Stress and Allomorphy in Woleaian Reduplication*

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1. Introduction

Woleaian shares the progressive and denotative affixes seen in other Trukic and Ponapeic languages of Western Micronesia (Harrison 1973, Sohn 1975). The progressive is invariably a prefix, and like in other Trukic languages (such as Chuukese, Puluwat, and Ulithian) it is bimoraic, with the second mora realized by geminating the initial consonant of the stem (*fati* → ***faf***-*fati* 'being angular', *fili* → ***fif***-*fili* 'choosing').

The denotative marker, however, occurs unpredictably as a suffixed syllable (*fati* → *fati*-***fati*** 'be angular', *perase* → *perase*-***rase*** 'scatter') or initial gemination (*fili* → ***ff****ili* 'choose', *feragi* → ***ff****eragi* 'spread'). In this paper, I argue that the shape and position of the denotative allomorphs can be predicted from the interaction of a morphological diacritic with the language's stress pattern. I show further that this same diacritic actually helps guarantee the size and shape of the progressive. Thus, while each reduplicative shape resembles a templatic operation, I will propose that the patterns of reduplication in Woleaian result from an emergent effect of general constraints on prosodic and segmental structure. I provide a theoretical analysis using Optimality Theory (Prince & Smolensky 1993, McCarthy & Prince 1993a,b) to do so.

The mapping of morphemes to prosodic constituents is something that I attribute to a general constraint requiring morpheme boundaries to foot boundaries. I will show that each reduplicative morpheme (including the geminate variant) respects such a requirement.

The analysis has implications for the study of Woleaian in particular, for Micronesian languages at large, and for reduplication theory in general. For Woleaian, it offers a principled account for the denotative allomorphy, as well as for the absence of bare-consonant or monomoraic suffixes, and for the absence of bivocalic prefixes. For Micronesian languages, it stands as an example of languages diverging only by the drift of a small number of constraints. For reduplication theory, it strengthens the case for modeling reduplication as the emergence of unmarked prosody.

This paper is organized as follows. In Section 2, I present the data and describe the relevant phonological and reduplicative generalizations. In Section 3, I present an Optimality-Theoretic account that captures the denotative allomorphy with an abstract diacritic. In Section 4, I argue that assigning this diacritic to the progressive morpeme predicts its invariantly word-initial bimoraic

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form. In Section 5, I discuss some of the weaknesses a templatic approach would have, particularly in the generalizations it fails to make, and summarize the implications of the current analysis.

2. Data and Generalizations.

In this section, I first provide a description of general phonological traits in Woleaian, such as segmental alternations, gemination, and the stress pattern. I then present Woleaian's two reduplicative morphemes, describing the allomorphy of the denotative affix and the invariantly bimoraic progressive prefix. All data in this section are from Sohn (1975) and Sohn & Tawerilmang (1976).

2.1 Aspects of Woleaian phonology

Before presenting an analysis of the denotative and progressive reduplicants, it is necessary to describe several other traits of Woleaian phonology. There are some segmental alternations that, if unacknowledged, would render the reduplicative data rather messy. It is also necessary to determine the prosodic status of initial and medial geminate consonants, and to describe the stress pattern.

First, Woleaian does not tolerate sequences of low vowels; which it avoids by raising alternate vowels.[1] Thus underlying *parasa* 'splash' arises as *perase*; and the reduplicated intransitive form is *perase-rase*. Although this alternation occurs independently of reduplication, the process motivating it is one of overriding priority, as can be seen in reduplicated forms like *cecaŋe* 'apply powder'. In Sections 3 and 4, I will not consider output candidates without this dissimilatory alternation.

Second, all word-final vowels are voiceless in Woleaian; the analysis will depend on these nonetheless being moraic and figuring in the foot structure, but it otherwise has no consequence except for any reader who is accustomed to seeing forms like *perase* transcribed as *peras*. It does have some importance for the discussion of pan-Micronesian phonology, since the final-vowel devoicing here is reflected as total deletion elsewhere in Trukic languages and in Ponapeic languages, and historical reanalysis (loss) in Kosraean.

Third, all consonants may be geminated, but a number of them have an articulatory change when lengthened. These changes are laid out in Table (1). A generalization to be made is that each of these consonants is a continuant when short but a stop when long; the segment transcribed as *g* is phonetically [γ]. A similar change actually occurs with *b*, which is phonetically [β], but whose long version is a stop.[2] It should be noted that although Sohn (1975) transcribes these

[1] See Blust (1996) and Suzuki (1997) for a discussion of this dissimilatory process.
[2] I follow Sohn's orthography, except I replace all digraphs as follows: *ü* for *iu*, *ö* for *eo*, *š* for *sh*, *c* for *ch*, and *ŋ* for *ng*.

stops as single symbols, he claims that they are still roughly twice the length of their short counterparts.

(1) Consonants that change manner when long:

l → *nn*	lütü →	nnütü	*to be jumping*
g → *kk*	gašee-y→	kkaše	*to throw*
r → *cc*	rago-mi→	ccago	*to hug*
s → *cc*	šagee-y→	ccage	*to chase*
β → *bb*	βuga →	bbuga	*to boil*

Fourth, it will be necessary to treat the first member of all geminates as moraic, even if word initial. This is consistent with other Trukic languages like Chuukese (Davis 1999, Muller 1999); furthermore, the fossilized reflex of initial gemination in Ponapean is a syllabic nasal (Harrison 1973) which appears to be moraic. For example, the Ponapean form *nda* 'to say' reduplicates as ***<u>ndi</u>***-*nda*; in which the initial nasal helps satisfy a bimoraic requirement.

Lastly, the stress pattern will be important for the analysis in Sections 3 and 4. Woleaian stress is similar to that in other Micronesian languages: primary stress is attracted to the right edges of words, and the stress system counts moras. More specifically, primary stress occurs on the penultimate mora, and secondary stress occurs on alternate preceding moras (Rehg 1993).

2.2 The Denotative affix

The Woleaian denotative affix creates what Sohn (1975) labels as "neutral" verbs; in more specific terms, it derives intransitives from transitives. Harrison (1973) uses the term "denotative" because the resulting form is like a predicative adjective; moreover, the affix can also attach to nouns and adjectives. While a suffix with a similar function can be seen in Ponapeic languages, as well as in Kosraean, Gilbertese, and Marshallese, Woleaian stands out since its denotative can occur as a suffix, like in other Micronesian languages, or as gemination of the initial consonant of the stem.[3] Table (2) provides examples of the geminated forms.

For each verb in Table (2), I provide the transitive with its object suffix, the underlying form of the verb stem, and the surface form of the denotative. Each verb has a denotative form with an initial long consonant, and curiously, the lengthened form of both *r* and *š* is *c*, while the lengthened form of *g* is *k*. For this table I adhere to Sohn's custom of transcribing *c* and *k* as single symbols, but Sohn claims that such segments are inherently long, and have roughly twice the duration of *r*, *š*, and *g*.

[3] Other Micronesian language show some evidence of initial gemination, but not to indicate the denotative (Harrison 1973).

(2) The denotative as initial gemination

Stem	***gloss***	***Denotative***	***gloss***
βüŋü-ti	*fall on it*	bbüŋü	*to fall on*
βuga	*boil it*	bbuga	*to boil*
faa-ti	*kick it*	ffa	*to kick*
feragi	*spread*	fferagi	*to be spread*
fili	*choose it*	ffili	*to choose*
gašee-y	*throw it*	kaše	*to throw*
lütü	*to jump*	nütü	*to be jumping*
ŋüsü-ri	*snort it*	ŋŋüsü	*to snort*
peša-ŋi	*stick to it*	ppaša	*to stick to*
pilegü-w	*bundle it*	ppilegü	*to be bundled*
rago-mi	*hug it*	cago	*to hug*
šagee-y	*chase it*	cage	*to chase*
sawee-y	*go along side of it*	ssawe	*to go along side of*
taariŋa	*be ripped (vulgar)*	ttariŋa	*to be ripped off*
tabee-y	*follow it*	ttabe	*to follow*

Table (3) provides examples of suffixed denotatives. Note that the order of stem and affix is not immediately certain for forms like *fatifeti* and many others, in which a complete bivocalic stem is reduplicated. I treat these forms as suffixed to be uniform with trivocalic denotatives in this group are clearly suffixed, as in *perase-**<u>rase</u>***.

(3) The denotative as a suffix

Stem	***gloss***	***Denotative***	***gloss***
βalü-w	*cover it*	βalü-**<u>βelü</u>**	*to cover*
βugo-si	*tie it*	βugo-**<u>βugo</u>**	*to tie*
βuro-ŋi	*peel it*	βuro-**<u>βuro</u>**	*to peel*
faŋošo	*current*	faŋošo-**<u>ŋošo</u>**	*to have a little current*
fati	*corner*	fati-**<u>feti</u>**	*to be angular*
file-ti	*stir it*	file-**<u>file</u>**	*to stir*
fitiye-li	*marry him*	fitiye-**<u>tiye</u>**	*to marry*
gare	*broil it*	gare-**<u>gare</u>**	*to broil*
gofetii-y	*chip it off*	gofeti-**<u>feti</u>**	*to chip off*
lape	*big, great*	lape-**<u>lape</u>**	*greater*
lewe-gi	*lick it*	lewe-**<u>lewe</u>**	*to lick*
maŋii-y	*remember it*	maŋi-**<u>meŋi</u>**	*to remember*
masowe	*hard*	masowe-**<u>sowe</u>**	*to be strong*
misi	*fool*	misi-**<u>misi</u>**	*tell lies*
perase	*to splash*	perase-**<u>rase</u>**	*to scatter*
tafiši	*to trap*	tafiši-**<u>fiši</u>**	*to sparkle*

To be sure that the choice of suffix or initial gemination is an arbitrary allomorphic one, it is necessary to show that the form of the denotative affix cannot be predicted from the form of the stem to which it attaches. That is, neither the stem-initial consonant, nor the vowels of the stem, nor the object-suffix class of the verb can predict whether the denotative is realized as a suffix or an initial geminate.

First, the initial consonant of the stem would predict the position of the affix only if there was a clear restriction on what could be geminated. Such a scenario would be clear if some kinds of initial consonants were always geminated, while stems with other initial consonants always receive suffixes. However, this is not the case, as seen by comparing *ffili* with *file-**file***, *gare-**gare*** with *kaše*, *bbuga* with *βugo-**βugo***, and *ttabe* with *tafiši-**fiši***.

(4) Denotative not predictable from stem's initial consonant

f…	fili → ffili	*choose*	file → file-**file**	*stir*
g…	gaše → kaše	*throw*	gare → gare-**gare**	*broil*
β…	βuga → bbuga	*boil*	βugo → βugo-**βugo**	*tie*
t…	taβe → ttaβe	*follow*	tafiši → tafiši-**fiši**	*trap/sparkle*

Second, the vowels of the stem cannot predict the form of the denotative, so it is not the case that the initial gemination is a strategy for avoiding the copy of certain vowels or sequences. For example, we see *lape* → *lape-**lape*** but *tabe* → *ttabe*, and *fili* → *ffili* but *misi* → *misi-**misi***.

(5) Denotative not predictable from stem's final vowel

…e	taše → ttaše	*follow*	lape → lape-**lape**	*great(er)*
…i	fili → ffili	*choose*	misi → misi-**misi**	*fool*
…o	rago → cago	*hug*	βuro → βuro-**βuro**	*peel*
…ü	βüŋü → bbüŋü	*fall on*	βalü → βalü-**βelü**	*cover*

Third, verbs can be classified by the specific object suffix they receive, but the form of any verb's denotative does not correlate with its particular object suffix. For example, the corresponding transitives of *file-**file*** and *bbüŋü* are *file-ti* and *bbüŋü-ti*; both have *–ti* as an object suffix. Similarly, the transitives of *ppeša* and *buro-**buro*** are *peša-ŋi* and *buro-ŋi*; both have *–ŋi* as an object suffix.

(6) Denotative not predictable from verb's transitive suffix class

-ti	βüŋü-ti ~ bbüŋü	*fall on*	file-ti ~ file-**file**	*stir*
-ŋi	peša-ŋi ~ ppeša	*stick to*	βuro-ŋi ~ βuro-**βuro**	*peel*
-Ø	βuga-Ø ~ bbuga	*boil*	perase-Ø ~ perase-**rase**	*scatter*
-y	tašee-y ~ ttaše	*follow*	maŋii-y ~ maŋi-**meŋi**	*remember*

Given these three sets of facts, the shape and position of the denotative affix cannot be predicted from the form of the stem to which it attaches. As a result it is necessary to attribute the allomorphy to some learned arbitrary distinction between verbs that geminate and verbs that take suffixes. A classical way of formalizing such distinctions in a grammar is to assign a morphological diacritic to one group, setting off a specific process, or “Minor rule” (as in Lightner 1968, Halle & Vergnaud 1987), which results in a particular allomorph being realized. The other allomorph then follows from more general “Elsewhere” rules (after Kiparsky 1973).

Optimality Theory is not restricted from using morphological diacritics, but doing so introduces the need for constraints over the distribution of such features. I leave open for now the question of which verbs are so marked, but return to it in Section 3, where it is proposed that suffixing verbs are the lexically marked class.

2.3 The Progressive affix

The progressive prefix in Woleaian inflects verbs for the habitual aspect. It invariably appears as a heavy syllable which is closed by a geminate shared with the initial consonant of the stem. Examples of Woleaian progressives are provided in Table (7).

(7) The progressive prefix

Stem	***Gloss***	***Progressive***	***Gloss***
gematefa	*explain it*	**kek**-kematefa	*be explaining it*
gettape	*touch*	**kek**-katepa	*to be touching it*
lüwanee-y	*think (it)*	**nün**-nüwane	*to think*
metafe	*to be clear*	**mem**-metafe	*to become clear*
mili	*stay*	**mim**-mili	*to be staying*
mmwutu	*to vomit*	**mwum**-mwutu	*to be vomiting*
mwoŋo	*eat*	**mwom**-mwoŋo	*to be eating*
pirafe	*steal*	**pip**-pirafe	*to be stealing*
raŋe	*yellow powder*	**cec**-caŋe	*apply poweder*
ro-si	*decorate it*	**coc**-co	*to decorate*
sašee-y	*scrutinize it*	**ses**-saše	*to scrutinize*
šalü-w	*water*	**cec**-calü	*to stick to*
tagee-y	*ride it*	**tet**-tage	*to ride*
tela-ti	*discuss it*	**tet**-tale	*to discuss*
toro-fi	*catch it*	**tot**-toro	*to catch*

The progressive verbs in Table (7) show the same effect of gemination on *g*, *r*, and *š* that is seen in Tables (2) and (3). Not only do they lengthen, but there is also an articulatory change, with long *g* appearing as *k* (*gettape* → *kekkatepa*), and long *r* and *š* both becoming *c* (*raŋe* → *ceccaŋe, šalü* → *ceccalü*). In each of these cases, the reduplicated consonant also reflects this articulatory change, so there are no forms like **reccaŋe* or **gekkatape*. I return to the issue of gemination in the progressive in Section 4.

A last descriptive point is that the heavy-syllable prefix is clearly not a third allomorph of the denotative affix. This can be shown by a number of stems that can derive both a heavy-syllable prefixed form and a denotative with one of the two allomorphs. I provide a number of such examples in Table (8) below.

(8) Stems that appear with either affix

Stem	**Progressive**	**Denotative**	***gloss***
βuga	**bbub**-buga	bbuga	*boil*
fase-ŋü	**fef**-fesa-ŋü	ffaso	*call*
gara	**kek**-kara	kkara	*broil, dry*
rago-mi	**cec**-cago	ccago	*hug*
šalü	**cec**-calü	ccalü	*be filled w/ water*
šeŋagi	**cec**-ceŋagi	cceŋagi	*hang*
tali	**tet**-tali	ttali	*rope, draw*
toro	**tot**-toro	ttoro	*catch*
gerage	**kek**-kerage	gerage-**rage**	*crawl*
kepate	**kek**-kepate	kepate-**pate**	*word, language*
metafe	**mem**-metafe	metafe-**tafe**	*become clear*
raŋe	**cec**-caŋe	raŋe-r**aŋe**	*apply yellow powder*

3. An Optimality-Theoretic account of the denotative affix

To capture the positional allomorphy of the denotative affix, I propose that verbs may bear an underlying diacritic, [+flag], whose surface correspondent is stress. Leftward alignment of this diacritic is formally required by ALIGN-FLAG-LEFT, defined as (9) below; this is the constraint-based equivalent to the use of a Minor rule. ALIGN-FLAG-LEFT is violated gradiently by any [+flag] that is not associated to the leftmost mora of the word. This forces any [+flag] verb stem to be word-initial, in which case the denotative affix can only be a suffix. The verb *buro* "to peel" is one such verb marked to be word-initial, therefore receiving a suffix for the denotative, as in *fàti-**fáti***.

(9) ALIGN-FLAG-LEFT Align [+flag] to the leftmost mora of a word.
Assess a violation for every mora between the left word-edge and the mora to which [+flag] associates.

The role of ALIGN-FLAG-LEFT in choosing the appropriate affix for the suffixing verb *βuro* 'to peel' is summarized in Tableau (11). This tableau includes the constraint MAXFLAG, defined in (10), which requires the underlying feature [+flag] to be present at the surface. In this and subsequent tableaux, the mora to which [+flag] associates is indicated as a stressed capital letter.

(10) MAXFLAG — Every [+flag] in the input must have a correspondent in the output.

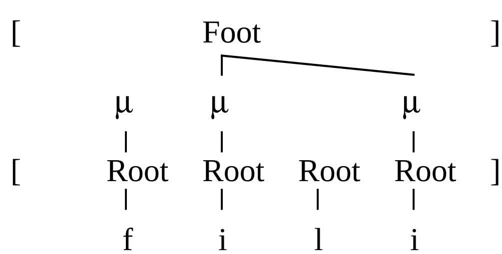
(11)	βuro [+flag] + DENOT	MAX FLAG	ALIGN FLAG-L
a.	☞ [βÙro][**βúro**]		
b.	[**βùro**][βÚro]		**!
c.	**b**[bÚro]		*!
d.	[**βùb**][bÚro]		**!
e.	**b**[búro]	*!	

In Tableau (11), the presence of the [+flag] specification prevents any affix material from intervening between the left word-edge and the stem, resulting in the suffixed output *βÙro][**βúro**]*. However, if the input had no [+flag], each candidate in Tableau (11) would be equally viable; it is in such a case that the effect of other constraints can emerge to produce initial gemination as the default exponent of the denotative.

3.1 The denotative of unflagged bivocalic stems

The denotative of *fili* 'choose' is *ffili*, which I analyze as containing a final bimoraic foot. The mora of the initial geminate is not footed. I provide a representation of such a structure in (12) below; what is important about this form is that that morpheme boundary (evaluated at the segmental level) is well-aligned to the foot boundary.[4]

(12) Prosodic representation of *ffili*



[4] This representation shows strictly moraic feet, regardless of syllable integrity. See Halle & Vergnaud (1987), Everett (1996), and Kennedy (2002) for discussions of moraic feet.

This representation satisfies the alignment constraint MORPHEME-TO-FOOT, as defined in (13). This follows from the fact that the exponent of the denotative is only the initial mora; as a result, all segmental material is morphologically an exponent of the stem.

(13) MORPHEME-TO-FOOT: Morpheme boundaries are aligned to foot boundaries.

Other logically possible parses of the string *ffili* include **[ffi][lí]*, in which primary stress does not occur on the penult, and **[f][físli]*, whose initial mora is parsed as its own foot. Both structures can satisfy MORPHEME-TO-FOOT, but there are several possible strategies for ruling them out: one is to forbid monomoraic feet, while the other is to minimize the number of feet in the word. I choose the second strategy, since it will also help rule out longer candidates like **[**fili**][fíli]*. To achieve this size restriction, I appeal to ALLFEETRIGHT, defined in (14).

(14) ALLFEETRIGHT Feet are final: assess a violation for every mora between each foot and the right edge of the word.

The effect of ALLFEETRIGHT is to prefer candidates with fewer feet. Thus, a reduplicated form in which the affix does not require an additional foot would be preferred over one with an affix that comprises its own foot. I summarize this in Tableau (16), where it is shown that regardless of the shape of a prefix, the best forms are those with single feet. Only one other candidate satisfies both constraints: ***fi**-fili*, with an unparsed initial syllable. I propose that this form is ruled out by a low-ranking constraint of the *STRUCTURE family, *SEGMENT, which is defined in (15).

(15) *SEGMENT Assess a violation for every root node in the output.[5]

(16)	fili + DENOTATIVE	MORPHEME-TO-FOOT	ALLFEET RIGHT	*SEGMENT
a.	fi[lí-**li**]	*!		**
b.	[f][fíli]		*!*	
c.	[fìli][**fíli**]		*!*	****
d.	[**fili**][fíli]		*!*	****
e.	[**fif**][fíli]		*!*	***
f.	[ffi][lí]		*!	
g.	**fi**-[fíli]			*!*
h.	☞ f[fíli]			

[5] In this and subsequent tableaux, I only note violations of *SEGMENT that are incurred by the reduplicant, since every candidate's stem would incur the same number of additional violations.

The introduction of AllFeetRight into the system has potentially undesirable consequences for the analysis of flagged stems. For example, most of the candidates in Tableau (11) above contain two feet; however, it is no stretch to imagine a suffixed form with a minimally-sized exponent of the denotative. That is, one can imagine an output **βuroo* which better satisfies AllFeetRight than the actual *βuro-**βuro*** does. This is especially worrisome since it must be considered that if an initial geminate consonant in *ffili* can satisfy Morpheme-to-Foot, then so could a final geminate vowel in **βuroo*.

There are two possible ways of parsing **βuroo*. One, **βu[rÓo]*, has its flag on a non-initial mora; as such, it is worse by Align-Flag-Left than *βuro-**βuro*** is. The full suffix will be chosen as long as Align-Flag-Left outranks AllFeetRight.

The other form, **[βÚro]o*, has its flag well-aligned, but at the expense of not having penultimate stress. Since AllFeetRight is ranked lower than Align-Flag-Left, there must be some other way ruling this form out. I appeal to the constraint Lapse, which forbids adjacent unstressed moras. These effects are summarized in Tableau (18).

(17) Lapse Unstressed moras must not be adjacent

(18)	βuro [+flag] + Denot	Lapse	Max Flag	Morpheme -to-Foot	Align Flag-L	AllFeet Right
a.	**b**[bÚro]				*!	
b.	☞ [βÙro][**βúro**]					**
c.	βu[rÓo]				*!	
d.	[βÚro]o	*!				*

The constraint hierarchy developed in this section makes the following generalization: verbs with a lexically specified [+flag] feature must receive a suffix to derive denotative forms, because the [+flag] feature forces the stem to be initial. Despite the activity of AllFeetRight, the suffix must be realized as its own foot. If the stem is not specified as [+flag], the affix is realized as initial gemination, in order to minimize violations of AllFeetRight. As yet, the only crucial constraint ranking is the position of Align-Flag-Left, MaxFlag, and Lapse over AllFeetRight. In the next section, I explore whether this analysis obtains similar results for the denotatives of trivocalic stems.

3.2 The denotative affix and trivocalic stems

Trivocalic stems in Woleaian show the same positional allomorphy that bivocalic ones do for the denotative affix. Unpredictably, some receive a suffix, as in *parasa* → *perase-**rase***, while others undergo initial gemination, as in *fetagi* →

ffetagi. Like *βuro*, I propose that suffixing trivocalic stems are specified with the [+flag] diacritic, which forces the denotative affix to follow the stem.

The evaluation of the denotative form of *parasa* is illustrated in Tableau (19). Prefixed forms like **__pera__-perase* are ruled out by ALIGN-FLAG; however, it is now crucial that MORPHEME-TO-FOOT be ranked over ALIGN-FLAG-LEFT. If this were not the case, the system might choose a suffixed candidate like (19a) **[pÈra][sé-__se__]*, which has a well-aligned [+flag], as opposed to the actual form (19e) *pe[rÁse][__rase__]*, in which alternating stress forces [+flag] to associate to its second mora.

(19)	parasa [+flag] + DENOTATIVE	LAPSE	MORPHEME-TO-FOOT	ALIGN FLAG-L	ALLFEET RIGHT
a.	[pÈra][sé-__se__]		*!		**
b.	[__pèp__]pe[rÁse]			***!	***
c.	[__perà__]pe[rÁse]			***!	***
d.	[ppe][rÁse]			**!	**
e.	☞ pe[rÁse][__ráse__]			*	**
f.	[pÈra]se[__ráse__]	*!			***

In Tableau (19) it appears that if the input were not specified as [+flag], then (19d) **[ppe][rÁse]* would emerge as the optimal candidate. In other words, the initial gemination pattern results simply from the absence of the [+flag] diacritic; this result is pursued in Tableau (20), which evaluates the denotative of the trivocalic stem *feragi*. In this case, the gemination pattern does not minimize violations of ALLFEETRIGHT, as was true of *ffili* in Section 3.1. Since the stem is itself trivocalic, any exponent of the denotative will result in a form with at least four moras, and thus at least two feet. The output (20d) *[ffe][ragi]* is therefore tied with (20e) *fe[ragi][__ragi__]* for ALLFEETRIGHT. Nevertheless, in a manner parallel to the choice of *ffili* over **__fi__-fili*, *SEGMENT can choose among them.

(20)	feragi + DENOTATIVE	MORPHEME-TO-FOOT	ALIGN FLAG-L	ALLFEET RIGHT	*SEGMENT
a.	[fèra][gí-__gi__]	*!		**	**
b.	[__ferà__]fe[rági]			***!	****
c.	[__fèf__]fe[rági]			***!	***
d.	☞ [ffe][rági]			**	
e.	fe[ràgi][__rági__]			**	****!

The denotative pattern can thus be summarized as follows: a stem will realize the denotative affix as initial gemination, in order to minimize violations of MORPHEME-TO-FOOT, ALLFEETRIGHT and *SEGMENT. However, if a stem is underlyingly specified with the diacritic [+flag], it emerges with a suffix for the denotative. This is true whether the stem contains two or three vowels. In the next section, I provide an analysis of the progressive affix. Given that verbs can be specified as [+flag], which indirectly forces them to be word-initial, the account must be able to predict prefixes even with such stems.

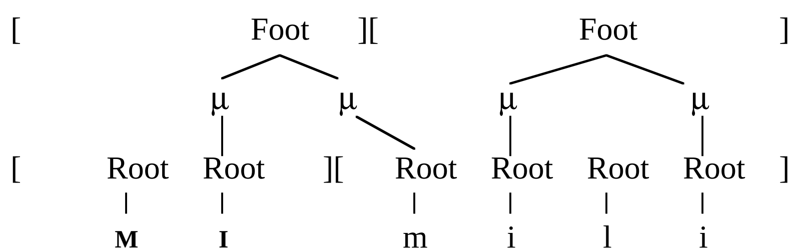
4. An Optimality Theoretic account of the progressive affix

In the preceding section, I attribute the shape of the denotative affix to MORPHEME-TO-FOOT, a non-morpheme-specific constraint that requires morphemes to be well-aligned to feet. Neither allomorph of the denotative violates this constraint. Since the progressive is also a morpheme, it is important to ensure that it too can satisfy MORPHEME-TO-FOOT.

The fact that gemination occurs at a morpheme boundary may suggest that Woleaian progressives cannot satisfy MORPHEME-TO-FOOT. For example, in a form like *[**mim**]-[mili]*, the medial geminate branches into two feet. However, there are two possible representations of the geminate in this form: single-root and two-root geminates.

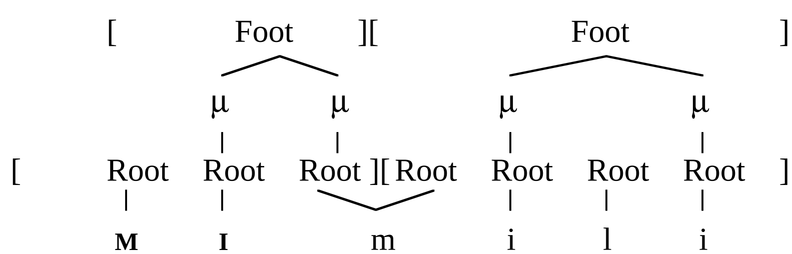
A single-root geminate here would violate MORPHEME-TO-FOOT, as the representation in (21) shows. Since the morpheme boundary must occur before the medial *m*, it falls within the first foot.

(21) Prosodic representation of single-root ***mim***-*mili*



However, a two-root geminate can satisfy MORPHEME-TO-FOOT, as long as the two roots of the geminate are analyzed as belonging to different morphemes. Such a representation is illustrated in (22) below. Since the morpheme boundary falls between the two halves of the geminate, it is well-aligned to feet.

(22) Prosodic representation of two-root ***mim***-*mili*



Selkirk (1990) and Davis (1999) offer some discussion of the advantages of single-root and two-root representations of geminates. What is curious here is that Woleaian initial gemination is represented as a single root, while medial gemination is represented as two roots sharing place features. Both structures satisfy MORPHEME-TO-FOOT.[6]

Although the progressive can satisfy MORPHEME-TO-FOOT, there will be some additional difficulty in derving its shape from the system developed in Section 3. In each tableau so far in this paper, I have included a candidate that looks like a progressive form, but the actual denotative is always more satisfactory. I repeat several such pairs in Tableaux (23-26), which compare each denotative form next to what the stem's progressive would look like.

(23)	fili + RED	MORPHEME-TO-FOOT	ALIGN FLAG-L	ALLFEET RIGHT	*SEGMENT
a.	[**fif**][fíli]			**!	***
b.	☞ f[fíli]				

(24)	feragi + RED	MORPHEME-TO-FOOT	ALIGN FLAG-L	ALLFEET RIGHT	*SEGMENT
a.	[**fèf**]fe[rági]			***!	***
b.	☞ [ffe][rági]			**	

(25)	parasa [+flag] + RED	MORPHEME-TO-FOOT	ALIGN FLAG-L	ALLFEET RIGHT	*SEGMENT
a.	[**pèp**]pe[rÁse]		***!	***	***
b.	☞ pe[rÁse][**ráse**]		*	**	****

(26)	misi [+flag] + RED	MORPHEME-TO-FOOT	ALIGN FLAG-L	ALLFEET RIGHT	*SEGMENT
a.	[**mìm**][mÍsi]		**	**	***
b.	☞ [mÌsi][**mísi**]			**	****

Tableaux (23) and (24) clearly show the problem: for *fili* and *feragi*, no ranking can choose the progressive form. Furthermore, although we could appeal to a constraint requiring the progressive to be a prefix (presumably, a formal Alignment constraint), this would still be satisfied by both *ffili* and *fferagi*. It may then be impossible for any augmentation of the constraint hierarchy to produce

[6] Interestingly, the segmental alternations seen in gemination, such as *ll* → *nn* and *gg* → *kk*, can be handled in a uniform manner, regardless of whether the geminate is represented as a single or double root node. The restriction against *ll*, for example, can follow from a constraint against any association between *l* and a mora. Since both single-root and double-root geminates involve segments linking to moras, the result is that *ll* is forbidden regardless of its representation.

the progressive reduplicant's shape. One recourse would be an appeal to a templatic constraint of the form PROG = $\sigma_{\mu\mu}$, but I reject this since it is a morpheme-specific alignment constraint, which makes the typological prediction of prosodic back-copy (McCarthy & Prince 1999).

The alternative I propose is to posit that the progressive affix itself is specified as [+flag]. The remainder of this section will show that the heavy prefix form of the progressive follows from this specification, regardless of whether the verb stem itself is [+flag].

4.1 The progressive of stems without [+flag]

If the progressive is specified as [+flag] and is attached to a bivocalic stem like *mili*, two facts follow: the progressive must be a prefix, and it must be bimoraic. Its status as a prefix is a result of ALIGN-FLAG-LEFT, which is violated by suffixed forms like (27b) **[mÌli][**__míli__**]*. The high rank of MAXFLAG ensures that a stress occurs somewhere in the reduplicant, ruling out forms like (27a) ****__mi__***-*[míli]* and, crucially, (27e) **m[míli]*.

This result is summarized in Tableau (27). Note that only the prefixed forms (27d) ***[__mÌm__]****[míli]* and (27c) ****[__mÌli__]****[míli]* are satisfactory by MAX-FLAG and ALIGN-FLAG-LEFT, and are ultimately differentiated by *SEGMENT.

(27)	mili + PROG [+flag]	MAX FLAG	ALIGN FLAG-L	ALLFEET RIGHT	*SEGMENT
a.	**__mi__**-[míli]	*!			**
b.	[mìli]-[**__mÍli__**]		*!*	**	****
c.	[**__mÌli__**]-[míli]			**	****
d.	☞ [**__mÌm__**]-[míli]			**	***
e.	m[míli]	*!			

In Tableau (28), the progressive form is shown to be a heavy syllable prefix for trivocalic stems as well. As was the case for Tableau (27), the number of plausible candidates is restricted by constraints like MORPHEME-TO-FOOT and MAXFLAG. Of the three prefixed forms, only (28c) ***[__meM__]****[metáfe]* and (28b) ****[__metÀ__]****[metáfe]* satisfy MORPHEME-TO-FOOT. However, they both incur a single violation of ALIGN-FLAG-LEFT, since the [+flag] element must occur on the second mora in order to ensure alternating stress.

(28)	metafe + PROG [+flag]	MORPHEME -TO-FOOT	ALIGN FLAG-L	ALLFEET RIGHT	*SEGMENT
a.	[**__mÈ__**-me][táfe]	*	**	**	**
b.	[**__metÀ__**]-me[táfe]		*	****	****!
c.	☞ [**__meM__**]-me[táfe]		*	****	***
d.	me[tàfe]-[**__tÁfe__**]		***!	*	****

I omit candidates with initial gemination, as in **mmetafe*, as possible progressive forms in Tableau (28). Such forms are avoided in one of two ways: if the initial geminate were a single-root geminate, MAX-FLAG would be violated, since the diacritic would be associated to the stem's segmental material and not to the prefix. If the initial geminate were a two-root form, as in **[**m**-me][tafe]*, then the morpheme boundary would not be well-aligned to a foot. Hence, neither representation could compete with the prefixed forms in Tableau (28).

Stems without [+flag] thus receive a heavy prefix for the progressive, regardless of how many vowels are in the stem. In the next section, I show how the same result obtains for stems that are [+flag]; that is, even if both the stem and affix are [+flag], the progressive affix still inevitably appears word-initially.

4.2 The progressive of [+flag] stems

Tableau (29) shows how the progressive of [+flag] *misi* would be evaluated. The process is nearly identical to the evaluation of *mili* in Tableau (27), but since there is an additional [+flag] specified in the input, there are more violations of ALIGN-FLAG-LEFT to assess.

Interestingly, since both the stem and affix are [+flag], (29b) **[mÌsi][**mÍsi**]* and (29c) **[**mÌsi**][mÍsi]* are both tied with (29d) *[**mÌm**][mÍsi]* by ALIGN-FLAG-LEFT, but the heavy-syllable form emerges through its better satisfaction of *SEGMENT.

(29)	misi [+flag] + PROG [+flag]	MAX FLAG	ALIGN FLAG-L	ALLFEET RIGHT	*SEGMENT
a.	**mi**-[mÍsi]		*	*	**
b.	[mÌsi][**mÍsi**]		**	**	****!
c.	[**mÌsi**][mÍsi]		**	**	****!
d.	☞ [**mÌm**][mÍsi]		**	**	***

One candidate I omit from Tableau (29) is **[**mÌ**][mÍsi]*, which contains a monomoraic prefix. This form satisfies ALIGN-FLAG-LEFT better than the actual output does, but I exclude it because it does not contain alternating stress.

The system also predicts a heavy-syllable prefix for [+flag] trivocalic stems like *parasa*. As was the case for *metafe* in Tableau (28), a monosyllabic prefix like (30a) **[**pÈ**-pe][rÁse]* violates MORPHEME-TO-FOOT. Since the remaining candidates all contain both a stem [+flag] and an affix [+flag], they are tied by ALIGN-FLAG-LEFT, regardless of the position of the affix. As a result, they are sorted out by *SEGMENT, which prefers (30c) *[**peP**]-pe[rÁse]* over the other remaining candidates.

Furthermore, I should add that a progressive candidate with initial gemination like **pperase* would not compete with the candidates in Tableau (30), since, like **mmetafe*, it would violate either MAX-FLAG or MORPHEME-TO-FOOT.

(30)	perase [+flag] + PROG [+flag]	MORPHEME-TO-FOOT	ALIGN FLAG-L	ALLFEET RIGHT	*SEGMENT
a.	[**<u>pÈ</u>**-pe][rÁse]	*	**	**	**
b.	[**<u>perÀ</u>**]-pe[rÁse]		****	**	****!
c.	☞ [**<u>peP</u>**]-pe[rÁse]		****	**	***
d.	pe[rÀse]-[**<u>rÁse</u>**]		****	**	****!

The progressive can thus be summarized as follows: the affix is specified underlying with the diacritic feature [+flag]. This is the same diacritic that forces denotatives to be suffixes for [+flag] verbs. The effect of this feature on the progressive affix is that the morpheme will always be realized as a prefix, regardless of whether the verb to which it attaches is also [+flag]. Furthermore, since the diacritic represents lexical stress, the prefix always forms its own foot, and as a result is consistently bimoraic.

The positional and prosodic qualities of Woleaian reduplication are therefore consequences of the ability of both verbs and reduplicants to be specified with the [+flag] diacritic. The progressive reduplicant is [+flag] and is thus always word-initial. However, since the denotative is not [+flag], its position depends on the verb stem to which it attaches. A [+flag] verb receives a denotative suffix; otherwise, the denotative is realized as an initial geminate. These generalizations are summarized in Table (31).

(31)		**Stem**	
		unspecified	[+flag]
Affix	unspecified	initial gemination	suffix
	[+flag]	heavy syllable prefix	heavy syllable prefix

5. Discussion

There are several important consequences of this analysis. First, three different shapes of reduplicants follow from the same system, with no explicit templatic requirement whatsoever. Second, allomorphy is handled simply by the presence of a morpholexical feature, and the ordering of the progressive and denotative affixes is a function only of this lexical feature, and not of a morpheme-specific constraint like ALIGN-PROGRESSIVE. Third, an apparently complicated system is shown to follow from a set of uncomplicated constraints.

The notion that the three reduplicative shapes are all functions of the same constraint hierarchy is an important result, especially since no shape variant is the product of a templatic requirement. Thus, despite the apparent morpheme-specific prosody of each affix, the allomorphy of the denotative and the consistent shape of the progressive are both emergent effects of the interaction between the diacritic [+flag] and Markedness constraints like ALLFEETRIGHT and *SEGMENT. As such, the analysis characterizes Woleaian reduplication as a prosodic case of the Emergence of the Unmarked (McCarthy & Prince 1994, 1999). A templatic approach would be dogged by a number of problems; particularly, its mechanism for dealing with the denotative allomorphy would no doubt be cumbersome.

The major problem for a templatic approach to the denotative is this: while the choice of initial gemination or suffixed foot is a function of the stem, a templatic requirement holds over the affix. As a result, a diacritic would have to be used to call explicitly upon some reduplicative allomorph. That is, a templatic approach needs to claim that a [+flag] stem (dispensing of the notion of [+flag] in Sections 3 and 4) can only take a [+flag] reduplicant, which is then subject to constraint like [+flag]RED = FOOT, and another constraint like [+flag]RED = suffix. It would therefore be a complete accident that disyllabic feet can only be suffixes, and conversely that gemination can only occur stem-initially. Add a second reduplicative morpheme to the system, and further complication arises: it is then also an accident that the progressive is never a suffix.

The fact that the ordering of affixes follows simply from the requirements of placing [+flag] is also a satisfying result. The alternative would be to appeal to specific ordering constraints like ALIGN-ASPECT, ALIGN-STEM, and ALIGN-DENOTATIVE. However, Woleaian suggests that these morpheme-ordering constraints are not necessary, since ALIGN-FLAG-LEFT is sufficient to achieve the proper order. It remains to be seen whether [+flag] and ALIGN-FLAG are present in other Micronesian languages, and can be used for the same effect. What is admittedly odd about the analysis (although, not necessarily a drawback) is its use of a diacritic to place lexical stress, despite the fact that the stress pattern itself remains unchanged by the presence of the diacritic.

Lastly, except for the addition of those constraints that operate over the diacritic [+flag], the analysis in this paper has made use of a small and uncomplicated set of constraints, such as *LAPSE, MORPHEME-TO-FOOT, ALLFEETRIGHT, and *SEGMENT. These same constraints appear in different orders of priority in the reduplicative systems of other Micronesian languages (Kennedy 2002), which illustrates the capacity of a constraint-based theory to characterize linguistic divergence simply as the reordering of formal priorities.

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