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REDUPLICATION AND VERBAL MORPHOLOGY IN PALAUAN

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Palauan, an Austronesian language spoken in the Palauan Islands of the western Caroline Islands, exhibits at least two types of reduplication in its complex verbal morphology. Both reduplications can have a similar semantic effect on the meaning of the reduplicated form – weakening or continuative – but their interactions with other morphophonemic processes differ sharply. These differences, I suggest, can be traced to Palauan word structure; they arise when certain morphological categories are contiguous. Once the need for such a concatenative structured representation of the Palauan word is demonstrated, it then becomes necessary to integrate the non-concatenative aspects of the morphology into the overall hierarchical structure in order to provide a unified picture of the morphological geometry of the language. I suggest that this can be done by appeal to a multi-dimensional extension of word-formation rules of the sort proposed in Selkirk 1982.

Section 1 presents a brief overview of the morphology of the non-reduplicated verbs, including discussion of the verb marker, the imperfect marker, and the resultant state infix. As a part of the analysis of the alternations of the imperfect marker, I propose that lexical assimilatory processes have access only to the underlying phonemic inventory of the language; no purely allophonic segments are derived by lexical phonological rules. Section 2 outlines the basic facts of Palauan reduplication and describes the phonological process of vowel cluster reduction. Although a precise formal statement of vowel cluster reduction is tangential to the main discussion, an understanding of this process is important in the determination of the prosodic shape of one of the reduplicative morphemes. In section 3, I illustrate the interactions of the morphology discussed in section 1 with reduplication. Here I propose that the differences exhibited

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by the two reduplicative prefixes can be accounted for by assuming that some of the morphological processes in question are conditioned with respect to the derived morphological category 'Stem', and in this section I also discuss ways of representing hierarchical structure within the word.[1]

1. AN OUTLINE OF THE NON-REDUPLICATIVE VERBAL MORPHOLOGY

A brief account of some of the allomorphy of the Palauan verbal system is necessary as a prelude to the discussion of the reduplication processes in the language. In this section I discuss the verb marker, the imperfect marker, and the resultant state infix.

1.1. The verb marker

The Palauan verb marker (VM) is affixed to most verbs in the form of a *mə* prefix.[2] Frequently the VM acts as a verbalizing affix, attaching to forms with independent existence as nouns. Where this is the case, the nominal form is cited in examples as well. Some Palauan verbs are shown in (1) (all examples are from Josephs 1975, Wilson 1972, or McManus 1977).

(1)	məkŋit	'to be bad'	(< kŋit)
	məsaul	'to be tired'	(< saul)
	məŋədub	'to swim'	
	mərdəkekl	'to jump'	
	məkiis	'to wake up'	

When the initial consonant of the root is *b*, however, the VM appears as *o*.

(2)	oboes	'get shot'	(< boes)
	obail	'get clothed'	(< bail)
	obəkall	'get driven'	(< bəkall)

The presence of a stem-initial *b*, however, is a sufficient but not a necessary determinant of the form of the VM as *o*. There are a small number of forms that display initial consonants other than *b* which require the *o* form of the VM.

(3)	oker	'to ask'	(< ker)
	osus	'to greet'	(< sus)
	osiik	'to look for'	(< siik)

The VM may also appear as an infix inserted after the first consonant of the stem, and here as well it displays an alternation between consonantal and vocalic forms. The VM appears as *m* in (4a) and as *u* ~ *o* in (4b).[3]

(4)	a.	sme?ər	'to be sick'	(< se?ər)
		lmuut	'to return'	(< luut)
		?əmiis	'to escape'	(< ?iis)
		ŋmelt	'to sink'	(< ŋelt)
	b.	?uarm	'to suffer'	(< ?arm)
		suebək	'to fly'	(< sebək)
		soisəb	'to go into'	(< sisəb)
		ruebət	'to run'	(< rebət)

The infixation process appears to be lexically governed: there seem to be no phonological or morphological factors that determine whether or not the VM is infixed or prefixed. The appearance of the vocalic VM infix, however, is determined by the presence of a bilabial consonant elsewhere in the stem (Josephs 1975).

In order to account for the distribution and shape of the VM, I will assume that the normal case involves prefixation, and where applicable, the rule in (5) will apply (here I adopt the μ-notation of McCarthy 1981).

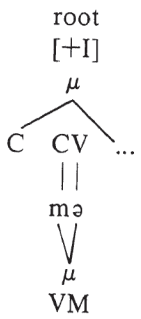
(5) mə → o / ___ C [+lab]
|
μ
VM

I assume that the forms in (3), which exhibit the *o* VM prefix with a non-bilabial as the stem-initial consonant, are marked with the diacritic feature [+O], which conditions the rule in (6).

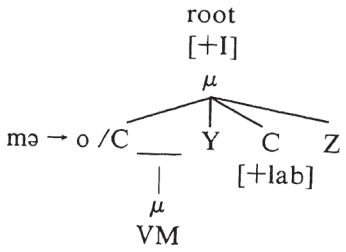
(6) mə → o / ___ ...
| |
μ μ
VM [+O]
root

Further, the forms that require the VM as infix will be marked with [+I] and represented as in (7), and the rule in (8) will then apply to change the form of the VM when a bilibial consonant is in the neighborhood.

(7)



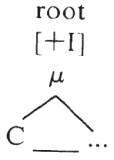
(8)



The air of redundancy between rules (5) and (8) is dispelled by forms like *mələseb* ('burn' imperfect) and *məlub* ('spit' imperfect), which show *mə* as the VM even though there is a labial consonant elsewhere in the word. These data indicate that the conditioning environment of (5) is strictly local – the VM prefix and labial consonant must be contiguous – while rule (8) has non-local effects. The VM infix will appear in its vocalic form if there is a labial consonant anywhere in the word, contiguous to the VM or not. (5) and (8) appear to be morphologically governed as well, since it is clear that there is no phonotactic constraint prohibiting more than one bilabial consonant in a word, given forms like *maməd* ('bedding given to visitors') and *beab* ('rat'), which show that bilabial consonants can co-occur within words. The minimum requirement for the *mə* sequence to appear as *o* is thus that it constitute the verb marker, and once the VM is infixed, a non-contiguous labial consonant will condition the appearance of the vocalic form of the morpheme.

The distribution and shape of the VM is summarized below in (9).

(9) VM: a. infix in



b. otherwise, prefix.

c. → o / ___ C
[+lab]

d. / ___ ...
|
μ
[+O]
root

e. root
[+I]
μ
/ C ___ Y C Z
[+lab]

f. otherwise, VM = mə

With this rather summary treatment of the verb marker, let us turn to the imperfect verb forms.

1.2. The imperfect

The imperfect of the Palauan verb is identical to the present tense forms shown above, except that it appears to display mutation of the stem-initial consonant shown in the parenthesized base forms in (10).

(10)

məŋat	'smoke'	(< ʔat)
məŋiis	'dig'	(< kiis)
məŋitakl	'sing'	(< ʔitakl)
omoes	'shoot'	(< boes)
omail	'clothe'	(< bail)
omtar	'swing'	(< btar)
məliud	'cut'	(< tiud)
məleel	'nail'	(< deel)
məlesəb	'burn'	(< sesəb)
məleŋ	'borrow'	(< leŋ)
məlukəd	'pay a fine'	(< ŋukəd)

If we peel off the verb marker from the forms in (10) and compare the results with the base forms, we see that there is an alternation of the stem-initial consonants. *ŋ* alternates with *ʔ* and *k*, *m* with *b*, and *l* alternates with *t*, *d*, *s*, *l*, and *ŋ*.

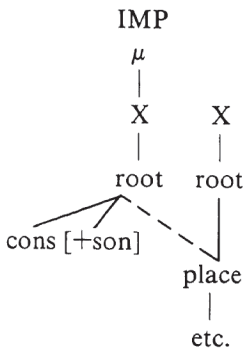
Josephs (1975) analyzes these alternations as the result of affixation and deletion. In his analysis, the imperfect marker has three lexical shapes, *ŋ*, *m*, and *l*, and the appropriate form is affixed to the appropriate stem. The initial consonant of the stem is subsequently deleted.

There is, however, an assimilatory relation between the stem-initial sonorant consonant in the imperfect form and the initial consonant of the base form that can be captured by rule. Note that with the exception of the *ŋ/l* alternation exhibited in *ŋukəd/məlukəd*, the consonant in the imperfect version shares a point of articulation with the consonant in the other form. *ŋ* of course does not strictly share a point of articulation with *ʔ*, but *ŋ* is the closest sonorant in point of articulation to *ʔ* (a voiced glottal stop, and by extension a glottal sonorant, being physically impossible). We might provisionally characterize this assimilation as 'find the closest sonorant'.

This quasi-rule, however, fails to explain the correlation of *l*, rather than *n*, with alveolar consonants. But, according to Josephs, there is no phonemic *n* in the grammar of Palauan. Where there are surface *n*'s, they derive from underlying *ŋ*'s assimilating to following alveolar consonants. This being the case, we can exploit the distinction between underlying and derived segment and state this assimilation of the imperfect marker as a lexical rule, and then go on to propose a constraint on lexical-phonological rules such that the input to and output of these rules may have access only to the underlying phonemic inventory. The nasal assimilation rule would be defined in the phonological component, where allophonic rules are normally stated, and surface *n*'s could be derived.

The lexical assimilation rule will be characterized autosegmentally in terms of hierarchical feature geometry as proposed in Clements 1985 and Sagey 1986. I propose that the imperfect marker be listed in the lexicon as a consonant specified only as [+sonorant]. It will acquire place features from a neighboring segment, the place features of which spread leftward and attach to the root node. (11) is a representation of this assimilatory process.

(11)



The eventual resolution and interpretation of the feature composition of this affix must appeal to the 'find the closest sonorant' principle previously mentioned, where the range of derived feature bundles is restricted to those displayed by the underlying phonemic inventory. In particular, glottal place features combine with the [+sonorant] feature to yield *ŋ*, and coronal place features combine with [+sonorant] to yield *l*.

The output of (11) is 'structure preserving' in a sense; no additional segments are derived by the rule. This situation is compatible with (if not predicted by) the theory of Lexical Phonology (Kiparsky 1982). It is not clear, however, that lexical phonology can countenance the other principle involved in determining the output of (11), 'find the closest phoneme'. According to Kiparsky (personal communication), a rule such as (11) should block, or its output should be uninterpretable, if there were no readily available phoneme. The facts of the Palauan imperfect, I believe, provide evidence against such an interpretation, although the issue deserves further investigation.

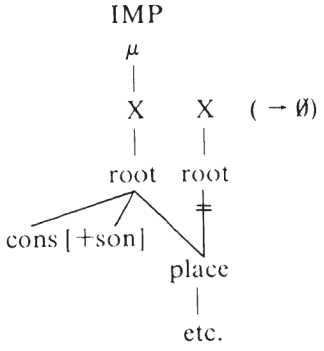
It is clear, though, that the *ŋ/l* alternation noted above cannot be described as an assimilatory process. Instead, I propose that this alternation simply be listed in the lexicon in the form of a morphological rule of the sort given in Lieber 1980.

(12) ŋ (C_0) $(V_0(C_0))_0$ ~ l (C_0) $(V_0(C_0))_0$

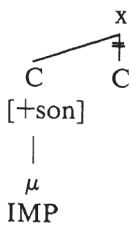
morphological rule defines the set
{(ŋukəd, lukəd), ...}

The representation of forms which undergo stem-initial consonant deletion subsequent to the assimilation shown in (11) is shown in (13a). Subsequent to the severing of the place node from the righthand segment, the timing slot, along with any features attached to it, is deleted. For representational convenience, I will abbreviate the more articulated structure in (13a) as (13b) in the rest of the discussion.

(13) a.

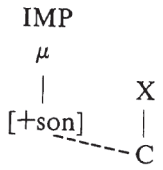


b.



A competing analysis employing a floating [+son] feature which simply docks onto the root-initial consonant, as in (14), is compatible with the data discussed so far, and in fact such an analysis may appear to be preferable, since it would require no delinking or deletion of the sort shown in (13).

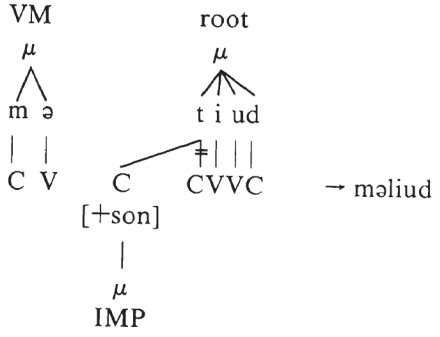
(14)



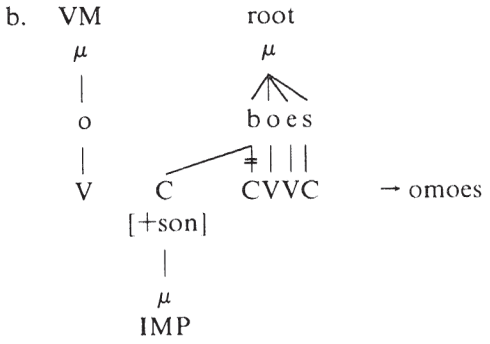
In such an analysis, there would be only one C-slot, and it would be shared between the imperfect marker and the root. There are cases to be discussed below, however, which demonstrate that both C-slots are required in the formation of a class of reduplicated imperfects. This being the case, I will assume that (11) and (13) are the proper statements of the processes exhibited in (10).

Representations for some of the forms in (10) are illustrated in (15). In (15b), the occurrence of the verb marker as *o* is conditioned by the bilabial quality, acquired from the initial consonant of the root, of the imperfect prefix.

(15) a.



b.



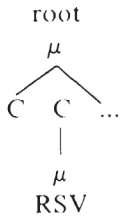
1.3. Resultant state verbs

The Palauan resultant state verb (RSV), akin to the adjectival passive participle in English, is formed from transitive verbs by infixing *-l-* after the initial consonant of the stem. If the initial consonant is *ʔ, s, t,* or *d*, a schwa is epenthesized to break up the cluster, and if the initial consonant is *r*, the *l* assimilates completely to the *r*.[4] In addition, presumably because of its adjectival nature, the RSV does not serve as host to the verb marker. Some RSVs are provided in (16).

(16)	bliiʔ	'sifted'	(< biiʔ)
	ŋləmodəl	'mopped'	(< ŋəmodəl)
	ŋlabək	'planed"	(< ŋabək)
	bloes	'shot'	(< boes)
	rrous	'divided up'	(< rous)
	bleob	'shaped'	(< beob)
	ʔəlat	'smoked'	(< ʔat)
	klimd	'cut'	(< kimd)
	səlesəb	'burned'	(< sesəb)

The forms in (16) can be represented schematically as in (17a); some specific examples are given in (17b-c).

(17) a.



b.



c.



To summarize this section, the Palauan verb marker, imperfect marker, and resultant state infix have been discussed. The change of the verb marker to *o* is accounted for by three separate rules, two of which are locally conditioned, and one of which is non-local in character. The facts of imperfect formation are accounted for by an assimilation rule and a delinking rule. It was suggested that the assimilation rule applies in the lexicon, and due to its lexical status, it obeys a proposed constraint on lexical-phonological rules that such rules of a feature-adding or feature-changing nature have access only to the underlying phonemic inventory of the language, a form of structure preservation. The morpholexical rule (12) states the relation between imperfect and non-imperfect forms that cannot be accounted for by the assimilation rule (11). Finally, the resultant state marker was analyzed as a simple infix, occurring after the first consonant of the stem.

Before considering the interaction of these processes with reduplication, I will discuss the simple cases of reduplication.

2. REDUPLICATION

2.1. Ce- reduplication

The simplest and most straightforward of the reduplication types to be discussed exhibits a reduplicative prefix of the form Ce-. When the prefix is attached to stative verbs or adjectives, the meaning of the original form is weakened, giving it a less definite quality.

(18)

səkool	'playful'
sesəkool	'rather playful'
beot	'easy'
bebeot	'sort of easy'

buboŋ	'senile'
bebuboŋ	'kind of senile'
soŋərəŋər	'hungry'
sesoŋərəŋər	'somewhat hungry'

Stative verbs formed with the VM prefix show a similar pattern, except that the VM prefix appears outside the Ce-affix.

(19)

məkekad	'itchy
məkekedad	'fairly itchy'
mədəŋe	'know'
mədedəŋe	'rather familiar with'
mətitur	'not know'
mətetitur	'rather unfamiliar with'
məsulaul	'sleep'
məsesulaul	'somewhat sleepy'

The above patterns can be formally described by representing the Ce-prefix as a CV skeleton with the phonemic melody pre-attached to the vowel slot. Following Marantz (1982), I will simply assume that the melody of the root is copied and then the initial consonant melody is associated with the C-slot of the prefix.[5] The pre-attached *e* prevents a root vocalic melody from being associated to the V-slot. Representations of some of the forms in (18) and (19) are shown below in (20).

(20) a.

səkool	s ə k o o l	
|	| | | | |	
CV	CVCVVC	
|		
e		
sesəkool		

b.

		dəŋe	d ə ŋ e
		|	| | |
CV	CV	CV	CVCV
||	|		
m ə	e		
mədedəŋe			

c.

buboŋ	b u b o ŋ	
|	| | | |	
CV	CVCVC	
|		
e		
bebuboŋ		

d.

		sulaul	s u l a u l
		|	| | | | |
CV	CV	CV	CVCVVC
||	|		
m ə	e		
məsesulaul			

2.2. CVX reduplication

A more interesting reduplication process involves what I will temporarily describe as a CV(C) prefix. The parenthesized consonant is filled with a consonantal melody only when the stem to which it is attached contains CVC as the initial three segments. If the initial three segments are CVV, then the reduplicative prefix appears as CV. The reduplicated forms shown below exhibiting this pattern are derived from so-called 'ergative' verbs (Josephs 1975), and the reduplicative prefix carries the meaning 'is easy to...' Again, as in (19), the VM appears outside the reduplication, and it changes to *o-* in the relevant environments. These forms also display the effects of two phonological processes that will not be discussed in detail here: a full vowel frequently weakens to schwa in unstressed position, and a schwa is epenthesized to break up impermissible consonant clusters. The vowel in the CV form of the reduplicative prefix, however, does not weaken to schwa.

(21)

obalə?	'get shot with a slingshot'
obələbalə?	'easy to shoot with a slingshot'
məsuub	'get studied'
məsusuub	'easy to study'
məŋiokl	'(starch) get cooked'
məŋiŋiokl	'easy to cook starch)'
məram	'get mixed'
mərəmram	'easy to mix'

The CV(C) prefix also attaches to non-ergative verbs and here, as with the Ce-prefix, it has a weakening effect or a continuative effect on the meaning of the verb. Here as well, the shape of the reduplicative prefix is governed by the initial three segments of the stem. CV appears when CVV are the initial segments in the root and CVC appears when the first three positions are occupied by CVC.

(22)

omdaob	'add salt water to'
omdodaob	'sink into salt water'
məsaik	'lazy'
məsisaik	'rather lazy'
məsaod	'explain'
məsosaod	'try to explain'
məkilt	'agile'
məkələkilt	'quite agile'

oker	'to ask'
okərker	'ask around'
oteb	'bark at'
otəbteb	'bark constantly'

The forms in (21) and (22) raise two issues. The first concerns the proper representation of the reduplicative prefix CV(C) and the contrast it displays between examples whose stems begin with CVC- and CVV-. The second concerns the choice of the vowel of the prefix when the prefix is attached to a CVV-stem.

If we temporarily assume that the prefix is either CVC or CV and follow the reduplication analysis of Marantz (1982), the wrong vowel will occasionally show up in the prefix when a CVV-stem is reduplicated. According to this approach, the phonemic melody of the stem is copied above the reduplicative affix, and the phonemes are associated to the skeleton in a one-to-one, phoneme-driven manner. Some examples are shown in (23), where the CVC and CV prefixes are appropriately affixed (a single shape for the reduplicative prefix is suggested below).

(23) a.

	r a m	r a m	
	| | |	| | |	
CV	CVC	CVC	
| |			
m ɔ			

mərəmram

b.

	ŋ iokl	ŋ i o k l
	| |	| | | | |
CV	CV	CVVCC
| |		
m ɔ		

məŋiŋiokl

c.

	d aob	d a o b	
	| |	| | | |	
VC	CV	CVVC	
| |			
o m			

*omdadaob
(omdodaob)

d.

	s aik	s a i k
	| |	| | | |
CV	CV	CVVC
| |		
m ɔ		

*məsasaik
(məsisaik)

Leaving aside the shape of the reduplicative prefix for the moment, let us consider the means by which the appropriate stem vowel appears in the prefix in the forms in (21) and (22). Elsewhere in the grammar of Palauan, a cluster of two or more vowels is reduced in unstressed position by a process of vowel cluster reduction (VCR), and geminate vowels also reduce in the same environment.[6]

In the possessed form of nouns containing vowel clusters, for example, the stress on the possessive suffix *(ŋ)ek* overrides stem stress and one of the vowels in the cluster is deleted. In (24), it is the first vowel of the cluster that is deleted, while in (25), the second vowel is deleted.

(24)	Free form	Possessed form ('my...)	
	sáik	sikék	'laziness'
	táem	temék	'time'
	iláot	iloték	'coconut syrup'
	bóid	bidék	'chant of travel between places'
	deleóŋəl	deloŋəlék	'relationship'
	ʔeísəʔ	ʔisəʔék	'stain'
	iébəd	ebədék	'lasso'
	berróus	berrusék	'dream'
	ekóek	ekekék	'trouchus'
	búil	bilék	'moon'
	ʔesíu	ʔesuʔék	'oyster'
	blekéu	blekŋék	'bravery'[7]
(25)	diáŋəl	diŋəlék	'boathouse'
	klakoád	klakodék	'fight'
	ʔeluáʔəd	ʔeluʔədék	'bitterness'
	beáʔəd	beʔədék	'tin'
	ŋiókl	ŋiklék	'action of cooking starch'
	uréor	urerék	'work'
	eólt	elték	'wind'
	ʔələʔéi	ʔələʔeŋék	'jealousy'
	ʔiéb	ʔibŋék	'speck in the eye'
	ʔeróu	ʔeroŋék	'white scar'
	bóes	bosék	'gun'
	úid	udék	'glue
	uíŋəl	uŋəlék	'tooth'
	diúkes	dikesék	'inheritance'
	líus	lisék	'coconut tree'
	ʔeluóməl	ʔelumələk	'baked fish wrapped in leaves'
	kléu	kleŋék	'young coconut'

As can be determined from (24) and (25), the output of this rule or rules is fairly unpredictable; there are sets of identical vowel clusters that pattern differently under VCR. Some of these VCR doublets, derived from (24) and (25), are shown in (26), where factors of vowel quality, order, and stress are all displayed.

(26)

deleóŋəl	eólt
deloŋəlék	elték
iébəd	ʔiéb
ebədék	ʔibŋék
berróus	ʔeróu
berrusék	ʔeroŋék
ekóek	bóes
ekekék	bosék
búil	úid
bilék	udék
ʔesíuʔ	líus
ʔesuʔék	lisék
blekéu	kléu
blekŋék	kleŋék

The only clear regularities that can be abstracted from the forms in (24) and (25) are, first, that *a* always bears stress when it is in a vowel cluster in which any vowel bears stress, and it always deletes when in an unstressed cluster, and, second, that *o* in a vowel cluster with *i* always bears stress and always deletes in an unstressed cluster. Other than these two regularities, the VCR patterns are largely unpredictable.[8]

Whatever governs VCR in the possessed nominal forms, though, appears to be active in the CV(C) reduplication. Insofar as there is evidence concerning the relation between a stem containing a vowel cluster, its possessed form, and its reduplicated form, the VCR patterns are identical. That is, the possessed form of *saik* is *sikek* and its reduplicated form is *məsisaik*. The possessed form of *ŋiokl* is *ŋiklek* and its reduplicated form is *məŋiŋiokl*. *boid* has as its possessed form *bidek*, while the reduplicated imperfect form (more reduplicated imperfects below) is *omiboid*. These facts clearly indicate that VCR is active in reduplication, and this being the case, there must be room enough in the reduplicative prefix to include vowel clusters, since simple left-right association of the melody to the skeleton would frequently yield the wrong results, as shown above in (23c-d).

Provision for the application of VCR in the reduplicative prefix can be ensured, and the reduplication pattern of the CVC-stems and the CVV-stems can be unified in either of two ways. First, the reduplicative prefix can be represented as CVX, where 'X' is a position on the prosodic template which can be occupied by either a consonant or a vowel,[9] and depending on which stem is reduplicated, either a consonantal or vocalic melody

will dock onto the X-slot. Word stress will be assigned, and then VCR (whatever its formal statement may be) will apply to any vowel cluster in the reduplicative prefix. If a consonantal melody docks onto the X-slot, then rules of vowel reduction and epenthesis will apply.

Another approach, due to McCarthy and Prince (1986), depends on the observation that the maximal syllable in Palauan is $CV\{^{V}_{C}\}$, that is to say, CVX. Following this approach, the reduplicative affix would simply occur as a maximal syllable prefixed to the root. Its melodic value would be acquired through mapping as much of the root melody onto the syllable template as possible.

In either case, a departure from the particular proposals of Marantz (1982) is clearly required, although both solutions (more clearly the CVX analysis, perhaps) to the problem posed by Palauan are conceptually consonant with the basic theory. Each of the proposals under consideration is empirically adequate for the data at hand,[10] so, somewhat arbitrarily, I will opt for representing the reduplicated forms according to the CVX proposal. Representations of some of the forms above are shown in (27).

(27) a.

	s a ik	s a i k
	| | |	| | | |
C V	C VX	CVVC
| |		
m ə		

mesisaik

b.

	ŋ i okl	ŋ i o k l
	| | |	| | | | |
C V	CVX	CVVCC
| |		
m ə		

məŋiŋiokl

c.

	r a m	r a m
	| | |	| | |
CV	CVX	CVC
| |		
mə		

mərəmram

d.

	b a lə?	b a l ə ?
	| | |	| | | | |
V	CVX	CVCVC
|		
o		

obələbalə?

Another productive reduplication pattern involves both reduplicative prefixes. Here, the CVX-prefix is internal to both the VM and the Ce-prefix.

(28)

məsesisaik	'kind of lazy'
məsaik	'lazy'
məkekərkar	'half awake'
məker	'awake'
mədedəkdakt	'kind of afraid'
mədakt	'afraid'

The separate analyses of the individual reduplicative prefixes can be adopted straightforwardly here to account for such forms, as (29) shows. As before, the melody of the root is copied above the reduplicative templates and then associated.

(29)

	d ak t	d a k t	d a k t	
	|	| | |	| | |	
CV	CV	CVX	CVCC	→ mədedəkdakt
| |	|			
m ə	e			

This completes the summary of the basic Palauan reduplication patterns. Two forms of reduplication were discussed, Ce- and CVX reduplication. The first pattern involved a CV template with the melody *e* preassociated to the V-slot, and simple copying and association provided the value for the C-slot. A second reduplication pattern involved the association of the root melody to a prefix of the form CVX. Where the X position is realized as a vowel, VCR, a phonological rule needed elsewhere in the grammar of the language, applies. Where X is realized as a consonant, other phonological rules of epenthesis and vowel reduction apply.

With the overview of verbal morphology from section 1 and the sketch of reduplication in this section, we are now in a position to consider their interaction.

3. REDUPLICATION AND PREVIOUS MORPHOLOGY

In this section, the interaction of reduplication and the previous morphology will be discussed. It will be seen that with respect to the verb marker, the two reduplication patterns discussed above pattern similarly. When it comes to the imperfect and the RSV infix, however, the behavior of the Ce- and CVX reduplications are quite different. The similarity will be accounted for by the adoption of certain copying conventions, and the differences will be seen to follow from certain assumptions about the morphological structure of the items in question.

3.1. Reduplication and the verb marker

As can be seen from the reduplication data in the previous section, the verb marker appears external to the reduplicative prefixes. Also, when the consonant next to the VM is [+labial], the VM changes to *o* by rule (5). Thus we have the following, where the conditioning labial may be part of the base stem or part of a reduplicative prefix.

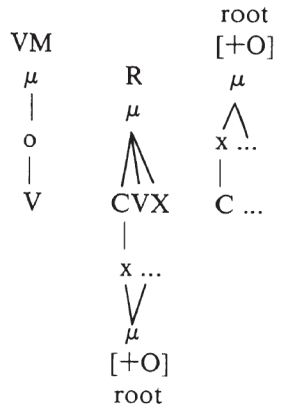
(30) obalə? 'get shot with a slinghot'
obələbalə? 'easy to shoot with a slingshot'

The forms with non-labial initial consonants which exceptionally require the VM as *o* also require *o* under either type of reduplication.

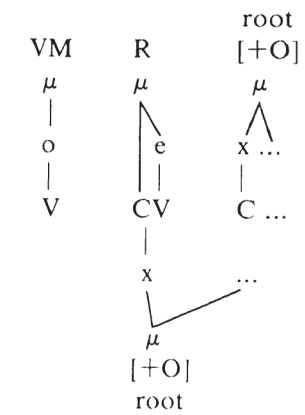
(30) oker 'ask'
okərker 'ask around'
osus 'to greet'
osesus 'to bow the head and walk by'
osiik 'to look for'
osisiik 'to look for casually'

Rule (6) will apply to the representations of the above forms, shown in (32), by virtue of the [+O] diacritic which is specified at the root level if we assume, following McCarthy (1981), that all but the prosodic skeleton is copied under reduplication. A desired consequence of this assumption is that in (32a), for example, any exception features or diacritics associated with the root morpheme will be copied along with the melody and will be accessible to the next round of affixation (R is the reduplicative morpheme). The situation is identical in (32b); the root node is copied, and [+O] comes along and provides the environment for rule (6) to apply.

(32) a.



b.



Rules (5) and (6), then, apply to non-reduplicated forms and to both types of reduplicated forms, showing that more than simply the phonemic melody of the base must be represented as attached to, or accessible by means of, the reduplicative affix.[11]

In the next two subsections, cases where the two reduplications behave differently are discussed. What is important about the facts under discussion

here is that in each case, the patterns of CVX reduplication mirror the patterns found in the non-reduplicated forms, while the Ce-reduplication is transparent to these processes.

3.2. Reduplication and the imperfect

The interactions of reduplication and the imperfect, however, show a dissimilarity between the Ce- and CVX reduplications. In short, both the imperfect marker and the consonant of the Ce-prefix show up overtly in imperfect forms with Ce-reduplication, while the initial consonant deletes in CVX reduplicated forms as well as in the simple imperfect, discussed in section 1.2. Some imperfect Ce-reduplications are shown in (33) (non-reduplicated imperfects and related forms are indicated).

(33)	ombebəkall	'sail, drive around'
	oməkall	'sail, drive'
	bəkall	'action of sailing'
	məŋʔeʔələbəd	'keep hitting'
	məŋələbəd	'hit'
	ʔələbəd	'club, whip (N)'
	ombebəllokl	'keep swaying'
	oməllokl	'sway'
	bləllokl	'swayed (RSV)'

As mentioned above, the imperfect marker induces the deletion of the first consonant of the CVX prefix in the imperfect. This pattern is identical to what was illustrated earlier with the simple imperfect. Examples of reduplicated imperfects and their non-reduplicated counterparts are shown below in (34).

(34)	mələbtub	'keep spitting'
	məlub	'spit'
	tub	'spit (N)'
	omələbaləʔ	'play around with a slingshot'
	omaləʔ	'shoot with a slingshot'
	balə	'slingshot'
	məŋəmkimd	'keep trimming'
	məŋimd	'trim'
	kimdii	'trim it' (perfect)
	omə[…]bart	'keep hiding'
	omart	'hide'
	blart	'hidden' (RSV)

And when both reduplication patterns are present in the same form, we find the pattern exemplified in (35), where the root-initial consonant surfaces when it is mapped onto the C-slot of the Ce-affix.

(35)		
	ombebibail	'wrap, clothe'
	omail	'clothe'
	bail	'clothing'
	ombebərəbart	'keep hiding'
	omart	'hide'
	blart	'hidden' (RSV)

The observational generalization here is that the consonant adjacent to the imperfect marker will remain if it is associated with the Ce-reduplicative prefix. If it is associated with the C of the CVX prefix or the initial C of the base stem, however, it will delete.

3.3. Reduplication and resultant state verbs

A difference between the two reduplications is also apparent in the RSV system. RSV reduplications of the Ce- type display the RSV infix in place after the first consonant of the base stem.

(36)		
	ŋeŋləmodəl	'not well mopped'
	ŋləmodəl	'mopped'
	ŋeŋləmull	'not well cut'
	ŋləmull	'cut'

CVX reduplications, however, show the RSV infix after the first consonant of the reduplicative prefix.

(37)		
	ŋləbəŋabek	'scraped all over'
	ŋlabek	'planed'
	rrurous	'sorted cut'
	rrous	'divided up'
	blibii?	'sorted out according to type'
	blii?	'sifted'

3.4. Morphological structure

The data in the two previous subsections show a clear pattern: the CVX prefix and the base stem behave identically with respect to imperfect

formation and RSV infixation. This fact can be accounted for straightforwardly by invoking some higher-order morphological structure and using this structure to delimit the domains of the consonant-deletion rule and RSV infixation. Specifically, I will assume that the root and the CVX reduplicative prefix together form a morphological unit that I will refer to as 'Stem'. I will also assume that the root may constitute a Stem on its own. The following rewrite rule expresses this categorization (see Selkirk 1982 for a discussion of the role of rewrite rules in morphology).[12]

(38) Stem → (affix) root

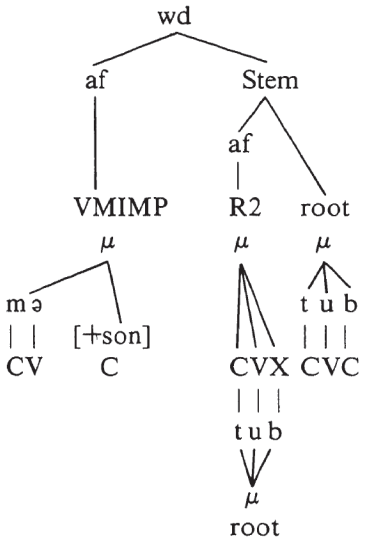
The CVX prefix, in this view, is of the lexical category 'affix', and it subcategorizes for a root as its sister. The proper characterization of the other Palauan affixes is immaterial for present purposes, so I will simply assume that the rules in (39) apply in the morphology of the language. The main point at this juncture is simply that the maximal and minimal expansion of Stem are CVX-root and root, respectively.

(39) word → affix word
word → (affix) Stem

We must further stipulate that the VM and imperfect marker may attach as sisters to either the Stem or word, and also that the Ce-affix is sister to Stem, immediately dominated by a word node.

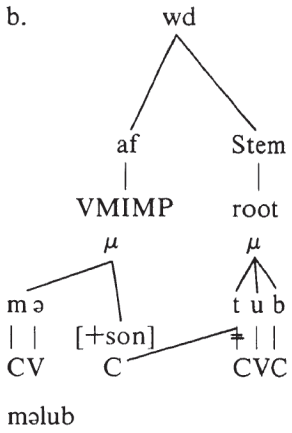
Given the structures in (40), then, the correct results involving the imperfect marker are obtained with the reformulated version of rule (13) as shown in (41). For present purposes, I am combining the VM and imperfect marker into one affix; nothing important hinges on this. See below for more discussion of the sort of morphological structure that is assumed here. In the representations below, 'R1' is the Ce-affix and 'R2' is the CVX affix.[13]

(40) a.



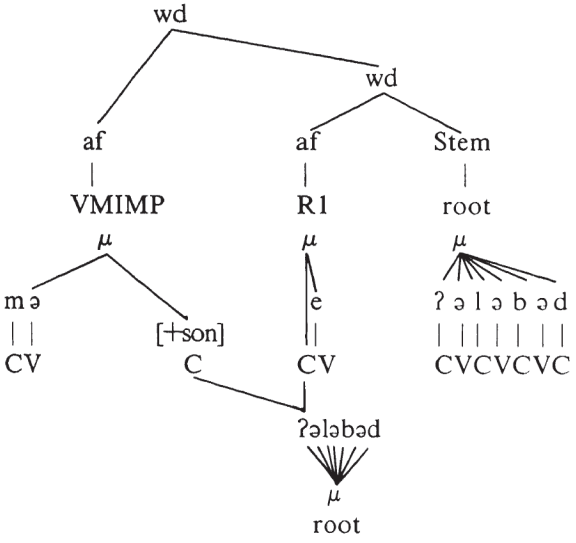
məlәbtub

b.



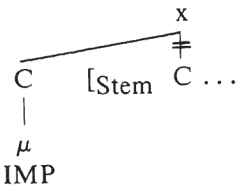
məlub

c.



məŋʔeʔələbəd

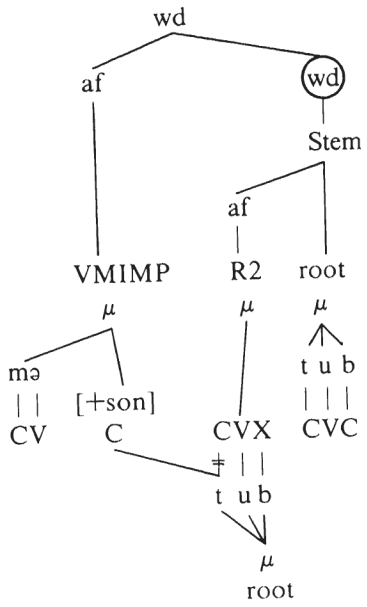
(41)



The Stem-initial consonant will be delinked when it is next to the imperfect marker. The rule will not apply when the imperfect marker is contiguous to a word boundary, as in (40c).

I assume that the lowermost A in A-over-A structures prunes when it is non-branching, so even though the rules in (39) do generate a word tree in which a non-branching word node is dominated by a word node, as in (42), the form **məl(ə)təbtub* (cf. (40a)) cannot be derived.

(42)



The circled node prunes, and the environment for rule (41) is met, and the rule applies, yielding *mələbtub*. Pending further clarification of Palauan morphological structure, I will let the rules in (38)-(39) and the pruning convention stand as they are.

Given the category Stem, the statement of the distribution of the RSV infix is immediately apparent. It occurs after the first consonant of the Stem. A subcategorization frame for the RSV infix is given in (43). The Ce-prefix is outside the Stem, hence external to the RSV infix. The CVX

prefix, however, is the leftmost constituent of the Stem when it occurs, and it is therefore vulnerable to RSV infixation.

(43) [Stem C C . . .]
|
μ
RSV

Note that this derived category of Stem is defined according to phrase structure rules, the normal interpretation of which assigns both category membership and linear order to a string of elements. When it comes to prefixation or suffixation, the normal interpretation is sufficient for most purposes (bracketing paradoxes aside), but there is no clear way to integrate an infix into morphological structure defined by such rules. Cases of infixation and Semitic root and pattern morphology in fact provided some of the original motivation for 'non-concatenative' morphology in the first place (McCarthy 1981, 1983; McCarthy and Prince 1986).

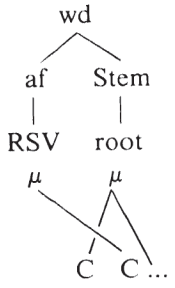
I assume, however, that the derivation of a form assembled according to the correct theory of morphology will reflect constituent structure and headedness,[14] as well as the relative scope of one subconstituent with respect to another. In other words, if the element in question is a morphologically complex element, its morphemes will presumably be arranged in a determinate configuration. This sort of organization may be simply expressed through word structure trees for concatenative systems, but a non-concatenative arrangement of intersecting morphemic tiers simply illustrates the separation of the phonetic/prosodic material into morphemes; it does not represent the higher-order structure that is also required in a full representation of the word. In other words, the tiers themselves need to be assembled so that the rest of the grammar is able to represent lexical relatedness (Williams 1981) or differentiate in a principled manner between, for example, Arabic *kattab* ('cause to write' perfective active) and *kuttib* ('write' perfective passive), where the vocalism determines the mood and the CV template expresses the causativity (McCarthy 1981). In this latter case, the difference between active and passive has considerable syntactic consequences, as do differences between causative and non-causative verb forms. These features must therefore be accessible to the syntax, and the elements bearing these features must, given Jaeggli's (1986) or Fabb's (1984) assumptions about the relation between a verb and a passive affix, have a particular arrangement (in this case, government).

Or, imagine a hypothetical case, like the familiar *unlockable* in English (the ambiguity of which can be explicated through two bracketings), where the affix corresponding to the *un-* prefix is instead an infix which attaches after the first consonant of the root (*lunockable*). A tiered representation

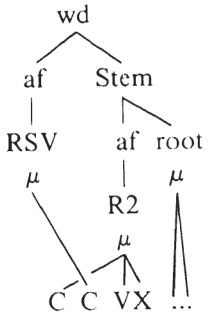
fails to explicate the hypothetical ambiguity, and bracketing according to the usual conventions is of no avail.

For the case immediately at hand, RSV infixation (and VM infixation as well, where appropriate), I assume that the infix must take scope over the Stem-level material so that its morpho-syntactic features can be visible to the syntax of the language for purposes of lexical insertion, predication, etc. It therefore seems clear that the RSV infix cannot be a constituent of the Stem. But on the other hand, given its infixal nature, it must occur (at least phonetically) inside the Stem. This apparent paradox can be resolved, however, if we view the word-structure rewrite rules above not as defining linear order as well as category membership, but simply category membership. Specifically, let them be interpreted as node admissibility conditions defining only category membership, and let there then be independent rules of linearization (somewhat in the sense of Gazdar, Klein, Pullum, and Sag 1986) or subcategorization which perform the linear arrangements. Further, let the rules defining category membership apply in a multi-dimensional projection, rounding up the morphological tiers into higher-order morphological constituents. Under this view, the RSV infix can be viewed as both a prefix and an infix (a 'virtual' prefix and an actual infix). Some attempts at representing this notion are in (44).

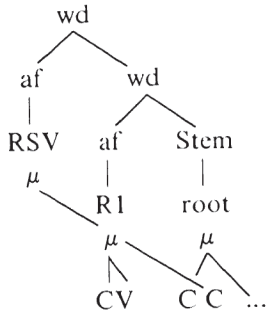
(44) a.



b.

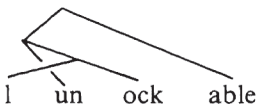


c.



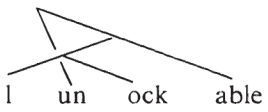
These representations differ from (43) in that they display more morphological information; the separate categories 'af' and 'Stem' are arranged in a structure that represents more than their prosodic relations. This mode of representation is applicable to the hypothetical case *lunockable* in the following way:

(45) a.



('able to be unlocked')

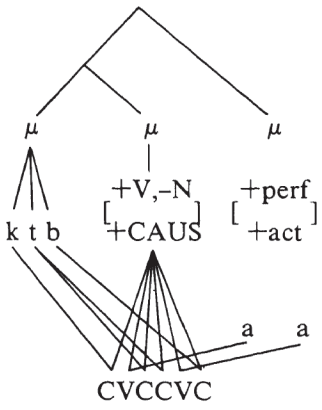
b.



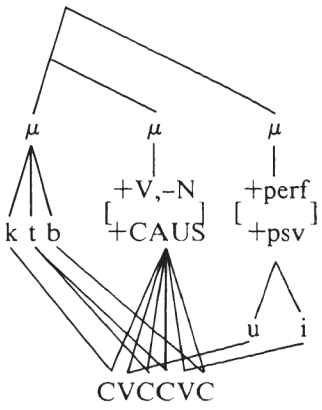
('unable to be locked')

Similarly, the Arabic cases mentioned above can be represented as in (46).[15] Here I assume that CVCCVC corresponds to the causative verbal morpheme and that the vocalism expresses the mood.

(46) a.



b.



Feature-percolation conventions such as those of Lieber (1980), Selkirk (1982), or DiSciullo and Williams (1986) are applicable to these structures without special stipulation for infixes or discontinuous material.

The category Stem, then, is motivated from two directions, the operation of the consonant delinking rule in the imperfect and the distribution of the RSV infix, and the Stem itself has been defined by reference to hierarchical structure.[16]

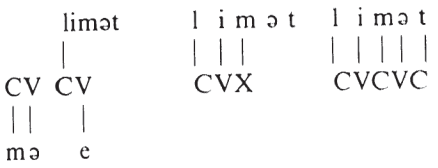
Given the independent motivation for hierarchical structure in Palauan (and elsewhere), it then becomes necessary to provide an account of how infixation and other non-concatenative arrangements can be represented within hierarchical structure, and the above discussion is a step in that direction.

Before concluding this section, I wish to reconsider the forms accounted for by the morpholexical rule (12). Recall that those imperfect forms did not exhibit the assimilatory relation between the imperfect marker and the adjacent consonant. The morpholexical rule states the alternation without appeal to any sort of affixation of the imperfect marker. The presence of this rule predicts that, under imperfect reduplication, the *l* of the imperfect allomorph will be taken as the first consonant of the root, and no *n*'s will appear in the reduplicated form. That is, the reduplicated form in (47) is predicted not to occur.

(47)	(*)	məlŋeŋəməŋimət	'keep bailing'
		məlimət	'bail'
		ŋimətii	'bail it (perf)'

If the reduplication process instead selects the imperfect allomorph of the root for imperfect reduplication, we should expect the form in (48b), after vowel reduction and epenthesis has applied to the representation in (48a).[17]

(48) a.



b. məleləməlimət

And (48b) is the attested form. There is thus evidence that the alternations expressed by the morphological rule and those accounted for with the imperfect marker archisegment are in fact different phenomena.

4. CONCLUSION

The above discussion presents a partial grammar of Palauan verbal morphology. In the present section, I will summarize the relevance of the apparatus involved in the analysis to earlier and current research. The Palauan material, I believe, bears on issues relevant to the theory of lexical phonology, prosodic morphology, and, in particular, the role of hierarchical representations in morphological theory.

As was mentioned, the procedure for determining the shape of the imperfect marker in section 1.2 is in many ways consonant with the theory of lexical phonology (Kiparsky 1982). In this theory, lexical rules are in

a sense 'structure preserving', and this principle is echoed in the analysis of the imperfect marker, where the output of the assimilatory rule is restricted to the underlying phonemic inventory. On the other hand, the status in lexical phonology of the associated principle, 'find the closest phoneme', is somewhat unclear, and more research is in order.

In section 2.2, the longer of the two reduplicative prefixes was analyzed as CVX, the maximal syllable in Palauan. This representation allowed for the unification of the reduplication patterns involving both CVV- and CVC-roots, a goal that could not be obtained if the reduplicative template could only consist of C's and V's, as in Marantz's original proposal (1982). This analysis, however, runs counter to the results of Moravcsik's (1978) survey of reduplication. There she notes, 'In other words, all such specifications are of the type: "reduplicate the first C and V of the word" ... and never of the type: "reduplicate the first two segments (regardless whether they are consonants or vowels)".'

To be sure, the full CVX reduplication is present in the above analysis only in intermediate forms. At the surface level, and Moravcsik's conclusions are based on an inventory of surface forms, the Palauan pattern is either CVC or CV. Only at the intermediate level, then, is Palauan a potential counterexample to Moravcsik's findings. Also, the CVX analysis assumes the unformulated rule of vowel cluster reduction. If vowel clusters instead are glide-vowel or vowel-glide sequences, as suggested in Wilson (1972) (see note 8), then perhaps a CVC reduplicative prefix can be maintained.

In addition, there is evidence that exception features tagged onto the root are passed through to the reduplicative affixes, so provision must be made in the theory for a mechanism by which more than the simple melody of a few segments is transferred in reduplication. Copying of everything except the CV skeleton is the analysis in section 3.1.

In section 3.4, evidence was adduced that the category of Stem is present in Palauan morphology. The internal structure of the Stem was analyzed as an example of concatenative morphology, while the statement of the distribution of the RSV infix was non-concatenative in nature. Specifically, the infix appears after the first consonant of the Stem. The apparent clash between concatenative and non-concatenative types of morphology can be resolved if the rules defining category membership are interpreted three-dimensionally, successively grouping the morphological tiers into constituents. Subcategorization rules or linearizing rules for the lexical items can then determine the linear order.

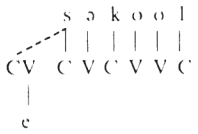
This proposal suggests that constituency is independent of linear order, and that the only difference between a concatenative system like that of English and a non-concatenative system lies in the way the grammars of the languages choose to line up their morphemes on the prosodic skeleton.

In other respects, we may hope for universality of constituent grouping among languages. This view of morphological constituency is quite similar to the theory of virtual projections in the syntactic component outlined in Vergnaud and Zubizarreta 1980 and to proposals in Higginbotham 1983 and McCawley 1982.[18]

NOTES

1. In an attempt to minimize the opacity of certain surface forms, I will allude to various phonological processes of epenthesis, vowel deletion, and vowel reduction along the way, but will not attempt to formalize them explicitly.
2. The source of the schwa in the verb marker is unclear. It may be the result of either of two phonological processes in the language, epenthesis or vowel reduction. If we assume that the vowel arises through epenthesis, then the lexical representation of the VM would be simply *m*. This choice might enable us to more easily relate the two surface forms of the VM, *mɔ* and *o*, by phonological rules, and the analysis of the VM when it appears as an infix (see (4a)) becomes more straightforward. I will, nonetheless, show the VM as *mɔ* in the discussion and examples in the text.
3. In general, round vowels turn to *w* when they are unstressed and occur before stressed vowels (Wilson 1972). The phonetic representations of the forms in (4), then, would have *w* in place of the vocalic infixed VM.
4. Epenthesis of *ɔ* here seems to be conditioned by a general constraint prohibiting homorganic clusters at the surface (Wilson 1972). It is tempting to speculate that the consonant-deletion rule (13) is part of this conspiracy as well as the vocalization of the VM *mɔ* to *o* in certain environments (see note 2), although data discussed with respect to the word structure proposals below is somewhat problematic for a generalization across all of these cases. That is, some of the cases subsumed under this constraint are evident only within the Stem and at its fringes, while others are observed throughout the word (see below for discussion of the Stem).
5. Another implementation would be shown below, where the melody of the initial consonant spreads leftward (since the two morphemes are on separatetiers, there is no crossover violation in this association).

(i)



Although I have no strong arguments against such analysis, I will analyze both reduplications as involving full melodic copying. An anonymous reviewer observes that if this analysis is adopted, then no copying of the [+O] diacritic will be necessary to condition the rule in (6) (see section 3.1 for discussion). This is true, but as discussed in 3.1, the reduplicative prefix in CVX reduplication must be able to condition rule (6) as well, and here, a simple spreading analysis like the one sketched above is not available, given assumptions concerning association lines. See note 11 for more discussion.
6. It seems that the grammar of Palauan is reluctant to allow underlying vocalic material to surface in unstressed position. VCR, degemination, and vowel reduction are all exuberantly active. There also is a vowel-deletion rule which also applies in unstressed position, affecting

u's generally and other vowels sporadically. These processes appear only to affect vocalic material in the Stem (see below for discussion of Stem).

7. I assume that application of VCR produces *blekuŋek* here and that the vowel-deletion rule mentioned in the previous note subsequently deletes the *u*.

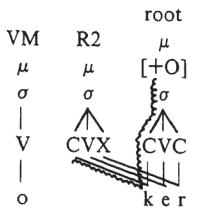
8. See Wilson 1972 for a glide-based analysis of VCR. Her analysis involves rules that merge glide-vowel sequences into vowels, and turn vowels into glides and glides into vowels. In addition, three deletion rules, exception features, crucial ordering restrictions, and word-final vowels which never surface are all important features of her analysis of VCR. She does not, however, consider the interactions of VCR and what I am analyzing as CVX reduplications, and I have not applied her analysis of VCR to CVX reduplications.

9. See Levin 1985, among others, for independent arguments for the superiority of an X-tier over a CV-template.

10. The two proposals would make different predictions about a base form with the shape of CCVC. The maximal-syllable hypothesis predicts CCVC+CCVC, while the CVX hypothesis predicts CC+CCVC (assuming Marantz's phoneme-driven convention) with epenthesis applying to break up clusters. Unfortunately, in the only Palauan CCVC forms that I have found, the second consonant is an infix and it could therefore be on a separate tier at the point in the derivation where the base melody is associated with the reduplicative affix. In any case, the RSV infix, as discussed below, is infixed into the reduplicative skeleton itself, so the CCVX issue does not arise in this case.

11. The facts can be derived as well under the maximal-syllable analysis discussed in the previous section. Here there would be no need to transfer the diacritic along with the melody if rules (5) and (6) were stated so as to apply before linearization. It would also have to be stipulated that the [+O] diacritic is accessible to the VM by virtue of the linking of the prosodic material if R1 or R2 to the melodic materical of the [+O] root, along the path indicated by the wavy line in the representation of *okərker* in (i).

(i)



An analysis that completely avoids the question, where R1 and R2 are infixes infixed after the shape of the VM is already determined, is also possible (following assumptions of Lexical Phonology), but I will not pursue it here.

12. See also Broselow 1983 for a discussion of how reduplicative copying is constrained by an extension of subjacency to morphological structure, and Myers 1987 for a discussion of the hierarchical nature of Shona word structure.

13. Even though the reduplicated structures in (40a,c) show more than one 'root' node, one attached to the base and others attached to the reduplicative affixes, only one of the root nodes is integrated into the overall word structure as defined by the rules in (38) and (39). Material dominated by this node will therefore count as the root of the word.

14. See Aronoff 1988 for a discussion of the relevance of the notion of 'head' to reduplication.

15. See Fabb1984 for an independent proposal along similar lines.

16. VM infixation, discussed in section 1.1, does not provide clear motivation for the Stem. While some of the forms that require an infixed VM still display the VM infixed after the first consonant of the root under Ce-reduplication,

(i)	sesme?ər	'rather sick'
	sme?ər	'sick'
	sesmau	'sort of used to'
	smau	'used to'
	?e?uarm	'sort of suffer'
	?uarm	'suffer'

the VM appears as a prefix under CVX or Ce-CVX reduplication of [+I] items.

(ii)	məleluluut	'leave continually'
	məluluut	'leave continually'
	lmuut	'leave'
	mərerəbərebət	'fall one by one'
	mərəbərebət	'fall one by one'
	ruebət	'fall'

Were these the only patterns, they might be accounted for by stipulating that the VM is infixed after the first consonant of a non-branching Stem. There is at least one Ce-reduplication of a [+I] form, however, shown in (iii), in which the VM appears as a prefix and the Stem is non-branching.

(iii)	mə?e?iis	'keep sneaking out'
	?əmiis	'sneak out'

It appears that in forms like those in (i), when the VM is infixed in reduplications, the meaning of the base form is weakened. When it is prefixed, as in (ii)-(iii), the continuative reading is derived. In any case, whenever CVX reduplication is involved, the VM is prefixed. Whether these facts are due to morphological structure or to rules of semantic interpretation is an open question.

17. There are a small number of forms whose roots are non-*ŋ*-initial which display the overapplication phenomenon illustrated above where *l* is the imperfect marker. They all involve roots with initial *d, s, l,* or *t*. These can be analyzed similarly with morpholexical rules. One might speculate that the assimilation/deletion analysis outlined in the text has become lexicalized with these forms. In no case, however, do there appear to be *ŋ*-initial roots which pattern in the normal fashion under reduplication.

18. See also the papers in Huck and Ojeda 1987. Note that it is not particularly important that all constituency be simultaneously represented. Certain derivations within Lexical Phonology, for example, or categorial grammar (e.g. Bach's (1979, 1981) 'right-wrap' applied to word structure; see also Hoeksema 1985) would be able to express the necessary constituency, though perhaps not all at the same level.

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