplicative patterns and is the same as explaining why particular words in a

language are of a particular shape and melodic content. This fact is an issue for language acquisition and the lexicon. The position on this topic that is assumed in this thesis is that part of acquiring a given language is the determination of the particular shapes of words and affixes and this includes reduplicative morphology. Thus, each reduplicative morpheme will contain structural information about its surface realization just as any other morpheme that has a fully specified melody.

The proposals outlined in this thesis will actually achieve the OT goal of eliminating templates from reduplication. Furthermore, these same proposals remove structural stipulations from all reduplication patterns and this is an advance over present OT analyses that still require structural stipulations to derive reduplicants larger than CV in size. Thus, the proposals in this thesis derive reduplicative templates without any reduplication specific mechanism and this allows a parsimony argument to be made in favor of the model proposed in this thesis.

2.4 Summary

This chapter has presented a summary of the previous approaches to reduplication. The primary topics of the formal representation of reduplication, the interaction of morphology and phonology, and reduplicative templates have been presented for the major models of reduplication. The reoccurring themes in this summary is that all previous models of reduplication are unconstrained in

the possible reduplicative templates that can be produced, rule based models cannot account for the interaction between morphology and phonology seen in the *overapplication* and *underapplication* of phonological rules, and finally that models of reduplication that use transderivational information in the guise of an Identity Constraint (Wilbur 1973) are unconstrained in power.

NOTES

[1] A better analysis of this type would be to posit only a single form in the lexicon and have the reduplication morpheme trigger the application of different rules that produce the phonological changes to the stem (as in Distributed Morphology, Halle and Marantz 1993). This is tenable for the Tagalog data that Carrier discusses since all of the changes (place assimilation, deletion and metathesis) resemble genuine phonological processes. An analysis of this form is to be preferred because the listing of allomorphs inherently makes the claim that the morphological process is suppletion.

[2] See Raimy and Idsardi 1997 for an OT model of reduplication without RED.