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A THEORY OF INTERNAL REDUPLICATION

E. BROSELOW AND J. MCCARTHY

1. INTRODUCTION

In the vast majority of the world's languages morphological affixes appear at the periphery of the word they are modifying - that is, they are suffixed or prefixed. Infixes, then, are a mild sort of morphological curiosity, since they forsake the peripheral position for some phonologically-determined slot inside the word. Typically, the only morphemes that are demonstrably infixes are those that show up inside fully-formed roots, like the familiar nasal present of Indo-European.

Even more exotic, though, is the very unusual phenomenon of infixing reduplication - where a copy of some portion of the root appears inside the root itself. Although infixing reduplication is extremely rare, it is of great intrinsic interest because of the challenge it presents to a theory of reduplication that has been emerging in recent research like Bell (1983), Broselow (1983), Marantz (1982), McCarthy (1981, 1982a), and Yip (1982). The view developing in this work is that reduplication is a special case of ordinary affixational morphology, where the affixes are phonologically underspecified, receiving their full phonetic expression by copying adjacent segments. This copying is mediated by the formal apparatus of autosegmental phonology, taken with some modifications from the theory of tonal systems in Goldsmith (1976) and Clements and Ford (1979). Infixing reduplications are a problem for this theory both in a complex formal way elucidated below and because they apparently subvert the fundamentally affixational character of reduplication claimed by the theory. But the issues raised by infixing reduplication have been difficult to resolve because of the scarcity of relevant examples and the poverty of whatever data have come to light.

We have collected and analyzed in considerable detail a number of areally and genetically distinct examples of systematic and productive rules of infixing reduplication. These rules bear directly on the empirical and theoretical issues underlying the treatment of reduplication and of

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nonconcatenative morphological processes as a whole. In this paper we will present our examples – from Levantine Arabic, the Malayan Austroasiatic language Temiar, the North American language isolate Zuni, the Hokan language Washo, the Austronesian languages Samoan, Chamorro, and Nakanai, the Chimakuan language Quileute, and various Salishan languages of the Northwest Coast – and we will argue that they support a particular conception of infixing reduplication that is generally compatible with the theory of prefixing and suffixing reduplication with a minimum of special pleading or ad hoc stipulations. This account posits a major typological distinction between true infixing reduplication, in which the infix is prefix- or suffixlike in its mode of autosegmental association, and prefixation of the infix to a prosodic constituent (a syllable or a metrical foot).

In section 2 of this paper we deal with the two previous proposals for incorporating infixing reduplication into the overall theory, those of Marantz (1982) and of Bell (1983). Section 3 analyzes three examples of true infixing reduplication, Levantine Arabic, Temiar, and Washo. Section 4 discusses several cases from the Austronesian and Salishan families of apparent infixing reduplication, a phenomenon which we analyze as prefixation of a CV sequence to the final prosodic constituent (either a syllable or a metrical foot) of the word. Section 5 contains a summary discussion of two intransigent, historically secondary cases of internal reduplication, while section 6 dismisses a number of illusory cases of internal reduplication that have appeared in the literature.

2. PREVIOUS PROPOSALS

2.1. *Marantz (1982)*

Marantz (1982) presents a theory of reduplication that seems to us both empirically correct and inherently desirable on grounds of intrinsic interest and formal restrictiveness. Marantz's proposal is an extension of the theory of nonconcatenative morphology offered by McCarthy (1981). The fundamental insight of this model is that reduplication is accomplished not by special and quite powerful copying transformations (as in the *SPE* framework) but rather by the normal morphological device of affixation. Following McCarthy, Marantz proposes that words are decomposable into two autosegmental levels (tiers), one, called the skeleton, representing the canonical pattern of the word in terms of the familiar units C and V and the other, called the phonemic melody, representing the phonetic properties of segments in terms of the usual distinctive features. Ordinary affixes of the sort found in concatenative morphological systems are

specified fully on both the skeleton and the phonemic melody tiers, but a reduplicating affix is specified only for its canonical form (expressed by a skeleton of the units C and V) and not for its segmental identity. Specification of the segments in the reduplicating affix for phonetic identity is achieved by autosegmental association of the phonemic melody of the adjacent root with the empty C's and V's of the affix. To understand the operation of this model we must first consider its properties in some detail.

Reduplication occurs in the special case of affixes that partially or completely lack a phonemic melody but have a CV skeleton. That is, these affixes are specified as to their canonical pattern but must obtain their phonemic melody elsewhere if they are to be phonetically realized. Marantz proposes a mechanism for associating a phonemic melody with the underspecified affix, embedded within the overall autosegmental framework. What follows is a modification of that algorithm, eliminating some redundancies while retaining the same empirical coverage:

- i. Create an unassociated copy of the phonemic melody of the root or stem.
- ii. Associate from the copied phonemic melody onto the CV-skeleton one-to-one from left to right in the case of a prefix and from right to left in the case of a suffix. This association respects the difference between C's and V's, associating them only with compatible (consonantal and vocalic) elements of the phonemic melody.
- iii. Erase all material from the phonemic melody or the CV skeleton that remains unassociated at this point.

There is one significant difference between the procedure above and that detailed by Marantz: as Marantz describes it, the root phonemic melody is copied "on the same tier as the melody and on the same side of the stem melody to which the affix is attached" (Marantz 1982: 445). Invoking "same side" here seems to us redundant; all notions of directionality are adequately handled by the prefixal/suffixal rubric of clause ii. of the association algorithm. We propose, then, that the copied phonemic melody and its original are independent, represented on different autosegmental tiers. In this respect our analysis holds more closely to the notion in McCarthy (1981) that each phonemic melody morpheme (or morpheme type) defines a separate tier of its own.

Consider in illustration of this procedure the Agta example in (1), reported in Marantz (1982: 439) after Healey (1960: 7):

Singular		Plural	
bari	'body'	barbari-k kid-in	'my whole body'
mag-saddu	'leak (verb)'	mag-sadsaddu	'leak in many places'
na-wakay	'lost'	na-wakwakay	'many things lost'
takki	'leg'	taktakki	'legs'

Under Marantz's proposal, the grammar of Agta stipulates a prefix CVC as responsible for the reduplication in (1). This prefix is specified only for its canonical form - the arrangement of C's and V's. It is spelled out or rendered pronounceable by association with a copy of the root's phonemic melody, as in the following derivation:

- (2) Underlying representation
- $$\begin{array}{c} \text{CVCCV} \\ ||| \backslash / \\ \text{t a k i} \end{array}$$
- Prefixation of CVC
- $$\begin{array}{c} \text{CVC+CVCCV} \\ ||| \backslash / \\ \text{t a k i} \end{array}$$
- Copying of root phonemic melody
- $$\begin{array}{c} \text{taki} \\ ||| \backslash \\ \text{CVC+CVCCV} \\ ||| \backslash / \\ \text{t a k i} \end{array}$$
- Left-to-right association
- $$\begin{array}{c} \text{taki} \\ ||| \backslash \\ \text{CVC+CVCCV} = \text{taktakki} \\ ||| \backslash / \\ \text{t a k i} \end{array}$$

(Here and subsequently, we terminate derivations with an equals sign followed by a conventional segmental representation of the derived form. These are only convenient translations of the formal autosegmental representation, in which unassociated material is erased, and they have no status in the theory.)

In (2) the prefixing, left-to-right mode of association is observed. We see the opposite with the suffixing reduplication of Dakota in (3), from Marantz (1982: 448, 466) after Shaw (1976):

(3)	Stem	Reduplicated form	
	ksa	ksaksǎ	'to cut'
	hǎska	hǎskaska	'be tall'
	p ^h e	p ^h ep ^h é	'sharp'
	xáp-a	xapxáp-a	'to rustle'
	núp-a	nupnúp-a	'two'

According to Marantz, the reduplicative morpheme for Dakota is the suffix CCVC. It participates in the following sample derivation:

(4) Underlying representation

CVCCV
| | | |
h ǎ s k a

Suffixation of CCVC

CVCCV+CCVC
| | | |
h ǎ s k

Phonemic melody copying

hǎska

CVCCV+CCVC
| | | |
h ǎ s k a

Right-to-left association

hǎska
///
CVCCV+CCVC = hǎskaska
| | | |
h ǎ s k a

Here the association must proceed from right to left, the appropriate mode for a suffix. Left-to-right association would yield the ill-formed representation **hǎskahas*.

The association mechanism proposed in connection with this theory is claimed to be part of universal grammar. The range of permissible variation lies only in the forms of the morphemes themselves (for example, the reduplicating affix can have partial specification of its phonemic melody, as in the well-known Nupe example) and in the rare and arguable cases of prefixes and suffixes that associate with the phonemic melody in the “wrong” direction. The important results accruing from this overall model are detailed in Marantz’s article.

Marantz (1982: 453n.) deals only very briefly with infixing reduplication, our concern here. Drawing on the example of Samoan plural reduplication, he tentatively suggests that the overall model for prefixing and suffixing reduplication will extend without modification to infixing reduplication as well. Since this suggestion bears directly on our goal here, we shall examine it in great detail. In section 3, we shall, as part of our theory, adopt with considerable elaboration an interesting suggestion made by Marantz in an earlier, privately circulated version of this paper.

Samoan forms plurals of verbs by reduplicating a CV sequence, sometimes initially, sometimes finally, and sometimes internally, apparently under lexical government. Verb stems may contain one, two, or three syllables, where syllables take the form (C)V. Only stems of three syllables will demonstrably have internal reduplication, since reduplication in shorter stems can always be attributed to prefixal or suffixal reduplication. Examples appear in (5), with the reduplicated material italicized:

(5)	a.	taa	<i>tataa</i>	‘strike’
		tuu	<i>tutuu</i>	‘stand’ ¹
	b.	nofo	<i>nonofo</i>	‘sit’
		moe	<i>momoe</i>	‘sleep’
	c.	alofa	<i>alolofa</i>	‘love’
		savali	<i>savavali</i>	‘walk’
		maliu	<i>maliliu</i>	‘die’

The reduplication morpheme is obviously CV. It may appear initially (as in (5a,b)) or finally, in which case it shows the usual prefixal or suffixal mode of autosegmental association. With internal placement of the CV plural morpheme (presumably after the first syllable), Marantz suggests the following derivation, claimed to be accomplished by “the machinery and conditions already introduced”:

- (6) Underlying representation

a	l	o	f	a
V	C	V	C	V

Infixation

$$\begin{array}{c} \bar{a} \qquad \qquad \bar{o} \ f \ \bar{a} \\ | \qquad \qquad | \ | \ | \\ \bar{V} + CV + CVCV \end{array}$$

Phonemic melody copying

$$\begin{array}{c} \bar{a} \quad \bar{lofa} \quad \bar{o} \ f \ \bar{a} \\ | \quad \quad | \ | \ | \ | \\ \bar{V} + CV + CVCV \end{array}$$

Left-to-right association

$$\begin{array}{c} \bar{a} \quad \bar{lofa} \quad \bar{o} \ f \ \bar{a} \\ | \quad | \ | \quad | \ | \ | \\ \bar{V} + CV + CVCV \end{array} \quad \bar{alolofa}$$

In fact, there is no sense in which the apparatus appropriate to prefixing and suffixing reduplication will apply without modification, as claimed, to yield the derivation in (6). First, less than the entire phonemic melody is copied in (6), and no proposal is offered for determining which portion of the phonemic melody should be copied and subject to association. So, we could as well have copied and associated initial *a*, yielding **aalofa*. Second, the direction of association is entirely undefined, since the CV infix does not come under the purview of the prefix/suffix rubric for association. Thus, the output is indeterminate between the correct form and **afalofa*, which is obtained by right-to-left association of the copied phonemic melody. These two serious lacunae in the account of Samoan force the conclusion that the proposals in Marantz (1982) are inadequate to the exigencies of infixing reduplication.

2.2. Bell (1983)

An alternative analysis of internal reduplication is offered by Bell (1983). Bell's account has the virtue of providing a more restrictive theory of reduplication; however, as we will see, this account is actually too restrictive, prohibiting various types of infixing reduplication which do in fact occur.

Bell's account avoids the first problem mentioned above, that of determining which portion of the stem melody is to be copied in internal reduplication. Like Marantz, Bell separates the stem into two units, pre-infixal and post-infixal, and inserts the infix between these units on the CV skeleton. Rather than maintain the original association between phonemic melody and CV skeleton, however, Bell stipulates that the association lines of either the pre- or post-infixal material are erased. The entire stem melody

is then copied and the copy associated with the unassociated portion of the stem skeleton and the infix. Under this account, the derivation of the Shuswap form *sqéqǵe* 'small dog' from *sqéǵe* 'dog', by infixation of *q* after the stressed vowel, is as in (7):

(7) Underlying representation

s q é ǵ e
 | | | |
 CCVCV

Infixation of C after the stressed vowel

s q é ǵ e
 | | | | |
 CCV + C + CV

Erase of post-infixal association lines

s q é ǵ e
 | | | | |
 CCV + C + CV

Phonemic melody copying

s q é ǵ e
 | | | | |
 CCV + C + CV = sqeqǵe

sqeǵe

Right-to-left association

s q é ǵ e
 | | | | |
 CCV + C + CV = sqéqǵe
 sqeǵe

Samoaan reduplication is handled similarly in Bell (1983), with the difference that in Samoaan the infix is specified syllabically rather than by C and V. The derivation of *aloloŋa* appears in (8):

(8) Underlying representation

Infixation of σ after the penultimate syllable

Erasure of post-infixal association lines

Phonemic melody copying and right-to-left association

In both Shuswap and Samoan, the direction of association is toward the infix, from right to left. We may assume that for Bell the direction of association depends on which portion of the melody (pre- or post-infixal) is dissociated. Since, however, it is not always clear whether one should dissociate the pre-infixal portion or the post-infixal portion, the direction of association is, as in Marantz's account of infixing reduplication, ultimately undefined. Furthermore, as Bell herself points out, this account of infixing reduplication vitiates the fundamental insight that motivates

Marantz's treatment of reduplication as a whole: the idea that reduplication is simply a special case of affixation. Under Bell's account, infixing reduplication differs from other infixing by erasing association lines either before or after the infix. Nonreduplicating infixation, of course, does not demonstrably disrupt the autosegmental association of the root segments surrounding the infix.

Apart from these technical issues, there is a serious empirical inadequacy in this theory: it fails to account for certain patterns of infixing reduplication that actually occur. Bell's approach divides the reduplicated form into two parts, a portion of the original stem skeleton that retains its association lines, and the remainder of the skeleton plus the infix, this latter portion associated with the copied stem melody. Since association within each part proceeds from the edge of the stem, the associated segments in the reduplicated form must appear in the same order in which they appear in the basic word, and appropriate segments may not be skipped over in the association process. Consider a hypothetical language that infixes a reduplicative morpheme C after the second consonant in a tri-consonantal stem $P_1P_2P_3$. There are two possible results for the infixed consonant under Bell's assumptions: it could be a copy of P_2 , by dissociation of the last consonant (P_3) in the phonemic melody and then right-to-left association of the final C slot and the infixed C with the copied melody (9a); or it could be a copy of P_3 , by dissociation of the first two consonants (P_1 and P_2) and then association of the free C-slots and the infixed C with the copied melody from left to right (9b):

The logically possible form $P_1P_2+P_1+P_3$ is not derivable, since it cannot be divided into two parts each of which contains a sequence of consonants identical to that occurring in the root. But, as we will demonstrate below, reduplication of just this type is found in Levantine Arabic, Zuni, and Quileute, and reduplication of the mirror-image type, $P_1+P_3+P_2P_3$, occurs in Temiar and Washo.

Thus neither of these approaches is satisfactory. Marantz offers an essentially unrestricted theory, in which the position of the infix, the

portion of the stem melody which is copied, and the direction of association can all vary freely, allowing almost any imaginable sort of reduplication. Bell's theory, on the other hand, is both internally underdefined and empirically too restrictive; it describes only a subset of the actually occurring internal reduplications.

In the following sections we will examine a variety of internal reduplication processes and will present a theory of internal reduplication which makes possible a revealing but restrictive description of the universally possible types of internal reduplication. We will argue that there are two types of internal reduplication: true infixing reduplication, which involves infixation within a template, copying of the entire stem melody, and association of the infix with that melody from either the left or the right; and apparent infixing reduplication, which involves prefixation of the reduplicative morpheme to a prosodic constituent - a syllable or a metrical foot - rather than to a morpheme, but which is governed by the same general conventions on copying and association that apply to normal prefixal and suffixal reduplications. We argue further that there is good reason to believe that the latter type of internal reduplication derives historically from cases of prefixation or suffixation to a morphological rather than to a phonological constituent.

This approach, then, allows only a very restricted set of copying operations. When the reduplicative morpheme is a true infix, the entire stem melody is copied and the direction of association is specified. When the reduplicative affix is a prefix or suffix to a prosodic constituent, the melody of that constituent is copied and association proceeds as with any ordinary reduplicative prefix or suffix. No other sorts of copying are permitted. This proposal is clearly more restrictive than that of Marantz (1982), in which the portion of the melody to be copied is undefined, but this proposal also is, as we demonstrate below, powerful enough to account for the cases of internal reduplication found in a wide array of languages.

TRUE INFIXING REDUPLICATION

3.1. *Levantine Arabic*

Most Semitic languages have a phenomenon of reduplication of biconsonantal roots, generally with intensive meaning.² In some modern Arabic dialects, particularly those of the Levant,³ there is a parallel process of reduplication in triconsonantal roots, usually with an intensive or sometimes a pejorative meaning. The biconsonantal and triconsonantal root reduplications seem formally quite distinct at first glance, as we can observe from the data in (10):

10)	Consonantal	Simple verb	Derived verb	Gloss (derived verb)
a.	If	laḥḥ (<laḥaḥ)	laḥlaḥ	'wrapped (intensive)'
	ḥl	ḥalla (<ḥalla)	ḥallaḥ	'untied, undid'
b.	frḥ	faraha	farahaḥ	'rejoiced'
	bḥṣ	baḥaṣ	baḥbaṣ	'sought'
	mṛṭ	marata	marmata	'cut unevenly'
	brd	barada	baradaḥ	'shaved unevenly'
	dḥl	daḥala	daḥdala	'rolled gradually'
	ṣrḥ	ṣaraha	ṣarahaḥ	'criticized severely'
	ḥlt	ḥalata	ḥalhaṭa	'sheared unevenly'
	qrṭ	qarata	qarqata	'crunched'
	ṣḥṭ	ṣaḥata	ṣaḥṣata	'dragged roughly'
	b9s	ba9asa	ba9abaṣ	'gave the finger to repeatedly'

Although biconsonantal roots reduplicate fully (that is, C_1C_2 becomes $C_1VC_2C_1VC_2$), triconsonantal roots have only partial reduplication, and that of a rather peculiar sort: a root $C_1C_2C_3$ reduplicates as $C_1VC_2C_1VC_3$. Accounting for this pattern of reduplication is obviously the problem here.

In fact, a solution is suggested by certain informal remarks made by Cowell (1964) as well as discussion with Munther Younes, who first brought these data to our attention. This solution claims that a verb form like *barbad* 'shaved unevenly' is derived from the simple verb *barad* 'shaved' by inserting a copy of the first root consonant to the right of the second root consonant. Intensive/pejorative reduplication in Arabic is, then, a case of internal reduplication.

These observations may be interpreted formally as follows. The intensive/pejorative morpheme is an unspecified C, inserted into the indicated position in the underived verb form $[CVC_VC]$. This unspecified affix then induces automatic copying of the phonemic melody (in this case, the Arabic triconsonantal root) on a separate autosegmental tier. Prefix-like behavior is stipulated for this affix, so there is left-to-right association of the phonemic melody with the infix C, yielding reduplication of the root-initial consonant. Unassociated material is erased. The full formal derivation appears in (11):

Underlying representation

Infixation

Phonemic melody copying

brd

Left-to-right association

In all details but one this derivation is consistent with the theory of prefixing and suffixing reduplication in Marantz (1982) as modified in section 2.1; the unique special stipulation (other than the placement of the infix itself, which any theory will need) is the requirement that association proceed from left to right. As we will see below in the analysis of Temiar, direction of association for infixing reduplication is a parameter, along which the grammars of particular languages may vary and therefore it should not be derived from some putative universal property of the theory. In view of the preponderance of such cases, we suggest that the unmarked direction of association is left to right.

We can now turn to the biliteral roots like *lf*, in which intensive/pejorative reduplication yields *laflaf* from the unmarked verb *lafaf* 'wrapped' (which is subject to morphophonemic alternation as *laff* - cf. Brame (1972)). As is demonstrated in McCarthy (1981), the unmarked verb is derived not by reduplication with its concomitant phonemic melody copying but rather by rightward autosegmental spreading of the second root consonant, filling up the vacant final C slot of a CVCVC template, as in (12):

(12)

Rightward spreading

→

It is to the result of this righward spreading that the process of intensive/pejorative reduplication motivated above applies, as in the following derivation (13):

(13) Underlying representation

Infixation

Phonemic melody copying

f

Left-to-right association

Biliteral roots, then, work in precisely the same way as triliteral ones with regard to Arabic intensive/pejorative reduplication, but the overall result does not give the surface appearance of internal reduplication. As we will see in the following section, essentially the same reduplicative properties of biconsonantal and triconsonantal roots are met with in an unrelated language, Temiar.

3.2. *Temiar*

The pattern of reduplication in the Austroasiatic language Temiar is only minimally distinct from that of Levantine Arabic, reflecting a formal difference only in the direction of association of the phonemic melody copy with the infix. Information about Temiar comes from a detailed

description by Benjamin (1976); an analysis of other aspects of Temiar verbal morphology appears in McCarthy (1982a).

Temiar, like Arabic, has biconsonantal and triconsonantal roots with slightly different morphological behavior. Biconsonantal and triconsonantal roots have a medial vowel as well that is part of the lexical information (cf. biconsonantal *k ɔ̄ w* 'to call', triconsonantal *s/ɔ̄ g* 'to lie down, marry'), but this vowel, as we shall see, does not participate in any of the reduplication processes. There are also disyllabic roots of the form CV(C)CVC, but these remain uninflected except for a single pattern of nominalization and therefore do not bear on the problem described here.

The data in (14) include essentially all the verbal inflections of Temiar (though not the related nominalizations):⁴

(14)	Temiar verbs	Biconsonantal Root	Triconsonantal Root
	Active Voice		
	Perfective	<i>kɔ̄w</i>	<i>sɔ̄g</i>
	Simulfactive	<i>kakɔ̄w</i>	<i>salɔ̄g</i>
	Continuative	<i>kwkɔ̄w</i>	<i>sglɔ̄g</i>
	Causative Voice		
	Perfective	<i>trkɔ̄w</i>	<i>srɔ̄g</i>
	Simulfactive	[<i>trakɔ̄w</i>]	[<i>sralɔ̄g</i>]
	Continuative	<i>trwkɔ̄w</i>	<i>srglɔ̄g</i>

The bracketed forms are generated by rule according to Benjamin (1976), but they happen not to be attested for these particular roots. All the verbs in (14) are given in their phonological underlying forms, subject to a subsequent process of epenthesis breaking up all initial consonant clusters.

Our concern here is with the reduplication evidenced in the active continuative, particularly that of the triconsonantal root. Recall that the pattern of reduplication in the triliteral root in Arabic places a copy of the root-initial consonant to the immediate right of the root medial consonant (so *barad* becomes *barbad*). In Temiar virtually the opposite happens to the triconsonantal verb: a copy of the root-final consonant is lodged to the immediate left of the root medial consonant. Thus, *sɔ̄g* becomes *sglɔ̄g*. The formal interpretation of this fact is quite straightforward. An infix C is inserted in the context [C-CVC] on the CV-skeleton tier. This infix induces automatic copying of the phonemic melody of the root, and autosegmental association is stipulated to proceed

from right to left, in the quasi-suffixal modality. We see this in the following derivation:

15) Underlying representation

s l ɔ g
| | | |
CCVC

Infixation

s l ɔ g
/ | | |
C+C+CVC

Phonemic melody copying

s l ɔ g
/ | | |
C+C+CVC

slɔg

Right-to-left association

s l ɔ g
/ | | |
C+C+CVC = sglɔg
|
slɔg

With erasure of the unassociated elements of the phonemic melody, we have the desired form *sglɔg*.

The moral to be drawn from the difference between Arabic and Temiar is a fairly clear one. In both cases infixation of an underspecified morpheme into the CV skeleton induces copying of the phonemic melody of the root. Because this copy of the phonemic melody appears on a different tier from the root melody itself (just as it does in all cases of ordinary prefixing and suffixing reduplication), both ends of the copy are accessible to application of the association procedure. Since infixes are not subject to the prefix/suffix rubric for direction of association, the direction must be stipulated for each infix. This stipulation accounts for the almost minimal difference between Arabic and Temiar with respect to redupli-

cation in triconsonantal roots. That is, direction of association of phonemic melody with infix skeleton is the essential parameter along which Arabic and Temiar vary.

Temiar has biconsonantal roots as well, and their behavior under reduplication is almost exactly the parallel of biconsonantal roots in Arabic. We see in (14) that the active perfective verb *kɔ̃w* yields *kwkɔ̃w* under infixing reduplication. A copy of the root-final consonant appears in the expected position, the context [C-CVC]. What is somewhat unexpected, on the other hand, is the copying of the root-initial consonant, straddling the copy of the root-final one. This is a quite general property of derived active biconsonantal verb forms in Temiar, since it occurs in the simulfactive as well (straddling the fully-specified, nonreduplicative infix *a*). As in underived Arabic verbs like *lafaf*, this copying of the initial consonant is a consequence of autosegmental spreading rather than reduplicative phonemic melody copying. This is precisely the mechanism responsible for reduplication of the final consonant in Arabic verbs like *lafaf* (from the root *lf*) (cf. McCarthy (1981)). In both languages, the effect of this spreading is to give identical canonical patterns to verbs from short and long roots by extending biconsonantal roots through autosegmental spreading into (effective) triconsonantal ones. Interestingly, Temiar differs from Arabic in having leftward rather than rightward spreading, so the derivation common to the causative and simulfactive biconsonantal verbs in Temiar is that in (16):

Infixing reduplication applies to the output of this leftward spreading to yield the following derivation:

Underlying representation

Infixation

Phonemic melody copying

k5w

Right-to-left association

It is interesting to speculate on the nature of the association mechanisms invoked in Arabic and Temiar. While Arabic has rightward spreading and left-to-right association of the phonemic melody with the template, Temiar has the converse of both operations. In McCarthy (1981) it was claimed, following Clements and Ford's (1981) theory of tone, that universal grammar provides only for the Arabic pattern of association, implemented by a set of universal association conventions. More recently, Pulleyblank (1983) has demonstrated convincingly that tonal phenomena demand a richer conception of the association mechanism, supplying a limited variety of association rules that are selected by particular grammars and that are ordered in the phonological derivation. It appears that the facts of Arabic and Temiar support this latter notion, but with a further restriction: there are evident symmetries in the direction of association and spreading in different rules in the same language. Further study of tonal phenomena will determine whether this observation is consistently borne out.

It remains only to account for the causative voice forms of the continuative aspect, *trwk5w* and *srglɔg*. All causatives have a fully specified infix *r* in second position; the continuatives are unremarkable in this respect. The triconsonantal causative continuative is exactly as we would expect, given this infix. The biconsonantal one, however, has *t* associated with the first C, a property that it shares with all biconsonantal causatives. This *t* fills up the initial position, thereby suppressing the automatic spreading that we saw in (17).

In summary, in Levantine Arabic and Temiar we have seen two cases of infixing reduplication that copy peripheral elements - that is, where the leftmost or rightmost segment is reduplicated in the middle of the root. As we demonstrated in section 2, such phenomena are quite in-

compatible with the account of infixing reduplication in Marantz (1982) and Bell (1983). Instead, we have proposed that reduplicative infixes are treated in essentially the same way as prefixes and suffixes are, with copying and association applied to the full phonemic melody. Reduplicative infixes crucially lack, however, an unmarked direction of association. On the contrary, the direction of association for infixes is unpredictable, stipulated in the grammar of particular languages. It is therefore all the more striking that the entirely unrelated examples of Levantine Arabic and Temiar should show perfectly symmetrical behavior, the former taking the quasi-prefixal option for association and the latter the quasi-suffixal one.

3.3. Zuni

An example of infixing reduplication with the quasi-prefixing mode of association (like Levantine Arabic) is provided by the language isolate Zuni, spoken in the southwestern United States. According to Newman (1965: 55), verbs of a particular morphological class and of the canonical pattern CVCV (verbs with “four-phoneme” roots) insert a copy of the root-initial consonant in the context [CVC V] to express a “medio-passive repetitive function”:

(18)	a. čolo		‘to make the sound of crackling paper’
	čolčo+ʔa		‘it makes irregular crackling sounds’
	+Pres.		
	b. ʔiti		‘to make a scratch’
	ʔitʔi+ti +kʔa +kka		‘he scratched it off’
	+Inch.+Caus.+Past		
	c. tomo		‘to strike the skin drum’
	čuwapɪ tomtɔ+kʔ +e +ʔa		‘who is making noises on the skin drum’
	+Caus.+Cont.+Pres.		

This pattern of reduplication can be described using precisely the same mechanism as that in Levantine Arabic: *infixation of C after the first CVC of the word, copying of the root melody, and association from left-to-right, in the quasi-prefixal mode, of the infixed C and the copied melody.*

3.4. Quileute

Yet another example of this sort of reduplication is provided by Quileute, a Chimakuan language of northwest Washington. Quileute’s interest lies in

its exemplification of infixation of both one and two segments. Internal reduplication of a single consonant after the first vowel of a word is one way of forming frequentatives or distributives in this language.⁵

qa:le?	'he failed'	qaqle?	frequentative
t ^s iko	'he put it on'	t ^s it ^s ko	frequentative
k ^w e:t ^s a?	'he is hungry'	k ^w e:k ^w t ^s a?	'several are hungry'
tuko:yo?	'snow'	tutko:yo?	'snow here and there'

This reduplication may be described, as in Zuni, as infixation of a reduplicative morpheme C after the first vowel of the word, with the phonemic melody copied and associated in the quasi-prefixal mode, from left to right.

The distributive or plural in Quileute may also be formed by infixing CV after the first vowel of the word. The C is realized as a copy of the word's first consonant. The quality of the infixed V depends to some extent on the quality of the stem vowel; if the stem vowel is *a*, the infixed vowel is *e* or *i*, whereas if the stem vowel is *e*, the copied vowel is generally *i*:

Singular	Plural	
a. qa:wat ^s	qa:qe:wat ^s	'potato'
t'a:dax	t'at'e:dax	'tail (of a bird)'
k'a?t'la	k'ak'e:t'la	'stones'
b. haba:	hahiba?	'tree'
c. deq'deq'	dediq'deq'	'mallard duck'
wesa?t ^s o:pat	wewisa?t ^s opat	'woman'

The alternation between *e* and *i* is "due to phonetic processes" (Andrade 1933: 188); it appears to depend on such factors as the point of articulation of the consonants surrounding the vowels and the accentual pattern of the word. We may therefore ignore the *e/i* alternation as probably irrelevant to the morphology. Thus this reduplication is best described as infixation of CV, with V prespecified as the vowel *e*. Copying and association proceed in the now-familiar way.

There is some independent support for this overall conception of Quileute reduplication from a class of eight forms that are doubly exceptional in their manner of reduplication. For one thing, they insert *Ce/i* after the second rather than the first vowel of the word, and for another they copy the second consonant of the word rather than the first:

(21)	Singular	Plura	
	sowač	sowa wič	'living things'
	kide:qet	kide:leqet	'whetstones'

This double exceptionality can be explained quite simply under the theory proposed here by assuming that the special property of these forms is that the initial syllable is invisible (extraprosodic) with respect to the morphology under consideration. It follows that the first syllable cannot serve as the lefthand environment for postvocalic infixation, nor can its phonemes be copied and associated by the reduplication mechanism proper. In other words, it is a lexical property of these exceptional forms that infixation and reduplication proceed as though the initial syllable were not present:

Underlying representation

Infixation of Ce/i / $[(C) V-$

Phonemic melody copying and left-to-right association

3.5. Washo

Our final case of true infixing reduplication is the most complex. As we will show, it is entirely compatible with the theory developed above if we admit one small additional stipulation – a declaration of root-final consonants as outside the purview of the association rule.

The Hokan language Washo has an intricate system of internal reduplication that has been analyzed in considerable detail by Winter (1970), based almost entirely on data from Jacobsen (1964). We take as our starting point many aspects of Winter's careful reanalysis, particularly

with regard to a process of vowel coalescence at the juncture of the infix and the original root.

A few very simple examples appear in (22) (cf. Winter (1970: 191)):

(22)	Singular	Plural	
	dá?a	da?á?a	'mother's brother'
	dámál	damámál	'to hear'
	?élel	?elélel	'mother's father'
	géwe	gewéwe	'coyote'
	bák?i	bík?ák?i	'grandmother's sister'
	bókókoŋ	bokókoŋ	'to snore'
	mó:k'o	mok'ó:k'o	'knee'
	súku?	sukúku?	'dog'
	gušú?	gušúšú?	'pet'
	gu?u	gu?ú?u	'mother's mother'
	bíníl	biníníl	'to try'

The plural is obviously formed by reduplication, but Winter's interpretation of the nature of this reduplication is rather more complicated than might first appear to be necessary. He takes the reduplicating morpheme to be an infix VCV, inserted "after the stem-initial consonant and before the (stressed) first vowel of the stem" (Winter 1970: 192). Thus, a form like *bokókoŋ* is decomposable as /b-*oko*-ókoŋ/, where the italicized sequence is the infix. A rule of vowel coalescence then takes the *o-ó* vowel string to a single *ó* that retains the original stress and distinct quantity of the second vowel. We will discuss this process in greater detail below.

The forms in (22) are insufficient to show why the infix should be VCV, placed before the stressed vowel; a VC infix in the same position or a prefinal CV infix would apparently do as well. The evidence for the more complex statement of infixation comes from roots with nonidentical vowels in the first and second syllable, where vowel coalescence yields some combination of the two vowels at the point of contact between the second vowel in the infix (which copies the second root vowel) and the first vowel of the root proper. Relevant data appear in (23):

(23) Singular	Plural	
a. t'ánu	t'anóno (<t'anónu)	'person'
ʔá:t'u	ʔat'ó:t'o (<ʔat'ó:t'u)	'older brother'
má:gu	magó:go (<magó:gu)	'sister's child'
b. báli?	baláli?	'to shoot' ⁶
c. p'ísew	p'isésew	'ear'
c'í:ge	c'igé:ge	'to scratch'
dúwe?	duwéwe?	'to try to, want to'
šémug	šémúmug	'brother's child (of a woman)'
ʔé:bu	ʔebú:bu	'mother's father's brother'
mé:hu	mehú:hu	'to be a boy'
wíc'ug	wic'úc'ug	'younger sister'
sí:su	sisú:su	'bird'
t'élí:liw	t'elí:liw	'to be a man'
ʔí:sa	ʔisá:sa	'older sister'
móya	moyáya	'shoulder'

By Winter's hypothesis, the phonological underlying representations of these forms are /p' +ise +ísew/ and so on. Our concern at the moment is with the coalescence of the vowels meeting across the right boundary of the infix (in this case, *e+i*).

In general, the coalescence process has the following properties. The length and stress of the second vowel in the sequence (that is, the root-initial vowel) are invariably preserved. Coalescence of two identical vowels yields a single vowel of the same type (22). With two nonidentical vowels, there are three possible circumstances:

- i. A round vowel followed by *a* yields *o* (23a). Subsequently, a rule of vowel harmony propagates *o* rightward, affecting following *u*.
- ii. Any other vowel followed by *a* yields *a* (23b). (More examples of this pattern appear below in (25).)
- iii. Any vowel followed by any vowel other than *a* yields a vowel identical in quality to the first in the sequence (that is, the root-final vowel) (23c).

The stress and quantity of the second vowel prevail regardless of vowel quality, a fact that obviously supports the usual autosegmental and metrical claim that vowel quality is an attribute represented on a distinct level from timing (quantity) and prosodic (stress) attributes. The following rules express these regularities:

Washo Coalescence

$$\begin{array}{l}
 \text{a. } \begin{bmatrix} V \\ \langle +\text{round} \rangle \\ 1 \end{bmatrix} \begin{bmatrix} V \\ +\text{low} \\ 2 \end{bmatrix} \rightarrow \emptyset \begin{bmatrix} 2 \\ \langle +\text{round} \rangle \\ \langle +\text{back} \rangle \end{bmatrix} \\
 \text{b. } V \rightarrow \emptyset \quad V \text{ —}
 \end{array}$$

Informed by these two rules of synalepha, we can conclude that the reduplicated sequence is in fact VCV, as Winter maintains. A root of the form $C_1V_1C_2V_2(C_3)$ will reduplicate internally to yield $C_1+V_1C_2V_2+\bar{V}_1C_2\bar{V}_2(C_3)$. Coalescence by rule (24) happens at the juncture of V_2 and $\bar{V}_1$, with the first, the second, or a combination of these vowels prevailing. We can therefore maintain the VCV characterization of the reduplicating infix.

Additional data relevant to the description of Washo reduplication come from the behavior of roots with canonical patterns other than CVCV(C). Although there apparently are no roots longer than two syllables or with noninitial stress, interesting complications arise in the case of vowel-initial roots and root-medial consonant clusters.

Although vowel-initial roots are described with a completely different reduplication pattern by Jacobsen (1964), Winter (1970) demonstrates that such roots also have VCV reduplication, albeit of necessity prefixed rather than infix. The problem presented by such roots is illustrated by the data in (25):

Singular	Plural	
íc'is	c'íc'is̃	'black'
í:l̥l̥	l̥:l̥l̥	'pure white'
ác'im	c'ác'im	'green, yellow'
á:t'i	t'á:t'i	'upwards, uphill'
ás̃iw	šás̃iw	'clear'
á:p'ig	p'á:p'ig	'to cut, sever'
íleg	léleg	'red'
ípeš	pépeš	'black'
ás̃uŋ	šóš̃uŋ	'red'
í:hu	hú:hu	'striped'
ípu?	púpu?	'to find'
áp'ɪl	p'áp'ɪl	'tail'
ík'ig	k'ík'ig	'rough'
íšš	šíšš	'heavy'

With a VCV reduplicating morpheme lodging to the immediate left of the stressed vowel we would expect VCV+VCV(C) to result (with the usual coalescence of vowels meeting across morpheme boundary), yielding, for example, **iléleg* as the plural of *ileg* (Winter 1970: 194). Winter observes, however, that no phonological word of Washo begins with an unstressed vowel, in recognition of which we can propose the following deletion rule:

$$V \rightarrow \emptyset / \# \text{ } \overline{\text{-stress}}$$

With this in hand, vowel-initial roots present no difficulties; they have VCV reduplication inserted to the immediate left of the stressed vowel (which happens to be prefixal position.)

A more interesting set of complications arises in the treatment of roots with medial consonant clusters. Since we have not yet been precise about the mechanism of autosegmental association in Washo, we do not have any prediction about which consonant of a medial cluster is associated with the VCV infix, but we do have the expectation that only one consonant will reduplicate. In fact, the data in (27) show that the second consonant of a medial cluster takes precedence (Jacobsen 1964: 329-331):

Singular	Plural	
émc [?] i	c [?] ímc [?] i	'to wake up'
ípc [?] ib	c [?] ípc [?] ib	'perfect'
álbul	bólbol	'spherical'
ámham	hámham	'light (in weight)'
ánkaš	kánkaš	'hollow'
élšm	šélšm	'to sleep'
?éwšĩ?	?ešĩwšĩ?	'father's brother'
sáksag	sasáksag	'father's father's brother'
nént [?] uš	net [?] únt [?] uš	'to be an old woman'
mókgo	mogókgo	'shoe'

The general pattern of behavior of roots with medial consonant clusters is that only the second member of the cluster is reduplicated (27). Interestingly, about 8 nouns are exceptional in having the reverse priority for medial cluster, like *emlu*, pl. *mumlu* 'to eat; food'.⁷ In summary, the basic, pretheoretical generalization underlying internal reduplication in Washo is that in (28):

$$(28) \quad (C_1)V_1(C_2)C_3V_2(C_4) \Rightarrow (C_1)+V_1C_3V_2+V_1(C_2)C_3V_2(C_4)$$

This extraordinarily complex pattern of reduplication, each aspect of which has been justified in some detail above, is obviously something of a challenge to the theory presented here. In fact, the analysis requires only a single stipulation not needed independently for simpler systems like Levantine Arabic and Temiar.

First, we shall say that the infixed string takes the form in (29a), like all reduplicating morphemes specified only for canonical form and unspecified for vowel and consonant quality. It is inserted in the context specified in (29b):

- a. +VCV+
b. Root [(C). X]

(29a) provides that a VCV sequence is reduplicated. (29b) lodges the reduplicative morpheme after the first consonant; it is thereby automatically an infix with consonant-initial roots but a prefix with vowel-initial ones.

Second, the direction of association must be stipulated to proceed from right to left, sharing this quasi-suffixal modality with other infixing reduplications like that of Temiar. This direction of association is proven by the behavior of roots with heterosyllabic internal clusters like *aŋkaš* or *saksag*. These reduplicate as *kaŋkaš* and *sasaksag* (from the phonological underlying representations *aka+aŋkaš* and *s+asa+aksag*). The fact that the second consonant of a heterosyllabic cluster reduplicates (the *k* or *š* of these two examples) follows from the stipulated direction of association, which gives priority to phonemic material on the right in the competition for the slots of the +VCV+ infix.

This analysis alone suffices for vowel-final roots like *dá?a*, *i:hu*, *émc'i*, and *mókgo*; sample derivations of the plural forms appear in (30):

Underlying representations

b		d.	
CVCV	VVCV	VCCV	CVCCV
	V//		
d a ? a	i h u	emc ? i	mokgo

Infixation

C+VCV+VCV	+VCV+VVCV	+VCV+VCCV	C+VCV+CVCCV
	V//	///	
d a ? a	i h u	emc ? i	mokgo

Phonemic melody copying and right-to-left association

Phonological rules

daʔaʔa hú:hu cʔímcʔ mogókgo

The phonological rules deriving the surface representations are those formulated above, including vowel coalescence and deletion of word-initial unstressed vowels.

Although the derivations in (30) go through with no more apparatus than that required independently by Arabic and Temiar, the extraordinary complexity of Washo reduplication does exact one small cost: root-final consonants must be excluded from the association procedure. Recall that association of the phonemic melody with the CV skeleton is said to be “phoneme-driven” (Marantz 1982), meaning that an attempt is made to associate the rightmost (respectively leftmost) phoneme before the next one is considered. Since root-final consonants systematically fail to associate as expected by this procedure, we must exclude them from the purview of the rule. This additional stipulation, which is the sole ad hoc feature of our analysis of Washo, can be accomplished by declaring word final consonants to be, in effect, extrametrical (or extrasyllabic) and thus exempt from right-to-left phoneme-driven association. Root-final consonants in Washo thus join a number of other types of peripheral elements that have been shown to deviate from ordinary prosodic behavior at different levels of phonological organization – syllabic (Steriade 1982), accentual (Hayes 1981, Prince 1982), and tonal (Pulleyblank 1983).

In the following derivations of the plurals of *dámal*, *ášiw*, *ábul*, and *sáksag*, the extrametricality of final consonants is indicated by parenthesization:

(31) a. b. c. d

Underlying representations

Infixation

Phonemic melody copying and right-to-left association

Phonological rules

damámál šášiw bólbol sasáksag

There is a certain amount of independent support for the special, extra-prosodic character of final consonants like those in (31). First, Jacobsen (1967) observes that consonants terminating word-final syllables have a more restricted distribution than other, word-internal syllable-final consonants. *h* is prohibited word-finally and *n*, *ŋ*, and *y* may not occur word-finally in a stressed syllable (except for transparent English loans like *kó:n* 'corn', *?išd+liŋ* 'string', and *zuláy* 'July'). It follows, then, that at some fairly deep lexical level presumably accessible by morphological rules as well as morpheme-structure constraints, word-final consonants have different distributional properties from syllable-final ones, supporting a different characterization of their structure. Second, Jacobsen notes the rather surprising behavior under reduplication of the three attested monosyllabic stems in the language.⁸ Of these, two reduplicate the final consonant: *á:m* 'to hit with a body part', pl. *má:m*; *ŋá:m* 'son', pl. *ŋamím*. The other inserts an irregular *d* in lieu of reduplication: *á:š* 'in, into', pl. *dá:š*. In the former it appears that the extraprosodicity of the final consonant may be suppressed when no other consonant is accessible to reduplication (a result exactly paralleling the stress behavior of monosyllabic words cross-linguistically, as noted by Hayes (1981) and Prince (1983)). In the latter case, an arbitrary consonant *d* is inserted to fill the otherwise vacant C slot. Finally, we note as a significant precedent for our analysis the detailed arguments by Steriade (1982) for the extrasyllabicity of certain initial consonants in Greek and Sanskrit, one effect of which is to render these consonants unavailable for copying or association by various reduplication rules. An alternative account of these data, which does not invoke the notion of segmental extrasyllabicity in Washo and instead recasts the basic association rules, is offered in McCarthy (to appear).

In summary, the complex internal reduplication system of Washo is analyzable in the theory we propose here entirely with independently necessary apparatus. It is of considerable interest that this theory not only predicts the highly constrained variation in the Arabic/Temiar/Zuni/Quileute cases but that it also extends with little elaboration to the extraordinary complexity of a case like Washo.

4. PREFIXATION TO A PROSODIC CONSTITUENT

4.1. *Samoan*

The preceding cases of infixing reduplication fundamentally require only the specification of the position of the infix and the direction of association; the copied portion, as in conventional prefixing and suffixing reduplication, is the entire phonemic melody of the morpheme to which the reduplicative affix is attached. However, the Samoan reduplication discussed in section 2 cannot be accounted for by this mechanism, since what is copied is apparently a medial portion of the melody (*alofa/alolofa*). But while the facts of Samoan do not lend themselves to description by the approach used to account for Levantine Arabic, Zuni, Quileute, Washo, and Temiar reduplications, they can be handled quite simply if it is assumed that reduplicative morphemes may be prefixed not only to morphological but to phonological constituents, as is argued for Warlpiri prefixing reduplication by Nash (1980). Nash shows that a number of puzzling constraints on the material accessible by Warlpiri reduplication are explicable if the reduplicative affix is prefixed not to the word but to the disyllabic metrical foot. In Samoan, what appears to be internal reduplication is simply a special case of prefixation: since this language has penultimate stress, we claim that CV is prefixed to the stressed syllable – or equivalently to the metrical foot⁹ – of the word. Then, as in other reduplications, the melody of the constituent to which the reduplicative affix is attached is copied, and association proceeds from left to right, as it normally does in prefixal association. Hence the derivation of the familiar example *alolofa*:

- (32) a. Prefixation to stressed syllable
 Underlying representation

Prefixation of CV to a prosodic constituent

Phonemic melody copying and left-to-right association

If we consider the reduplicative infix CV to be prefixed to the stressed syllable, then that syllable's phonemic melody is copied and associated (32a). If prefixation is to the disyllabic metrical foot, then the entire foot's melody is copied and associated (32b).

This approach also provides a unified account of reduplication in verbs of one, two, and three syllables. Since in this language stress falls on the penult in words of two or more syllables, all the reduplications illustrated in (5) can be analyzed as prefixation of CV to the stressed syllable (or foot), rather than as prefixation in monosyllabic and disyllabic verbs and as infixation in verbs of three syllables. The derivations in (33) illustrate this:

(33) Underlying representation

b

Infixation

Phonemic melody copying and association

As these representations suggest, the penultimate stress of the basic form remains in the derived form: *tatáa*, *nonófo*, *alolófa*.

There are two important respects in which the facts of Samoan underdetermine the analysis. First, as we have already shown, Samoan is equally compatible with prefixation to two different levels of prosodic constituency, the syllable or the metrical foot. Since Samoan infixes CV, it will never potentially reduplicate more than a single syllable and thus cannot test the accessibility of the rest of the foot to the copying and association mechanisms. We shall see in section 4.3 that the language Nakanai does contain the crucial cases, supporting foot-level prefixation of the reduplicative morpheme. Second, Samoan reduplication can be analyzed equally well as reduplication of a syllable or as prefixation of CV to a syllable, since all syllables are open in this language. However, prefixation of CV (and not of an unmodified syllable) to a stressed syllable (or a foot) is demonstrably required for other languages, in particular Chamorro.

4.2. Chamorro

Chamorro, an Austronesian language spoken in the Marianas Islands, employs two major sorts of reduplication according to Topping (1973, 1980): reduplication of the first (C)V of the stressed syllable - the penultimate in Chamorro - and reduplication of the final syllable. The first reduplication is used for actions which are "habitual, continuative, or taking place at the moment of speaking" (Topping 1980: 44). A closed

stressed (penultimate) syllable is not reduplicated in its entirety; rather, only the onset and vowel are copied (34a). By a different process of reduplication, the first CV of the final syllable of adjectives may be copied word-internally (34b), with an intensifying effect (Topping 1983: 183):

a. Continuative Reduplication

sága	sásaga	'stay'
égga	é?egga	'watch'
hugándo	hugágando	'play'

b. Intensifying Reduplication

dánkolo	dákololo	'big'
buníta	bunítata	'pretty'
métgot	métgogot	'strong'
ñálan	ñálalan	'hungry'

There are two observations to be drawn from these data. First, both processes clearly must be described as prefixation of CV to a syllable rather than total reduplication of that syllable, since syllable-final consonants are not reduplicated. Second, it appears that Chamorro recognizes not only prefixation of CV to a stressed syllable or metrical foot, the type in (34a) also found in Samoan, but also prefixation to another sort of constituent that is characterized prosodically, the final syllable of the word, the type of reduplication in (34b). In both cases, the mechanism copies the phonemic melody of the constituent to which CV is prefixed, as the following derivations illustrate:

a. Continuative Reduplication b. Intensifying Reduplication

Underlying representation

Infixation

Phonemic melody copying and association

This completes the derivation of these forms, except for one remaining property: the continuative reduplicated form has stress on the antepenult (e.g. *hugáando*) and not the penultimate stress that we would expect from (35a). It appears, however, that Chamorro has quite a large number of stress-attracting prefixes, as well as stress-neutral ones (Topping 1973; 1980). Thus, we can say that the CV continuative prefix is a member of the stress-attracting class, presumably causing some systematic deformation of the metrical tree on the output in (35a). The other CV prefix, that of the intensive, is not a member of the stress-attracting class.

4.3. *Nakanai*

A whole host of infixing reduplication phenomena are met with in *Nakanai*, an Austronesian language spoken on the northern coast of the island of New Britain in Papua New Guinea. As we will see, *Nakanai* reduplicative infixes are prefixed to the metrical foot of a word, copying the entire foot or portions of it, an extension of our theory suggested by Williams (1983). A further complication of *Nakanai*, one that we will not discuss here, is the apparent conditioning of the reduplication pattern by the phonological shape of the root, yielding several different mutually ex-

clusive patterns of reduplication.¹⁰ Information on Nakanai reduplication as well as the fundamental characterization of it as infixing come from a detailed study by Johnston (1980), although the analysis he presents, involving total reduplication and deletion of excess material, is quite different from the one we adopt here. Our treatment has been informed by the discussion of Nakanai reduplication in an unpublished study by Williams (1983), who first brought these data to our attention.

With the exception of forms containing one of a small number of stress-neutral or stress-attracting suffixes, Nakanai stress is invariably penultimate and therefore the metrical foot is a disyllabic one, subtending the last two syllables of a word. Syllable structure is extremely simple: (C)V. It follows that sequences of vowels, which are often met with in Nakanai words, are to be analyzed in all cases as heterosyllabic and are stressed accordingly. This penultimate stress is of great importance in the system of nonconcatenative morphology, in every case determining the placement of infixes and the domain of reduplication. A case in point is the disyllabic reduplication pattern evidenced in (36), with data from Johnston (1980: 148):

(36)	Simple	Reduplicated	Gloss (of reduplicated form)
a.	ligi	ligiligi	'hurting'
	vorovoro	vorovoro	'pounding'
	rutu	ruturutu	'gathering food for feast'
	mila	milamila	'salty'
b.	abiri	abiribiri	'washing'
	karusu	karusurusu	'ribs; battens'
	sekela	sekelakela	'one at a time'
	kuruve	kuruveruve	'many sweet potatoes'

Here we see total reduplication in the forms of (36a) but partial reduplication in those of (36b). This distinction can be understood by saying that the metrical foot is reduplicated. That is, a CVCV infix (the maximal disyllabic sequence) is added to the left of the metrical foot,¹¹ whereby that infix copies the disyllabic metrical foot of the word. The derivation proceeds as in (37):

(37) Underlying representation

Infixation

Phonemic melody copying and left-to-right association

As in our other cases of prefixation to a prosodic constituent, the phonemic melody of the metrical foot along is copied, so that is the maximal sequence that may be reduplicated.

Of course, there are many simpler alternative accounts of the data in (36) that refer neither to feet nor to infixation; for example, disyllabic suffixing reduplication would do as well. Considered in the light of the other reduplication rules in this language, however, the derivation in (37) turns out to be correct. Under certain phonologically characterizable conditions (mostly in free variation with CVCV reduplication), Nakanai reduplication rules copy less than the whole metrical foot, with the copied material invariably showing up as an infix to the immediate left of the stressed syllable. The three patterns of reduplication in (38), (39), and (40) are cases in point (data from Johnston (1980: 149-150)):

(38)	a.	lolo	lololo	'hearing'
		bebe	bebebe	'butterflies'
		susu	sususu	'drinking from breast'
		baa	babaa	'spaces'
		goo	gogoo	'smoldering'

	b. burulele bilau	burulelele bilalau	'sliding on buttocks' 'songs'
(39)	pati kavu gapu kedi	paipati kaukavu gaugapu keikedi	'floating' 'wearing lime on face' 'beads' 'being careful'
(40)	a. pita beta sio sile biso b. valua vokakea	papita babeta sosio sesile bobiso valalua vokakakea	'muddy' 'wet' 'carrying on ceremonial litter' 'tearing' 'Biso sib-member' 'men' 'white men'

In (38b) we see a clear case of CV infixing reduplication, paralleled by prefixation in the disyllabic (and therefore initially stressed) words of (38a). In (39) a CVV sequence is arguably infixed, although unfortunately we have been unable to locate examples of trisyllabic stems undergoing this pattern. The forms in (40) also involve CV infixing reduplication, but with a special property distinguishing them from those in (38). In (40) we find a CV infix copying the second of two vowels rather than the first, as is expected by left-to-right association. In this delimited class of cases, a language-particular association rule applies, taking precedence over the universal direction of association with prefixes, yielding the desired result. In all of these cases reduplication is clearly accomplished by prefixing a CV skeleton to the metrical foot of the word, as in the following derivations:

(41) Underlying representations

Infixation

Phonemic melody copying and left-to-right association

Some roots whose penultimate syllable begins with a vowel take a VC infix, also placed in foot-initial position, as evidenced in (42) from Johnston (1980: 148-149):

(42)	Simple	Reduplicated	
a.	abi	ababi	'getting'
	oli	ololi	'digging'
b.	kaiamo	kaiamamo	'residents of Kaiamo village'

Here, sample derivations will proceed as in (43):

(43) Underlying representations

Infixation

Phonemic melody copying and left-to-right association

There is another type of VC reduplicative infixation in Nakanai - one that we will discuss below in section 5.2.

There is still another infix in Nakanai - this one fully specified and not reduplicative. *il* (alternating phonologically with *ul*, *ir*, and *ur*) is a marker of non-concrete nominalization, falling immediately to the left of the stressed vowel: *ali* 'eat', *ilali* 'feast'; *taga* 'afraid', *tilaga* 'fear'. It is restricted to disyllables (longer words have an unrelated suffix). Interestingly,

reduplicative and *il* infixation may combine in the same form to yield concrete nominalizations, as in the following (from Johnston (1980: 176-177); infixes are italicized):

- (44) a. tuga 'walk' *tuluga* 'trip' *tulugaluga* 'sandal'
 muga 'be first' *muluga* 'the first' *mulugaluga* 'leader'
 b. pou 'sit' *pulou* 'residence' *pulolou* 'chair'
 peho 'die' *pileho* 'death' *pileleho* 'corpse'
 baha 'send' *bilaha* 'sending' *bilalaha* 'servant'

In (44a) the output of *il* infixation is subject to reduplicative infixation of CVCV; in (44b) it is CV that is infixed. Informally, the derivation of the forms on the right in (44) proceeds first by infixation of *il* or one of its allomorphs to the left of the (stressed) penultimate vowel; syllables are then restructured to accommodate this new material. Then a reduplicative infix lodges to the left of the metrical foot and the phonemic melody of the foot is copied (including both the root and portions of the *il* infix). The formal derivations proceed as in (45):

- (45) Underlying representations

a.

il infixation

Reduplicative infixation

Phonemic melody copying and left-to-right association

There are several morals to be drawn from Nakanai internal reduplication. One quite obvious one is that the enormous variety and complexity of the reduplication phenomena in this language provide quite striking confirmation for our claims about infixing reduplication as prefixation to a prosodic constituent. Another conclusion is that prefixation to the metrical foot, rather than to the stressed syllable, is a necessary property of at least this one system. Several modes of internal reduplication in Nakanai copy and associate phonemic melody material from outside the stressed syllable (though still from within the metrical foot) – instances are provided by the examples in (36), (39), (40), (42), and (44). Since the Samoan and Chamorro examples (as well as those of the following section) are clearly just as compatible with prefixation to the foot as prefixation to the stressed syllable, and since Nakanai demonstrably requires prefixation to the metrical foot, we must assume that prefixation to the metrical foot is the universal mode, though with vacuous results in some cases.

4.4. *Thompson and Shuswap*

Our final example of reduplication by prefixation to a prosodic con-

stituent is one of the cases adduced as evidence for the analysis of internal reduplication in Bell (1983). This is the diminutive in Shuswap, a Salish language of British Columbia. The Shuswap diminutive is stress-sensitive: a copy of the consonant preceding the stressed vowel in the base form appears after that vowel in the diminutive:

- (46) $\text{pés}\bar{\partial}\lambda k^w e$ 'lake' $\text{péps}\bar{\partial}\lambda k^w e$ 'little lake'
 $k\bar{\partial}p q i n'$ 'her head aches' $k\bar{\partial}p q i q n'(+k n)$ 'my head aches'¹²

Bell's analysis of such facts, summarized above in section 2.2, essentially involves reduplicative association from the middle of the form rightward; it is clearly unavailable under the theory we present here.

A different analysis of these facts is provided in Broselow (1983), where the diminutive in Shuswap and in the closely related language Thompson is analyzed as involving prefixation of the reduplicative morpheme CV to the stressed syllable, with deletion of the original stem vowel in certain cases. Under this analysis, examples like $\text{péps}\bar{\partial}\lambda k^w e$ and $k\bar{\partial}p q i q n'$ are derived as follows:

- (47) Underlying representation

Prefixation of CV to stressed syllable

Phonemic melody copying and left-to-right association

Stem-vowel deletion

pépsðłk^we

kðpqíqn

The stem vowel is actually retained under some conditions – before a resonant in Shuswap (Kuipers 1974) and before a laryngeal in Thompson (Thompson and Thompson 1981).

This analysis not only is fully compatible with the theory we have presented but also has the added virtue of allowing the diminutive in a number of different Salish languages to be analyzed similarly. Thus, in Lushotseed (Puget Sound Salish), the diminutive consists of CV prefixed to the stem, rather than to the stressed syllable. The deletion of the stem vowel is not entirely predictable, but most often takes place when the stem vowel is flanked by voiceless consonants, as Hess and Hilbert (1976) point out.¹³ In all these related languages, then, the diminutive is a CV prefix; the languages differ only in the constituent to which the CV is prefixed (the stem for Lushotseed and the stressed syllable for Thompson and Shuswap).¹⁴

An apparent problem for this analysis, however, arises in words in which the stressed syllable apparently begins with a consonant cluster. The following Shuswap examples are from Bell (1983):

(48)	sqéǵe	'dog'	sqéqǵe	'little dog'
	cqéłp	'fir tree'	cqéqłp	'little fir tree'

If the diminutives in (48) are derived by prefixing CV to the stressed syllable, copying the melody of that syllable, associating it with the prefix from left to right, and deleting the stem vowel, then we would expect *sésqǵe and *cécqłpe rather than the actual forms. In fact, *sqéǵe* is not a problem; as is demonstrated in Broselow (1983), the *s* in this form is a word-level affix that does not participate in reduplication. So the base of reduplication for *sqéǵe* is the stem *qéǵe*. In *cqéłp*, however, *c* is not a prefix but rather part of the root *cq*, one of the small number of roots that does not exhibit the canonical CVC shape. We would expect this *c*, therefore, to be available for copying and association with the reduplicative prefix CV.

The solution to this problem lies in an examination of the syllable structure of these languages. Most Salish languages allow long strings of consonants with apparent disregard for the considerations of relative sonority that universally govern cooccurrence of consonants in tauto-syllabic clusters. The consonants in the Salishan clusters, however, are often pronounced with a slight vocalic offset, sometimes perceived as a very short, often voiceless vowel. This observation motivated Newman's

(1947) claim that the Salish language Bella Coola contains vocalic consonants – consonants that constitute both the onset and the nucleus of a syllable. If we assume, following Newman, that Shuswap also contains vocalic consonants, and that the universal restrictions on relative sonority apply in Shuswap as well, then we must assign the following structure to *cqéłp*. The initial cluster is not tautosyllabic, but rather the *c* constitutes a syllable of its own, with the consequence that this language has simple onsets:

Under this analysis of the prosody of *cqéłp*, its diminutive is derived in the normal fashion:

Underlying representation

Prefixation of CV to stressed syllable

Phonemic melody copying and left-to-right association

Stem vowel deletion

cqéqλp

Thus the diminutive in Shuswap and Thompson can be analyzed as yet another example of the familiar pattern of prefixation to a stressed syllable.

5. OVERVIEW OF THE THEORY AND PROBLEMATIC CASES

5.1. *Summary*

Based on an elaborated theory of nonconcatenative morphological processes, we have recognized a taxonomy of the phenomena known as internal reduplication. What we have called true internal reduplication fundamentally involves placement of the reduplicative morpheme (a CV skeleton) at some phonologically-specifiable but otherwise arbitrary position in the matrix root. The entire phonemic melody of the matrix root is copied and associated with this infix, association proceeding in a stipulated direction, reflecting the fact that true infixes are neither prefixes nor suffixes and thus may not invoke the unmarked direction of association provided in Marantz (1982). The other half of our taxonomy is also properly infixing but is interpreted in our theory as prefixation (respectively suffixation) to a prosodic constituent - a syllable or metrical foot - with appropriate left-to-right (respectively right-to-left) mode of association.

Although the empirical coverage of this theory is quite extensive, there remains a relatively intractable residue of two cases known to us that are not obviously compatible with either branch of the typology, although they are certainly analyzable by invoking language-particular association rules. There are two possible approaches to these recalcitrant data. On the synchronic side, McCarthy (to appear) argues that data of this sort demand a reformulation of the association rules proposed in Marantz (1982) along the lines of associating all vowels before all consonants. Here our approach is essentially diachronic, demonstrating that these examples are historically secondary. We show that they are derived by a historical process of re-analysis known as misdivision from erstwhile reduplicating suffixes, a diachronic source for conventional infixes that has often been noted (Ulan (1975), Moravcsik (1977)).

5.2. *Problematic Cases*

A case of internal reduplication which is classifiable neither as prefixation

to a syllable nor as copying of the stem melody with association from either the right or the left is provided by Lushootseed (Puget Sound Salish). We will argue that the highly marked internal reduplication exhibited by this language arose from an unmarked process of reduplication at a morpheme boundary, and that the language-specific rule required to describe this process reflects its marked character.

Lushootseed has an extremely rich system of reduplication, insightfully described in Hess and Hilbert (1976). Among the various reduplication processes in this language is one which copies the first VC of the word. This may be used in one of four reduplications. The first describes “activities that are performed randomly, inconclusively” and “languid states” (Hess and Hilbert 1976: 161):

(51) Random Reduplication

$g^w\theta d\acute{I}l$	‘sit’
$g^w\theta d\theta d\acute{I}l$	‘just sitting around’
$?ib\theta\acute{s}$	‘walk’
$?ibib\theta\acute{s}$	‘pace back and forth’
$y\acute{u}bil$	‘die, starve’
$y\acute{u}bubil$	‘be run down’

Reduplication of VC is also used for particularized or isolated nouns:

Particularizing Reduplication

a. $d\acute{I}b\theta\acute{t}$	‘us’
$d\acute{I}bib\theta\acute{t}$	‘just us’
b. $st\acute{a}d\theta y?$	‘woman’
$st\acute{a}dad\theta y?$	‘woman (living) alone’

In addition, reduplication of VC may be used in two other cases. The first, used for counting people, involves reduplication of some part of the numeral. Numerals are lexically marked for the type of reduplication they take in this case, but most often it is the first VC which reduplicates:

Counting Reduplication

a. $c\theta l\acute{a}c$	‘five’
$c\theta l\theta l\acute{a}c$	‘five people’
b. cuk^ws	‘seven’
$c\acute{u}k^wuk^ws$	‘seven people’

And finally, a small class of words forms their plurals by means of VC reduplication, rather than the normal CVC reduplication:

(54) Plural Reduplication

a. stubš	'man'
stúbubš	'men'
b. ?íbac	'grandchild'
?íbibac	'grandchildren'

The correct formal treatment of these cases is not obvious. Since there is no evidence in favor of representing consonants and vowels on separate tiers in this language, simply associating a single copy of the stem melody with the prosodic skeleton plus infixed VC would involve an illegal crossing of association lines. Nor can this be described as suffixation of VC to a syllable, since the copied consonant may be part of either onset or coda: VC reduplication occurs in words of the shape CVCVC, CVC, and CVCC. And an attempt to copy the entire stem melody and associate it from either right or left with the infixed VC will give the wrong results, given the convention that association proceeds from the phonemic to the prosodic tier:

- (55) a. Left-to-right association b. Right-to-left association
- $$\begin{array}{c}
 \text{y u b i l} \\
 | \quad | \quad | \quad | \\
 \text{CVC+VC+VC} = * \text{yubyl} \\
 \quad \quad \quad | \\
 \quad \quad \quad \text{y u b i l}
 \end{array}$$

$$\begin{array}{c}
 \text{y u b i l} \\
 | \quad | \quad | \quad | \\
 \text{CVC+VC+VC} = * \text{yubilil} \\
 \quad \quad \quad | \\
 \quad \quad \quad \text{y u t}
 \end{array}$$

Since this reduplication clearly does not involve affixation to a phonological constituent, the only means of accounting for these facts within the constrained framework developed above is to treat VC reduplication as affixation to a morpheme. In fact, in many if not most cases, it is just that; most words of Lushootseed are built on CVC roots, and the *il* in *yúbil* and *g^wədíl* is a verbal suffix. Thus most words involving VC reduplication are derived, at least historically, from a CVC root plus some sort of suffix. If the VC reduplicative morpheme is analyzed as a suffix on the root, its position and its phonemic content follow from the general conventions on suffixation; the root melody will be copied, and this copied melody will be associated, as is normal in suffixation, from right to left:

- (56)
- $$\begin{array}{c}
 \text{y u b} \quad \quad \text{i l} \\
 | \quad | \quad | \quad | \\
 \text{CVC+VC+VC} \\
 \quad \quad | \quad | \\
 \quad \quad \text{y u b}
 \end{array}$$

But there is an (admittedly) small number of cases which are not so

analyzable. These few forms could imply be entered in the lexicon; however, the process is still relatively productive, applying to borrowings from Chinook jargon which are presumably not analyzable as bimorphemic.¹⁵ Thus we need some way to account for internal reduplication of VC. This can be done simply by providing a language-specific association rule, one which stipulates that the first vowel of the copied melody is associated with the V of the infix. After this rule has applied, association can proceed from left to right:

This language-specific rule is a costly addition to the grammar of Lushootseed but consistent with the historically secondary status of this pattern of reduplication.

Another case of a very similar sort comes from the extinct Penutian language Takelma (Sapir 1922). Takelma shows a wide variety of reduplication processes, some of which seem to interact with each other and with morphological processes of glottalizing consonant mutation and vocalic Ablaut. We shall focus here on just two types of Takelman reduplication that are clearly productive and that have formal and diachronic properties very like those of Lushootseed.

Sapir describes processes of V and VC reduplication used in verb inflection, chiefly in forming various sorts of aorists. We follow Sapir in classifying the morphological types on a purely formal basis, not according to their function:¹⁶

Stem	V-reduplication	VC-reduplication
a.		
hemg- 'take out'	hemeg- (aorist)	hememg- (freq.)
masg- 'put'	mats!ag- (aorist)	mats!aasg- (freq.)
baxm- 'come'	baxam- (aorist)	baxaaxm- (freq.)
t!üülg- 'trail'	t!üüg- (aorist)	t!üüülg- (usit.)
b.		
t!an- 'hold'	t!ana- (aorist)	
naak- 'say'	naga- (aorist)	
som- 'cook'	somo- (aorist)	
bil- 'jump'	bili- (aorist)	
mil- 'love'	mülli- (aorist)	
gin- 'go somewhere'	gini- (aorist)	

The difference between the two types (58a) and (58b) lies in the canonical form of the stem (this obviously correlates with a functional difference as well, whence the gaps in the columns in (58b)) - in the former the stem is cluster-final and in the latter it ends in a single consonant.

The observation underlying (58) is that there are two different reduplication affixes, V and VC, whose placement depends on the canonical pattern of the stem: they are suffixed to [CVC] stems and infixes into the cluster in [CVCC] stems. An obvious move would be to say that syllabification has some role in the placement of the reduplicating affix - if both stem types were to contain only a CVC syllable, then the reduplicative affix could be suffixed to the word-initial syllable. This analysis cannot be maintained, however, because Takelma does allow certain coda clusters (Sapir 1922: 38). Some of the stems in (58a) have possible tautosyllabic final clusters: *hemg*, *masg*, *t!ülg*, *ging*. Others do not, however, with no difference in their morphological behavior: *baxm*, *wism*.¹⁷ There are, then, no useful inferences we can draw here about syllable structure to determine the placement of the reduplicating affixes.

A brute force analysis would go something like this. The reduplicating affixes are V and VC, and they are placed in the environment [C₀VC_ (C)] in the stem. The rules of autosegmental association must be stipulated to apply first to the vowel nucleus and then from left-to-right, exactly as was required in Lushootseed. The following derivations illustrate this:

(59) Underlying representation

Association

As it happens, the cluster-final stems are historically secondary, generally arising from what Sapir calls “petrification” of consonantal suffixes. Synchronically these erstwhile suffixes have ill-defined aspectual or classificatory functions and are in some cases formally bound to the preceding material, so the historical inference probably cannot be maintained as a synchronic analysis. Sapir himself is inconsistent in showing the stem boundary for such forms. The conclusion is that Takelma reflects a stage of ongoing reanalysis, where suffixes are losing their independence and, as a consequence, have trapped a reduplicative suffix. Under our account, in Takelma, as in Lushootseed, a special, language-particular rule is unavoidable.

Interestingly enough, the questionable status of Lushootseed and Takelma reduplication as a case of true internal reduplication is shared by the Samoan reduplication discussed in section 4.1, though here it seems ultimately to have been fully incorporated into the system. As Pratt (1878) points out, roots in Samoan “are sometimes monosyllabic, but mostly disyllabic. Polysyllabic words are nearly all derived or compound words...” (Pratt 1878: 3). Many of the initial syllables of trisyllabic verbs are listed in a relatively recent dictionary of Samoan (Milner 1966) as “nonproductive prefixes”, and there is a clear connection between many trisyllabic verbs and corresponding disyllabic words:

(60)	a. ta?ele	‘bathe’
	?ele	‘earth, dirt’
	b. maliu	‘die’
	liu	‘change’
	c. mafai	‘be able’
	fai	‘do’

If all trisyllabic verbs may be analyzed as consisting of a disyllabic stem plus a monosyllabic prefix, plural reduplication is simply a case of prefixation of CV to a stem:

(61) prefix + pl + stem

CV	CV CVCV	
t a	ʔele	⇒ taʔeʔele 'bathe, pl.

parallel to

nofo	⇒ nonofo	'sit, pl.'
------	----------	------------

Thus Samoan internal reduplication, like internal reduplication in Lushootseed, has its origins in the familiar process of reduplication at a morpheme boundary.¹⁸

A rather different sort of problem arises in the only pattern of internal reduplication in Nakanai not discussed above in section 4.3. Under certain highly specific phonological conditions, VC infixing reduplication applies to words with consonant-initial penults (Johnston 1980: 149):

(62) a. haro	hararo	'days'
hari	harari	'running'
velo	velelo	'bubbling forth'
hilo	hililo	'seeing'
b. baharu	bahararu	'widows'

One aspect of these data is quite simple to account for: why does the VC reduplicative infix lodge to the immediate left of the stressed vowel but not to the left of the initial consonant of the metrical foot? The explanation for why the infix should appear foot-internally in these cases but not elsewhere is that the extremely restrictive phonotactics of this language would permit no other position. That is, an infix of the form VC cannot be prefixed directly to a CV(C)V foot without creating a consonant cluster, a configuration not countenanced by the syllable structure of this language. Instead, we find the infix lodging in the nearest position to foot-initial that is phonotactically permissible, just before the stressed vowel.¹⁹ This placement of the infix is attested as well with the fully-specified *il* infix of Nakanai. The infix is prefixed to the metrical foot, but phonotactics force it into the postconsonantal position.

Another aspect of the data is more complex. With infixation of VC before the stressed vowel, copying of the phonemic melody of the metrical foot, and left-to-right phoneme-driven association, we would derive surface forms like **bahharu*, because the foot-initial consonant *h* is associated first with the VC infix. As in Lushootseed and Takelma, a language-particular association rule is needed to link the first vowel in the copied

phonemic melody with the V-slot of the infix. Since this pattern of reduplication is subject to a host of restrictions on the segments in the foot (the penult must begin with a fricative or sonorant and must contain a nonround vowel while the ultima must begin with a sonorant), it is not surprising that such phonological conditions would be implemented as conditions on the language-particular association rule. In other words, this aspect of Nakanai reduplication would require certain ad hoc stipulations even independent of the particular requirements of the theory we propose here.

Sample derivations for some forms in (62) appear in (63):

(63) Underlying representations

a.

b.

Infixation

Phonemic melody copying and association

6. NON-EXAMPLES OF INTERNAL REDUPLICATION

6.1. *Semitic Root and Pattern Morphology*

In the Semitic language family there are a number of morphological processes that, at first glance, appear to involve some sort of internal reduplication. Although Semitic languages undoubtedly do evidence such phenomena (witness the Levantine Arabic example of section 3.1), the vast majority of the types of reduplication found in these languages are quite different, lacking the crucial element of phonemic melody copying. This is root-and-pattern morphology, a fundamentally different sort that makes use of quite different formal mechanisms (McCarthy 1981).

A case in point is the formation of the second conjugation of the verb in Arabic, the characteristic morphology of which is reduplication of the medial root consonant: *katab* 'wrote', *kattab* 'caused to write'. No phonemic melody copying is involved in the derivation of such forms; rather, there is a one-to-many association of the medial root consonant with C positions of the CV-skeleton, to give a representation like that in (64) (cf. McCarthy (1981)):

into the root-and-pattern category occupied by the Semitic phenomena of section 6.1. Information on Cupeño is taken from the data and analyses by Hill (1966), (1970), and (1973).²¹

Cupeño recognizes a category of verbal mood, called the *habilitative*, that glosses roughly as 'can do x'. In verbs of one major morphological class, the *habilitative* is formed as in (65):²²

(65)	Verb Stem	Habilitative	Gloss
a.	čál	čá?a?al	'husk'
	tów	tó?ð?ðw	'see'
	həlʸóp	həlʸó?ð?ðp	'hiccup'
	qáw	qá?a?aw	'be sick'
	kəláw	kəlá?a?aw	'gather wood'
	ŋíy	ŋí?i?iy	'go away'
	k ^w á?	k ^w á?a?a?	'eat'
b.	páčik	páci?ik	'leach acorns'
	čáspəl	čáspə?əl	'mend'
	?ísax ^w	?ísa?ax ^w	'sing men's songs'
	cáŋnəw	cáŋnə?əw	'be angry'
c.	pínə?wəx	pínə?wəx	'sing enemy songs'
	xáləyəw	xáləyəw	'fall'
d.	čí	čí?	'gather'
	hú	hú?	'fart'
	pí	pí?	'bewitch'
	?áyu	?áyu	'want'

The fundamental observation underlying these data is as follows. In (65a-c), the stressed syllable of the *habilitative* stem is followed by two unstressed syllables. In (65a) both of these posttonic syllables contain ?V, where V is a copy of the stressed vowel. In (65b) the final syllable contains a single such ?V sequence, where V is a copy of the vowel in the immediate posttonic syllable. And in (65c) no copying has occurred at all. The vowel-final stems in (65d) simply remain unaffected by this morphology; if end-stressed they develop a final ? by phonological processes.

To account for these morphological data we must say that the rightmost vowel in a consonant-final stem is reduplicated (with intervening glottal stops) until a particular output target is reached. This target is that the stressed syllable of the *habilitative* is followed by exactly two more syllables. Reduplication of the rightmost vowel applies 0, 1, or 2 times until this target is fulfilled.

Clearly this is a case of root and pattern morphology, expressed, as in the analysis of Classical Arabic in McCarthy (1981), by a morphological

template. The Cupeño morphological template simply expresses the output target, and autosegmental spreading accomplishes the reduplication McCarthy (1982b), without phonemic melody copying. The template essentially requires that the stressed syllable be followed by exactly two other syllables in the habilitative:

- (66) Cupeño Habilitative Template
 $[x\acute{\sigma}\sigma\sigma]$, where x is a variable

Material that precedes the stressed syllable is apparently irrelevant to habilitative formation, whence the initial variable. The reason that the template is expressed by syllables rather than C's and V's is that the particular form of the tonic and posttonic syllables is irrelevant to forming the habilitative – they may be closed or open, providing only that they fall within the overall canons (CV, CVV, CVC) of Cupeño syllable structure. The final syllable must be closed, but this is presumably an artifact: only consonant-final stems are allowed to participate in this morphological process in the first place.²³

The formal correlate of reduplication in Cupeño is autosegmental spreading of the rightmost stem vowel to the posttonic syllables of the template in (66). This spreading, like that of Arabic, does not involve phonemic melody copying, as is clear from the derived representations in (67):

- (67)
$\begin{array}{cccc} x & \acute{\sigma} & \sigma & \sigma \\ \swarrow & \downarrow & \downarrow & \searrow \\ CV & CV & CV & CVC \\ & & / & // \\ h\partial & l^y & \partial & p \end{array}$ $h\partial l^y \partial ? \partial ? \partial p$	$\begin{array}{cccc} x & \acute{\sigma} & \sigma & \sigma \\ \swarrow & \downarrow & \downarrow & \searrow \\ CV & CV & CVC & - \\ & & / & // \\ p & \acute{a} & \acute{c}i & k \end{array}$ $p\acute{a} \acute{c}i ? i k$	$\begin{array}{cccc} x & \acute{\sigma} & \sigma & \sigma \\ \swarrow & \downarrow & \downarrow & \searrow \\ CV & CVC & CVC & - \\ & / & / & // \\ p & \acute{í} & n & \partial ? w \partial x \end{array}$ $p\acute{í} n \partial ? w \partial x$

The unassociated C positions in these derived representations are filled with glottal stops by a rule of epenthesis that is independently motivated in Cupeño. Infixation cannot be involved in this reduplication process because not all forms reduplicate; only those with fewer than two syllables following the stress do, and then only until the target is reached. This behavior is characteristic of root-and-pattern systems and not truly reduplicating ones. Moreover, Cupeño reduplication cannot involve phonemic melody copying because only the rightmost vowel is reduplicated (by autosegmental spreading); phonemic melody copying would necessarily reduplicate adjacent consonants as well. We conclude that Cupeño re-

duplication is far more typical of Semitic root-and-pattern morphology than of the other types of reduplication discussed here.

6.3. *Kaingang*

The Brazilian Je language Kaingang has been claimed by Poser (1982) to have a syllabically-dependent process of infixing reduplication, a claim that has great relevance to the hypotheses advanced above. We will show, however, that this is a misanalysis, and that an empirically adequate account of Kaingang reduplication and related phenomena does not involve infixing, though it may refer to the syllable. All information on Kaingang comes from the description in Wiesemann (1972).

Poser cites the following data, in which the plural stem is formed by reduplicating the final syllable of the root:

Root	Plural stem	
vã	vãvã	'to throw away'
jẽmĩ	jẽmĩmĩ	'to grasp'
kry	krykry	'to itch'
vãsãn	vãsãnsãn	'to exert, fatigue'
mrãn	mrãnmrãn	'to strike'

Poser points out that strings of the form CV, CVC, CCV, and CCVC may be copied, essentially forcing a characterization of the copied material as a single syllable, precisely as Wiesemann (1972) describes it.

Wiesemann's description of Kaingang reduplication has it that the copied syllable is prefixed to monosyllabic roots and infixes before the last syllable of polysyllabic roots (which amount to the same thing). From just the data in (68), invoking infixation in this case is quite mysterious; all the facts so far could as well be handled simply by suffixing a copy of the final syllable. Poser (1982), however, makes an ingenious argument for infixing reduplication from the following observation. The penultimate syllable of the derived, plural stem sometimes contains segments not identical to those of the final syllable, as in (69):

Root	Plural stem	
ta	tygtam	'to cover'
kavè	kavigvè	'to be dirty'
gòn	gungòn	'to swallow'
pan	pynpan	'to twinkle'

If Kaingang reduplication is seen as infixing, then the interpretation of

kavigvè is that the reduplicating affix is prespecified for the sequence *ig* and therefore by autosegmental association copies only the consonant *v* of the final syllable. Kaingang is seen as a case where the reduplicating infix may be partly specified for fixed phonemic material. Poser's conclusion is that Kaingang reduplication inserts a completely (68) or partly (69) unspecified syllable before the final syllable of the root.

Although this account is clearly compatible with the theory presented above, it nevertheless fails on grounds of empirical considerations purely internal to the grammar of Kaingang. Poser's interpretation of the data in (69) as partial infixing reduplication is in error; the changes in vowels and consonants in the allegedly reduplicated syllables are in fact independent of reduplication. These changes include vowel raising and *g*-insertion, and they may occur as a mark of the plural without concomitant reduplication (Wiesemann 1972: 97-98):

Root	Plural stem	
kupe	kugpe	'wash oneself'
kype	kygpe	'baptize'
pafã	pygfã	'to calm'
pefã	pigfã	'to calm'
tãry	tãgry	'thin'
vãfè	vãgfè	'spin'

Most telling of all for the independence of reduplication and these alternations in the penultimate syllable is the existence of hierarchies of plurality exploiting different ones of these devices separately (Wiesemann 1972: 99):

Root	Paucal	Plural	
kavè	kavigvè	kygvè	'dirty'
kãgje	kuje	kugje	'stretch out s.'
te	tigte	tãgte	'die'

The conclusion is as follows. Kaingang has a rule whose formal effect is simple reduplication of the final syllable; the only supportable characterization of this process is suffixation. Kaingang also has rules of mutation in the sense of Lieber (1983), McCarthy (1983a, 1983b) that affect the penultimate syllable. A penult so affected may be root internal or it may be the former root-final syllable, now followed by a copy of the original root-final syllable. Infixing reduplication is entirely superfluous in treating the full range of relevant data.

6.4. Language Games

A number of language games or speech disguise systems appear to involve infixing reduplication. In view of the utter pervasiveness of such phenomena in the languages of the world, it seems appropriate to discuss them here. As we will show, the seeming cases of infixing reduplication in language games all break down into two types: those with reduplication by autosegmental spreading (of the root-and-pattern type) and those where the reduplication is actually suffixing.

An example of the first type is the Tagalog speech disguise game known as *baliktad*, described by Conklin (1956). In this game, various infixes are inserted in the postnuclear position of every syllable:

Basic Form	Language Game Form	
hindi?	higíidindigíidi?	'not, not'
taṅháali?	tagáadaṅhagáadaligíidi?	'noon'

The typical feature of these games is insertion of some string with fixed consonants and unspecified vowels - in (72), the infix is $gVVdV$. These unspecified vowels then copy the adjacent vocalism of the basic form. Phonemic melody copying is, if anything, an impediment to the analysis of this sort of reduplication; rather, the specification of the infix vowels is accomplished by autosegmental spreading (McCarthy 1982a). This is clear from the sample derivation in (73):

Underlying representation

CVCCVVCVC
 |||||
 t a ṅ h a l i ?

Infixation

g d g d g d
 | | |
 CV+CVVCV+CCVV+CVVCV+CV+CVVCV+C
 // | | \ //
 t a ṅ h a l i ?

Autosegmental spreading

The output of the derivation in (73) is not quite the same as the actual form in (72); the actual form has three distinct stresses (each occurring on the infixed syllable) and it has a short vowel in the fourth syllable from the left. It turns out that there is a common explanation for these two prosodic facts – each syllable of the basic form, with its accompanying infix, constitutes a single phonological word. That is, we have three phonological words, bounded as indicated, in *tagáadan#hagáada#ligítidi?*. There are several results of this claim. First, each of the phonological words has an expected penultimate stress. Second, Tagalog does not permit long vowels in syllables to the left of the penultimate (Carrier 1979), so the distribution of long vowels in this form is actually consistent with Tagalog prosody. Third, the shortening of the syllable *haa* (antepenultimate in the second phonological word) is also a consequence of this limitation of long vowels to the last two syllables.

We have dwelt at such length on this question of language-game prosody because it turns out to have great relevance for the treatment of reduplicating game systems of the second type. Consider the following data from a system known as “Chicken Language”, “Helefe Language”, or “Robber Language”, originally from German but borrowed into English:

(74) Basic	Language game
a.	
Ein gutes Wort findet einen guten Ort	Einheinlefein guhulefu tesheslefes worthortlefort finhinlefin dethetlefet einheinlefein nenhenlefen guhulefu tenhenlefen orthortlefort
b.	
Secret languages are fun	sihilðfi krðthðtlðfðt læŋhæŋlðfæŋ gwiðhijlðfjðzhðzlðfðz arharlðfar fðnhðnlðfðn

In this language game each syllable of the base form appears followed by *hRlðfR*, where R is a copy of the rhyme of the base syllable. The sources (Chrismann (1893) and Bach (1914) for German and Berkovits (1970) for

English) typically indicate something like the junctures in (74), treating each original syllable with the accompanying material as a single prosodic word. We have confirmed this observation with a speaker who learned the secret language in (74b) in childhood.²⁴ It follows, then, that from the standpoint of the phonological word the Chicken Language (as well as the many others like it) is a type of suffixing reduplication. Each syllable of the basic form is treated as a single phonological word to which a reduplicating skeleton is suffixed. It is likely that this avoidance of true infixing reduplication in language games is to be explained by considerations of processing load rather than any formal attribute.

7. CONCLUSION

In this paper we have explored the consequences for infixing reduplication of a fairly rigorous adherence to the basic conceptual apparatus of conventional prefixing and suffixing reduplication in Marantz (1982). The result has been an empirically justified typology of infixing reduplication rules that brings them well within the purview of the rest of the theory of reduplication and of nonconcatenative morphology in general. Specifically, we recognize that some reduplicating infixes behave in a quasi-prefixal or quasi-suffixal manner, associating from the right or the left with the full phonemic melody of the root. Other reduplicating infixes also act as prefixes, but to a prosodic rather than a morphological constituent. Remaining counterexamples unearthed in our extensive survey of infixing reduplication rules are to be considered as the historical residue in synchronic grammars of erstwhile prefixes or suffixes, involving nothing more than the stipulation of a single language-particular association rule in each case.

NOTES

1. The nonreduplicated forms of monosyllabic verbs are transcribed with short vowels in Pratt (1878) and Marsack (1980), but with long vowels in Neffgen (1918).
2. We are indebted to Morris Halle and Terrell Morgan for helpful insights into the analysis presented here and in section 3.2.
3. This phenomenon has been reported in Palestinian and Syrian Arabic (Cowell 1964) and Meccan Arabic (Bakalla 1973). Maghribi dialects may have it as well, but it seems not to occur in Egyptian (Cairene) Arabic or, of course, Classical Arabic.
4. The forms in (14) appear in an essentially phonemic representation. As we interpret the discussion in Benjamin (1976), the macron indicates a difference in vowel tenseness, not length, and it is therefore to be ignored in representations of the CV-skeleton.
5. Quileute examples come from Andrade (1933), with some translation of the

transcription into conventional symbols and with accent marks eliminated. The alternation in vowel length evinced in some examples is apparently erratic.

6. *wá:síw*, *wasí:síw* 'Washo' is an exception, according to Jacobsen.

7. The existence of cases like the following is taken by Jacobson (1964) and Winter (1970) to indicate that medial clusters of glottal stop plus sonorant are reduplicated in their entirety:

Singular	Plural	
á?lag	?lá?lag	'flattened, smooth'
bá?lew	ba?lé?lew	'Paiute'
í?wid	?wí?wid	'to wave'
há?wa	ha?wá?wa	'four'
á?yan	?yá?yan	'to billow (?)'
ɳá?miŋ	ɳa?mí?miŋ	'to give birth; child'
?mó?mo?	?mo?mó?mo?	'to be a woman'
ín?y+n	?yɛ?y+n	'varicolored'
ál?mul	?mól?mol	'big and round'

The obvious alternative is to treat each of the clusters above as a single segment – a glottalized sonorant, paralleling the glottalized obstruents already admitted in the language – to account for the behavior under reduplication. Jacobsen (1964: 74) considers and rejects this idea, which enjoys considerable support from the fact that these would be the only word-initial clusters in the language and from other phenomena, on grounds that these clusters can arise through word or morpheme concatenation or through deletion of intervening vowels. This circumstance obviously requires an apparatus of conflation rules to create complex segments out of erstwhile clusters, a move that seems to us entirely appropriate.

8. Stems with cluster-final allomorphs are considered by Jacobsen (1967) to be monosyllabic but are convincingly shown by Winter (1970) to be underlyingly disyllabic with vowel deletion in some contexts.

9. Essentially this suggestion was made by Marantz in an earlier, privately circulated version of Marantz (1982).

10. See Williams (1983) and McCarthy (to appear) for discussion.

11. An alternative account, pursued by Williams (1983), holds that the infix is itself specified as two syllables (or perhaps even as a metrical foot). The interesting question of the appropriateness of these two modes of representation would take us too far afield, and thus we do not pursue it here.

12. The diminutive is used with first person as an expression of modesty.

13. See Broselow (1983) for examples and a detailed analysis of the Lushootseed diminutive.

14. Thompson and Thompson (1981) also argue that the Thompson diminutive is related to the CV stem prefix; they claim that the internal diminutive derives historically from misanalysis of the prefixal diminutive.

15. We are indebted to Thomas Hess for this information.

16. Here and subsequently we essentially follow the phonemicization (minus the accents) of Takelma in Shipley (1969). This is Sapir's own phonemicization but was never published by him; it comes from Mary Haas's class notes.

17. Stems of the latter type appear finally or before consonant-initial suffixes with a linking vowel that Sapir (1922: 126) calls "constant *a*": *masg-a* 'put it!', *mats!asg-a* 'he always put it', *baxm-a-tee* 'I shall come'. This intrusive vowel does not occur when the reduplicated form does not end in a cluster (as in the second column) or

when the suffix is vowel-initial: *baxam-tee* 'I came', *baxaax-mia*? 'they keep coming'. Moreover, Sapir notes that constant *a* may occur even with stems that have a permissible tautosyllabic final cluster: *süümt-a* 'boil it!' *ts/ümüümt-a* 'he boils it'.

18. This point is made by Churchill (1908) as well; we are indebted to Ellen Woolford for bringing this reference to our attention.

19. Recent loans into Nakanai inconsistently retain closed syllables, a type not met with in the native vocabulary. For example, we find (Johnston 1980: 175) *siapan* 'a Japanese', pl. *siapanipani* and elsewhere *bokis* 'box', pl. *bokikisi*; *kes* 'case', pl. *keikesi*. A very interesting form is *masasta*, the reduplicated plural of the Tok Pisin loan word *masta* 'European'. This is presumably a case of VC infixing reduplication with the usual left-to-right association.

20. The lowland East Cushitic language Afar has a rule of apparent internal reduplication (Bliese 1977: 215-216) that could conceivably be analyzable by spreading without phonemic melody copying as proposed by Levin (1983), if, as seems likely, this language has formally distinct consonantal and vocalic melodies. There is, however, a paucity of relevant examples, and at least one of the available examples is quite inconsistent with the account in Levin (1983). Further research on this phenomenon is obviously necessary.

21. We are indebted to Jane Hill for comments on this material and confirmation of the data and transcriptions and to Paul Kiparsky for first bringing this example to our attention.

22. The transcription systems of the various sources have been normalized to that of Hill (1966). Underlying stem-final schwas have not been written since they are only arguably part of the lexical representation and because they must in any case be deleted before the formation of habilitatives.

23. In McCarthy (1982b) it was suggested that the Cupeño habilitative template is actually composed of a single dactylic metrical foot. Although this hypothesis may be correct, we have suppressed it here because there is no independent evidence for such foot structure in Cupeño (which generally has a lexical stress system).

24. We are indebted to Martha Wright for service as our consultant on this matter.

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