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In the recent literature, reduplication has been claimed to cause two serious problems for theories of morphology and phonology. First, as McCarthy (1979) points out, no one has developed an observationally adequate formalization of reduplication rules without adopting a notation which allows morphological rules to be written that never occur cross-linguistically. Most investigators have either implicitly (e.g. Wilbur (1973), Munro and Benson (1973)) or explicitly (e.g. Carrier (1979)) employed a transformational notation for reduplicative processes. Munro and Benson (1973, 18) characterize a reduplicative adjective formation rule of Luiseño as shown in (1), while Carrier (1979, 353) formulates a reduplication rule of Tagalog as shown in (2) (where M is a morpheme).

(1)
$$C_1V_1C_2V_2 + C_1V_1C_2V_2 + i + č$$

(2) $(M) C V X$
 $1 \ 2 \ 3 \ 4 \rightarrow 1, 2, 3 \ , 2, 3, 4$

Given the formal apparatus of (1) or (2), one can write many types of morphological rules which are not instantiated in natural languages. For example, although expressible in the transformational notations of (1) and (2), mirror-image reduplication rules such as (3a,b) are not found in any language.

(3) a. $C_1V_1C_2V_2 + V_2C_2V_1C_1$ b. C V C V $1 \ 2 \ 3 \ 4 \rightarrow 4, 3, 2, 1, 1, 2, 3, 4$

An adequate theory of reduplication would formalize the process while allowing one to express only the sorts of reduplication which occur cross-linguistically and not the sorts of rules exemplified in (3).

Wilbur (1973) presents the most extensive discussion of the second apparent problem for an analysis of reduplication—its unusual interaction with certain phonological pro-

Among the many people who have aided and abetted with the proverbial useful discussions, I would particularly like to thank Morris Halle and Shelly Lieber, who provided the title. I have also benefited greatly from the comments of three anonymous *LI* reviewers. This work was supported by an NSF Graduate Study Fellowship.

The research summarized here was conducted during the 1979–1980 academic year. The article itself was written in August, 1980, and has since been revised. In the time since the ideas presented here were developed, they have been productively set to work by a number of other linguists, e.g. in Halle and Vergnaud (1980a,b), Pranka (1981), and Yip (1981).

cesses. As we shall see in section 2, some phonological rules appear to "overapply" to reduplicated forms, that is, to apply to segments in both the base and the copied material in a reduplicated form although only one set of these segments occurs in the proper environment for the application of the rule. This behavior of reduplicated forms has led some linguists (e.g. Carrier (1979)) to order the overapplying phonological processes before reduplication in the grammar. The output of these processes may thus be copied by reduplication, yielding the appearance of overapplication. Although this approach accounts for the occurrence of the output of the phonological processes in both the base and the copied material, it has the result of mixing morphological and phonological processes. The conceptually simpler theory would place these processes in separate components of the grammar. Moreover, as Wilbur (1973) points out, the ordering approach would not be able to account for the other puzzling interaction of phonological rules with reduplication: some phonological rules appear to *underapply* to reduplicated forms; that is, they do not apply to segments in either the base or the copied material in a reduplicated form although one set of these segments occurs in the environment of the rule. An adequate theory of reduplication would explain these apparently aberrant interactions of reduplication and phonological processes and predict just which phonological processes will "over- and underapply" to reduplicated forms.

The solution to these problems associated with reduplication is simply to make the minimal special assumptions or statements about reduplication. Except for the fact that the material attached to the stem in reduplication resembles the stem phonologically, reduplication rules look like normal affixation processes. To provide the best account of reduplication rules, we say they *are* normal affixation processes. The one unique feature of reduplication, the feature which leads us to group together diverse morphological processes under the title *reduplication*, is the resemblance of the added material to the stem being reduplicated. As demonstrated in section 1, we can devise a simple procedure for lending to the reduplicating affix phonemic material from the stem to which it attaches without adding unneeded power to the grammar.

The solution to problems posed by reduplication, then, is to say that there is nothing special about reduplication other than the resemblance between the affix and the stem to which it is attached. An extension of John McCarthy's recent account of Arabic verbal paradigms (McCarthy (1979; 1981)) provides a simple formalism for reduplicating processes which does not involve the full power of transformations (section 1). As for the interaction of reduplication with phonological and other morphological rules (section 2), once we establish that reduplication is simply affixation, recent improvements in phonological and morphological theory explain this interaction by predicting which rules will appear to over- and underapply to reduplicated forms. No special ordering of reduplication rules or special conditions on phonological rules prove necessary to account for the data.

1. The Formal Nature of Reduplication

In this section I exploit a proposal made by John McCarthy (1979; 1981) in an analysis of the Arabic verbal system to provide a formal account of reduplicative processes.

McCarthy claims that words should be represented (in part) as consonant-vowel *skeleta* (his *prosodic templates*) connected to phonemic *melodies* on separate tiers in accordance with the principles of autosegmental phonology (see Goldsmith (1976) on autosegmental phonology and Halle and Vergnaud (1980a) on "tiered phonology").

I will review McCarthy's discussion of Arabic verbs in section 1.2. I will support the claim that most reduplication processes are best analyzed as the affixation of a consonant-vowel (C-V) skeleton, itself a morpheme, to a stem. The entire phonemic melody of the stem is copied over the affixed C-V skeleton and linked to C and V "slots" in the skeleton according to principles to be made explicit below. Section 1.4 attempts to unify the analysis of C-V skeletal reduplication with the remaining examples of reduplication found in the literature.

1.1. What Reduplication Is Not and Preliminary Indications of What It Is

Ignoring difficulties, I will tentatively identify reduplication as a morphological process relating a base form of a morpheme or stem to a derived form that may be analyzed as being constructed from the base form via the affixation (or infixation) of phonemic material which is necessarily identical in whole or in part to the phonemic content of the base form. This working definition of *reduplication* matches, for the most part, the term's use in the literature. In providing a formal analysis of reduplication processes, this article will give, in essence, a formal definition of reduplication to replace the rough characterization above. To the extent that this formal definition excludes processes which share crucial properties with the processes it includes, to that extent my analysis of reduplication is in error.¹

1.1.1. Reduplication Is Not Constituent Copying. Many languages include morphological processes which copy entire morphemes or words (Moravcsik (1978) cites many examples). For instance, Warlpiri forms the plural of some nouns, primarily those referring to humans, by *total reduplication* (Nash (1980, 130)).

¹ This definition does exclude some of the Semitic "doubling" and "gemination" processes discussed in McCarthy (1981). McCarthy explains how these processes differ crucially from what I will call "reduplication"; see footnote 7.

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(5) a.	kurdu 'child'	kurdukurdu 'children' ²
b.	kamina 'girl, maiden'	kaminakamina 'girls, maidens'
c.	mardukuja 'woman, female'	mardukujamardukuja 'women, females'

Any theory of morphology will need some mechanism to effect the copying of an entire morpheme as in (5).

Banking on this fact, one might propose a straightforward analysis of reduplication claiming that it always involves the copying of a constituent of a morpheme at some level of analysis or at some tier in an autosegmental representation of the morpheme. On this hypothesis (found, for example, in McCarthy (1979, chapter 4)), reduplication could copy a phoneme, a syllable, a metrical foot, an entire morpheme, or some other constituent of a morpheme but could not copy pieces of constituents which do not themselves make up a constituent.

However, well-attested reduplication rules do copy sequences of consonants and vowels from a morpheme which form no constituent of the morpheme. For example, we find reduplication rules which prefix a copy of the first CV of a stem to the stem regardless of whether the C and V constitute the entire first syllable of the word or only its onset and syllabic nucleus.³ Quileute forms plurals with such a rule according to Andrade (1933, 189) as reported in Moravcsik (1978):⁴

(6) a.	ci•phókwat′ 'Negro'	cici · phókwat' 'Negroes'
b.	qa•x 'bone'	qaqa•x 'bones'

Tagalog employs three distinct processes of reduplication, one which prefixes a copy of the first CV of a stem to the stem making the copied V short, one which prefixes a copy of the first CV of a stem to the stem making the copied V long, and one which prefixes a copy of the first CV(C)CV(C) of a stem to the stem making the copy of the second V long (Carrier (1979)). These reduplication processes, sometimes in connection with additional affixation, are used for a variety of derivational and inflectional purposes. Although the inclusion of the last C in the third reduplication process depends on the stem being reduplicated in a manner discussed in footnote 5, none of the Tagalog reduplication rules respect the syllabification or constituent structure of the forms to which

³ In the pages to follow I will write as if there were no problem in deciding whether a given reduplication process involves prefixing, suffixing, or infixing. In fact, there are usually strong arguments for classifying a reduplicating rule in one of these categories, some of which may be found in the sources I cite. However, for most of the discussion below, it will not be important whether we consider any particular reduplication rule as prefixing, or infixing the "copied" material.

⁴ Andrade (1933, 189):

Reduplication concerns regularly only the initial consonant or the first vowel of the word or both.... This principle is strictly adhered to even in cases in which a monosyllabic stem has a terminal consonant, or when we may infer from the general phonetic tendencies that the consonant following the first vowel belongs to the initial syllable.

 $^{^2}$ For the most part I will employ the orthography of my sources in cited examples, providing phonetic interpretation only when relevant to the discussion. I have occasionally modified transcriptions to substitute more widely used symbols for more obscure ones, to ease typographic reproduction, or to standardize different sources on the same language. I have also left out stress and tone markings in some examples where these have no bearing on the issues at hand.

they apply. That is, they copy a CV or CV(C)CV(C) whether or not these form a constituent (syllable or metrical foot).

(7) a.	lākad 'walk'	pag-lalākad 'walking'
b.	kandīlah 'candle'	pag-kakandīlah 'candle vendor'
c.	linis 'clean'	mag-līlinis 'will clean'
d.	um-takboh 'run'	um-tātakboh 'will run'
	(<i>tumakboh</i> after infixation)	(>tumātakboh)
e.	ma-talīnoh 'intelligent'	ma-talītalīnoh 'rather intelligent'
f.	baliktad	balībaliktad 'all topsy-turvy'

Examples (7b,d,f) clearly display reduplication processes which do not copy a constituent.

The CV reduplication processes in Quileute and Tagalog copy a C and a V regardless of whether they make up a syllable or only part of a syllable. There are also reduplicating processes which prefix a copy of the first CVC of a stem to the stem regardless of whether the CVC constitutes the first syllable of the stem or the first syllable plus the onset of the following syllable. For example, Agta forms various sorts of plurals by CVC prefixing reduplication (examples from Healey (1960, 7)).

(8) a.	bari 'body'	barbari-k kid-in 'my whole body'
b.	mag-saddu 'leak (verb)'	mag-sadsaddu 'leak in many places'
с.	na-wakay 'lost'	na-wakwakay 'many things lost'
d.	takki 'leg'	taktakki 'legs'

In examples (8a,c), reduplication copies material which does not make up a constituent of the word being reduplicated.

As reported in Krause (1980), Chukchee also exhibits a CVC reduplication rule which does not respect syllabic structure and which, therefore, does not copy a phonological constituent. Copying the initial CVC of a noun to the right of the noun produces the absolutive singular in Chukchee.

(9) a.	jil?e- 'gopher'	jil?e-jil 'abs. singular'
b.	nute- 'earth, ground'	nute-nut 'abs. singular'

Examples like (9b) demonstrate the copying of a CVC sequence which does not constitute a syllable in Chukchee.

1.1.2. Reduplication as Affixation of Skeletal Morphemes. We have seen that the constituent copying theory of reduplication fails because reduplication may copy sequences of Cs and Vs which do not form a constituent. However, every reduplication process may be characterized by a "skeleton" of some sort, either a C-V skeleton, a syllabic skeleton, or a skeleton of morpheme symbols (see (4)). That is, the shape of the copied material in reduplication is fixed for the reduplication process; the shape is independent

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of the hierarchical structure of the morpheme being copied.⁵ After reviewing a large sample of reduplication rules from the world's languages in connection with the Stanford Project on Language Universals, Moravcsik (1978, 307) concluded that⁶

whereas the relevant string [i.e. the portion of a stem to be copied by reduplication] could in principle be defined by any phonetic property (segmental or suprasegmental) or in terms of absolute linear position, or in terms of simply the number of adjacent segments involved; and it could also be left undefined (i.e. "reduplicate any one or more segments in the total string"), reduplicated phonetic strings I found invariably defined in reference to consonant-vowel sequences and absolute linear position.

My own research has identified only one exception to Moravcsik's claim (brought to my attention by David Nash), the Yidin^y reduplication rule to be discussed in section 1.4.

Moravcsik's generalization suggests that reduplication rules involve the affixation of a C-V skeleton to a stem, the C-V skeleton borrowing phonemes from the phonemic melody of the stem to which it attaches. After an introduction to C-V skeleta in the form of a review of McCarthy's (1979; 1981) work on Arabic verbs, I will present a theory of reduplicative processes which claims that most reduplication is just that—the affixation of a C-V skeletal morpheme to a stem and the association of a copy of the stem's phonemic melody with the affixed skeleton. As will be shown in section 1.4, this theory readily extends to the syllabic reduplication of Yidin^y and the full morpheme reduplication found in many languages.

1.2. An Introduction to C-V Skeleta: McCarthy's Analysis of the Arabic Verbal System

With the preliminary observations of the workings of reduplicative processes made in section 1.1, we are almost prepared to develop a complete formal account of reduplication. First, however, we must examine McCarthy's (1979; 1981) use of C–V skeleta

⁵ Aside from the Yidin^y syllabic reduplication and the whole morpheme reduplications discussed in section 1.4, I know of two cases in which the C-V skeleton of the reduplicating morpheme does depend on the stem to which it attaches: CVCCV(C) reduplication in Dyirbal (Dixon (1972)) and Tagalog (Carrier (1979); see examples (7e,f)). In both languages, a morpheme-final C following the first CVC(C)V of a stem is either optionally (Dyirbal) or obligatorily (Tagalog) reduplicated along with the CVC(C)V. Note that the dependence of the C-V skeleton of the reduplicating morpheme on the stem in these cases has nothing to do with the syllabification or hierarchical structure of the stem. The rules in question do not copy an additional syllablefinal C unless it is also morpheme-final. Moreover, when the constitution of the reduplicating C-V skeleton does seem to depend on the stem, i.e. when the extra C is copied, what the reduplication rule reduplicates is an entire stem. We have already noted that total morpheme or stem reduplication is quite common crosslinguistically. Thus, what we should say about the reduplication in Tagalog and Dyirbal which copies the extra morpheme-final C is not that the C-V skeleton of the reduplicating morpheme is dependent on the stem in these cases but rather that there is no C-V reduplicating skeleton involved at all—the rule is copying a stem. That is, the reduplicating affix has two allomorphs in Tagalog and Dyirbal. One, a morpheme skeletal affix (see section 1.4), attaches either obligatorily (Tagalog) or optionally (Dyirbal) to stems of the form (C)V(C)CVC#, copying the whole stem. The other allomorph, the C-V skeletal affix CVCCV, attaches to all other stems. See section 2.2.2.2 for further discussion of the Tagalog case.

⁶ McCarthy (1979, 367–368) provides an insightful discussion of the significance of Moravcsik's findings for the "tiered phonology" model assumed in this article.

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in his analysis of Arabic verbs. This review serves two purposes: to explain the mechanisms of C-V skeleta, phonemic melodies, and their association and to give independent justification for the formal machinery required for an analysis of reduplication.

Consider table 1, an expanded piece of McCarthy's table 1 (1981, 385). Each row displays part of the inflectional paradigm for the Arabic root *ktb* 'write' in one *binyan* (plural, *binyanim*) or conjugation.

The first binyan [not included in my table 1/AM] is a possible category for nearly all roots that can appear as verbs. It is relatively unmarked phonologically, at least in the finite forms and it has no special semantic properties . . . But the others, the so-called derived binyanim, generally involve some special modification of the meaning of the root. So, for instance, the third triliteral binyan is usually reciprocal, while the sixth is usually the reflexive or effective of the reciprocal. It is, in general, an idiosyncratic property of any root whether it can appear in a particular binyan. Nevertheless, neologisms abound, loanwords are easily incorporated into the system, and speakers of Modern Standard Arabic report a reasonable facility in extending a root to other binyanim and interpreting the result. (McCarthy (1979, 239))

McCarthy notes that, for the most part, each binyan has a characteristic C–V shape, shown in the last column of table 1. The same triliteral root, ktb, appears in all the forms in table 1 and, with one exception (the imperfective active), the same vocalic melodies appear consistently within each column (see the second to last row in table 1). The key to a revealing analysis of the Arabic verbal system, McCarthy claims, is to separate the root consonants and vocalic melodies from each form as morphemes in themselves. These morphemes attach to the various C–V skeletal binyanim of the second to last column in table 1 according to the principles of autosegmental phonology with a more or less predictable semantic effect.

The binyanim, considered as C-V skeletal morphemes, operate in a manner similar to derivational affixes in other languages. Although, as McCarthy notes, they do not always impart the same meaning to the roots with which they associate, they possess a usual semantics which allows their extension, for example, to borrowed roots. For what follows, we shall assume that the binyanim, the consonantal roots, and the inflectional vocalic melodies are all morphemes—they all have lexical entries containing information about their possible combination with other morphemes and about the categorial and semantic results of such combinations.

Constituents of the autosegmental morphemes root, binyan, and inflectional vowel melody link together as dictated by the constraints of autosegmental phonology (cf. Goldsmith (1976)). The overriding principle of autosegmental phonology states that

(10) Linking lines never cross.

In the Arabic verbal system, another principle requires that

(11) Each slot in the skeleton is linked to at least one segment in the phonemic melody.

On McCarthy's analysis, each morpheme is arranged on a separate "tier" or level.

	Per	fective	Impe	rfective	Pai	rticiple		
Binyan	Active	Passive	Active	Passive	Active	Passive	C-V Skeleton	Gloss
II	kattab	kuttib	ukattib	ukattab	mukattib	mukattab	CVCCVC	'cause to write'
III	kaatab	kuutib	ukaatib	ukaatab	mukaatib	mukaatab	CVVCVC	'correspond'
IV	2aktab	Puktib	u ² aktib	u ² aktab	mu ² aktib	mu ² aktab	CVCCVC	'cause to write'
Ν	takaatab	tukuutib	atakaatab	utakaatab	mutakaatib	mutakaatab	CVCVVCVC	write to each other'
ШЛ	nkatab	nkutib	ankatib	unkatab	munkatib	munkatab	t ccvcvc	'subscribe'
VIII	ktatab	ktutib	aktatib	uktatab	muktatib	muktatab	n CCVCVC 	'write, be registered'
×	staktab	stuktib	astaktib	ustaktab	mustaktib	mustaktab	t ccvccvc s t	'write, make write'
Inflec- tional Vocalic Melody	5	, i u	$\left\{ \begin{bmatrix} u \\ a \end{bmatrix} + \right\} a \left\{ \begin{matrix} i \\ \phi \end{matrix} \right\}$	(u+) a	(mu +) a i	(mu +) a		
Not abstract	e: ''The forms away from cer	in the table <i>i</i> tain generally	rre all stems, so the accepted phonolo	ey do not contai gical processes.	n mood, agreemer '' (McCarthy ()	it, or case, gender (979, 242-243))	, or number markin	ng Some of the forms

Table 1. Paradigm for the Arabic root ktb 'write'

Principle (10) prevents the crossing of lines that connect the same two tiers, while principle (11) ensures that each of the C and V slots in a binyan will be connected to some phoneme.

The perfective active of *ktb* in binyan III (see table 1) serves as a simple illustration of the association of autosegmental morphemes.



Principle (10) rules out the linking of morphemes shown in (13); principle (11) rules out the incomplete linking in (14).



Binyan II illustrates an attractive feature of the autosegmental approach to Arabic verbs. Consider *ktb* in the perfective active of binyan II (see table 1).



Principle (11) insists that one of the root consonants attach to two C slots in the skeleton, while McCarthy justifies the rules and principles which yield *kattab* instead of *kaktab* or *katbab*. McCarthy thus provides a simple account of the gemination of the middle consonant of a triliteral root in the second binyan.

Finally, consider *ktb* in binyan VIII perfective active.



This form illustrates the fact that phonemes may be preattached to slots in a C–V skeletal morpheme. Not only is the skeleton CCVCVC characteristic of binyan VIII, but also the second C is invariably t (cf. ktasab < root ksb 'earn'). This latter generalization is captured by linking a t to the second C slot of the CCVCVC skeletal morpheme within the lexical entry of the skeletal morpheme itself. We shall see that the preattachment of phonemes or features to skeletal morphemes is a widespread feature of reduplication.

McCarthy claims that the phonemes (i.e. feature matrices) in a phonemic melody are unspecified for the feature [\pm syllabic]. This feature is acquired by the phonemes through their attachment to the C–V skeleton, where C is equivalent to [-syllabic] and V to [+syllabic]. However, arguing from the Arabic data, Halle and Vergnaud (1980b, 7) conclude "that in the melody tier the feature [\pm syllabic] is specified and that the linking [of melody to C–V skeleton] is subject to the further condition (5b)" (= (17)).

(17) Unless overridden by a special proviso, feature complexes containing the feature [-syllabic] can be linked only to C slots in the skeleton, and feature complexes containing the feature [+syllabic] can be linked only to V slots in the skeleton.

One argument for condition (17) comes from the perfective passive binyan II form of *ktb*, *kuttib* (see table 1). If a phoneme of the vocalic inflectional morpheme *ui* were unspecified for $[\pm syllabic]$, it could link either to a C slot, acquiring the feature [-syllabic] and therefore designating a glide, or to a V slot, acquiring the feature [+syllabic] and therefore designating a vowel. Thus, if McCarthy were correct, we would have no *general* way of ruling out associations of morphemes such as (18a) for the binyan II perfective passive of *ktb*, in place of the correct (18b).

On the other hand, if phonemes in a phonemic melody are specified for the feature $[\pm syllabic]$, the linking of the *u*, a [+syllabic] element, to the C slot in (18a) would be prohibited by Halle and Vergnaud's condition (17), which proves essential for the analysis of reduplication.

Because the consonant and vocalic melodies in Arabic form distinct morphemes and therefore may be placed on distinct "tiers", McCarthy (1979; 1981) is able to avoid assuming principle (17) and specifying the feature $[\pm syllabic]$ in his phonemic melodies. For each sort of morpheme consisting of a phonemic melody, McCarthy specifies the melody-bearing elements, Cs or Vs, to which elements of that sort of morpheme may attach. McCarthy rules out the linking illustrated in (18a), for example, by stipulating that the melodic elements of inflectional morphemes must attach to V slots, not C slots. For the Arabic data at least, McCarthy's method of ruling out linkings like (18a) is equivalent to assigning all of the melodic elements in a morpheme one value of the feature $[\pm syllabic]$ and adopting principle (17). As will become apparent below, Mc-Carthy's method is unavailable when [+syllabic] and [-syllabic] melodic elements are intermixed on a single tier. In the analysis of reduplication, we must adopt (17) over the procedure of specifying for each melodic tier to which melody-bearing elements the items on that tier may link.

1.3. Reduplication and C-V Skeleta

In section 1.1, I claimed, following Moravcsik (1978), that each reduplicating process can be characterized by a skeleton. The essence of this article's formal analysis of reduplication is the claim that the skeleton which is characteristic of a reduplication rule is actually a reduplicating morpheme, i.e. a skeletal affix comparable to the binyanim of the Arabic verbal system. Reduplication is simply the affixation of a skeleton to a stem, as in (19), where Agta initial CVC reduplication is exemplified (see the forms in (8)).

$$\begin{array}{c} (19) \\ & t \ a \ k \ i \\ & | \ | \ | \ | \ | \\ CVC + [CVCCV] \end{array}$$

This section discusses reduplication characterized by C-V skeleton morphemes; the analysis is extended to syllable and full morpheme reduplication in section 1.4.

On the analysis of C–V reduplication as the affixation of a C–V skeleton morpheme, we are left with the problem of how to link up some of the phonemes from the stem to the added C–V skeleton. However we accomplish this, we will be expressing that sole characteristic of reduplicating morphological processes which distinguishes them from other affixing processes: namely, that the phonemic melody of a reduplicating affix is dependent on the phonemic melody of the stem to which it attaches.

I propose that the only mechanism available to morphological theory to lend the stem's phonemic melody to a reduplicating affix is the copying "over" the reduplicating affix of the entire phonemic melody of the stem, i.e. the copying of the stem's phonemic melody on the same tier as the melody and on the same side of the stem melody to which the affix is attached.⁷ This wholesale copying of a phonemic melody, as shown in (20), along with some specific constraints on the autosegmental association of the phonemes of the copied melody with the Cs and Vs of reduplicating morphemes, constitute the

⁷ Adapting the proposals of an earlier version of this article, McCarthy (1981, 412–413) suggests that reduplicating skeletal affixes should carry a feature [+reduplication], which "has the effect of causing automatic copying of all the melodic elements in some morpheme—formally, all the daughters of some μ in a particular tier." This copying process may appear to require "transformational power", but, as McCarthy points out, "The copying induced by the presence of the feature [+reduplication] is part of universal grammar, not part of some language-particular reduplication transformation, and consequently it is irrelevant to the whole problem of restrictiveness." In connection with his discussion of the [+reduplication] feature, McCarthy (1981, 414) explains the formal distinction between the sorts of reduplication discussed in this article, all of which involve the [+reduplication] feature, and the sorts of "reduplication" he himself analyzes from Semitic languages, which do not involve this feature.

increased power in the morphological component necessary to handle reduplication cross-linguistically.

It seems unlikely that any less machinery could be sufficient to account for reduplication phenomena.

Note that, once we assume reduplication to be the affixation of a C–V skeletal morpheme, phonemic melody copying as in (20) is required to yield the correct output. If we simply attached the phonemes in the phonemic melody of the stem to the added C–V skeleton, association lines would cross in violation of the basic condition on autosegmental phonology given in (10).⁸

If we copy the entire phonemic melody of the stem over the C-V skeletal reduplicating affix, how do we ensure that the correct phonemes are associated with the appropriate slots in the skeleton? Four general conditions on the linking of phonemic melodies with C-V skeleta, two of which we have already encountered in our discussion of the Arabic verbal system, predict the correct association for most reduplicative processes.

Condition A: Unless overridden by a special proviso, feature complexes containing the feature [-syllabic] can be linked only to C slots in the skeleton, and feature complexes containing the feature [+syllabic] can be linked only to V slots in the skeleton.

Condition B: After as many phonemes as possible are linked to C_-V slots one-toone in accordance with other conditions and principles, extra phonemes and C_-V slots are discarded. There is no multiple attachment of phonemes to C_-V slots or of C_-V slots to phonemes.



Condition C: The slots in a C–V skeleton may be preattached to distinctive features.

⁸ As an *LI* reviewer points out, even if we allowed association lines to cross in reduplication, special stipulations would be necessary to demand just the sort of "nested" crossing illustrated in (21) and to rule out other conceivable association line crossings (in particular, crossings which would allow the mirror-image reduplication rules schematized in (3)).

These features take precedence over the features of any phonemes from a phonemic melody which may link to these slots.

Condition D: (i) Linking of the phonemic melody to the reduplicating skeleton either begins with the leftmost phoneme of the melody linking to the leftmost C–V slot in the skeleton eligible under Condition A and proceeds from left to right or begins with the rightmost phoneme of the melody linking to the rightmost C–V slot of the skeleton and proceeds from right to left. In the unmarked case, reduplicating prefixes associate with their melodies from left to right, reduplicating suffixes from right to left. (ii) The association of phonemic melodies and C–V reduplicating affixes is "phoneme-driven" in the sense that, for each phoneme encountered linking from left to right or from right to left, the association procedure scans along the skeleton to find a C–V slot eligible for association with the phoneme under Condition A.

The first condition constraining the linking of borrowed phonemic melodies in reduplication to the reduplicating C-V skeleta, Condition A, prevents the association of a [-syllabic] phoneme to a V slot or a [+syllabic] phoneme to a C slot. This condition is just (17) above, which was motivated in connection with the use of C-V skeleta in the analysis of Arabic verbs.

Agta provides the clearest example of the need for Condition A in reduplication. Recall that Agta forms plurals by initial CVC reduplication (see the examples in (9)). However, when the stem begins with a vowel, only the initial VC is copied.

Condition A prevents the attachment of the u to the C slot in (22b), for example, yielding perhaps *uffufu or *wufuffu.

Dakota provides further evidence that the linking of phonemes with the C–V reduplicating skeleton respects their \pm syllabicity (data from Shaw (1976); see also the discussion of Dakota reduplication in section 2). Dakota suffixes a CCVC reduplicating skeleton to verbs to form their plurals, but only the final (C)CV of a V-final stem is copied.

šič 'be bad' (23) a. šič šikšič 'be bad. pl.' = $(\check{c} > k \text{ by phonological rule})$ CVC + CCVChaska 'be tall' b. haska haska haskaska = $\dot{C}\dot{V}\dot{C}\dot{C}\dot{V} + \dot{C}\dot{C}\dot{V}C$ 'be tall, pl.' haska haska *haskaaska CVCCV +haska haska *haskaskaa = CVCCV +

Given that a phonemic melody associates with the slots in a suffixal skeleton from right to left (see Condition D), Condition A accounts for the phonemic shape of the reduplicated portions in (23), ruling out the starred associations in (23b).

Unlike Condition A, Condition B on the one-to-one linking of phonemes to C-V slots is not operative in the association of phonemes with C-V skeletal morphemes in the Arabic verbal system. Although it does not appear to be a general constraint on autosegmental linking, Condition B does find ample motivation in the analysis of particular reduplication processes. It is Condition B that ensures the proper association of the Dakota CCVC reduplicating suffix with the melody *šič* as shown in (23a), prohibiting the association displayed in (24).⁹

⁹ Condition B may also allow us to capture the fact that Sanskrit initial reduplication copies only one consonant of an initial cluster.

Reduplicating C–V skeleta, like the binyanim skeleta of the Arabic verbal system, may have features or phonemes preassociated with C–V slots, a possibility formally encoded in Condition C. For example, Akan copies an initial CV of verbs to form "multiple activity" or "multiple state" forms of the verbs (see Schachter and Fromkin (1968)). The V of the copy is always a [+high] version of the first stem vowel.¹⁰

The preattached [+high] feature in (25) takes precedence over any $[\pm high]$ specification of the phoneme associated with the V slot of the reduplicating prefix.

Yoruba (Delano (1965)) forms nouns from verbs by prefixing a CV reduplication skeleton whose V is fixed to i (these examples were provided by Doug Pulleyblank).



I have assumed here that the case of a preattached phoneme in a reduplicating skeleton is simply a limiting case of preattached features. While in Akan only the feature [+high]is preattached to the V of a C–V skeleton, in Yoruba the complete set of distinctive features necessary to yield the phoneme /i/ is so attached. Although a vowel from the stem's phonemic melody links to the V slot in the reduplicating prefix in Yoruba, all of its features are overridden by preattached features. One might assume, on the other hand, that when a full set of features is preattached to a slot, no phoneme from a

¹⁰ An *LI* reviewer notes that a similar situation exists in Nupe.

The reduplicating prefix in these Sanskrit examples is CV. By prohibiting the attachment of more than one consonantal phoneme to a single C slot, Condition B insists that only one member of an initial cluster be copied.

Although it seems clear that the least sonorous member of an initial cluster has priority for linking to the sole C slot of the CV reduplication prefix (see Kiparsky (1979)), how to state this condition formally remains a problem. Clearly, what is required for Sanskrit is a marked phoneme to C–V skeleton linking rule, in addition to Conditions A–D.

phonemic melody may associate with the slot. McCarthy makes such an assumption in his analysis of Arabic verbs (see above). The two different approaches to the preattachment of phonemes make different predictions for certain situations, none of which I have been able to find in real-language data, unfortunately. Consider for example the association of the phonemic melody /tasidu/ with the C-V skeleton CVCCV, to which /n/ has been preattached in the second C slot. If phonemes may link to slots to which a full set of features has been preattached, the association will yield *tani*- (given Condition D, to be discussed below), as in (27a); if phonemes may not attach to such slots, the association will yield *tansi*-, as in (27b).

(27) a.
$$t a s i d u$$
 $t a s i d u$
 $| | | | | | | | | | | | | | | = tani-tasidu$
 $CVCCV + CVCVCV$
 $| n$
b. $t a s i d u$ $t a s i d u$
 $| | | | | | | | | | | = tansi-tasidu$
 $CVCCV + CVCVCV$
 $| n$

A final constraint on the association of phonemic melodies with C-V skeletal reduplicating affixes, Condition D, determines which phonemes and C-V slots are discarded when there are not enough C-V slots to link to all of the phonemes or not enough phonemes to link to all of the slots. It is Condition D, working in consort with Condition B, that allows us to copy the entire phonemic melody of a stem over the reduplicating C-V affix although only part of the stem may be reduplicated. We need no special (presumably transformational) mechanism to copy just the correct phonemes of the stem; it suffices to specify the C-V shape of the reduplicating affix, which, as we have seen, is independent of the shape of the stem to which the affix attaches.

All of the reduplication processes illustrated to this point (except the Sanskrit reduplication rule discussed in footnote 9) have employed the linking procedure unmarked under Condition Di. For an example of unmarked linking, consider the Dakota reduplication process illustrated in (23). Since this is a suffixing reduplication rule, association begins from the rightmost phoneme in the copied phonemic melody and proceeds leftward. Associating in the opposite direction yields the incorrect result displayed in (28b).

(28) a. hạska hạska

$$| | | | | | /// = h$$
ạskaka
 $CVCCV + CCVC$
b. hạska hạska
 $* | | | | | | // = *h$ ạskahạs
 $CVCCV + CCVC$

I have found sporadic examples of linking marked under Condition Di in my survey of reduplicating rules. Consider, for example, the Chukchee reduplication illustrated earlier in (9). The CVC reduplicating suffix in Chukchee links to its phonemic melody from left to right, the marked linking according to Condition Di.

(29) a. nute- 'earth, ground'

As shown in (29), unmarked linking of phonemes to skeletal slots produces the wrong results in Chukchee.¹¹ Madurese (Stevens (1968, 34)) provides an example of a reduplicating prefix which links to phonemic melodies from right to left. One use of this prefix is to form plurals.

(30) búwáq-án 'fruit'

 $b \dot{u}w\dot{a} q \quad b \dot{u}w\dot{a} q - \dot{a} n$ $/// \quad | | | | | = w \dot{a}q - b \dot{u}w \dot{a}q \dot{a}n$ $CVC + CVCVC - \dot{f}ruits'$

Again, unmarked linking of skeleta to melodies yields the wrong result for this Madurese reduplication process.¹²

Condition Dii proves necessary for reduplication rules such as the CVCCV(C) prefixing process in Tagalog discussed above (see examples (7e,f)). Phoneme-driven association ensures that the linking (31a) results, rather than the linking (31b).¹³

¹¹ It appears that Tzeltal (Berlin (1963)) also contains several reduplicating suffixes which link to their phonemic melodies from left to right, the marked linking according to Condition D.

¹² Another example of marked linking for reduplicating prefixes is found in Til (Reichard (1959)). Til prefixes a reduplicating C to form a sort of plural or continuative. Unexpectedly, the phoneme which links to this skeletal C is the last, not the first, consonant in the stem.

¹³ The use of the feature [\pm long] in (31) is somewhat problematic. Many linguists have argued against the existence of [\pm long] as a distinctive feature. Within the tiered phonology framework assumed in this article, long vowels have been analyzed as a single [+syl] phoneme linked to two V slots at the C-V skeletal tier:

When the association procedure reaches the *i* in the phonemic melody, *talīnoh*, it scans until it finds a V slot in the C-V skeleton with which to link the *i*, skipping over a C in the skeleton.

Nash (1980) shows that Condition Dii on the association of phonemic melodies with C-V reduplicating affixes accounts for an otherwise puzzling fact of Warlpiri reduplication. Verbal reduplication, forming a sort of intensive of the verb, normally copies the initial CVCCV of a stem or preverb but copies only the first CVV when the first vowel of the stem or preverb is long. Assuming that long vowels are represented as sequences of two Vs in Warlpiri at the C-V skeleton level, simply writing the reduplicating prefix as CVCCV accounts for the difference in the copied material between stems with initial long vowels and those with initial short vowels (the diagrams in (32) are adapted from Nash (1980, 143)). (In the orthography Nash employs, rn and rl represent single phonemes.)

Because the linking of phonemes to C–V slots in reduplication is "phoneme-driven", as specified in Condition D, we cannot give the Tagalog reduplicating prefix in (31a) the skeleton CVCCVV, avoiding the [+long] feature. According to the linking principles, a CVCCVV skeleton would yield the form **taliotalinoh* in (31a). One might replace the final V in the skeleton in (31a) with the following notation:

⁽ii) 🔨

This notation would be read to indicate that a single phoneme must attach to both of the connected V slots, as in (i). Since it is tangential to the main points of this article, I will not pursue here the analysis of vowel length in Tagalog.

According to Condition Dii, the association procedure must scan the C–V skeleton for a V slot for the second *i* in (32b), skipping over both C slots and yielding the correct result, *tiitiirlparnkaja*.¹⁴

1.4. Syllabic and Whole Morpheme Reduplication¹⁵

The theory presented so far accounts only for reduplication processes which may be characterized by a C–V skeleton whose make-up is independent of the constituent being reduplicated. However, other sorts of reduplication processes do exist. In addition to the reduplication of entire morphemes or stems, which is a fairly common phenomenon among the world's languages, at least one language, Yidin^y, exhibits a syllable copying reduplication rule. The examples of Yidin^y reduplication presented in Dixon (1977) and discussed in Nash (1979; 1980) clearly indicate that Yidin^y reduplicates the first two syllables of a stem regardless of the C–V make-up of these syllables. Nominal reduplication forms plurals (Dixon (1977, 156)).

(33) a.	dimurU 'house'	dimudimurU 'houses'
b.	gindalba 'lizard sp.'	gindalgindalba 'lizards'

Note that the *r* of *dimurU*, which belongs to its third syllable, is not reduplicated, while the *l* of *gindalba*, which closes its second syllable, is copied. Thus, neither of the skeletal prefixes CVCCVC or CVCCV will account for Yidin^y reduplication; whether or not the final C in the first CV(C)VC of a word is reduplicated depends on the syllabification of the word. Verbal reduplication, forming an intensive or repetitive of a verb, has the

¹⁴ Although details remain to be worked out, the analysis of reduplication presented in this section can probably handle internal reduplication. Though far less common in my survey of reduplicative processes than initial and final reduplication, clear cases of internal reduplication do exist. For example, Samoan constructs plural forms of some verbs by adding a copy of the CV of the penultimate syllable just before (or just after) this CV (Marsack (1962)).

(i)	singular	plural	
	alofa	alolofa	'love'
	galue	galulue	'work
	maliu	maliliu	'die'

Just as I claimed that initial and final reduplication are the prefixation and suffixation, respectively, of a C-V skeletal morpheme, so I would claim that internal reduplication is the infixation of a C-V skeletal morpheme. As with any infixing process, the problem for an analysis of internal reduplication is how to specify where in a stem the infix belongs. Once we place the C-V skeletal infix in the correct location in our Samoan examples, the machinery and conditions already introduced produce the proper result.

(ii) a
$$| of a = 1 of a | of$$

¹⁵ McCarthy (1979; 1981) provides a somewhat different analysis of syllable and full morpheme reduplication from the one outlined in this section. I do not present an alternative to McCarthy's analysis because I believe there is evidence to decide between the approaches; rather, the analysis of this section represents an attempt to unify syllable and full morpheme reduplication with the C–V skeletal reduplication processes discussed above.

same formal analysis as nominal reduplication—it also copies the first two syllables of a stem regardless of their C–V make-up (Dixon (1977, 233–236)).¹⁶

(34) a.	dadama-n 'jump'	dadadadama-n 'jump a lot'
b.	dugarba-n 'have an	dugardugarba-n 'have an unsettled
	unsettled mind'	mind for a long period'

An extension of the analysis of reduplication presented in the above paragraphs allows for syllabic reduplication without greatly increasing the power of the morphological component. It also permits us to connect C–V skeletal reduplication processes with full morpheme reduplication. Let us suppose, following McCarthy (1979) among others, that the structure of a morpheme is hierarchical, including at least the levels shown in (35).



C-V skeletal reduplication affixes a C-V skeleton to a stem with a structure like (35) and borrows the phonemic melody of the stem.¹⁷



We may analyze Yidin^y syllabic reduplication as the prefixation of a syllabic skeleton

¹⁶ One apparent exception to the principle that Yidin^y reduplicates the first two syllables of a stem is successfully explained in Nash (1979). A nasal apparently closing the second syllable of a stem which is homorganic with a following stop is not copied.

- (i) galambata 'march fly' galagalambata 'march flies'
 - madinda-an 'walk up' madimadinda-n 'keep walking up'

Nash argues convincingly that such homorganic nasals belong to the following syllable and that, if reduplication copies the first two syllables of a stem, they are thus not expected to reduplicate.

¹⁷ Note that I have connected the Cs and the V of the CVC reduplicating prefix in (36) to a syllable symbol σ . Southern Paiute provides some evidence that the C–V slots of skeletal morphemes should be organized into syllables in this manner. (For the data that follow, I rely on Pranka (1981). However, the analysis suggested here is due to a conversation between Moira Yip and the author.) Setting aside certain complications, we may say that Southern Paiute copies the first (C)V of a stem plus the next C only if it is nasal. If we postulate a CVC skeletal prefix for Southern Paiute with the Cs and the V attached to a single σ , we predict exactly this behavior. Since, according to Sapir (1930, 37), only nasal Cs may close a syllable in Southern Paiute, only a nasal second consonant from the stem's phonemic melody may attach to the second C slot in the reduplicating

to a stem, as shown in (37). The syllabic skeleton, lacking a phonemic melody and a C-V skeleton, borrows both from the stem to which it attaches.



We must assume that the Cs and Vs of the stem in syllabic reduplication are copied clustered in the syllabic units that they form in the stem. If the copied Cs and Vs were not joined together in these syllabic units, the reduplicated form of dimurU would be *dimurdimurU, with the onset of the root's second syllable copied as the coda of the second syllable of the prefix:



prefix. Since a nasal C beginning the second syllable of a stem will be copied, it is not the first syllable of the root which is copied in Southern Paiute reduplication. Rather, Southern Paiute copies a C and a V plus another C, if this may form a syllable with the first C and the V. Within the theory presented here, we cannot account for the Southern Paiute facts by preattaching the feature [+nasal] to the second C slot in a CVC prefix. According to our linking conditions, such a prefix would effect the copying of the first C and the first V of a stem plus a nasalized version of the second stem consonant.

If I am correct in unifying C-V and syllabic reduplication, we must see the linking of syllabic clusters to the syllable slots labeled σ as parallel to the linking of phonemes to C and V slots.

Following the above line of analysis, full morpheme reduplication becomes the addition of a morphemic skeleton to a stem. The morphemic skeleton, lacking a syllabic skeleton, a C-V skeleton, and a phonemic melody, borrows all three from the stem to which it attaches.



Note how normal affixation fits naturally onto this continuum from total morpheme reduplication through C-V skeletal reduplication. Normal affixation is the addition to a stem of a morpheme which has a C-V skeleton and a phonemic melody of its own (but perhaps not a syllabic skeleton if the affix cannot be syllabified in isolation); the morpheme borrows *nothing* from the stem to which it attaches.



Although the above analysis of a syllabic reduplication process leads to an elegant unification of C–V skeletal reduplication with full stem reduplication and of both of these with normal affixation, it nonetheless leaves us with a mystery. Why, of all the reduplication processes studied by Moravcsik, myself, and others, is there only one clear example of syllabic reduplication (namely, Yidin^y)?

1.5. Conclusion

In this section I have supported an analysis of reduplication as the affixation (or infixation) of a skeletal morpheme. I have shown that the analysis is able to formalize reduplication processes of the world's languages and to account for many of their properties. Most of the formal apparatus employed in the analysis finds independent justification in the analysis of the Arabic verbal system (for further examples of the operation of "tiered phonology", see Halle and Vergnaud (1980a,b)). The one mechanism added to the grammar specifically for reduplicative processes is the wholesale copying over the reduplicating morpheme of an autosegmental tier or tiers—e.g. the phonemic melody—from the stem to which the reduplicating morpheme affixes. By avoiding the exploitation of a full transformational notation, the present analysis explains why reduplicative processes like those illustrated in (3) are not found in any language. To mimic the processes in (3) employing the grammatical apparatus described above would require crossing association lines in violation of the fundamental constraint on autosegmental representations, (10).

(41)
$$p_1 p_2 p_3 p_4 p_1 p_2 p_3 p_4$$

* $V C V C + C V C V$

2. The Interaction of Reduplication and Phonological Rules

In the previous section, I introduced and extensively supported an analysis of reduplication according to which reduplicating processes are simply affixation. This account runs up against the problems for analyses of reduplication in generative grammar discussed at length in Wilbur (1973). Reduplication is generally a derivational or inflectional process used to encode, for example, the intensive of verbs or the plural of nouns. If we consider reduplication to be a normal word formation process, as in section 1, we expect it to precede all phonological rules in the derivation of a reduplicated form (cf. Aronoff (1976)), and we expect reduplicated forms to be subject to all phonological rules just as any derived or inflected word would be. In fact, as Wilbur documents, certain phonological rules in a variety of languages appear to over- and underapply to reduplicated forms. Reduplicated forms are not entirely aberrant; most generally applicable phonological rules apply to them exactly as they apply to any morphologically complex word. However, there seems to be a class of phonological rules which treat reduplicated forms specially.

In Dakota, for example, morpheme-initial velars are palatalized following a prefix ending in i (Dakota data from Boas and Deloria (1941) and Shaw (1976)).

(42)	k ^h á 'to mean'	nič ^h á 'he means thee'
	k²ú 'to give'	nič'ú 'he gives to thee'

In reduplicated forms, the initial velars of both the reduplicated portion and the original root palatalize, whether or not the second velar is preceded by i.

(43) —nape kíčosčoza 'he waved his hand to him' (from koza 'to wave')

Palatalization seems to have overapplied to the second velar in (43), doing its work even though its structural description is not met.

The overapplication of a phonological rule to reduplicated forms can always be handled by ordering reduplication after the phonological rule in question. The output of the rule then reduplicates with the rest of the morpheme, with either the original or the copy sometimes ending up in an environment which would not have triggered the rule. One problem with this solution is that reduplication has all of the properties of a regular word formation rule and regular word formation rules can be ordered to precede all phonological rules. Ordering reduplication after certain phonological rules implies that one can place a derivational or inflectional affixing rule somewhere in the middle of the phonology, an option that is, apparently, not otherwise needed.¹⁸

In addition to loosening constraints on the organization of grammar, the ordering solution to the overapplication of phonological rules to reduplicated forms cannot be extended to explain the *underapplication* of certain rules to these forms. To take another example from Dakota: certain word-final *as* in Dakota change to *e* before a number of morphemes including the phrase-ending morpheme, /2/.

- (44) a. háska¹⁹ 'to be tall'
 - b. č^hą-kį iyúha hąske-? 'all the trees are tall'

However, the final a of at least a certain class of reduplicated verbs does not change to e before these same morphemes even when the final a of their unreduplicated roots does change. Thus, despite the fact that the final a of háska changes to e before -?, as shown in (44b), the final a of its reduplicated form, háska-ska, does not change to ebefore -?, as shown in (45).

(45) c^há-kị háska-ska-? 'the trees are tall'

If reduplication were ordered after the rule changing a to e, we would expect *hąske-ske-? in (45); if before, we would expect *hąska-ske-?. Since rule ordering provides no explanation for the underapplication of rules to reduplicated forms, it is a questionable solution to their overapplication. One would expect the same analysis to cover both cases of irregular rule interaction.

Wilbur herself offers a reason for the fact that rules over- and underapply to reduplicated forms. She attributes this special behavior of reduplicated forms to the *Identity Constraint* (Wilbur (1973, 58)):

(46) The Identity Constraint

There is a tendency to preserve the identity of R_o [what is copied in reduplication] and R_r [the copy] in reduplicated forms.

Wilbur suggests that the Identity Constraint may be realized as a global condition on the rules which over- and underapply to reduplicated forms. A rule which overapplies would be written to apply both to a segment in R_o and to the corresponding segment in R_r if the rule's environment is met for the segment in R_o . A rule which underapplies would be written to apply to a segment in R_r only if the corresponding segment in R_o

¹⁸ An anonymous *LI* reviewer has pointed out that, even setting aside reduplication, some morphological rules have been argued to "follow" phonological rules in some sense. I know of no convincing arguments to this effect consistent with the restrictive theories of phonology and morphology I am assuming here (but see Anderson (1975)).

¹⁹ A vowel with a superimposed comma, e.g. q, represents a nasalized vowel in this orthography.

also occurs in the appropriate environment. The rule would thus fail to apply when a segment X in R_r but not the corresponding segment X' in R_o appears in the right environment.

The difficulty is that the Identity Constraint explains nothing. Wilbur observes that rules appear to over- and underapply to reduplicated forms and invents a constraint which merely encodes this fact. Many rules apply "normally" to reduplicated forms; that is, they apply wherever—and only where—their environments are met. For example, a rule of Devoicing in Dakota, which devoices fricatives before boundaries, is responsible for the s in example (43), repeated here as (47).

(47) kíčosčoza (from koza 'to wave')

Although they destroy the identity of R_o and R_r , rules like Dakota Devoicing (given as (62) below) do not violate the Identity Constraint, which does not insist that phonological rules preserve the identity of R_o and R_r but merely allows that they might. A real solution to the application problem will explain why only certain rules and not others over- and underapply in reduplicated forms. If we can make the behavior of rules with respect to reduplicated forms follow from an independently motivated theory of phonology without keying on the duplicative nature of reduplication, we will have explained the phenomenon instead of merely remarking upon it.

The Identity Constraint as formalized by Wilbur makes an empirical prediction regarding the possible application of phonological rules to reduplicated forms which data from Karok (Bright (1957)) actually disconfirm. Therefore, Wilbur's solution to the application problem can be rejected on empirical as well as explanatory grounds.²⁰ Karok forms a derived intensive verb indicating the repetition of a short action by suffixing a CVC reduplicating skeletal morpheme.

(48)	parak 'to separate with a wedge'	parak-rak 'to split logs with wedges'
	tasir̃ 'to brush'	tasin-sir 'to brush (repeatedly)'

(In (48), \tilde{r} is a morphophoneme which nasalizes to *n* before a consonant.) The morphophoneme that Bright writes as *v* deletes between an *a* or *o* and a consonant-initial suffix. In the reduplicated forms of $\begin{cases} a \\ o \end{cases} v$ -final stems, however, neither the *v* before the reduplicating suffix nor the final *v* of the suffix deletes, even when a consonant-initial suffix is added to the reduplicated form.

(49) ²u·mxávxam (< ²u·mxav) 'to pull up by the roots'; -tih 'durative'
²u·mxavxá·vtih 'to be pulling up by the roots'
When v (but not v) comes to stand between a(·) or o and a consonant, in that order, it is replaced by lengthening of the preceding vowel (if not already long)... The only exception occurs in reduplicated forms, where v is always retained. (Bright (1957, 34))

Thus, v Deletion appears to underapply in reduplicated forms. However, Wilbur's Iden-

²⁰ Tagalog presents another empirical problem for Wilbur's proposals; see section 2.2.2.2.

tity Constraint cannot account for the underapplication of v Deletion in Karok. The Identity Constraint blocks the application of a rule to a segment or segments in the copy portion of a reduplicated form when the corresponding segment or segments in the original are not in the proper environment for the rule. In $2u \cdot mxavxa \cdot vtih$, both the stem and copy v stand between an a and a consonant and thus should delete under the Identity Constraint to yield $*2u \cdot mxa \cdot xa \cdot tih$.²¹

I will demonstrate that the behavior of phonological processes with respect to reduplication is predicted by current theories about the organization of phonology and the lexicon. To account for the data, all we need to assume is our conclusion from section 1—that reduplication is simply derivational or inflectional affixation. To switch perspective, given that my data are correct, the behavior of reduplicated forms will provide considerable support for the current theories of phonology and the lexicon which predict this behavior. The strategy of this section, then, is to show that the apparent problems and paradoxes associated with the interaction of reduplication with phonological processes are in fact pseudoproblems and paraparadoxes. Once the grammars of reduplicating languages are examined with care, difficulties surrounding the interaction of reduplication rules with phonological processes disappear.

The cases of apparent over- and underapplication of phonological rules to reduplicated forms fall into two classes. In the first, we find phonological processes that do not apply within the reduplicating affix (the "copy") although their environments are met there. It will be shown (section 2.1) that in Luiseño, the rule in question is a cyclic rule, which, according to current interpretations of the cycle (see e.g. Mascaró (1976), Halle (1979)), should not apply within morphemes in nonderived environments. Therefore, we should not expect it to apply within the reduplicating morpheme.

The second class of cases exhausts the remaining types of examples of over- and underapplication of phonological processes to reduplicated forms. For Dakota and Tagalog, I will suggest that these processes meet the criteria to be considered *morpholexical rules* in the sense of Lieber (1980). That is, they are not phonological rules at all, but rather rules which express the relationships between allomorphs of morphemes, both of which are listed in the lexicon. If the phonological processes in question are morpholexical rules and reduplication is considered an affixing word formation rule like any other affixing rule, then we can explain the interaction of these processes with reduplication without any extra machinery. In fact, Lieber's theory predicts the appearance of under- and overapplication of morpholexical rules in reduplicated forms; it prohibits what would look like the "normal" application of these rules to such forms. Since both the "input" and "output" of a morpholexical rule are listed in the lexicon, reduplication, an affixing process, must build on one of these listed allomorphs. If it builds on the

²¹ In an earlier version of this article, I included an analysis of Karok reduplication in section 2.2. There I provided evidence that v Deletion between $\{a, o\}$ and a consonant is "morpholexical" in the sense to be defined below and that, therefore, apparent underapplication of v Deletion to reduplicated forms is expected (see section 2.2 for a discussion of the relationship between the morpholexical character of a rule and its apparent over- or underapplication to reduplicated forms).

pseudoinput to the morpholexical rule, the illusion of underapplication results; if it builds on the pseudooutput, the result is the illusion of overapplication. We take up this second class of cases in section 2.2^{22}

2.1. Reduplication and Cyclic Rules: Luiseño²³

Munro and Benson (1973, 16) note that "the surface phones \check{c} and \check{s} of Luiseño are in complementary distribution such that [(50) holds of them]":

(50)
$$\check{c} \rightarrow \check{s} / _ \left\{ \begin{array}{c} \# \\ [-\operatorname{cont}] \end{array} \right\}$$

The grammar of Luiseño includes a regular derivation process, schematized in (51), which forms moderative adjectives from verbs by reduplication.

(51) $C_1V_1C_2V_2 \rightarrow C_1V_1C_2\dot{V}_2 + C_1C_2V_2 + \dot{s}$ Páva 'be red' PaváPvaš 'pink' máha 'to stop' mahámhaš 'slow'

reduplication in Luiseño is this: when the initial consonant of a verb is \check{c} , it does not become \check{s} in the adjective-forming reduplicating suffix even though it immediately precedes a consonant. That is, $\check{c} \to \check{s}$ appears to underapply in reduplicated forms.

(52)	čára 'to tear'	čaráčraš 'torn'
	čóka 'to limp'	čukáčkaš 'limping'

What prevents $\check{c} \to \check{s}$ from applying in the reduplicated forms of (52)? Wilbur (1973) claims that $\check{c} \to \check{s}$ is subject to the Identity Constraint, (46). This constraint blocks the

 23 Aronoff (1976) and McCarthy (1979), among others, have argued from the Luiseño data to different conclusions. However, they were not aware of the crucial data exemplified in (53) and (54), or at least they do not mention such data.

²² I will not discuss here all of Wilbur's (1973) examples of the over- and underapplication of phonological processes to reduplicated forms, but will instead restrict attention to those languages for which sufficient data exist to answer crucial questions about the phonological processes involved. As will become clear in the pages to follow, an explanation of the apparent over- and underapplication of phonological processes depends on determining properties of these processes which often cannot be extracted from even a fairly careful grammar of a language. Wilbur, for the most part, simply accepts the analyses of her sources, writing that a phonological process is a rule, for example, if her sources claim that it is. To understand more clearly why not all of Wilbur's (1973) examples are treated here, consider the case of the underapplication underapplied within a reduplicating prefix in Akan because it was a cyclic rule. Reviewing Wilbur's source on Akan (Schachter and Fromkin (1968)) more carefully in preparation for rewriting the article, I realized that there was no evidence for the rule of Palatalization at all; it was simply a device used to reduce the underlying inventory of phonemes. The state of the art was such in 1968 that one freely exploited rule ordering and lexical exceptions to replace phonemes with rules.

rule in the copy (\mathbf{R}_r) of the reduplicated form because the \check{c} in the original (\mathbf{R}_o) does not meet the environment of the rule, that is, it does not immediately precede a consonant. The failure of $\check{c} \to \check{s}$ to apply in the reduplicated forms thus preserves the identity of \mathbf{R}_r and \mathbf{R}_o .

On the analysis of reduplication given in section 1, we need not say anything about the interaction of $\check{c} \rightarrow \check{s}$ and reduplication in Luiseño. Since, as we shall see, the $\check{c} \rightarrow \check{s}$ rule is "cyclic", in a technical sense, and since the \check{c} -C combinations in the reduplicated forms in (52) are entirely internal to the suffixal adjective-forming morpheme, CCV, current theories of the application of cyclic rules (see e.g. Mascaró (1976), Halle (1979)) predict that $\check{c} \rightarrow \check{s}$ will not apply within the copy portions of these reduplicated forms.

Contrary to the claims of Munro and Benson (1973), \check{c} and \check{s} are not in complementary distribution in Luiseño. In fact, $\check{c} \to \check{s}$ is a neutralizing rule with a restricted range of application. Davis (1976) indicates that there is one Luiseño word in which \check{s} precedes a vowel, the exclamatory $\check{s}\check{o}x$ 'oh!' (cf. $\check{c}\check{a}ra$ 'to tear', $\check{c}\check{o}ka$ 'to limp'), but discounts this as a counterexample to complementary distribution because "exclamations in many languages frequently display exceptional phonological characteristics" (p. 197). Kroeber and Grace (1960) include an example of \check{s} before a [+cont] consonant, x, but their transcription of *mašxai* 'isn't it?' might be a result of their failure to distinguish \check{s} from \check{s} , a retroflex (see Davis (1976)).

 (53) quawíčxal 'Bloomeria aurea' mašxai 'isn't it?' páčxam- 'to launder'

If \check{sox} and $ma\check{sxai}$ constituted the only examples of the breakdown in complementary distribution between \check{c} and \check{s} outside of reduplication, it would be difficult to argue that $\check{c} \rightarrow \check{s}$ is a neutralizing rule, that is, that \check{s} is an underlying phoneme in Luiseño. Although \check{sox} and $ma\check{sxai}$ do suggest that \check{s} and \check{c} are not in complementary distribution, what is important for the present analysis is that \check{c} occurs in underived morpheme-internal environments before the very consonants in front of which $\check{c} \rightarrow \check{s}$ applies when the context, [-cont], is derived,

- (54) a. po-xečla 'its point, of an arrow'²⁴ but pu·šla 'eye, nom.', pu·čil 'eye, obj.' moš-la-t 'belt' < moči 'to weave'
 - b. čačmis 'a stone tool'
 but pa·-ŋawišmi 'them of the water', pa·-ŋawiči 'him of the water'
 neš-ma-l 'old woman' < ne·ču- 'to become an old woman'

Although *po-xečla* appears among my sources only in Kroeber and Grace (1960), Bright (1968) confirms their *čačmis*.

²⁴ Kroeber and Grace (1960, 22) suggest that *po-xečla* 'its point, of an arrow' is derived from *xeči-* 'strike' and *-la* 'place of'. However, this is undoubtedly an historical derivation, not a synchronic analysis. First, note that the meaning of *po-xečla* is not a predictable combination of the meaning of its constituent parts; rather, it has developed a specialized usage. Moreover, as Kroeber and Grace point out, *-la* is not a "truncating suffix"; that is, the final vowel of *xeči-* would not delete before *-la* if the proposed derivation were synchronically valid.

Drawing on the work of Kiparsky (1973), Mascaró (1976) and Halle (1979) identify as "cyclic" the class of rules which appear to apply only in derived environments. That $\check{c} \rightarrow \check{s}$ fails to apply before certain consonants (e.g. before *m* in $\check{c}a\check{c}mis$) when \check{c} appears before these consonants in the underlying form of a morpheme but applies before the same consonants when the environment is derived indicates that $\check{c} \rightarrow \check{s}$ is "cyclic" in the technical sense. Halle (1979, 18) formulates the condition on cyclic rules which prevents them from applying in nonderived environments in a manner which blocks application of a cyclic rule when the environment for the application of the rule is entirely contained within the underlying representation of a morpheme, be it root or affix. Since the \check{c} -[-cont] combinations in the reduplicated forms in (52) are entirely contained within the reduplicating suffix, CCV, Halle's formulation of the condition on cyclic rule application correctly predicts that $\check{c} \rightarrow \check{s}$ will fail to apply within such forms.

One might argue that the environment internal to the reduplication affix in Luiseño is a "derived" environment since the copying and linking of a phonemic melody in reduplication "derives" the phonemic shape of the affix. However, as long as the copying and linking processes in reduplication are not phonological rules, the technical definition of the cycle in Halle (1979, 18) yields the correct results for Luiseño. The juxtaposition of the \check{c} and the [-cont] within the reduplicating affixes in (52) is not the result of some phonological rule, nor would the application of $\check{c} \to \check{s}$ within those affixes make "specific use of information" outside the reduplication affix. Therefore, according to Halle's definition of the cycle, $\check{c} \to \check{s}$ should not apply in (52), if it is a cyclic rule.

To summarize, $\check{c} \to \check{s}$ fails to apply within the Luiseño reduplicated forms discussed above because $\check{c} \to \check{s}$ is a cyclic rule, the interior of the reduplicating prefix is not a derived environment, and cyclic rules apply only in derived environments. Note that, for our purposes, showing that $\check{c} \to \check{s}$ applies regularly in derived environments but fails to apply in nonderived environments was sufficient to demonstrate that the rule is "cyclic". That $\check{c} \to \check{s}$ is "cyclic" in the sense of applying once in each phonological cycle is of no importance here. We do not even need a theory of the phonological cycle to predict that $\check{c} \to \check{s}$ will not apply within the derived adjectives of (52). The forms in (54) demonstrate that $\check{c} \to \check{s}$ does not apply within nonderived environments, and the interior of the reduplicating suffixes in the adjectives of (52) is not a derived environment. Therefore, $\check{c} \to \check{s}$ should not apply in (52). The theory of the cycle found in Halle (1979) and the other sources cited above simply leads us to expect to find rules like the Luiseño $\check{c} \to \check{s}$, i.e. rules which apply only in derived environments; such rules need not be considered problematic.

Knowledge of more of the phonology of Luiseño than I have presented here might lead one to raise two objections against the analysis of Luiseño outlined above. First, Luiseño contains a rule of Vowel Syncope which might be used to derive the surface form of reduplicated adjectives shown in (51) from the underlying structure schematized in (55), as suggested by Munro and Benson (1973).

```
(55) C_1V_1C_2V_2 + C_1V_1C_2V_2 + \check{s}
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If a rule of Syncope produces (51) from (55), we would expect the cyclic rule of $\check{c} \rightarrow \check{s}$

to apply to any $C_1 = \check{c}$, since the preconsonantal environment for the rule would be derived.

However, there is no reason to suppose that Syncope is involved in the derivation of reduplicated forms. First, Syncope is not a regular phonological rule. Davis (1976, 212) lists the three main environments for the application of Syncope; all of them are at least partially morphological and none of them resemble (55). Second, Syncope does not apply uniformly in constructions almost identical to (55). There is an intensive-forming verb reduplication process in Luiseño which creates a structure almost exactly like (55), but Syncope fails to apply within the reduplicated portion of this structure, illustrated in (56) (Munro and Benson (1973, 18)).

(56) $C_1V_1C_2\dot{V}_2 + C_1V_1C_2V_2$ tikí-ðiki (tíki 'light, set fire')

As Syncope is not regular in the necessary environment, if we wished to have Syncope delete the second occurrence of V_1 in (55), we would have to add an additional morphological environment to the rule, stating explicitly that it applies to the first vowel in the adjective-forming reduplicating suffix. Clearly, nothing argues against simply giving the adjective-forming reduplicating suffix the form CCV in place of CVCV; in fact, simplicity considerations demand this move.

The second objection to attributing the failure of $\check{c} \rightarrow \check{s}$ in reduplicated forms to the underived nature of the \check{c} -C combinations in these forms is that $\check{c} \rightarrow \check{s}$ sometimes blocks in derived environments as well. Kroeber and Grace (1960) point out, and Davis (1976) confirms, that there are certain consonant-initial suffixes in Luiseño which do not trigger $\check{c} \rightarrow \check{s}$ in a stem-final \check{c} . These include the agentive forming *-kawut* and *-ku*•t, which delete the final vowel of stems to which they attach, and the Tense/Aspect markers *-q(a)*, *-quat*, and *-qus* (examples from Davis (1976, 202)).

(57) a.	míč-ku∙t 'strangler'	míči 'to choke someone'
	néč-kawut 'one who pays'	néči 'to pay'
b.	wáč-qa 'are a few (of things))'
	wáč-quat 'were a few (yeste	erday)'
	wáč-qus 'used to be a few'	

In addition, when \check{c} is the final consonant in a CVC reduplicating prefix (which adds a protracted reading to verbs), it fails to undergo $\check{c} \rightarrow \check{s}$ (Davis (1976, 201)).

(58) néč-niči-q 'pays in dribs and drabs' < néči- 'to pay' núč-nuči-q 'keeps going (and) squashing things' < núči- 'to squash'</p>

The failure of $\check{c} \rightarrow \check{s}$ to apply in (57)–(58) seems to indicate that the rule's environment is morphological; therefore, its blockage in the reduplicated forms might show only that the reduplicating suffix is not on the list of $\check{c} \rightarrow \check{s}$ triggers. However, in every case where $\check{c} \rightarrow \check{s}$ fails to apply in a derived environment outside of reduplicated forms, a boundary intervenes between the \check{c} and the [-cont] segment which serves as the environment for the rule. As noted by Davis (1976), the rule operates without exception when its environment is morpheme-internal and derived via Vowel Syncope. It seems that the failure of $\check{c} \rightarrow \check{s}$ in (57)–(58) can be explained as a boundary phenomenon and that, therefore, $\check{c} \rightarrow \check{s}$ is a regular cyclic rule. Thus, the fact that \check{c} does not become \check{s} in the reduplicated forms in (52) supports the claim that the reduplicating affix is in fact a morpheme and is thus a nonderived environment in the technical sense.

2.2. Reduplication and Morpholexical Rules

In section 2.1 we saw that a rule which appeared to underapply internally in reduplicated forms was a cyclic rule, which we do not expect to apply morpheme-internally in nonderived environments. Simply by identifying the nature of the rule in question we could predict its behavior with respect to reduplicated forms. Similarly, I shall show that the remaining class of phonological processes which either over- or underapply to reduplicated forms share a property which predicts their over- and underapplication. Crucially, these processes do not apply to all morphemes meeting their structural description. For each morpheme, one must learn separately whether or not the process will apply (although there may be some generalizations that can be expressed regarding the classes of morphemes which undergo or do not undergo the process). The processes also have morphological rather than purely phonological environments.

Aronoff (1976) has called processes meeting the above criteria *allomorphy rules*. In Aronoff's theory these rules apply in consort with word formation rules basically to adjust stems according to which affixes have been added to them. Carrier (1979) suggests that all allomorphy rules precede all phonological rules, with reduplication, considered as a form of allomorphy, forming the border between allomorphy rules to reduplicated forms—the output of an allomorphy rule will be copied through reduplication if it appears in the appropriate portion of a stem. However, it should be obvious that the ordering of allomorphy before reduplication has nothing to say about the *underapplication* of allomorphy in reduplication. We shall return to Carrier's proposal below.

Lieber (1980) has given evidence that the processes described above should not be considered rules at all in the usual sense. Rather, both the putative "input" and "output" of these processes are to be listed in the lexicon. The relation between the "input" and "output" allomorphs is described by a *morpholexical rule*, but morpholexical rules play no generative role in the phonology.

Morpholexical rules are predicates which define sets of ordered pairs of lexical items [the "input" and "output" of the morpholexical rule], both of which are listed in the permanent lexicon . . . It is purely arbitrary whether or not any given lexical item conforms to the specifications of a lexical class as defined by its morpholexical rules. (Lieber (1980, 74–75))

Listing both allomorphs related by a morpholexical rule, Lieber argues, explains their availability to various derivational and compounding processes.

Processes which by Lieber's independently justified criteria are identified as mor-

pholexical rules appear to over- and underapply to reduplicated forms simply because reduplication is a normal affixing process, which must build on one of the listed allomorphs of a morpheme. If reduplication applies to the allomorph which is the output of the morpholexical rule wrongly considered as a generative process, the process will appear to have overapplied to the reduplicated form (if the structural change is located within the reduplicated portion). If reduplication applies only to the pseudoinput of the morpholexical rule considered as a phonological process and the reduplicated form ends up in an environment meeting the structural description of the process, the process will appear to have underapplied to the reduplicated form. Thus, assuming that reduplication is merely an affixing word formation rule, Lieber's theory demands that processes which independent criteria identify as morpholexical rules either over- or under"apply" in reduplicated forms.

2.2.1. Dakota. Reduplication of verb roots in Dakota either signals the plurality of an inanimate subject or forms the iterative, distributative, or intensive of the verb. Dakota verb roots fall into two classes: C-final and V-final stems (see Shaw (1976)). The C-final stems appear with a stem-extending a before a word or enclitic boundary. The reduplicating morpheme is a CCVC skeletal suffix. According to the principles of association of a C-V skeletal morpheme with a phonemic melody given in section 1, this suffix has the effect of copying the last (C)CVC of a C-final stem and the last (C)CV of a V-final stem. The reduplicated forms of C-final stems behave like their C-final basic forms in exhibiting a stem-extending a before a word or enclitic boundary.

(59)	a.	V-final	stems	
		ksa	ksa-ksá	'to cut'
		háska	háska-ska	'be tall'
		p ^h e	p ^h e-p ^h é	'sharp'
	b.	C-final	stems	
		xáp-a	xap-xáp-a	'to rustle'
		nýp-a	nụp-nýp-a	'two'

Many phonological rules operate normally within reduplicated forms, often making the reduplicated root phonologically distinct from the reduplicating suffix. Wilbur (1973) would say that these rules are not subject to her Identity Constraint. I list some of these rules and examples of their operation as they appear in Shaw (1976, 332ff).

(60)
$$C \rightarrow \phi / _ C C^{25}$$

ksap-a ksap-ksap-a \rightarrow ksa-ksap-a
(61) $\begin{bmatrix} -\cot \\ -\sin \end{bmatrix} \rightarrow \begin{bmatrix} -g \\ -asp \end{bmatrix} / _ [+\cos]$
čik²-a čik²-čik²-a \rightarrow čik-čik²-a

 25 The Cs in (60) are merely cover symbols for a complex of distinctive features; they do not refer to the Cs of C–V skeleta. All of the phonological rules presented here apply to segmental phonemes, i.e. to elements of the phonemic melody linked to C–V slots. Unlinked phonemes and C–V slots left over from the reduplication process should be considered deleted when the phonological rules apply.

(62)
$$\begin{bmatrix} -\sin \\ + \cot \end{bmatrix} \rightarrow [-\text{voice}] / _ [-\text{seg}]$$

puz-a puz-puz-a \rightarrow pus-puz-a
(63)
$$\begin{bmatrix} -\cot \\ + \cot \end{bmatrix} \rightarrow \begin{bmatrix} -\cot \\ -ant \\ -son \end{bmatrix} / _ + [+ \cot]$$

zut-a zut-zut-a \rightarrow zuk-zut-a
o-zut-a o-zul-zul-a \rightarrow o-zuk-zul-a
(64)
$$\begin{bmatrix} -\sin \\ -\cot \\ -\cot \end{bmatrix} \rightarrow [+\text{voice}] / _ = \begin{bmatrix} -\sin \\ + \sin \end{bmatrix}$$

lil-a lil-lil-a $\xrightarrow{(63)}$ lik-lil-a $\xrightarrow{(64)}$ lig-lil-a
(65) $C_i \rightarrow \phi / _ + C_i$
xux-a xux-xux-a $\xrightarrow{(62)}$ xux-xux-a $\xrightarrow{(65)}$ xu-xux-a
(66)
$$\begin{bmatrix} -\sin \\ -\cot \\ + \cot \end{bmatrix} \rightarrow \begin{bmatrix} +\sin \\ -nasal \end{bmatrix} / _ = [-seg]$$

 $k^hat-ya \rightarrow k^hal-ya$ $t^heex-ya \rightarrow t^hel-ya$ skie \rightarrow skil
 k^hat-a $k^hat-k^hat-a \rightarrow k^hal-k^hat-a$
Pot-a Pot-Pot-a \rightarrow Pol-Pol-a

That rules (62) and (66) operate in reduplicated forms at the boundary between the stem and reduplicating suffix completes the argument that reduplication must be considered an affixation process. Recall that the cyclic rule of $\check{c} \rightarrow \check{s}$ in Luiseño does not apply within the "copy" portion of reduplicated forms although the environment of the rule is met within the copy. The interior of the copy is thus not a "derived environment" in the technical sense; it is treated as the interior of a morpheme. The application in the above examples of rules (62) and (66), rules that apply only at boundaries, clearly shows the presence of a boundary between the copied material and the stem in reduplicated forms. When we claim that reduplication is affixation, we are claiming that reduplication involves the addition of a morpheme to a stem, creating the derived structure [reduplicating morpheme [stem]] or [[stem] reduplicating morpheme] (as in the Dakota case), *quod est demonstratum*.

Although the rules described above apply regularly to reduplicated forms, two phonological processes in Dakota appear to treat reduplicated forms irregularly: a rule of Velar Palatalization and a rule of $[\pm nasal] a$ to e Ablaut. Among the rules of Dakota, these two alone operate so as to preserve the identity of copy and stem in reduplicated forms. Why is it that just these two processes and not those in (60)–(66) obey Wilbur's Identity Constraint?

2.2.1.1. Velar Palatalization. Dakota Velar Palatalization changes k, k^h , and k^2 to \check{c} , \check{c}^h , and \check{c}^2 after a nonlow front vowel.

(67)	k ^h úte 'shoot'	ni-č ^h úte 'he shoots at you'
	káhita 'sweep'	i-čáhite 'broom'
	k'a 'dig'	mni-č ² á-pi 'well'
	k ^h iyatą 'side'	le-č ^h iyatą 'on this side'

However, some initial k, k^h , and k^2 never change to \check{c} , \check{c}^h , and \check{c}^2 .

(68)	kų 'to covet'	nikų 'he covets thee'
	ma-k ^h áta 'I am warm'	ni-k ^h áta 'you are warm'
	k ^h o 'to prophesy'	t ² enik ^h o 'he prophesies your death

Although one can make certain generalizations about which morphemes with initial velars will undergo Palatalization ("neutral verbs", for example, never change initial velars (Boas and Deloria (1941, 14))), within morpheme classes which can undergo Palatalization, which morphemes will have changeable and which unchangeable velars is an arbitrary matter (Boas and Deloria (1941, 14 and elsewhere)).

Moreover, one cannot predict on independent grounds which morphemes with final i or e will trigger Palatalization. Shaw (1976) claims that all *i*-final morphemes may trigger Velar Palatalization but that the rule is sensitive to the sort of boundary intervening between the i and the velar. However, although certain boundaries may block Palatalization, the evidence indicates that boundary information alone is not sufficient to determine whether or not the rule will apply. Thus, Boas and Deloria (1941, 14) note:

Verbs with initial k, k^h , and k^2 except those with fixed initial ki change in their possessive forms, but retain k, k^h , k^2 in dative forms.

ki-č^húwa 'he pursues his own' ki-k^húwa 'he pursues for him' [from k^huwa 'pursue']

The two forms given differ only in the palatalization of the second velar. If we separate velar from prefix in either form by a boundary which would, on Shaw's account, block Palatalization, main stress would fall on either the initial or the last syllable according to the rules in Shaw (1976), *not* on the second syllable. The stress pattern shown is expected only if the prefix and velar are separated by a boundary which *does* allow Palatalization to cross it.

The data show, then, both that the morphemes which undergo Velar Palatalization form an arbitrary class and that the triggering environment for the rule must be morphologically specified. By the criteria given above, Velar Palatalization therefore qualifies as a morpholexical rule in Lieber's (1980) sense; we must list in the lexicon both the palatalized and unpalatalized allomorphs of each morpheme exhibiting the alternation.

Velar Palatalization appears to overapply in reduplicated forms. Although only the initial velar of the root is in the correct environment for Palatalization, the initial velars of both root and copy show up as palatals when a reduplicated form of a root with a changeable initial velar follows a Palatalization trigger.

 (69) a. kaya 'to make' wič^há-ki-čaxčax-?iyèya 'he made it for them quickly' them-DAT-makemake-quickly

 koza 'to wave' napé kí-čosčoza²⁶ 'he waved his hand to him' hand DAT-wavewave

If the palatalized and unpalatalized allomorphs of a root with a changeable initial velar are both listed in the lexicon, then the "overapplication" of Palatalization in reduplicated forms is exactly what we expect. Reduplication suffixes a CCVC skeleton to a stem. Now morphemes added to the right of a morpheme with a changeable initial velar do not choose either the palatal-initial or velar-initial allomorphs; they may be attached to both. For example, the derivational prefix $ka \sim ča$, which adds the instrumental reading 'by striking or sudden force' to verbs, has an initial changeable velar. The verbs to which it attaches do not choose between the allomorphs of the prefix. Rather, since a prefix added to the combination of instrumental prefix plus verb may choose either the palatal-initial or velar-initial version of this derived verb, the verb root must be able to attach to both allomorphs of the instrumental prefix.

(70) ka-k^hóka 'to make a noise by striking'
i-čá-k^hoka 'to make a noise by striking against' (*i* = locative prefix)

The locative prefix i, a Palatalization trigger, chooses the palatal-initial form of the instrumental prefix plus verb root combination.

Just as a verb root attaching to the right of the instrumental prefix attaches to either the palatal- or nonpalatal-initial allomorph of this prefix, so the reduplicating morpheme, which attaches to the right of the verb root, may be affixed to either allomorph of a root with a changeable initial velar, as shown in (71).

(71) a. $koz \rightarrow koz$ -koz-a b. $čoz \rightarrow čoz$ -čoz-a

The dative prefix *ki* chooses the palatal-initial allomorph of any stem—simple, reduplicated, or prefixed—which has both palatal- and velar-initial alternative forms related by the morpholexical rule of Velar Palatalization. Thus, it chooses the reduplicated form in (71b) to yield (69b), producing the illusion of the overapplication of Velar Palatalization in reduplicated forms.

Palatalization cannot apply normally to reduplicated forms (i.e. just to the initial velar) because it does not apply at all. If the reduplicating morpheme attaches to the palatal-initial allomorph of a verb, apparent overapplication of Velar Palatalization results (see (71b)). If the reduplicating morpheme attaches to the velar-initial form, the

²⁶ Note that the palatalizing dative in these examples is the "second dative". The nonpalatalizing dative crucial to the argument that palatalizing triggers form an unpredictable class is the "first dative" (see Boas and Deloria (1941, 87) for a discussion of the distinction between the datives).

result is (71a). Since reduplication in Dakota is a suffixing process and only prefixes choose palatal- or nonpalatal-initial allomorphs, reduplication applies to both allomorphs, yielding the range of data displayed above.

2.2.1.2. Excursus on Morpholexical Rules. Before continuing, I should make explicit an elaboration on Lieber's morpholexical rule theory which I assumed in the discussion of Dakota Velar Palatalization. A morpholexical rule expresses the relation between two sets of allomorphs, a marked set and an unmarked set. (Lieber (1980) calls the marked set stems and the unmarked set roots and provides an algorithm for picking out the root in a lexical entry.) The marked set contains the "output" of the morpholexical rule wrongly considered as a phonological rule; the unmarked set contains the input. In the case of Dakota Velar Palatalization discussed above, the velar-initial allomorphs are unmarked, the palatal-initial allomorphs marked. Each morpholexical alternation is either righthanded or lefthanded. A "righthanded" morpholexical alternation is one whose marked forms are chosen by material that subcategorizes to the right for the stem exhibiting the alternation. In the paradigmatic case, the marked form of a righthanded morpholexical alternation is chosen by a prefix. Since palatal-initial allomorphs are chosen by prefixes, the Velar Palatalization morpholexical rule of Dakota is righthanded. A "lefthanded" morpholexical alternation is one whose marked forms are chosen by material that subcategorizes to the left, e.g. suffixes. Every morpheme which attaches to a stem exhibiting a righthanded morpholexical alternation and subcategorizes to the right for this stem must choose one of the allomorphs of the stem. A set of such morphemes is specially marked to choose the marked allomorph; the rest choose the unmarked allomorph by default. A subset of *i*-final prefixes in Dakota choose palatal-initial allomorphs; the remainder choose velar-initial forms. Similarly, every morpheme attaching to a stem exhibiting a lefthanded morpholexical alternation and subcategorizing to the left for this stem must choose one of the allomorphs of the stem. Again, some of these morphemes are marked to choose the marked allomorph, while the rest automatically choose the unmarked allomorph. A morpheme attaching to a stem exhibiting a morpholexical alternation but not subcategorizing to the right for a stem with a righthanded alternation or to the left for a stem with a lefthanded alternation does not choose either allomorph and therefore attaches to both. Thus, in the paradigmatic case, a suffix will not choose either allomorph of a stem with a righthanded morpholexical alternation and a prefix will not choose either allomorph of a stem with a lefthanded alternation. The combination of such a morpheme and stem will exhibit the same alternation as the stem alone.

In the Dakota case examined above, since reduplication is a suffixing process in Dakota and Velar Palatalization is a righthanded morpholexical rule, the reduplicating morpheme does not choose either the velar-initial or the palatal-initial allomorph of a stem exhibiting this alternation. Therefore, the reduplicated form itself exhibits the palatal- vs. velar-initial alternation, and, when a Velar Palatalization triggering prefix chooses the palatal-initial allomorph of the reduplicated stem, the result is apparent overapplication of Velar Palatalization.

2.2.1.3. Ablaut. Dakota includes a rule of $\{a, q\} \rightarrow e$ Ablaut, which changes a morpheme-final a or q (nasalized a) to e before a list of morphemes, mostly enclitics, including:

(72)	ya	adverbial e	ending
	šni	'not'	
	s'e	'as though	,
	ka, ča	'a kind of,	rather'
	lak ^h a	'evidently,	, for'
	2	phrase-fina	al enclitic
(73)	haska '	to be tall'	hąské-ya adverb
	ap ^h a 'to strike'		ap ^h é-šni 'he didn't strike it'
	-		ap ^h é-s ² e 'as though he had hit him'

As Shaw (1976, 134-135) points out, many enclitics, including those in (74), do not trigger Ablaut.

(74)	šna	habitual	
	k ^h es	'but always; whenever'	
	he	interrogative	
	{hạ, he}	continuative	
(75)	ya 'to go	,	
	omani-ye-? 'he goes about to travel'		
	omani-ya	a-he-? 'he was going about to travel'	

It should be clear from the lists of Ablaut triggers and nontriggers that the rule's environment is morphological (Shaw (1976) takes great pains to prove that there is no way to predict which morphemes will trigger Ablaut on independent grounds). We must also simply list the morphemes undergoing the rule:

Not all stems change terminal a, but no generally valid rules can be given that would allow a classification of stems according to definite principles. (Boas and Deloria (1941, 30))

Agreeing with this conclusion, Shaw (1976) divides verb stems according to their behavior with respect to Ablaut into six classes whose membership cannot be predicted on any independent grounds.

(76)	Class i:	V-final stems ending in unchanging a
	Class ii:	V-final stems ending in unchanging <i>q</i>
	Class iii:	V-final stems ending in changeable a
	Class iv:	V-final stems ending in changeable <i>q</i>
	Class v:	C-final stems whose stem extension a does not change
	Class vi:	C-final stems whose stem extension a changes

(77)	Class i:	niyá 'to breathe'
		niyá-šni 'he is not breathing'
	Class iii:	eyá 'to say'
		eyé-šni 'he didn't say'
	Class v:	cáx-a 'to freeze'
		cáv-a-s?e 'as if frozen'
	Class vi:	yúz-a 'to take hold of'
		yúz-e-šni 'he didn't catch it'

Since both the morphemes undergoing the rule and the morphemes triggering it must be listed, Dakota Ablaut meets the criteria for morpholexical status. Consequently, both the a- or q- and e-final allomorphs of stems with changeable a or q must appear in the lexicon.

Reduplicated forms of Class iii and iv roots do not change final a, a although their unreduplicated counterparts do.

(78) háska 'to be tall'

č^há-kị iyúha háske-? 'all the trees are tall' tree-DET all tall-enclitic č^há-kị háska-ska-? 'the trees are tall' tree-DET tall-redupl-enclitic ap^há 'to strike' ap^hé-šni 'he didn't strike it' ap^há-p^ha-šni 'he didn't strike it repeatedly'

If Ablaut were a phonological rule, we would have to explain why it fails to apply in reduplicated forms. However, the independently motivated identification of Ablaut as a morpholexical rule predicts its under "application" to reduplicated verbs. Consider a Class iii or Class iv root. Both the a- or q- and e-final allomorphs of the root are listed in the lexicon and are potentially available for affixation of the reduplicating morpheme. However, the data above show that Ablaut is a lefthanded morpholexical alternation; that is, the marked—e-final—allomorph is chosen by suffixed material. Although pre-fixes attach to both allomorphs of a stem, a morpheme attaching to the right of the stem must choose either the a-, q-final or e-final allomorph.

(79) a. ya 'to go'

[o[mani[ye]]]-? omaniye-? 'he goes about to travel'
[about[walk[go]]]-enclitic
[[o[mani[ya]]]he]-? omaniya-he-? 'he was about to travel'
[[about[walk[go]]]continuative]-enclitic
b. ap^há 'to strike'
ap^há 'to strike'
ap^hé-šni 'he didn't strike it'
ap^há-pi-šni 'they did not strike it'

In (79a), the prefixes o and mani attach to both allomorphs of $ya \sim ye$. Thus, the enclitic ² may choose the *e*-final version of the derived verb, while the enclitic $ha \sim he$ chooses the *a*-final form. In (79b), on the other hand, the enclitic pi must choose one of the allomorphs of $ap^h a \sim ap^h e$, since pi is a right-attaching morpheme affixing to a stem with a lefthanded morpholexical alternation. Because it is not on the list of morphemes taking the marked (*e*-final) allomorph, it chooses the unmarked (*a*-final) form. The enclitic *šni*, which chooses the marked (*e*-final) allomorph of a stem exhibiting the ablaut alternation, must attach to the form of the combination of $ap^h a \sim ap^h e$ and pi with verb root-final *a* in (79b) because there is no other form.

Since Ablaut is a lefthanded morpholexical alternation and the reduplicating affix is a right-attaching, left-subcategorizing morpheme in Dakota, the reduplicating morpheme must choose one or the other of the allomorphs of a stem with changeable a or q. The reduplicating suffix does not appear on the short list of Ablaut triggers (which does not contain any derivational morphemes resembling the reduplicating morpheme); therefore, it must choose the unmarked or a-, q-final allomorph. Thus, although a root may have two allomorphs, its reduplicated form will have only one—the a-, q-final version—simply because reduplication is a suffixing process. Since the reduplicated form has only the a-, q-final alternate, an Ablaut triggering enclitic cannot choose the e-final allomorph and attaches to a reduplicated verb as if it were a Class i or Class ii verb, giving the appearance that Ablaut blocks in reduplicated forms.

In contrast to Class iii and iv stems, Class vi verbs do change final a in their reduplicated forms.

(80) sič 'be bad'
 sič-a-pi 'they are bad'
 sič-e-ki 'the bad one'
 siksič-e-ki 'the bad ones'

This behavior of Class vi roots confirms the hypothesis, amply supported in Shaw (1976), that the verbal extension a is indeed not part of what we have been calling C-final stems. As should be clear from the phonological shape of the reduplicated forms of Class vi verbs, the reduplicating suffix attaches directly to the root without the stem extension, suffixing CCVC to a form with the shape . . . (C)VC to yield . . . (C)VC-(C)(C)VC. We must assume that C-final stems subcategorize either for the stem extension not subject to this alternation (Class v stems). This selectional information is inherited by the reduplicated form from the stem to which the reduplicating suffix is attached. When an Ablaut trigger chooses the *e*-final form of a Class vi verb in either its reduplicated or unreduplicated version, it is choosing not an allomorph of the stem but rather an allomorph of the stem extension.

2.2.2. Tagalog. Two phonological processes—Nasal Substitution and Syncope—appear to overapply to reduplicated forms in Tagalog. Arguing that these processes are

"allomorphy rules" in the sense of Aronoff (1976), Carrier (1979) suggests that all allomorphy rules precede all phonological rules in the grammar and that reduplication, as a special sort of allomorphy, appears in a special component which marks the border between allomorphy and phonology. Allomorphy precedes reduplication; reduplication precedes phonology. The criteria Carrier uses to determine whether a process qualifies as allomorphy are just those that we have claimed mark a process as morpholexical: the set of morphemes which undergo the process cannot be identified on independent grounds and the process must be morphologically triggered. We have argued above that Carrier's analysis is basically correct, as she has identified the class of rules which must necessarily "precede" reduplication in some sense. However, because she treats allomorphy rules as rules which apply in the same manner as phonological rules, she cannot explain the underapplication to reduplicated forms of rules which meet her criteria for allomorphy status (e.g. Ablaut in Dakota). If allomorphy precedes reduplication, we always expect the illusion of overapplication of allomorphy rules to reduplicated forms. Also, although Tagalog reduplication resembles allomorphy in important respects (see Carrier (1979) and Lieber (1980) on this point), in most languages reduplication more closely parallels inflectional and derivational affixation, as the examples in the preceding pages should make clear. Thus, it is difficult to motivate cross-linguistically Carrier's isolation of reduplication in a special component following word formation rules and allomorphy. On the other hand, the analysis given above for the apparent over- and underapplication of morpholexical rules in Dakota accounts for the apparent overapplication of Nasal Substitution and Syncope in Tagalog without any special assumptions about reduplication. Reduplication is simply affixation and as such precedes all phonological rules.

2.2.2.1. Nasal Substitution. Tagalog exhibits three different sorts of reduplication, which Carrier labels RA, R1, and R2. RA prefixes a CV with the V specified [+long]; R1 prefixes a CV with the V specified [-long]; and R2 prefixes CVCCV to a stem with the second V specified [+long] unless the stem begins CVC(C)VC followed by a morpheme boundary, in which case the entire stem is copied (see footnote 5 for a discussion of this aspect of R2 reduplication; see (7) above for further examples of all three sorts of reduplication).²⁷

²⁷ I will sometimes write as if the various reduplicating prefixes RA, R1, and R2 are each single, uniform morphemes. Actually, as each prefix has a variety of uses (see Carrier (1979) for numerous examples of the

A rule of Nasal Substitution replaces a stem-initial obstruent with the homorganic nasal after a prefix-final y, deleting the y.

```
(82) Nasal Substitution
n - [-cont]
1 2 →
4 2
[+nasal]
/maŋ-bilih/ → mamilah 'ST-shop'
/maŋ-dikit/ → manikit 'ST-get thoroughly stuck'
```

Carrier (1979) demonstrates that if Nasal Substitution were a rule, it would have to occur before reduplication.

(83)	maŋ-ka?ilanan	maŋ-ka²ilanan
Nasal Subst	ma-ŋa ⁷ ilanan	RA Redup maŋ-kāka?ilanan
RA Redup	ma-ŋāŋa ² ilanan 'ST-will need'	Nasal Subst *ma-ŋāka?ilanan
	maŋ-pulah	maŋ-pulah
Nasal Subst	ma-mulah	R2 Redup man-pulāhpulah
R2 Redup	ma-mulāhmulah	Nasal Subst ma-mulāhpulah
Vowel Shortening	ma-mulahmulah	Vowel Shortening ma-mulahpulah
h Deletion	ma-mulamulah	h Deletion *ma-mulapulah
	'ST-turn a	
	little red'	

If reduplication, as a normal word formation process, were ordered before Nasal Substitution, considered a normal phonological rule, Nasal Substitution would appear to overapply to reduplicated forms, applying to obstruents in both the copy (reduplicating prefix) and the stem although only the obstruent in the copy would meet the environment of the rule.

(84) ma-pulah 'red'

```
pa-mu-mulan 'turning red' < paŋ-C V -pulah

[-\log]

ma-mū-mulah 'will turn red' < maŋ-C V -pulah

[+\log]
```

ma-mula-mulah 'turn a little red' < maŋ-R2-pulah

reduplicating prefixes at work), each must be understood as the morphological form of a set of homophonous morphemes. Tagalog makes extensive use of a small set of affixes in various combinations. In addition to the reduplicating prefixes, such affixes as ka- and -an are multiply ambiguous.

See footnote 13 on the use of the feature $[\pm long]$ on the reduplicating prefixes in (81).

Carrier shows that Nasal Substitution "is restricted to apply to a certain morphologically specified set of stems in the environment of a morphologically specified set of prefixes" (1979, 64). Some obstruent-initial stems never undergo Nasal Substitution.

(85) /maŋ-basah/ → mambasah 'ST-read' /maŋ-dukut/ → mandukut 'ST-pick pockets' /maŋ-guloh/ → maŋguloh 'ST-create disorder'

Compare the examples in (85) to those in (82) (the $/\eta$ / of the ST prefix assimilates to a following obstruent if it does not delete through Nasal Substitution). Also, some *ŋ*-final prefixes never trigger Nasal Substitution. One such prefix is the accidental/result prefix *mag-kay*-.

(86) /maŋ-dikit/ → ma-nikit 'ST-get thoroughly stuck to' but /mag-kaŋ-dikit/ → mag-kan-dikit 'get stuck to accidentally as a result of'

Since which obstruent-initial stems will undergo Nasal Substitution and which *y*-final prefixes will trigger it is generally arbitrary, Nasal Substitution qualifies as a morpholexical rule, and both nasal-initial and nonnasal-initial allomorphs of each morpheme "undergoing" the rule must be listed in the lexicon (as must both the *y*-final and vowel-final allomorphs of the prefixes which trigger Nasal Substitution). We may account for the apparent overapplication of Nasal Substitution in reduplicated forms by allowing the reduplicating prefix to attach to either allomorph of stems exhibiting the alternation captured by the morpholexical rule of Nasal Substitution.

$$\begin{cases} (87) \\ mulah \\ mulah \\ \end{cases} \rightarrow \begin{cases} pupulah \\ mumulah \\ \end{cases}$$

A Nasal Substitution trigger would choose the nasal-initial allomorph of a reduplicated form, yielding the appearance of overapplication of Nasal Substitution.²⁸

We could circumvent this problem by simply allowing reduplicating prefixes not to choose between the allomorphs of a stem subject to Nasal Substitution. However, this move would involve weakening the theory of morpholexical rules to permit prefixes not to choose allomorphs of righthanded morpholexical processes, a weakening that is not independently motivated. In an earlier version of this article, I argued that Tagalog reduplication displays a peculiar property which leads us to predict that reduplicating prefixes will not choose allomorphs of righthanded morpholexical rules in this language: Tagalog reduplicating prefixes do not subcategorize for the stems to which they attach. I refer the reader to Lieber (1980) for some discussion of Tagalog reduplication along these lines.

²⁸ This account of the interaction of Nasal Substitution and reduplication is problematic in one way, however. Since prefixes choose the nasal-initial allomorphs of stems subject to Nasal Substitution, the rule is a righthanded morpholexical process. Thus, the reduplicating morphemes, being prefixes, should choose one or the other of the allomorphs of a stem subject to Nasal Substitution, presumably the nonnasal-initial or unmarked (root) allomorph. It seems then that morpholexical theory predicts the *underapplication* of Nasal Substitution to reduplicated forms rather than its overapplication. A reduplicated form should exhibit only a nonnasal-initial allomorph.

2.2.2.2. Syncope. In addition to Nasal Substitution, a rule of Syncope in Tagalog also appears to interact unusually with reduplication. Syncope deletes the last vowel in stems before the verbal suffixes *-an* and *-in*. As illustrated in (88), in some verbs Syncope is obligatory, in some it is optional, and in some it is inapplicable. No independent criteria determine to which morphemes Syncope will apply: "among those roots which have light penultimate syllables, it is not possible to distinguish in phonological terms the ones which undergo syncope from the ones which do not" (Carrier (1979, 87)).

(88)	t-um-iŋin 'ST-watch'	*tiŋin-an tiŋn-an 'watch-OT (object topic marker)'
	d-um-umih 'ST-make dirty'	dumih-an dumh-an 'make dirty-OT'
	mag-wakas 'ST-end'	wakas-an *waks-an 'end-OT'

Only the verbal suffixes -an and -in trigger Syncope. The nominalizing suffix -an, for example, which is homophonous with the verbal suffix -an, does not trigger Syncope even in verbs which undergo the rule when the verbal suffix -an attaches.

(89)	mag-bigay 'ST-give' bigy-an 'give-OT'	bīgāy-an 'a giving to one another
	s-um-akay 'ST-board'	sākāu on 'o boording bu monu'
	saky-all board-101	sakay-an a boarding by many

Since both its environment and its target must be morphologically specified, Syncope qualifies as a morpholexical rule.

If both processes are considered rules, R2 reduplication must follow Syncope.

(90)		tiŋin-an		tiŋin-an
	Syncope	tiŋn-an	R2 Redup	tiŋīn-tiŋin-an
	R2 Redup	tiŋnān-tiŋnan	Syncope	tiŋīn-tiŋn-an
Vowel	Shortening	tiŋnan-tiŋnan	Vowel Shortening	*tiŋin-tiŋn-an
/tiŋin-a	n/ → tiŋnan '	look at-OT'		
R2-tiŋiı	n-an → tiŋna	ntinnan 'look at a bit-OT'	*tiŋintiŋnan	

The problem here is not actually one of overapplication of a phonological process in reduplicated forms. If we reduplicated *tinin-an* to derive *tinin-an-tinin-an*, Syncope could apply normally to both *nin-an* sequences, yielding the correct *tinnantinnan*. However, since R2 reduplication never copies more than two syllables, we cannot derive the input

to Syncope, *tinin-an-tinin-an*, necessary for this analysis. Noting that the "overapplication" of Syncope in Wilbur's (1973) sense cannot derive forms like *tinnantinnan*, Carrier (1979) rightly points out that the reduplication of syncopated forms in Tagalog is an example of an unusual interaction of a phonological process and reduplication about which Wilbur's Identity Constraint has nothing to say. We must explain here why a phonological process, Syncope, appears to apply before a word formation process, reduplication.

As was the case with Nasal Substitution, the interaction of Syncope with reduplication follows from the identification of Syncope as a morpholexical rule and of reduplication as a normal prefixation process. Since syncopated forms are chosen by suffixes, Syncope is a lefthanded morpholexical rule. Therefore, the R2 reduplicating prefix will attach to both allomorphs of a stem exhibiting the Syncope alternation, yielding two alloforms of the combination R2 plus root.

(91) a. $\begin{cases} R2 - CVCVC \\ R2 - CVCC \end{cases}$

Syncope triggers choose the syncopated form (91b).

This analysis of the interaction of reduplication and Syncope raises an interesting problem for the theory of reduplication presented in section 1. Let us suppose, with Lieber (1980), that morphemes are inserted into unlabeled binary branching tree structures. The subcategorization frames of morphemes ensure the proper deployment of morphemes within these structures, while a system of feature percolation labels the nodes and combines features of the inserted morphemes to produce feature matrices for the entire word and subunits of the word. Since R2 prefixes to V roots, not V' forms (see Carrier (1979)), a word like *tignantignan* must have the tree structure shown in (92).



Recall that R2 copies the first CV(C)CV of a stem unless the first CV(C)CVC is followed by a morpheme boundary, in which case it copies the entire stem (see footnote 5). We might say that R2 has two allomorphs, the C-V skeleton CVCCV and a morphemic skeleton μ (see section 1.4). The morphemic skeletal allomorph attaches to stems beginning CV(C)CVC[-segment], while the C-V skeletal allomorph attaches elsewhere. Forms like *tignantignan* display the shape we would expect if R2 attached to the combination of a V stem and verbal suffix, as in (93), rather than to the V stem alone, as in (92); the stem *tinnan* but not *tinn* begins CV(C)CVC[-segment].



Since V'_2 in (93) begins CVCCVC[-segment], the morphemic skeletal allomorph of R2 appears, yielding the correct result. The paradox here is this: the selectional restrictions associated with the R2 reduplicating prefix demand the structure in (92), while only the structure in (93) produces the correct reduplicated form.

Pesetsky (1979) provides examples from Russian and English in which certain considerations (e.g. semantic interpretation) require a prefix to attach to a root and a suffix to attach to the derived stem, as in (92), while other considerations (e.g. the phonological cycle) demand that the prefix attach to the combination of the root and the suffix, as in (93). For example, the English comparative suffix, *-er*, attaches to many monosyllabic adjectives, to some disyllabic adjectives with light final syllables, but to no adjectives with three or more syllables.

(94)	red	redder	dark	darker
	little	littler	happy	happier
	putrid	*putrider	turquoise	*turquoiser
	palatable	*palatabler	excellent	*excellenter

The selectional restrictions on -er thus demand the structure in (95a) for the word *unhappier*; if the structure were (95b), -er would have to attach to a trisyllabic adjective. However, the semantic interpretation of *unhappier* requires the bracketing in (95b); a man who is unhappier than Elmer is more unhappy than he is, not not more happy.



It is tempting to speculate that whatever the solution to the dual bracketing problem in Russian and English turns out to be, it will carry over to the Tagalog example as well. At the moment, how to derive the R2 reduplicated form of syncopated stems remains a problem for future research.

3. Summary and Conclusion

In section 1, I claimed that reduplication is best analyzed as the affixation of a skeletal morpheme to a stem. In section 2, I tried to show that the analysis of reduplication as affixation explains the otherwise puzzling interaction of reduplication with certain phonological processes. The fact that reduplication processes can generally be characterized by a fixed consonant-vowel shape, a fact captured in the identification of reduplicating morphemes as C-V skeleta, provides considerable support for McCarthy's autosegmental representation of words on different tiers including a phonemic melody and a C-V skeleton. Given that reduplication is simply affixation, the interaction of reduplications, is predicted by Halle's (1979) interpretation of the phonological cycle and Lieber's (1980) morpholexical theory. This article thus provides striking confirmation of both Halle's and Lieber's proposals.

At first glance, reduplication seems a rare bird among morphological processes, an exotic curiosity. Struck by the apparent novelty of reduplication, previous investigators have treated reduplication as a special case—and were confronted with problems as a result. Beginning with the assumption that reduplication is minimally different from processes we are accustomed to, I have not only constructed an elegant account of reduplication and its properties but have also been able to illuminate important issues in phonology and morphology. When we recognize that the same theory must cover the duckbill platypus as well as the house cat, we gain a deeper understanding of both the platypus and the cat.

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Harvard University Society of Fellows 78 Mount Auburn Street Cambridge, Massachusetts 02138