

The Multiple Processes of Olo Verb Reduplication

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This paper examines the different processes of reduplication in Olo,¹ a language of Papua New Guinea. Verb reduplication in Olo marks the continuous aspect. In recent years reduplication has been used in phonological argumentation (Marantz 1982; Mester 1988; McCarthy and Prince 1990). This paper deals with two of the main phonological problems in reduplication: the isolation of that part of the word to be reduplicated, and the infixion of reduplicated material. It also deals with a third, more minor problem, that of invariant melodic material being involved in reduplication. This paper will examine the different types of reduplication in Olo and compare the adequacy of CV phonology (Marantz 1982), prosodic methodology (McCarthy and Prince 1990), and moraic theory (Hyman 1985; Hayes 1989) in accounting for the data. Olo has reduplication that involves infixial data and noninfixial data, which makes it useful for comparing the different approaches. The conclusions reached in the paper are that Hyman's (1985) approach to moraic theory, particularly the attachment of the syllable onset to the first mora, combined with tier conflation provide the best account for the Olo data not involving invariant melodic material, while McCarthy and Prince's (1990) approach of echo morphemes provides the best solution to the reduplication involving invariant phonemes.

1 The Sound System in Olo

The Olo language has seven vowels: /i, I, e, a, u, U, o/. The phoneme /e/ has an allophone [æ] which only occurs before velars. A chart of the vowels is given in figure 1.

	Front	Central	Back
high	i		u
mid	I		U
low	e	a	o

figure 1

Olo Vowel Chart

¹ The Olo language is spoken in the Sandaun (West Sepik) province of Papua New Guinea by approximately 13,000 speakers. It is divided into 3 main dialects (Staley ms.) with many subdialects. Olo is a member of the Wapei family of the Torricelli phylum (Laycock 1975), a phylum level isolate.

All the vowels can be the nucleus of a single vowel syllable. Olo has 5 diphthongs [ei], [ai], [oi], [au], and [ou] that can form the nucleus of the syllable. The mid vowels are not found as a member of a diphthong. Further, the sequences [eu], [ie] or [il] are not found in any Olo word. There are a few words in Olo that have a sequence of high vowel – low vowel. In all cases there is a syllable break between the vowels. The evidence of a syllable break is based on timing distinctions between these vowel sequences and those constituting diphthongs and the difference in stress patterns. Words with a high vowel – low vowel sequence have different stress levels on the two vowels, as in example 1, while those which have diphthongs have a single stress level in the diphthong, as in 2.

- 1 a. *lí.o*
older sister
- b. *pu.á.pe*
a type of palm tree
- 2 *l-áu*
3m-come

The consonants of Olo are /p, t, k, f, s, l, r, m, n, N, w, y/. A chart is given below for the sounds.

	labial	alveolar	velar
stops	p	t	k
fricatives	f	s	
lateral		l	
liquid		r	
nasals	m	n	N
semi vowel	w	y	

figure 2

Olo Consonant Chart

The stops in Olo are lenis and unaspirated. Voicing is noncontrastive for stops in Olo. Olo has three nasals, the bilabial (m), alveolar (n), and velar (N). While both the bilabial and alveolar nasals have full distributions, the velar nasal only occurs before a velar stop. It is contrastive with the alveolar nasal as shown in example 3.

- 3 *[wangu]²* *[waNgu]*
A man's name land crab

² The orthography uses the ng to signal the phonetic sequence [Ng], while the sequence nk signals the phonetic sequence [ng].

Stress is mostly predictable, occurring on the penultimate syllable. There are a few words which have the antepenultimate syllable stressed. A contrastive pair is given below in example 4.

- 4 a. *wai.kó.pou*
man's name
- b. *wá.ko.pou*
wooden pestle

The most frequent syllable pattern is CV. In a count done on the 104 verbs which reduplicate³, the CV pattern made up 126 of the 222 syllables, accounting for close to 56% of all the syllables. The different CV patterns for Olo syllables are given in figure 3.

syllable	number	%
V	29	13
VV	10	5
VC	20	9
VCC	2	1
CV	126	56
CVV	15	7
CCV	6	3
CCVV	1	0
CVC	13	6

figure 3

Words in Olo are most frequently composed of two syllables: 508 of the 862 words (59%) in the sample of Olo nouns⁴ and reduplicative verbs. Three syllable words comprised 217 out of the sample (25%) and there were 103 one syllable words in the sample (12%). There were just 17 four syllable words, comprising just 2% of the sample. Words of more than four syllables are permissible, but must be formed with inflectional morphology. The longest one I have found consists of 6 syllables.

³ The data is taken from (Staley 1994a), and my own field notes and observations. The data was gathered over a period of 10 years (1981-1991) while living in the speech community. The data is not the result of complete elicitation of reduplication, but rather a collection of the known reduplicated verbs. There are surely other verbs which reduplicate, but there are also others that clearly do not reduplicate. One example of a verb that does not reduplicate is *retai* 'know'.

⁴ The sample of nouns used in the paper is composed of all the nouns listed in Staley (1994a).

1.1 The general outline of verb reduplication

For most Olo verbs, describing the reduplication process is amenable to prose statements. A prose statement is useful in giving a general outline of the range of data. Olo has three main classes of verb reduplication: final CV, initial syllable, and reduplication of the final C with the insertion of an invariant *e*. The reduplication of the final CV is the most common type of reduplication making up 82 of the 104 instances of reduplicated verbs. Examples 5 and 6 illustrate this type of reduplication.

- | | | | | |
|---|--------------------------|---|---------------|-------------------------------------|
| 5 | <i>ailo</i> ⁵ | 'to call out' | <i>ailólo</i> | 'calling' |
| 6 | <i>alfo</i> ⁶ | 'put: <u>3m</u> :inside (something else)' | <i>alfofo</i> | 'to keep putting: <u>3m</u> inside' |

The second type of reduplication takes the initial syllable⁷ and duplicates it and attaches it as a prefix on the verb as in 7. There are only 3 verbs that use this form of reduplication.

- | | | | | |
|---|-------------|-----------|---------------|--------------|
| 7 | <i>resi</i> | 'stretch' | <i>resesi</i> | 'stretching' |
|---|-------------|-----------|---------------|--------------|

The third form of reduplication reduplicates the onset of the last syllable and places it and the invariant vowel *e* preceding the final syllable.

- | | | | | |
|---|---------------|--------------|-----------------|--------------|
| 8 | <i>flousi</i> | 'suck on' | <i>flousesi</i> | 'sucking on' |
| 9 | <i>aisi</i> | 'buy, bring' | <i>aisesi</i> | 'buying' |

1.2 Infixing the reduplicated final CV, a further complication

The first type of reduplication, that of the final CV, is not simply just a case of reduplicating the last syllable, as could appear from 5 and 6. In 10 of the 82 examples the final vowel is not reduplicated, as in example 10 and 11. It is not the case that this is an instance of syllable reduplication and then reduction of the diphthong, because diphthongs are found before consonants in nonfinal positions, as in example 11.

- | | | | | |
|----|--------------|----------------|----------------|----------------------|
| 10 | <i>aplei</i> | eat: <u>3p</u> | <i>aplelei</i> | 'eating: <u>3p</u> ' |
|----|--------------|----------------|----------------|----------------------|

⁵ The reader is reminded that the normal stress pattern is penultimate, with antepenultimate the only option. Thus on two syllable words the stressed syllable is penultimate. In all cases if the stress is on the penultimate syllable before reduplication it will shift to remain on the penultimate syllable. The same stress shift occurs for words with antepenultimate stress to maintain the antepenultimate stress pattern.

⁶ The underlined consonant is an object infix marker, and is obligatory in the third person. For more information on this see Staley (1989). Underlining is used in the paper to mark out infixes.

⁷ The reduplication is of more than the initial CV as the subject prefix can be included in the part reduplicated, as will be explained below.

11 *einei* 'go around'

einenei 'going around'

This class of data is crucial to the problem because it involves specification of exactly what is going to be reduplicated and affixing it inside the word.

2.0 Olo Reduplication and CV phonology

Since the prose description of how to reduplicate in Olo includes reference to the final CV of a verb, CV phonology should be a useful way to account for the data in a theoretical way. However, CV phonology does not adequately account for the facts of Olo reduplication.

Marantz (1982) proposes firstly that the whole word is reduplicated and then only the part that is actually needed is attached to the word. He does this by using the idea that there is a separate tier composed of consonants and vowels that give the shape of the morpheme, but which does not specify the actual sounds. A display of different tiers is given in figure 4.

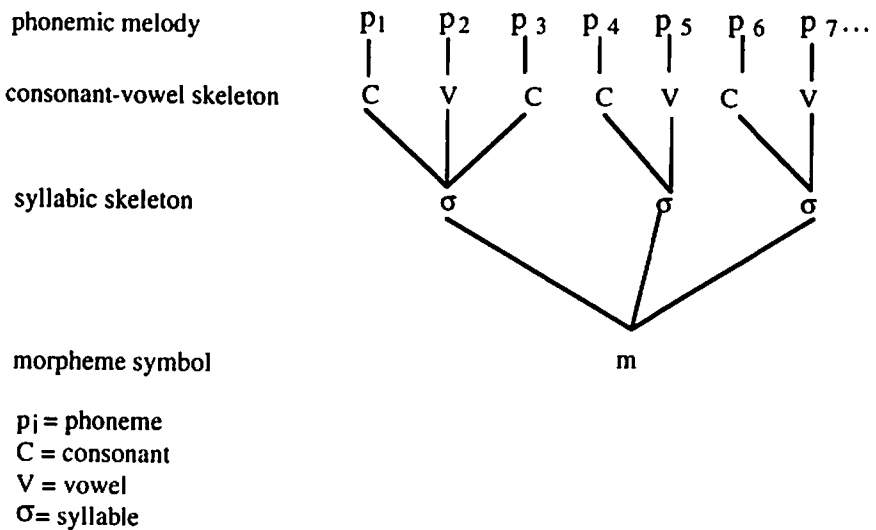


figure 4

Marantz proposes that using the CV skeleton will account for the vast majority of reduplicated data. The skeleton of Cs and Vs is provided by the grammar, the proper CV pattern to be filled is specified according to the particular class of root. The skeletal pattern is filled either from right to left or left to right until all of the skeletal elements are filled or there are no more melodic elements to fill them. Marantz provides some Agta data to illustrate the process, given below in example 12.

12 t a k k i t a k k i
 | | | | | | |
 CVC + CV C C V = taktakki 'legs'

Marantz proposes that the actual morpheme is a CV skeleton and the actual phonemic material is copied from the root. This will account for some of the data in Olo. One of the words for which it accounts is given in example 13.

13 o t o p a o t o p a = otopapa 'blowing'
 | | | | | |
 VCVCV + CV

With further data, however, this analysis quickly runs into problems. The first is that Marantz specifies no mechanism for selection of a word internal section for reduplication. As can be seen from examples 10 and 11 above, the final vowels are not reduplicated. This means that the blind search mechanism that Marantz proposes of scanning either left to right or right to left is inadequate to handle data involving infixes.

2.1 Directional Scanning

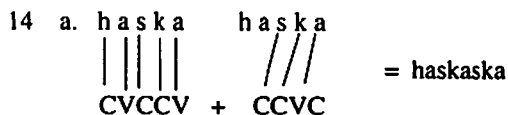
A key part of dealing with reduplication involves specifying which part of a word gets reduplicated. The rule must specify all and only those parts which are copied. Marantz (1982:446-447) proposes 4 conditions for specifying the mechanisms of reduplication. The fourth, *Condition D: (i)*, states:

“Linking of the phonemic melody to the reduplicating skeleton either begins with the leftmost phoneme of the melody linking to the leftmost C-V slot in the skeleton eligible under Condition A⁸ and proceeds from left to right or begins with the rightmost phoneme of the melody linking to the rightmost C-V slot of the skeleton and proceeds from right to left. In the unmarked case, reduplicating prefixes

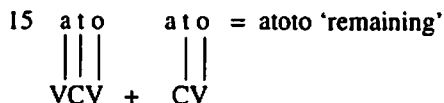
⁸ Condition A simply states that nonsyllabic material is linked to C's and syllabic material to V's.

associate with their melodies from left to right, reduplicating suffixes from right to left."

In practice this condition means that the linking is done from one end of the word and moves toward the other until there are either no more C or V slots to fill or phonemes to fill them. The filling of slots in a one to one fashion and the discarding of left over material, either slots or phonemes, is Marantz's condition C. Marantz illustrates Condition D using Dakota data, given below in example 14. In (14 a) where the reduplication is correct, the scanning starts at the rightmost phoneme which is a vowel and so it is associated with the first V. The next phoneme is a consonant so it is associated with the next C, and finally the next consonant is associated with the next C. At this point there are no more members of the skeleton to be associated and the left over phonemes are dropped as is the rightmost C of the skeletal tier. The scanning in this case is right to left. Left to right scanning is illustrated in 14 b. In this particular case it produces the wrong pattern.



As can be seen from examples 13 and 15, Olo uses a Right to Left scanning. For CV phonology to work with words like *otopa* 'blow' and *ato* 'remain', the skeletal pattern for reduplication must be CV.



However Right to Left scanning will not work with words that have final diphthongs, as shown in example 16 a. The attachments needed are given in 16 b.

16 a. $e\ i\ n\ e\ i$ $e\ i\ n\ e\ i$
 * $\begin{array}{c} | \\ | \\ | \\ | \\ | \end{array}$ $\begin{array}{c} | \\ | \\ | \\ | \end{array}$ $\begin{array}{c} | \\ | \\ | \end{array}$ = * $e\ i\ n\ e\ i\ i$
 VVCVV + CV

b. $e\ i\ n\ e\ i$ $e\ i\ n\ e\ i$
 $\begin{array}{c} | \\ | \\ | \\ | \\ | \end{array}$ $\begin{array}{c} | \\ | \\ | \\ | \end{array}$ $\begin{array}{c} | \\ | \end{array}$ = $e\ i\ n\ e\ n\ e\ i$
 VVCVV + CV

A possible solution is to scan Right to Left for a C and then reverse the scan direction to Left to Right. While this is a possible solution, it violates condition *D* and would jeopardize the whole notion of directional scanning. Example 17 shows how this could work.

17 *einei* 'go around'

RL scan for C

$e\ i\ n\ e\ i$
 |
 C

now reverse scan and look for V

$e\ i\ n\ e\ i$
 ||
 CV

reduplicate the skeleton and infix
 around'

$e\ i\ n\ e\ n\ e\ i$ 'going

Since one of the key notions of using the CV skeleton must be violated to account for the Olo data, this approach can be safely rejected as a means of handling Olo reduplication.

3. Prosodic Morphology and Olo Reduplication

When we examine the proposals made by McCarthy and Prince we find that they provide many of the answers we need to account for the types of reduplication in Olo, although their work is not a complete solution.

McCarthy and Prince (1990:209-210) propose three "fundamental theses"

- (i) **Prosodic Morphology Hypothesis.** Templates are defined in terms of the authentic units of prosody: mora (μ), syllable (σ), foot (F), prosodic word (W), and so on.

- (ii) **Template Satisfaction Condition.** Satisfaction of templatic constraints is obligatory and is determined by the principles of prosody, both universal and language-specific.
- (iii) **Prosodic Circumscription of Domains.** The domain to which morphological operations apply may be circumscribed by prosodic criteria as well as by the more familiar morphological ones. In particular, the **minimal word** within a domain may be selected as the locus of morphological transformation in lieu of the whole domain.

McCarthy and Prince propose that the templates used in reduplication are not composed of CV skeleton tiers (Mester 1988), but rather are equivalent to some prosodic unit (their thesis *i*). They further propose that when doing morphology, the template must be followed. And finally they claim a preeminent position for the minimal word as being the center of morphological change, (their thesis *iii*). This places great importance on identification of the minimal word for any given language. Following the outline presented in McCarthy and Prince (1990), it should be possible to establish the minimal word for a given language. The minimal word is established by looking for those patterns of prosodic units which make up the overwhelming majority of phonological words in a language. If McCarthy and Prince are right, the establishment of the minimal word should be both straightforward and noncontroversial for a given language. The minimal word should be made up of one or more of the prosodic units—feet, syllable, or mora. In actual practice, it seems that the most likely candidate will consist of one or more feet. When dealing with feet it is important to determine whether the feet are trochaic (left headed,⁹ as in examples 18 and 19) or iambic which does not occur in Olo.



18

⁹ A trochaic foot has stress on the first syllable in the foot.



19

The data in Olo are very straightforward when it comes to determining the minimal word. Of the 104 instances of words that reduplicate, only 3 are composed of a single syllable. Only 17 are made up of three syllables. The vast majority, 84, are two syllable words, making up 80.8% of the sample. All two syllable words in Olo are trochaic, with the first syllable being stressed. The three syllable words are also trochaic. The distinction is that most (12) of the three syllable words have their feet calculated from the right, and the other 5 from the left. Overall 92.3% of the sample can be best analyzed as composed of trochaic feet with the calculation of the feet starting at the right. Another 4.8% can be analyzed as trochaic feet, working from the left, not the right. It is clear from this that the minimal word in Olo is two syllables making up a trochaic foot.

The second stage of the analysis concerns syllable weight. Some syllables in Olo have two moras, and some have one. In Olo a heavy syllable has either a diphthong or a coda. The second vowel in the diphthong or the syllable coda fills the second mora. Syllables with diphthongs are never closed, so there is no need for extra heavy syllables in Olo. In the 104 Olo reduplicative verbs, single mora syllables vastly outnumber syllables with two moras: 182 to 26. Double moras only occur 7 times as the second syllable of the foot. From this we can conclude that the basic syllable in Olo reduplicating verbs has only a single mora.

Figure 4 gives the figures for the different CV patterns in Olo reduplicating verbs. The symbol '#' indicates the number of examples and the number below the 'stress' column indicates which syllable from the left of the word is stressed. Two syllable words are always stressed on the penultimate syllable. An underscore '_' is used to delineate a syllable break where the object infix occurs¹⁰. At this point it is possible to conclude that the minimal word in Olo consists of a single trochaic foot, composed of two syllables, each with a single mora.

¹⁰ The process of infixation will be discussed later in the paper. What is important at this point is that in these cases no consonant would occur in this position if the infix did not occur. In those cases without the underscore this is not true, as a root consonant occurs in the syllable margin.

one syllable	#	two syllable	#	three syllable	#	stress
V	2	VCV	20	VCVCV	5	1
VV	1	VVCV	6	VCVCV	2	2
		VCVV	5	V_VCV	1	2
		VCCV	8	VCCVCV	5	2
		VCCVV	2	VCCVCVV	1	2
		VVCCV	1	VCVCCV	1	2
		VVCVV	2	CVCVCV	2	2
		VCCCV	1			
		VCCCVV	1			
		CVCV	21			
		CVVCV	3			
		CVCVV	2			
		CVCCV	10			
		CCVVCV	1			
		CV_V	1			
TOTAL	3		84		17	

Figure 4

3.1 The minimal word and reduplication in Olo

McCarthy and Prince show the workings of extrametricality for reduplication and infixation using Chamorro and Samoan data (McCarthy and Prince 1990). In Samoan each vowel is a separate syllable and stress is penultimate. The stressed syllable of Samoan words is reduplicated to indicate plurality. When the words are trisyllabic or longer the reduplicated part is infixed preceding the stressed syllable, as in example 20.

20 *galúe* 'work' *galulúe* 'works'

McCarthy and Prince (1990) propose analyzing the minimal word in Samoan as the rightmost trochaic foot. Doing this allows them to exclude everything which precedes this foot as extrametrical and to treat the reduplicated part as a prefix, not an infix. They say: "In all such cases, the sometime infix is a prefix to a prosodically characterized base" (McCarthy and Prince 1990:230). The steps for this procedure are illustrated in example 21 using their Samoan data. In example 21, the asterisk "*" marks off the extrametrical material from the minimal word.

- 21 *saváli* -> *sa* * *vali* (select the stressed trochaic foot as the minimal word)
 -> *sa* * *vali* (select the first syllable of the minimal word)
 -> *sa* * *va + vali* (reduplicate the syllable)
 -> *sa* * *vavali* (place as a prefix on the beginning of minimal word)
 -> *savavali* (reconstitute the word by replacing the extrametrical material)
- savaváli*

Of the 84 two syllable reduplicating verbs in Olo, exactly half fit the minimal word pattern of a trochaic foot with two single mora syllables. In each case the first syllable is stressed and the second syllable reduplicates, with the reduplication being affixed¹¹ to the verb, as in 22 and 23.

- 22 *fále* *falé-le*
 arrive arriving
- 23 *áto* *ató-to*
 remain remaining

In the process of reduplication, the 16 words which have a heavy initial syllable show no distinction from words with light initial syllables, since the reduplication affects the second syllable of the word. Those words which have a heavy second syllable are affected, however. In this case the final vowel in the heavy syllable is considered extrametrical and does not participate in reduplication and is considered outside of the word for purposes of affixation of the reduplicated morpheme.

- 24 *ifei* -> *ife* * *i* (select the trochaic foot as the minimal word)
 -> *ife* * *i* (select the second syllable of the minimal word)
 -> *ife + fe* * *i* (reduplicate the syllable)
 -> *ife-fe* * *i* (place as a suffix on the end of minimal word)
 -> *ifefei* (reconstitute the word by replacing the extrametrical material)
- ifei* *iféfei*
 sit sitting

Three syllable words function in an identical manner to two syllable words. The minimal word is identified, the second syllable of that minimal word is reduplicated, the suffix is added and then any extrametrical part is replaced. The selection of the minimal word in a three syllable word is more complicated because stress maybe on either the first

¹¹ In these words the reduplicated morpheme does not illustrate infixation as it is not demonstrably inside the word. The process is identical to those words which do illustrate infixation of the reduplicated morpheme. However according to the proposals of prosodic morphology, this infixation in the whole word is treated as a suffix on the minimal word.

or second syllable. The minimal word for Olo is defined as a trochaic foot, that is, with stress on the first syllable of the foot. Example 15 shows the process with two three syllable words which have the initial syllable stressed. In this case all of the last syllable is extrametrical, and as such is ignored for purposes of reduplication and affixation of the reduplicated affix. This allows the affix to be treated as a suffix rather than an infix.

- 25 a *itipi* -> *iti* * *pi* (select the trochaic foot as the minimal word)
 -> *iti* * *pi* (select the second syllable of the minimal word)
 -> *iti + ti* * *pi* (reduplicate the syllable)
 -> *iti-ti* * *pi* (place as a suffix on the end of minimal word)
 -> *ititipi* (reconstitute the word by replacing the extrametrical material)

itipi *ititipi*
 go.down going.down

- b *álowi* -> *alo* * *wi* (select the trochaic foot as the minimal word)
 -> *alo* * *wi* (select the second syllable of the minimal word)
 -> *alo + lo* * *wi* (reduplicate the syllable)
 -> *alo-lo* * *wi* (place as a suffix on the end of minimal word)
 -> *alolowi* (reconstitute the word by replacing the extrametrical material)

*álowi*¹² *ałólowi*
 cut-3m cutting-3m
 cut him cutting him

When the initial syllable is not stressed, that syllable becomes extrametrical, so the minimal word can be formed out of a trochaic foot, as in example 26. In this case the extrametrical material is placed before the minimal word.

- 26 *elési* -> *e* * *lesi* (select the trochaic foot as the minimal word)
 -> *e* * *lesi* (select the second syllable of the minimal word)
 -> *e* * *lesi + si* (reduplicate the syllable)
 -> *e* * *lesi-si* (place as a suffix on the end of minimal word)
 -> *elesisi* (reconstitute the word by replacing the extrametrical material)

ełési *ełesisi*
 burn-3m burning-3m
 burn it burning him

¹² The *-l-* infix is underlined to show that the verb is inflected for a 'third person masculine singular object'. When infixation forms a geminate cluster, the cluster is reduced to a single consonant. In this word the presence of the *l* in the root is shown by the third plural form *aplowi* 'cut them'.

4 Initial syllable reduplication

There are three words in Olo that reduplicate the first syllable to mark continuous aspect, *resi* 'stretch', *ratei* 'exist, live' and *renko* 'lay your head on something as a pillow'. The reduplicated forms are given below. It is obvious that all the analyses can handle this data as it matches the examples given earlier in 13, 15, 18 and 19 in having only a CV pattern on the edge of the root to reduplicate, and need not involve infixation.¹³

27	a.	<i>resi</i>	'stretch'	<i>rerési</i>	'stretching'
	b.	<i>ratei</i>	'live'	<i>rarátei</i>	'living'
	c.	<i>renko</i>	'lay with your head on something as a pillow'	<i>rerénko</i> ¹⁴	'laying with your head on something as a pillow'

The data given in 27 is interesting because it shows a second pattern of reduplication. The initial syllable reduplication is a very small pattern, making up less than 3% of the data. Further, *ratei* in 27b also reduplicates according to the pattern illustrated in 24 (shown below in 28), which is becoming the dominant way to mark continuous aspect. The initial syllable reduplication is used for *ratei* by a only a few conservative speakers, some of whom use both patterns.

28	<i>ratei</i>	->	<i>rate</i>	*	<i>i</i>	(select the trochaic foot as the minimal word)
		->	<i>rate</i>	*	<i>i</i>	(select the second syllable of the word)
		->	<i>rate+te</i>	*	<i>i</i>	(reduplicate the syllable)
		->	<i>rate-te</i>	*	<i>i</i>	(place as a suffix on the end of minimal word)
		->	<i>rate</i>			(reconstitute the word by replacing the extrametrical material)
	<i>ratei</i>		<i>ratétei</i>			
	live		living			

4.1 Inclusion of the subject prefix in the reduplicated form.

A complication in the behavior of the words with initial syllable reduplication is that reduplication is done after affixation of the subject prefix. Olo uses single consonant subject prefixes (Staley 1994a; Staley to appear). The prefix for third person plural is *p*. When the subject is third person plural and the verb is marked for continuous aspect, the *p* is reduplicated along with the onset of the syllable in the root, as in 29.

¹³ While it would be possible to claim that the reduplicated part is infixed it would unduly complicate the analysis and give no benefit.

¹⁴ The *n* is combined with the *k* as part of the onset of the next syllable as will be discussed below.

- | | | |
|----|---------------------------|--------------------------------|
| 29 | <i>Pe p-ratei uf.</i> | <i>Pe pra-p-ratei uf</i> |
| | they 3p-live village. | they CONT-3p-live village |
| | They live in the village. | They are living in the village |

There are two possible analyses: either the reduplicated part can be seen as the initial syllable (or mora), or it can be analyzed as a reduplication of a CV skeleton with the skeleton being made up of the sequence CCV. The data does not allow a choice between the two analyses. However, since skeletal reduplication does not work for the other types of reduplication, proposing it as a solution here would only further complicate the grammar.

5. The status of nasal + velar stops

The behavior of the velar stop in conjunction with the alveolar and velar nasals shows that the combination of a nasal and a velar stop is treated in the language as a single unit.¹⁵ The nasal is not the coda of one syllable and the stop the onset of the next. Rather they both are either in the onset or in the coda. So, if the stop is used in reduplication, the nasal is used also. This is illustrated in examples 30 and 31.

- | | | |
|----|-----------------|--------------------|
| 30 | <i>[eréNga]</i> | <i>[ereNgáNga]</i> |
| | meet | meeting |
| 31 | <i>[óNglo]</i> | <i>[oNglólo]</i> |

The same behavior is exhibited for an alveolar nasal preceding a velar stop, but not for an alveolar nasal preceding an alveolar stop. Compare 32 a. with b.

- | | | |
|----|------------------|------------------|
| 32 | a. <i>[Ingi]</i> | <i>[Ingingi]</i> |
| | follow | following |
| | b. <i>[antu]</i> | <i>[antútu]</i> |
| | run | running |

From this behavior we conclude that only the nasal and velar stop form a single unit. The sequence /mp/ is never involved in reduplication, and while the sequence of /nt/ does occur in reduplicated words, only the *t* in the sequence *nt* is used in the reduplication. I propose that the unit formed here is either the syllable onset, in which case they are reduplicated; or as shown in 32 b, the coda of a previous syllable where the velar is not part of the onset of the following syllable and included in the reduplication. While this works mechanically it would be useful to have some independent evidence to show that this is actually what is happening. I believe this evidence is provided by the

¹⁵ This section should be viewed as a report of ongoing research. The analysis works well, although its motivation is not as clear.

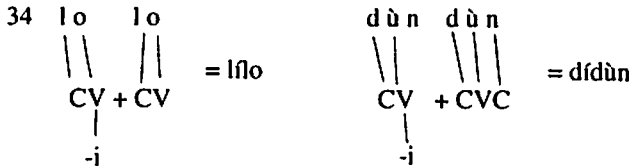
voicing patterns for the stops. All velar stops following nasals are voiced. However, all alveolar stops following nasals are voiceless. This is illustrated in example 33. While the environment is similar and the CV structure of both is VCCV, the crucial difference, I claim, is the syllable division. In the one case the syllable is divided between the nasal and the alveolar stop, and in the other case the syllable break precedes the nasal, as shown in example 33.

- 33 a. *inki* [l.ngi]
follow
- b. *antu an.tu*
run

The different syllable divisions provide both a unit to be used for reduplication (as in 32a) and the different environments needed to account for the distinct voicing patterns (as shown between 33a and 33b).

6 Melodic Overwriting

In his work on reduplication, Marantz (1982) discusses the issue of melodic overwriting, in which a certain portion of the reduplicated template is prespecified. This happens in those languages where part of the skeletal template is invariant. Marantz illustrates this with Yoruba data,¹⁶ given below in 34.



McCarthy and Prince argue that prespecification is inadequate to account for the data involving what they call echo word formation (McCarthy and Prince 1990). In cases of echo word formation, the CV template as proposed by Marantz (1982) clearly cannot work. To handle data from a Dravidian language, Kolami,¹⁷ the skeletal template would have to be either CV or CVV, with the choice based on whether the root had a heavy syllable or not. In those cases where the word to be reduplicated has only a single vowel in the first syllable, only a single vowel is overwritten. In cases where two vowels are in the first syllable, both are overwritten. Marantz's prespecification approach cannot handle this because there is no way, within the theory, to specify whether one or two vowels

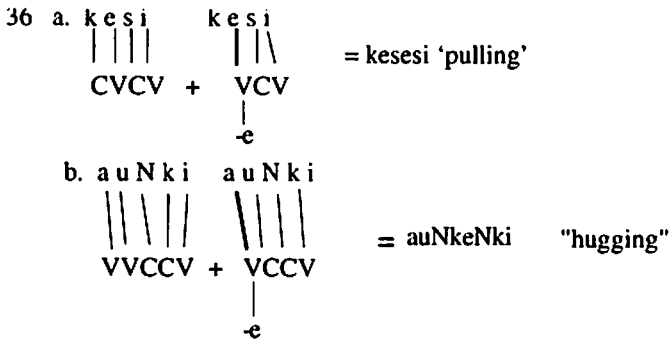
¹⁶ Marantz cites (Delano 1965) as his source.

¹⁷ McCarthy and Prince cite (Emeneau 1955) as their source.

should be written out. The data from McCarthy and Prince (1990:244) is given in example 35. The initial morpheme is echoed, i.e. repeated, and suffixed, but the melody of the initial syllable is overwritten by *gi*. The weight of the form to be repeated is transposed to that of the overwritten material. This means that the template cannot be specified as a skeletal pattern.

35	<i>pal</i>	<i>pal + gil</i>	'tooth'
	<i>kota</i>	<i>kota + gita</i>	'bring it!'
	<i>iir</i>	<i>iir + giir</i>	'water'
	<i>maasur</i>	<i>maasur + giisur</i>	'men'
	<i>saa</i>	<i>saa + gii</i>	'go (cont. ger.)' ¹⁸

Besides the data that McCarthy and Prince have cited to counter Marantz's proposal, Olo data involving reduplication with an invariant part cannot be handled by simple prespecification. In some Olo reduplicating words, the consonants come from the root, but the vowel is an invariant *e*, as in example 36 where attempts to handle the Olo data using Marantz's prespecification are given. In 36a the final vowel of the root is also dropped when the compound is formed because it gives rise to the sequence of [ie] which is disallowed in Olo words. The situation in Olo is similar to Kolami, except that instead of the prespecification of a single or dual vowel template, Olo has a choice of one or two consonants. The two patterns for the template are VCCV and VCV, with the choice dependent on the root. Clearly, it is not ideal to have two separate analyses.



¹⁸ McCarthy and Prince do not provide the surface forms for this data, I assume they should be:

palgil
kotagita
iirgiir
maasurgiisur
saagii

Rather than deal with a prespecified phoneme, McCarthy and Prince (1990) propose a mechanism that is tautological compounding of the whole base, with the invariant part substituting for a single prosodic unit in the compounded part. "The echo morphology of Kolami, then, consists of tautologous compounding, plus the melodic echo morpheme *gi*, along with the information that this melody links to the second member of the compound" (McCarthy and Prince 1990:245). The basic formulation is that the echo morpheme replaces a prosodic unit and maintains the weight of the prosodic unit, since the weight comes from the metrical template, not the melody.

With some modification McCarthy and Prince's formulation will work fairly well for Olo. The basis is to take the melodic material *e* and use the information supplied with it to overwrite the first syllable of the second member of the compound. Examples of how this will work in Olo are given in 37. In the first column the root is given, with the echo morpheme *e* plus the reduplicated root in parentheses. The second column shows the echo morpheme replacing the first syllable of the reduplicated root. The final vowel of the root is also dropped when the compound is formed. This is due to the forming of the disallowed vowel sequences [ie] or [il]. The final form is the surface manifestation.

	compound parts	root + echo replacement	final forms	surface form
		and second part of root		
37 a.	<i>eni</i> + (e + eni) follow	eni + (e+ni)	-> eni + eni	-> <i>eneni</i> following
b.	<i>esi</i> + (e + esi) hold	esi + (e+si)	-> esi + esi	-> <i>esesi</i> holding
c.	<i>kesi</i> + (e + kesi) pull	kesi + (e+si)	-> kesi + esi	-> <i>kesesi</i> pulling
d.	<i>aungi</i> + (e + aungi) hug	aungi+ (e + ngi)	-> aungi + engi	-> <i>aungengi</i> hugging
e.	<i>aisl</i> + (e + aisl) buy	aisl + (e + si)	-> aisl + esl	-> <i>aisesl</i> buying
f.	<i>aisi</i> + (e + aisi) sell	aisi + (e + si)	-> aisi + esi	-> <i>aisesi</i> selling

McCarthy and Prince (1990 p245) propose as a constraint on this type of reduplication that the overwritten form cannot be of a different metrical weight from the base form that is overwritten. They state "Only templates, not melodies, can supply invariant prosody. Thus, we predict the non-existence of an echo-word system that takes arbitrarily long input and that specifies both the quality and the quantity of some segment in the output."

It is clear that Olo is a counter example to this prediction. In example 37 a-c the first syllable that is replaced by the *e* is a light syllable, with only a single mora of length. However in 37 d-f the first syllable is clearly two moras long, yet it is replaced by a vowel with only a single mora. In this case the weight of the replaced syllable is not specified by the template of the echo of the root, but must be specified along with the invariant melody. This is so not because of violation of some inherent principle of metrical phonology, but is because the overwrite is not on the moraic tier, but rather on the syllabic tier. For this type of analysis to work on the Olo data, it must be permissible for the invariant part to supply not only the melody, but also the prosody. It is only with these modifications that tautological compounding can account for the Olo data presented in 37.

6.1 Morphological infixes and prosodic rules

The reduplication data in Olo has been shown to be amenable to the theory of prosodic morphology (McCarthy and Prince 1990). In particular, this theory provides a way to account for the infixation of the reduplicated forms. It then becomes relatively easy to predict that the second syllable of the minimal word is used to form the reduplicated form. Ideally the process should not just account for the infixation of reduplicated elements, but for all types of infixation.

There are 30 Olo verbs which take an infix to mark the third person PATIENT, (1994a; Staley to appear). The location of the infix can be specified very precisely, it always follows the first syllable of the root. With the exception of the masculine dual form, all the infixes are a single consonant. The forms are given in figure 5.

-l-	masculine singular
-ut-	masculine dual
-n-	feminine singular
-m-	feminine dual
-p-	plural.

figure 5

It would be providential if these PATIENT infixes worked in the same manner as the reduplication infix/suffix by occurring at the boundary of the minimal word. Unfortunately, the PATIENT infixes take no account of the minimal word, which means that prosodic morphology is unable to account for this type of infixation. Therefore, if prosodic morphology is used to account for one type of infixation, a totally separate mechanism must be proposed to account for the other type, which unduly complicates the grammar.

The word *alei* 'eat' is composed of the minimal word *ale* and the extrametrical part *i*. The PATIENT infix occurs following the *a*.

- 38 *Ki k-áplei.* *Ki k-aplélei.*¹⁹
 I 1s-eat-3p I 1s-eat-3p-CONT
 I eat them. I am eating them.

The root is clearly two syllables, with the first syllable stressed, and the only the final vowel can be considered extrametrical. The syllable or second syllable cannot be extrametrical, since was the basis of the prosodic morphology account of reduplication. Prosodic morphology will not therefore work for both types of infixation.

A possible solution would be that the infix is actually a prefix which metathesizes after the first vowel. This would allow the view of “no infixes inside minimal words” to be maintained. However, there are a number of problems with metathesis as a solution. The first is that it occurs nowhere else in Olo phonology. The second is that consonants which are word initial in other instances do not metathesize (example 39).

- 39 a. *Pe p-lolpo.*
 they 3p-fight
 They fight
- b. *nari*
 grab at
- c. *Ki k-rapo yalu*
 I 1s-split firewood
 I split firewood.
- d. *Ki k-rantuwe*
 I 1s-push-3f
 I push her.

In each case in example 39 neither the initial consonant of the root nor the subject prefix is metathesized into the root. This makes it difficult to justify the suggestion that the PATIENT infix has some special standing such that it metathesizes inside the minimal prosodic word. Rather we must concede that prosodic morphology cannot account for both types of infixes in Olo and that a separate mechanism is needed to account for the placement of PATIENT infix. Allowing another mechanism to handle infixation reduces the support for prosodic morphology to account for the reduplication in Olo. Prosodic morphology can account adequately, if clumsily, for why the last syllable is not fully reduplicated, but only the onset and first vowel from the reduplicated syllable.

¹⁹ The second underline delineates the continuous aspect.

7 A possible alternative solution

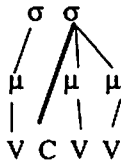
Given that CV phonology has been rejected because of the lack of a coherent unit to posit as a locus for reduplication, and given that prosodic morphology cannot handle infixation effectively, it would be worthwhile to look for another metrical unit to use as a locus of reduplication. Ideally we require a single unit which can be reduplicated, as well as a single method to handle the infixation of both the reduplicated material and the object marker.

7.1 Moraic phonology and reduplication in Olo²⁰

Since the syllable, without setting up extrametrical units, is too large a unit to account for the material being reduplicated, we need to find another smaller unit. The next smaller unit would be the mora. There are two variants of moraic phonology in current theory. One was proposed by Larry Hyman (1985) and the other by Bruce Hayes (1989). The differences between them are more than a notational variation, since they make different predictions. Hyman's notation provides a coherent unit to reduplicate, while Hayes' does not.

The difference that I will focus on is the choice of node to which a syllable initial consonant is attached. Hayes attaches the consonant onset directly to the syllable tier; Hyman attaches the onset to the first mora of the syllable. The differences are shown in 40, substituting 'μ' for Hyman's 'X'.

40 Hayes



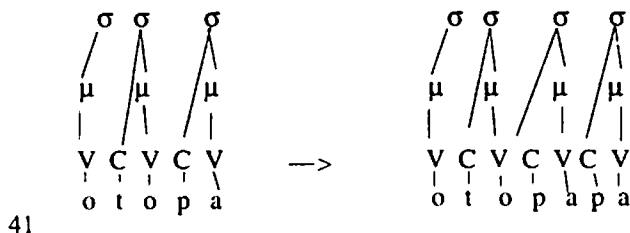
Hyman



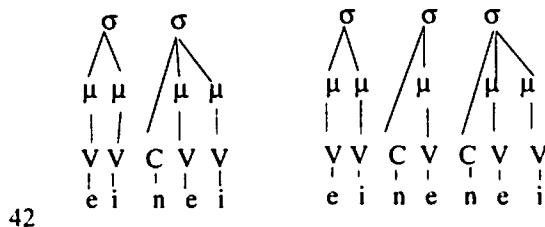
In examining the data, we find that Hayes' model can account for the same set of data that is handled well by CV phonology, namely the verbs in which the reduplicated syllable is CV.²¹ In this model the node that would be reduplicated is the syllable. Example 41 shows reduplication using Hayes' model.

²⁰ Parts of the following sections appeared in (Staley 1994)

²¹ Hayes' model is compared to CV phonology to show that it produces no better account than CV phonology, which has already been rejected as inadequate. I do not compare Hayes' work to prosodic morphology (which can account for the reduplication data) since Hayes' model does no better than the worst competitor. Much of section 7 is devoted to showing that Hyman's model is superior to Hayes'.



The important data that the model must handle are final diphthongs. The theory needs to be able to select the correct CV and to do so by finding a node which fits the criteria and encapsulates all and only the data that should be reduplicated. Example 42 gives the analysis of the unreduplicated and reduplicated form of *einei* 'go around' according to Hayes' model.

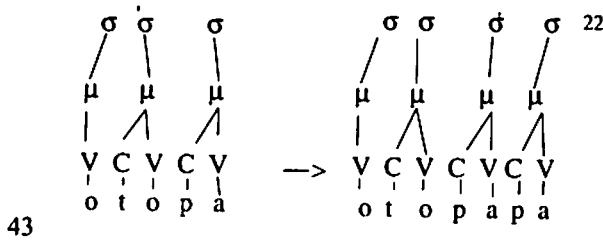


This model is clearly inadequate to handle the Olo data. It has nothing to reduplicate that contains just the material needed. The only candidate for reduplication is the final complex syllable, which has an extra mora that does not get reduplicated.

While Hayes' model handles some of the Olo data (no more than CV phonology), it does not give any mechanism to account for reduplication of the type found in 42 (prosodic morphology account save the final syllable of the minimal word.) Within Hayes' theory we have no node to reduplicate, which make it difficult to specify the location of the reduplication.

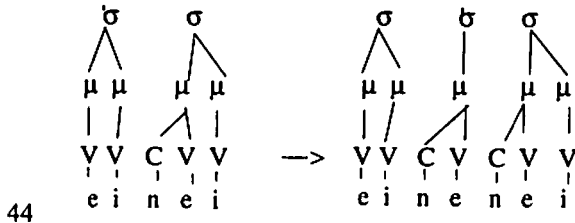
7.2 Hyman's model

We will now compare the final model under consideration in respect to the same data. I will suggest that the item reduplicated is the first mora following the stressed syllable. Example 43 shows this with a final CV pattern.



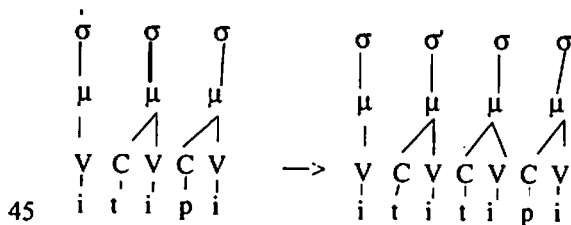
In 43 the data could be interpreted to be a reduplication of either the final mora, or of the final syllable.

Both CV phonology and the model developed by Hayes failed to account for the situation where the reduplicated part is contained in a heavy syllable of the form CVV. The depiction of the data using Hyman's model is given in 44 where reduplication is based on the first mora following the stressed syllable.



Hayes' model gives us no node that contains all and only the elements that need to be reduplicated, while Hyman's model provides what is needed to account for the diphthong data in Olo. On this basis, Hyman's model is preferable to Hayes'.

By taking the first mora following the stressed syllable we are also able to account for reduplication of words which have an initial stressed syllable as in example 45.



Hyman's model accounts for the same data as prosodic morphology but it has no mechanism to account for either type of infixation. On the other hand the mechanisms of

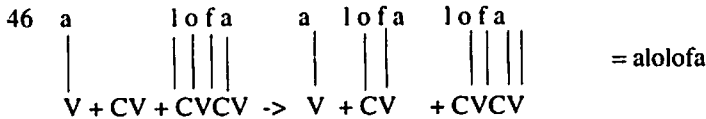
²² Word stress in Olo shifts to the right on reduplication.

Hyman's model are simpler than those of prosodic morphology having no need to appeal to some prosodic notion of the minimal word.

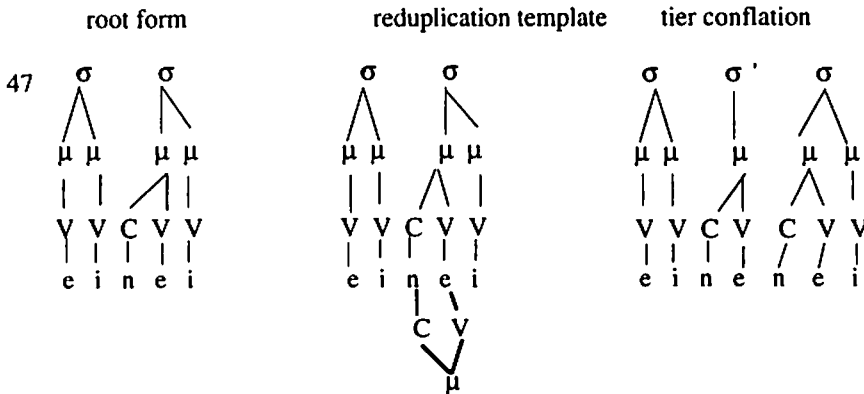
7.3 Infixation revisited

The location of the two classes of infixation in Olo, reduplication and the object infix, can each be specified precisely. The object infixes are always placed after the first mora of the root. The reduplicating infixation copies the first mora of the syllable following the stressed syllable and infixes it.

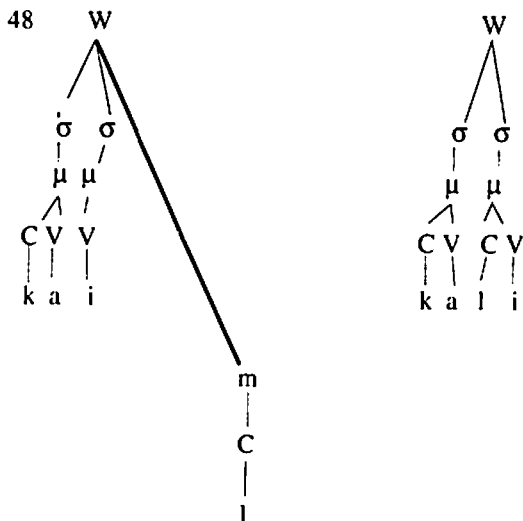
Marantz (1982:453 fn: 14) proposes treating infixation as simple conflation of the tiers as in example 46 using Samoan data.



The problem for Marantz was to find a way to specify just what to reduplicate. Since we have a way to specify this, we can treat reduplication as tier conflation. Example 47 shows the process of reduplication and infixation as tier conflation.



By this analysis the reduplicated morpheme is a mora on a different plane which is then conflated into the word and the invariant infixes can be conflated into the word; it is just that they bring their own prosodic and melodic material. This is shown in example 48.



In examples like 48 the conflation rules specify that the morphemic material is placed after the first mora, which allows the appropriate placement of infixes and their incorporation into the overall word structure. This is done without reference to concepts such as the minimal word. Thus we are able to account not only for reduplicative infixing, but also the object infixing.

8 Exceptional forms

There are two further points about the range of data that marks Continuous Aspect in Olo. The first involves the two one syllable words that reduplicate as two full words.²³ In both cases, there is a phonological break between the words and they each are assigned word stress (example 49).

- 49 a. *Wof l-a.* *Wóf l-á* *l-á.*
 river 3m-floods river 3m-floods 3m-floods
 The river floods. The river is flooding.
- b. *Ki k-é.* *Kí k-é* *k-é*
 I 1s-go I 1s-go 1s-go
 I go. I am going.

²³ There are only three one syllable verbs in Olo. The third one, *au* 'come' has an alternate form *aule* which is used when reduplication the lexeme.

The other interesting behavior involves three words which take an affix *pi* to mark the continuous aspect. In two of the cases this involves using *pi* as a suffix, and in the third it is placed as a prefix. Each of these roots can also form the Continuous Aspect by reduplicating the mora following the stressed syllable. The data is given in 50.

- 50 a. *kapo* *kapo-pi* *kapopo*
 sew sew-CONT sew-CONT
 sew sewing sewing
- b. *yapo* *yapo-pi* *yapopo*
 squeeze.with.fingers squeeze.with.fingers-CONT squeeze.with.fingers-CONT
 squeeze squeezing squeezing
- c. *p-aitei* *pi-p-aitei* *p-aiteitei*
 3p-be.on.side.of CONT-3p-be.on.side.of 3p-be.on.side.of-CONT

This data is not explainable by general phonological processes.

9 Conclusion

This paper has been an overview of reduplication in Olo. There are three main types of reduplication. The first is reduplication of the first syllable, or as would make the analysis more consistent, the first mora. Unfortunately none of the words involved has more than single mora first syllables so this question can not be resolved. The second is reduplication of the final C and insertion of an invariant *e*. This is best analyzed as a case of tautological copying with a syllabic overwrite. The final and most common type is reduplication of a final CV which involves copying the mora following the stressed syllable. This can be analyzed either of two ways. The first is, using Prosodic Morphology, involves determining the minimal word and then treating everything else as extrametrical and reduplicating the final syllable of the minimal word. The second way to analyze the data using Hyman's moraic model, reduplicates the mora following the stressed syllable. While both treatments account for the reduplication data, prosodic morphology is more complicated in having to posit a "minimal word", and it also fails to account for the placement of the Object infix. I believe this is a telling point, as the model was designed to account for infixation data. Hyman's model is much simpler than prosodic morphology: it gives a node to reduplicate, a way to find it, and the infixation can be treated as a type of tier conflation.

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