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THE INTERACTION OF REDUPLICATION AND PHONOLOGY IN KANKANAEY[1]

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1. INTRODUCTION

Structural linguists have traditionally analyzed language in terms of distinct components or levels, generally described as phonology, morphology, and syntax, which operate somewhat independently of each other. Within this framework, reduplication has been categorized as a morphological or grammatical process (Sapir 1921), having no interaction with the phonological component.

Generative linguists have maintained the distinction between syntax and phonology, regarding syntactic rules as providing the input to phonological rules and therefore necessarily preceding them. The role of morphological rules, including reduplication, is not so clear, but they have been regarded as applying to the output of syntactic rules in order to spell out the exact underlying representation upon which the phonological rules will operate.

There seems to be evidence, however, that some morphological processes can apply following phonological rules. Aronoff (1976), for example, distinguishes reduplication rules from other word formation rules in that they can apply either before the phonology, before word-level rules, or after the phonology. He is careful to point out, however, that reduplication rules do not interact with the rules of the phonology in the same sense as ordinary phonological rules, but occur only at the clearly defined breaks in the phonology as specified above.

My object in this paper is to demonstrate that Kankanaey has two types of reduplication with respect to ordering, one which precedes the phonological rules and one which follows. These two types of reduplication will be characterized as morpheme-level and word-level processes respectively.

Before proceeding to the discussion of reduplicated forms, it will be necessary to describe some of the phonological rules[2] that apply to unreduplicated forms in the language, because as Wilbur (1973) notes, the analysis of reduplicated forms should be in keeping with the analysis of the rest of the language.

2. THE PHONOLOGY OF UNREDUPLICATED FORMS

2.1. PRELIMINARIES

Kankanaey has two syllable patterns, CV and CVC. Distribution of segments within the syllable has the following restrictions: In unaffixed roots, glottal never occurs syllable-final; neither do the glides *w* and *y* when preceded by the vowels *o* and *i* res-

[1]Kankanaey is a Nuclear Cordilleran language of Central Luzon spoken by approximately 100,000 people. The data upon which this paper is based were gathered in Kibungan, Benguet Province, during the author's intermittent periods of residence there from 1974 to 1978.

[2]An earlier description of Kankanaey phonology may be found in Allen (1977). A number of rules described there have been omitted or simplified to exclude details irrelevant to the present discussion, and the rule ordering has been modified so as to obviate the need for the cyclical application of rules proposed in the earlier analysis. Gratitude is extended to Austin Hale and Greg Thomson for their helpful suggestions on an earlier draft of this paper.

pectively. For purposes of this paper, we will assume that the glottal in glottal-initial roots is underlying. We will also assume that one syllable of every root has underlying primary stress, but that stress placement is not predictable by rule.[3]

All Kankanaey examples are written phonemically with the exception of the high central vowel /ɨ/, which is symbolized as *e*. The phonemes of Kankanaey and their feature values are given in Appendix I. Feature specifications are intentionally redundant to assist the reader in interpreting the rules given in the body of the paper. Boundary symbols used in the rules are as follows: syllable ($), morpheme (+), word (#).

2.2. STRESS SHIFT

Inherent root stress shifts one syllable to the right upon suffixation of roots whose canonical form is other than CV́(C) or CVCCV́. With roots of canonical form CVCCV́C, such stress shift occurs only when the final vowel of the root is *e*. The first three examples below illustrate the syllable patterns in which stress shift does not occur. The remaining examples give an indication of the wide range of syllable structures in which it does occur.

Root	+ –en or –an	Gloss
dán	dánen	'walk'
kibtót	kibtóten	'startle'
pok?í	pok?í?an	'push apart'
padsék	padsekán	'insert in the ground'
sílpo	silpó?an	'connect'
lampáso	lampasó?an	'husk the floor'
kontalá	kontalla?én	'oppose'
láko	lakó?an	'buy'
?ólnos	?olnósen	'arrange'
kaloskós	kaloskosén	'wash downhill'
kalópti	kaloptí?en	'roll up'
saliw?á	saliw?a?én	'divert'
palsí?it	palsi?ítan	'shoot with a slingshot'
yamóyam	yammoyámen	'smooth over'
sakóbo	sakkobó?an	'cover'
?edép	?edpén	'extinguish'
pelá	pella?én	'wean'
kalim?óyot	kalim?oyótan	'grow over another plant'

2.3. GLOTTAL EPENTHESIS

$$\emptyset \rightarrow ? \;/\; V+ \_\_ \begin{bmatrix} V \\ \text{Suffix} \end{bmatrix}$$

Upon suffixation of vowel-final roots, glottal is inserted between the final vowel of the root and the suffix vowel, thus blocking the formation of vowel clusters in conformity to syllable structure conditions.

Root	+ –en or –an	Gloss
mekmék	mekmekén	'crumble'
?ópop	?opópen	'cover an opening'
pok?á	pok?á?en	'remove from near surface'
komtó	komtó?an	'cut off top of bush'

[3]For evidence supporting these assumptions, see Allen (1975).

2.4. NASAL ASSIMILATION

$$\begin{bmatrix} +\text{nas} \\ +\text{bk} \end{bmatrix} \longrightarrow \begin{bmatrix} \begin{bmatrix} \alpha\,\text{cor} \\ \alpha\,\text{bk} \end{bmatrix} \\ \\ \begin{bmatrix} +\text{cor} \end{bmatrix} \end{bmatrix} / \underline{\quad} + \begin{bmatrix} \begin{bmatrix} -\text{low} \\ -\text{son} \\ \alpha\text{cor} \\ \alpha\text{bk} \end{bmatrix} \\ \\ \begin{bmatrix} \text{C} \\ +\text{son} \end{bmatrix} \end{bmatrix}$$

When a prefix ending in a velar nasal is affixed to a root with initial nonglottal stop or sibilant, the velar nasal assimilates in point of articulation to the initial consonant of the root. When the initial root consonant is a sonorant, the prefix nasal 'assimilates' to the coronal point of articulation.[4] Note that if the initial consonant of the root is glottal, no assimilation occurs.

The somewhat unusual assimilation of a velar nasal to the alveolar point of articulation preceding sonorants might lead us to question whether the final nasal of the prefix is really a velar underlyingly. For example, we might postulate a rule which substitutes the subject focus prefix *man-* in place of the nominalizing prefix *maŋ-* whenever it occurs with sonorant-initial roots. This is essentially the analysis adopted by Gieser and Reid in their respective analyses of Kalinga and Bontoc morphophonemics. Such an analysis, however, could be objected to on the grounds that syntactic rules precede phonological rules, and therefore, a syntactic entity, such as a verb focus affix, cannot be blocked by a phonological feature such as [+sonorant].

There is also at least suggestive evidence that in Kankanaey, the prefix *maŋ-* does indeed occur before sonorants. In the closely related dialect spoken in the town of Sagada to the north, the prefixes *men-* and *maŋ-* occur in the same grammatical environments as their Kankanaey counterparts, *man-* and *maŋ-*, but the nasal assimilation and initial consonant deletion rules (see 2.5) are not operative, with the result that Kankanaey forms such as *manôtok* 'one who appoints', *mamâdaŋ* 'one who helps', and *manôlot* 'one who follows' are paralleled in Sagada by *maŋdôtok*, *maŋbâdaŋ*, and *maŋsôlot*. With sonorant-initial roots such as *lípat* 'betray', *layád* 'like, love', and *nemném* 'think', the Kankanaey nominalized forms, *manlípat*, *manlayád*, and *mannemném*, have as Sagada counterparts the forms *maŋlípat*, *maŋlayád*, and *maŋnemném*, an occurrence which would be highly unlikely if the underlying affix were *man-* rather than *maŋ-*.

2.5. INITIAL CONSONANT DELETION

$$[-\text{son}] \longrightarrow \emptyset \;/\; \begin{bmatrix} \begin{bmatrix} +\text{nas} \\ +\text{bk} \end{bmatrix} \\ \\ \begin{bmatrix} +\text{nas} \\ -\text{bk} \\ \text{derived} \end{bmatrix} \end{bmatrix} + \underline{\quad}$$

The initial nonsonorant consonant of a root is deleted when preceded by a prefix with a final velar nasal or derived nonvelar nasal. This rule clearly operates on the output of

[4] Strictly speaking, this latter part of the rule does not describe a process of assimilation, as no feature of the affected segment becomes identical to a corresponding feature in the environment part of the rule. There would thus be good grounds for considering this a separate rule. I have chosen not to do so, however, for purposes of convenience and because similar assimilation rules in other Philippine languages have generally been described as single processes.

the nasal assimilation rule above, as that rule is the only one which derives nonvelar nasals. It is necessary to specify that the [-back] nasals are derived, because initial consonants do not delete in roots prefixed by *man-* or *pan-*, affixes whose final nasal is underlying. The following examples illustrate the combined output of rules 2.4 and 2.5.

Root	+ maŋ-	Gloss
? óbad	maŋóbad	'untie'
kán	maŋán	'eat'
bidkíŋ	mamidkíŋ	'pick up something light'
depáp	manpáp	'catch'
sádoŋ	manádoŋ	'dance (women)'
layád	manlayád	'like, love'
wanés	manwanés	'put a loincloth on someone'
yamyám	manyamyám	'scold'
megmég	manmegmég	'feed chickens or ducks'
nígay	mannígay	'fish'
ŋalát	manŋalát	'converse'

A possible alternative to this appeal to a global rule might be to consider rules 2.4 and 2.5 a single rule. This could be done by using a transformational notation as below.

$$\begin{bmatrix} +\text{nas} \\ +\text{bk} \end{bmatrix} + \begin{bmatrix} \begin{bmatrix} \text{C} \\ -\text{low} \\ -\text{son} \\ \alpha\text{cor} \\ \alpha\text{bk} \end{bmatrix} \\ \begin{bmatrix} \text{C} \\ +\text{son} \end{bmatrix} \\ \begin{bmatrix} \text{C} \\ +\text{low} \end{bmatrix} \end{bmatrix} \Longrightarrow \begin{bmatrix} \begin{bmatrix} +\text{nas} \\ \alpha\text{cor} \\ \alpha\text{bk} \end{bmatrix} \\ \begin{bmatrix} +\text{nas} \\ +\text{cor} \end{bmatrix} + \begin{bmatrix} \text{C} \\ +\text{son} \end{bmatrix} \\ \begin{bmatrix} +\text{nas} \\ +\text{bk} \end{bmatrix} \end{bmatrix}$$

This type of notation captures the three types of nasal assimilation that occur, depending on the following consonant, while at the same time predicting whether or not that following consonant will delete. Such a notation, however, seems to be intuitively incorrect, because it claims that the assimilation and deletion processes occur simultaneously. It would seem more logical to claim that the root-initial consonant does not delete until the nasal has had a chance to assimilate to its point of articulation.

2.6. SYNCOPE OF INITIAL ROOT VOWEL

$$\begin{bmatrix} \begin{bmatrix} \text{V} \\ +\text{hi} \\ +\text{cent} \\ -\text{stress} \end{bmatrix} \\ \begin{bmatrix} \text{V} \\ +\text{hi} \\ -\text{cent} \\ -\text{stress} \end{bmatrix} \end{bmatrix} \longrightarrow \emptyset \quad / \quad \text{V}_x\text{C} \_\_ \text{C} \begin{bmatrix} \begin{bmatrix} \text{V} \end{bmatrix} \\ \begin{bmatrix} \text{V} \\ -\text{cent} \end{bmatrix} \end{bmatrix} (\text{C})$$

where V_x is the vowel of an infix or prefix.

With infixed or prefixed CVCV́(C) roots in which no consonant cluster precedes the initial root vowel,[5] that vowel syncopates as follows: High central vowels syncopate before any vowel; high noncentral vowels syncopate only before noncentral vowels. The forms given below illustrate the application of both syncope of V_1 and syncope of V_2.

Root	Prefixed	Infixed	Suffixed	Combination	Gloss
kedéŋ	makdéŋ	komdéŋ[6]	kedŋén	kakdeŋán	'finish'
? edás	? id? ás	? omdás	? eddasán	? indasán	'attain'
telík	manlík	tinlík	tellikén	———	'run off w/ wife'
talék	? ittalék	tommalék	talkén	panalkán	'trust'
sagák	massagák	sinnagák	saggakén	———	'step into mud'
kasín	? ikkasín	kinnasín	kassinén	———	'separate'
takóm	? ittakóm	tinnakóm	takkomén	———	'encompass'
piták	mappiták	pommiták	pittakén	panpittakán	'split'
liŋéb	? illiŋéb	lommiŋéb	liŋbán	maliŋbán	'hide'
pisít	mapsít	pinsít	pistén	———	'squash'
sokát	? issokát	———	sokkatán	sinokkatán	'change'
topíg	? itpíg	tompíg	toppigén	panpigán	'throw'
ponó	mapnó	pomnó	pon? én	———	'fill'

2.7. SYCOPE OF FINAL ROOT VOWEL

$$\begin{bmatrix} [\text{V}, +\text{hi}, +\text{cent}, -\text{stress}] \\ [\text{V}, +\text{bk}, -\text{cent}, -\text{stress}] \\ [\text{V}, +\text{bk}, -\text{stress}] \end{bmatrix} \longrightarrow \emptyset \;/\; \text{C} \begin{bmatrix} [\text{V}] \\ [\text{V}, -\text{bk}, -\text{cent}] \\ [\text{V}, -\text{cent}] \end{bmatrix} \text{C} \_\_\_\_ \; (\text{C}) + (\text{C})\,\acute{\text{V}}$$

Upon suffixation of any CVCV́(C) root (and subsequent stress shift), the final vowel of the root syncopates as follows: High central vowels syncopate following any vowel, front vowels syncopate following front vowels, and back vowels syncopate following noncentral vowels.

This rule could almost be stated as the mirror image of the V_1 syncope rule, except that the earlier rule predicted that initial vowel *i* would syncopate when followed by

[5]According to this condition on consonant clusters, syncope occurs with CVC- prefixes only in the case of *maŋ-* and then only after the initial consonant deletion rule (2.5) has applied. If it were to occur with other CVC- prefixes, an unallowable three-consonant cluster would result.

[6]An alternative spelling for this form is *kemdéŋ*. See also Table 3, #21. The rule accounting for vowel harmony of this type is given below:

a) $\text{o} \rightarrow \text{e} \;/\; \text{C} + \_\_ [+\text{nas}] + \text{e}$

b) $\text{o} \underset{\text{opt}}{\rightarrow} \text{e} \;/\; \text{C} + \_\_ [+\text{nas}] + \text{Ce}$

This rule is also bled by syncope of V_1.

o, whereas the paradigm of 'throw' shows that final vowel *i* does not syncopate when preceded by *o*. This difficulty could be overcome by modifying the V_1 syncope rule to state that high central vowels syncopate before any vowel, high front vowels before front vowels, and high back vowels before noncentral vowels. We would be justified in making such a modification, because there are no actual examples of initial *i* syncopating in a root with following *o*. I merely inferred it in order to capture the generalization for V_1 syncope that high noncentral vowels syncopate when followed by noncentral vowels. Perhaps Tables 1 and 2 will assist in visualizing the similarities between the two syncope rules.

V_1 \ V_2	a	e	i	o
a	*	*	*	*
e	X	X	X	
i	*	*	X	
o	*	*	X	X

Table 1. V_1 syncope

V_2 \ V_1	a	e	i	o
a	*	*	*	*
e	X	X	X	
i	*	*	X	*
o	*			X

Table 2. V_2 syncope

Key to Tables 1 and 2:

* = no syncope occurs

X = syncope occurs

blank = no examples

There would be a real advantage in collapsing the two rules into some sort of mirror image rule, because such a rule would recognize the two syncopes as a single related process rather than two separate rules which are coincidentally almost identical. The rule would then have to be specified as left to right iterative to account for forms such as *kakdeŋán* (root *kedéŋ*), in which both root vowels meet the structural description of the syncope rule after the application of stress shift.

In spite of the advantages I can see in collapsing the two syncope rules into one, I find myself at a loss in trying to come up with an adequate formalism or even stating the combined rule in prose, so I will continue to treat them as separate rules. Syncope of V_1 will then, of course, have to be ordered before syncope of V_2 in order to account for forms such as *kakdeŋán*.

2.8. GEMINATION

$\emptyset \rightarrow C_x$ / #Y . . . VC_x ___ VCV́. . . Z# where #Y . . . Z# is a word consisting of two or more morphemes. Upon affixation or reduplicating of a root, the initial consonant of the prestress syllable geminates if the stressed syllable is preceded by at least two open syllables. Gemination does not occur in words of one morpheme (unaffixed roots), as is evidenced by forms such as *? aligóŋgoŋ* 'to crowd around' and *? asikáso* 'to look after', where in both cases the stressed syllable is preceded by two open syllables, yet gemination fails to occur. When the first form is suffixed, stress shift occurs, bringing a closed syllable into the prestress position, so gemination still cannot occur — *? aligoŋgóŋan*. In the case of the second form, however, suffixation and stress shift do not change the prestress syllable pattern, so gemination occurs — *? akikasó? en*. Additional examples of gemination may be noted in the examples given for stress shift and syncope (2.2, 2.6).

2.9. GLOTTAL METATHESIS

$$\begin{bmatrix} C \\ +\text{low} \end{bmatrix}_1 \begin{bmatrix} C \\ -\text{low} \end{bmatrix}_2 \rightarrow 2\ 1$$

Glottal metathesizes with a following nonglottal consonant. It should be noted that in unreduplicated forms, such a sequence never occurs underlyingly, but is derived from the operation of the V_1 syncope rule.

ma-	+	?edép	→	ma?dép	→	mad?ép	'be extinguished'
?i-	+	?emés	→	?i?més	→	?im?és	'use for bathing'

3. RULE INTERACTION

Generally speaking, the ordering relationship between the above rules is fairly transparent, so a brief summary is all that will be required at this point.

Stress shift must precede gemination and syncope of V_2, because both the latter rules are affected by stress movement. In the case of gemination, its interaction with stress shift varies, depending on the nature of the syllables preceding the stressed syllable. In a form such as *? asíkaso,* in which two open syllables precede the stressed syllable both before and after stress shift occurs, the two rules are neutral with respect to feeding and bleeding. Stress shift must precede, however, because the reverse order would result in an incorrect form — **? assikasó? en.* With roots having a syllable structure similar to *? aligóŋgoŋ,* stress shift and gemination have a bleeding relationship, because the stress shift rule results in there being a closed syllable in the prestress position. Finally, in roots of the form *kontalá,* stress shift feeds gemination. Stress shift feeds syncope of V_2, because the syncope rule operates only on unstressed vowels, and stress shift acts to destress the vowels in question.

Nasal assimilation is ordered before initial consonant deletion, because the nasal assimilation rule derives the [-back] nasal needed to meet the structural description of the consonant deletion rule.

Initial consonant deletion precedes syncope of V_1 and gemination, standing in a feeding relatonship to both these rules. In a form such as *mannalék,* derived from underlying *maŋtalék,* it creates the open syllable needed for the operation of the gemination rule. Similarly, for a form such as *maŋdéŋ* (underlying *maŋkedéŋ*), it deletes the initial consonant *k*, thus reducing a consonant cluster which would otherwise block syncope.

Syncope of V_1 precedes syncope of V_2 and gemination, standing in a bleeding relationship to both these rules. If V_1 were to follow gemination, for example, gemination would incorrectly apply to underlying *madepáp* 'to be caught' to give the surface output **maddepáp* rather than the correct form *madpáp.* Similarly, if it were ordered following syncope of V_2 the second rather than the first *e* of underlying *kakedéŋan* would syncopate to yield the incorrect form **kakedŋán* in place of the correct *kakdeŋán.* Syncope of V_1 must also be ordered preceding glottal metathesis, because it feeds it, creating the *? C* cluster upon which the metathesis rule operates.

Syncope of V_2, like that of V_1, bleeds gemination, blocking incorrect outputs such as **tallekén* (correct form *talkén)* from underlying *talékeŋ.*

4. RULE MODIFICATIONS REQUIRED BY REDUPLICATED FORMS

We are now ready to consider the effect of reduplicated forms on the above phonological rules. There are three types of reduplication in Kankanaey, C_1V_1, $C_1V_1C_2$, and $C_1V_1C_2$ $(C_3)V_2$, but these three basic types fulfill a bewildering array of semantic and syntactic functions, depending on the nature of the reduplicated form. For example, CV reduplication pluralizes nouns and kin terms, adjectivalizes numerals, adjectivalizes verb roots prefixed with *ka-*, forms the superlative with adjectives affixed with *ka- . . .-an*, and with verbs affixed with the basic focus affixes, indicates continuity in a state or activity already begun, sometimes implying repetition, plurality of subject, permanence, or irrevocability. CVC reduplication has a similar number of functions. This, coupled with the fact that many verb roots are semantically incompatible with one or more types of reduplication, creating a distressing number of incomplete paradigms, makes it imperative that we limit the present discussion in some way so as not to get bogged down with irrelevant details.

Accordingly, we will limit our consideration to CV and CVC reduplication of inflectionally affixed verbs.[7] Two types of CVC reduplication will be distinguished, one which indicates progressive action or action in progress, and one which indicates intensive, comparative, potential, repeated, or customary action, depending on the semantic components inherent in the root. These two types of CVC reduplication will henceforth be designated CVC (1) and CVC(2), respectively. A few forms exhibiting a special type of CVC reduplication will also be considered in passing, because they support the need for modification of the glottal metathesis rule and create the need for a cluster simplification rule. In these forms, CVC reduplication is combined with the infixation of glottal stop after the second consonant of the root to diminutivize a noun or to indicate that the action of a verb is done in pretense or play. As glottal infix never occurs without accompanying CVC reduplication, it would seem reasonable to consider them a discontinuous morpheme of some sort. The paradigms given in Table 3 will serve as the basis for the remainder of our discussion.

	Root	CVC + -? -	Gloss
1.	wa? ó	wawwa? ? ó	'only eight'
2.	kapĭ	kapkap? ĭ	'few old coffee beans'
3.	kabáyo	mankabkab? áyo	'pretend to ride horseback'
4.	? aklát	? ak? aklát	'tattered old jacket'
5.	kantĭna	mankankantína	'to play at keeping store'
6.	kiyáp	kikki? ? á p	'toy chicks'
7.	bowáya	bobbo? ? áya	'toy crocodile'

	Root	CVC (1)	CVC (2)	CV	Gloss
8.	ta? óli	mantatta? óli			'return'
9.	bá? on	? ibabbá? on[8]		? ibbabá? on	'take a lunch'
10.	? iyán	man? iy? iyán			'stay overnight'
11.	towĭli	mantowtowĭli	mantot? owĭli	mantottowĭli	'turn head'
12.	? ówas	man? ow? ówas			'wash'
13.	sĭyek	siysiyékan	sis? iyékan	sissiyékan	'laugh at'
14.	sĭyek	masmasĭ yek	masis? ĭyek	massisĭyek	'laugh, be amused'
15.	se? éd	sedsed? én			'wait for'
16.	kedsé	makmakedsé	makedkedsé		'be naughty'
17.	sadót	masmasadót	masadsadót		'be lazy, sad'
18.	? egás	magmag? ás	ma? eg? egás		'fall'
19.	? edép	madmad? ép	ma? ed? edép		'be extinguished'
20.	dán	manmandán			'walk'
21.	segép	semsemgép			'enter'

Table 3. Paradigms of reduplicated forms[9]

[7]Extending our consideration to other types of reduplication would have no significant effect on the conclusions drawn in this analysis.

[8]Apparently reduplication copies only segmental features, not suprasegmental features such as stress.

[9]Affixes appearing in the paradigms are: *man-* (# 3, 5, 8, 10-12, 20), *? i-* (9), *-em-* (21), *ma-* (14, 16-19), *-an* (13), and *-en* (15).

4.1. GLOTTAL METATHESIS OR ASSIMILATION

Looking first at forms 1, 8, and 9, it becomes apparent that the glottal metathesis rule will have to be modified to account for cases where the glottal assimilates to rather than metathesizes with the following consonant. Comparing these forms with the examples given for the syncope rules, it appears that the factor conditioning assimilation is the presence of a root-medial glottal. We may now replace the metathesis rule (2.9.) with the following two rules, which are unordered with respect to each other.

a) Glottal metathesis

$$\begin{bmatrix} C \\ +\text{low} \end{bmatrix}_1 \begin{bmatrix} C \\ -\text{low} \end{bmatrix}_2 \quad V \quad \begin{bmatrix} C \\ -\text{low} \end{bmatrix} \quad \rightarrow \quad 2 \quad 1$$

Glottal metathesizes with the following consonant if the consonant following the next vowel is nonglottal.

b) Glottal assimilation

$$\begin{bmatrix} C \\ +\text{low} \end{bmatrix} \rightarrow \begin{bmatrix} C_x \\ -\text{low} \end{bmatrix} \; / \; \_\_ \; \begin{bmatrix} C_x \\ -\text{low} \end{bmatrix} \; V \; \begin{bmatrix} C \\ +\text{low} \end{bmatrix}$$

Glottal assimilates to the following consonant if the consonant following the next vowel is glottal.

4.2. SEMIVOWEL REPLACEMENT

Looking next at forms 6-7 and 10-12, it appears that a rule will be needed which replaces syllable-final semivowels with glottal in certain CVC reduplication patterns. No such rule was required for unreduplicated forms, because sequences of *ow* and *iy* never occur preceding syllable boundaries in unreduplicated forms. The rule may be stated as follows:

$$\begin{bmatrix} -\text{cons} \\ -\text{syl} \\ \alpha\text{bk} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{cons} \\ +\text{low} \end{bmatrix} / \quad \begin{bmatrix} C_1 \\ -\text{low} \end{bmatrix} \begin{bmatrix} +\text{syl} \\ \alpha\text{bk} \end{bmatrix} \; \_\_\_\_ \$$$

Condition: C_1 is a stem-initial consonant not belonging to the progressive reduplication morpheme.

A semivowel is replaced by glottal when it occurs syllable-final following its corresponding vowel and when the initial consonant of the syllable does not belong to the progressive reduplication morpheme. Semivowel replacement is ordered before glottal metathesis or assimilation (4.1.), because it stands in a feeding relationship to it, creating the *? C* cluster upon which the latter rule operates. This relationship is illustrated by the derivation of form 6.

kiykiy? áp	CVC + -? - + kiyáp
ki? ki? ? áp	semivowel replacement
kikki? ? áp	glottal assimilation

The rule must specify that semivowel replacement does not apply in syllables with initial glottal because of forms like the following: *? iy? iyógtan* (*? iyógtan* + CVC (2)) 'younger sibling'.

4.3. CONSONANT CLUSTER SIMPLIFICATION

$C \rightarrow \emptyset / C\_\_\_C$

A consonant is deleted when it occurs between consonants. This rule is needed to account for the absence of the infixed glottal following the second consonant of the root in forms 4 and 5. Clearly, the underlying glottal is deleted in such environments, because its presence would violate the syllable structure rules of Kankanaey.

With the modifications and additions described above, the phonological rules will now account for all unreduplicated forms and reduplicated forms 1-12. Notice that CV reduplication has no effect on the phonology other than feeding the gemination rule.

5. THE CASE FOR POSTPHONOLOGICAL REDUPLICATION

5.1. APPARENT EXCEPTIONS TO PREPHONOLOGICAL REDUPLICATION

The reduplicated forms that we have considered thus far can all be accounted for under the standard theory that morphological processes such as reduplication precede all phonological rules. But forms 15, 18, and 19 appear to be exceptions to this ordering analysis. Note that they are also irregular in that the CVC(1) reduplication copies the first three segments of the *affixed* root, whereas in the previously considered forms, it ignores the affix and copies the first three segments of the root alone.

Before we accept the possibility that reduplication may occur after the phonological rules have applied, let us preserve the traditional prephonological order and see if it is possible to derive form 15 using the phonological rules that successfully account for the rest of the language. Given the underlying form *se?se?éden,* stress shift applies to yield *se?se?edén.* Syncope of V_2 now applies to the final unstressed vowel of the root to give *se?se?dén.* We are now faced with a dilemma, because glottal assimilation would apply to the first glottal-consonant sequence and glottal metathesis to the second. If we allow the two rules to apply simultaneously, we obtain an incorrect output, **sessed?én.* Ordering assimilation before metathesis would produce the same result. If we order metathesis before assimilation, the assimilation rule will be bled, and the final output will be **se?sed-?én.* One other possibility remains, and that is to allow metathesis to apply right to left iteratively. But the output is still incorrect, **ses?ed?én.* Even if one of these solutions did derive the correct form, *sedsed?én,* it would still present a problem, because we would then be faced with a rule modification that would be required only for the reduplicated forms – *sedsed?én, magmag?ás* and *madmad?ép* – but not their unreduplicated counterparts, *sed?én, mag?ás,* and *mad?ép.*

If, on the other hand we accept the analysis that CVC (1) reduplication follows all other phonological rules for forms such as 15, 18, and 19, no ad hoc rule adjustments will be necessary, and the derivation is quite straightforward. Starting from the underlying form *se?éden,* stress shift would yield *se?edén,* syncope would then apply to give *se?dén,* metathesis would yield *sed?én,* and finally, reduplication would apply to give the correct surface output *sedsed?én.*

5.2. IRREGULAR REDUPLICATION IN OTHER LANGUAGES

Before considering further the implications of the above rule ordering solution to the class of CVC(1)reduplicated forms as a whole, let us consider a few cases in other languages where reduplicated forms behave irregularly with respect to phonological rules, and then examine some of the devices that have been proposed to account for these irregularities.

Wilbur (1973) distinguishes two categories of irregular forms. One group consists of those forms in which either the original element (R_0) or the reduplicated element (R_1) fails to undergo a phonological rule when it apparently meets the structural description of the rule. The other group consists of those forms in which either R_0 or R_1 undergoes a rule for which it apparently does not meet the structural description.

Both Wilbur (1973) and Aronoff (1976) cite data from Madurese as an example of the first type of irregularity. In Madurese, a general rule of nasal assimilation fails to apply to reduplicated forms.

Root	Redup. form	Expected redup. form	Gloss
kun	kunkun	*kungkun	'orders'
bang	bangbang	*bambang	'wings'

If we analyze reduplication as preceding the assimilation rule, such reduplicated forms will have to be marked as exceptions to the rule, even though they seem to meet the structural description.

Another assimilation rule in Tagalog is taken as an example of the second type of irregularity, in which the phonological rule applies to R_0 even though it does not meet the structural description of the rule. The Tagalog rule is similar to the rule in Kankanaey in which a velar nasal of a prefix assimilates to the point of articulation of the initial consonant of the stem, the stem consonant then deleting. In the examples below, the underlying representation of the prefix is *mang-*.

Root	Redup. form	Expected redup. form	Gloss
bigáy	mamimigáy	*mamibigáy	'give'
sumpâ	manunumpâ	*manusumpâ	'curse'
kúha	mangungúha	*mangukúha	'take'

Once again if we analyze reduplication as preceding the assimilation rule, we will have to mark the above forms as exceptions, because the nasal assimilation rule appears to act on the initial root consonant of both R_0 and R_1, even though R_0 fails to meet the structural description of the rule.

5.3. PROPOSED SOLUTIONS TO IRREGULAR REDUPLICATION

Wilbur discusses three possible devices for handling the types of irregularity described above: rule ordering, boundaries, and exception features. She then rejects these devices in favor of a fourth notion, which she designates as the Identity Constraint. I will briefly describe the above four devices as they apply to Madurese and Tagalog and then demonstrate that the only device capable of handling the Kankanaey data is that of rule ordering.

5.3.1. RULE ORDERING SOLUTION

For both the Madurese and Tagalog examples, the simplest solution for dealing with the irregular behavior of reduplicated forms is that of rule ordering. In the case of Madurese, if the nasal assimilation rule precedes reduplication, it will be unable to apply to the unreduplicated forms *kun* and *bang*, because they do not meet the structural description of the rule. Reduplication will then apply to give the correct forms *kunkun* and *bangbang*. Rule ordering also provides a straightforward solution to the over-application of the assimilation rule in Tagalog. Given the underlying form *mangbigáy*, the assimilation rule will apply to give *mamigáy* and reduplication will then take place to give the correct output *mamimigáy*.

5.3.2. BOUNDARY SOLUTION

The boundary solution postulates a unique type of boundary which would be inserted between the reduplicated element and the root at the time of reduplication and then eliminated before the final output. Phonological rules would be unable to apply across the boundary, but because the boundary would be present only in reduplicated forms, it would not affect the operation of phonological rules in the regular forms of the language. Applying the boundary solution to Madurese, the reduplicative boundary % would be inserted prior to the operation of the assimilation rule to give *kun%kun* and *bang%bang*. The assimilation rule would then be unable to apply because of the presence of the boundary, the boundary would be eliminated, apparently as the result of some convention, and the surface output would thus be *kunkun* and *bangbang*.

The boundary solution becomes a little more complicated in cases of overapplication of a phonological rule, such as the Tagalog assimilation and reduction rule. In such cases, the special boundary must be specifically mentioned in the rule in order for the rule to apply. Given the underlying form *mangbibigáy*, the special boundary is first inserted to give *mang%bi%bigáy*. A nasal copying rule would then have to be formulated which would copy the *ng* of the prefix to a position preceding the special boundary marker before the initial stem consonant. The nasal assimilation rule would then apply across the special boundary to produce the correct form *mamimigáy*.

5.3.3. EXCEPTION FEATURES SOLUTION

The third notation examined by Wilbur is that of exception features. She concludes that the best way to use this notation with reduplicated forms is to assign them by means of a readjustment rule rather than by marking the lexical representation of the reduplicated form with a diacritic feature. For the Madurese examples, a readjustment rule such as the following would be formulated: Reduplicated forms are marked [–nasal assimilation rule]. This would block reduplicated froms from undergoing the rule while allowing other forms to correctly undergo the rule.

The Tagalog examples would be handled by means of a positive exception feature. This feature would be assigned by a readjustment rule to the first consonant of the stem, which would at the same time be marked +redup. A simplified form of the readjustment rule might be as follows:

$$+\text{segment} \rightarrow +\text{nasal assimilation rule} \;/\; \# \_\_\_ +\text{redup}.$$

The result of this rule for the underlying form *mangbibigáy* would be to make the *b* of the root subject to the nasal assimilation rule, even though it is not in the correct environment for undergoing the rule. Both R_1 and R_0 would then undergo the rule, R_1 because it met the structural description of the rule, and R_0 because of being marked +nasal assimilation rule and the correct surface form *mamimigáy* would result.

5.3.4. IDENTITY CONSTRAINT SOLUTION

Wilbur then dismisses the above three notations as inadequate, because in her opinion they fail to take into account an important generalization which must lie behind the irregular behavior of reduplicated forms in general. This generalization is defined in terms of the Identity Constraint: 'There is a tendency to preserve the identity of R_0 and R_1 in reduplicated forms' (1973:58).

Basically, this tendency is realized by allowing global conditions to be incorporated into phonological rules. The phonological rules would then be allowed to look back to

the morphological level to determine whether two segments were in the identical copy relationship of R_0 and R_1. If such were the case, the rules would then apply or fail to apply to the two segments in question with a view to maintaining their identity to the greatest possible extent. In the case of a rule which failed to apply, a global condition such as the following would be formulated on the rule:

X (and X') → Y if X (and X') / A____B

where X stands for R_0 and X' stands for R_1. Basically, this condition states that a phonological rule must be able to determine whether R_0 and R_1 were both in the proper environment for the rule to apply in their underlying representation. If not, then neither form will be allowed to undergo the rule. In the Madurese example, the assimilation rule would look back to the underlying representation *kunkun* and take note of two facts: first, that the two segments were in a copy relationship to each other; and second, that the R_0 was not in the right environment to undergo the rule. The rule would then desist from applying to either segment in order to preserve their identity as copied segments on the surface.

Overapplication of a rule would call for a global condition such as the following:

X (and X') → Y if AXB

In other words, if R_1 or R_0 is in the proper environment for undergoing a certain phonological rule, the segment which is in a copy relationship to it will also undergo the rule. To take the Tagalog example, the assimilation and reduction rule would look back to the underlying representation *mangbibigáy* and note that the two segments *bi* were in a copy relationship to each other and that the reduplicated segment was in the correct environment for undergoing the rule. The rule would then apply itself to both segments in order to maintain the original copy relationship on the surface, even though the actual shape of the segments would be different from the underlying one.

It can thus be seen that the Identity Constraint is a useful principle, at least for some languages, for handling the irregular behavior of reduplicated forms with respect to the application of phonological rules. Whereas the other three devices were unable to identify the motivation behind the irregularities, the Identity Constraint is able to characterize all such irregularities as arising from the deliberate tendency of languages to preserve the identity of R_0 and R_1 in reduplicated forms.

Unfortunately, however, this Identity Constraint falls far short of being the 'universal statement on the behavior of languages containing reduplication rules' that Wilbur claims it to be (1973:58). She herself admits that some languages ignore the constraint entirely, that in some languages it affects only certain phonological rules, that identical rules may be affected in one language and not in another, that in a given language it may affect a rule only as it applies to stems of a certain shape, and that there is no way to predict whether a rule that is subject to the identity constraint will in fact be successful in preserving the identity of R_0 and R_1. In light of all the above exceptions and limitations to the constraint, it is difficult to conceive of it as a truly universal statement on the behavior of languages.

5.4. THE FOUR SOLUTIONS AS APPLIED TO KANKANAEY

Let us return now to the Kankanaey data and attempt to gauge the relative effectiveness of the four devices discussed above in accounting for the CVC(1) reduplicated forms in #15, 18, and 19. Any one of the three forms could be selected as the basis for the comparison, as all three behave identically with regard to the application or non-application of phonological rules, so we will choose #18, *magmag?ás*, which would have the underlying form *ma?ma?egás*.

Considering first the boundary solution, we will insert the special reduplicative boundary as follows: m*a? %ma?%egâs*. It is not clear whether this is a case of failure of a rule to apply or of overapplication of a rule, so we will consider both possibilities. In the former case, the boundary marker should act to prevent a phonological rule or rules from applying across it. Considering the rules that would be relevant to the derivation, syncope of V_1 would not be blocked by a boundary marker and would apply to R_0 to give *ma? %ma? %gâs*. Neither glottal metathesis nor glottal assimilation would apply because of the presence of the boundary markers, so the surface output would be the incorrect **ma?ma?gâs*. Apparently, then, the correct form, *magmag?âs*, is not the result of rule failure.

If, according to the boundary solution, the correct derivation is a case of overapplication of a rule, the rule must be specified as applying wherever the special boundary occurs. Starting again with the form *ma? %ma? %egâs*, syncope would apply to give *ma? %ma? %gâs*. Both assimilation and metathesis could now apply, and if we allowed them to apply simultaneously, the output would be **mammag?âs*. Trying to reorder the metathesis and assimilation rules or modifying them to apply iteratively would also derive incorrect forms as we have already seen in the case of #15 (section 5.1.).

The only way the boundary solution could be made to account for *magmag?âs* would be to introduce an ad hoc copying rule, as in the Tagalog example (5.3.2.), which would copy the consonant following the second boundary marker to a position after the first boundary marker.

ma? %ma? %egás	underlying form
ma? %gma? %egás	copy rule
ma? %gma? %gás	syncope of V_1
ma? %gmag%? ás	metathesis
ma%gmag%? ás	cluster simplification
magmag? ás	% deletion

Such a copying rule however would not account for suffixed forms such as #15, *se?%se?ĕd%en* because the consonant copied would need to be the one preceding rather than following the second boundary marker; in form #9, it would incorrectly derive **? ibbabbâ? on;* and in forms such as 3, 11, or 16, its only function would be to create three-consonant clusters *(manḵkabkab?âyo, manṯtowtowîli,* and *makḏmakedsê,* respectively) which would then have to be reduced by the cluster simplification rule (4.3.). Clearly the boundary solution is not an effective one for Kankanaey.

It should be clear by now that both the exception features solution and the Identity Constraint solution will meet the same fate as the boundary solution when faced by the type of irregularity posed by Kankanaey, the reason being that all these solutions are based on the premise that there are only two types of irregularities, one in which either R_0 or R_I fails to undergo a phonological rule even though it meets the structural description and one in which either R_0 or R_I undergoes a phonological rule even though it does not meet the structural description. The Kankanaey example falls under neither of these categories. And there is clearly no reason for a rule to overapply or underapply to preserve the identity of R_0 and R_I, as the identity is never threatened in the first place.

Moreover, the above three solutions all suffer from the defects of constituting an entirely unnecessary enrichment of phonological theory and requiring decidedly ad hoc rule adjustments.

The only solution which is able to account satisfactorily for the data is the ordering solution, and we have already shown that it is able to do so without ad hoc reorderings or

modifications of individual phonological rules. Furthermore, it can account for the data without appealing to global conditions. Wilbur objects to the ordering solution on the grounds that the ordering of phonological rules before reduplication claims that reduplication can interact with phonological rules just as any other phonological rule and that it can be fed and bled by phonological rules. No such claim, however, is made in the analysis of Kankanaey reduplication. Rather, exceptional forms such as 15, 18, and 19 lend support to Aronoff s assertion that reduplication rules are not phonological rules in the common sense because they can intervene in the phonology only at certain specific points, postphonologically in this case. There is no sense in which they can be fed or bled by the preceding phonological rules, because they blindly reduplicate the first CVC of whatever output the phonological rules send their way. It makes no difference whether the preceding phonological rules have applied or not. This should be clear from comparing forms 16-17 with 18-19. In both cases, reduplication (CVC(1)) copies the affix along with the root. And in spite of the fact that no phonological rules apply to the first pair of forms while both syncope and glottal metathesis apply to the second pair, reduplication remains neutral to feeding or bleeding by either of these rules. So it seems that for Kankanaey at least, Wilbur's objection to phonological rules preceding reduplication is invalid.

We might legitimately question, however, what grounds there are for assuming that forms 16-17 represent post-phonological reduplication, when no phonological rules apply. Reduplication could just as easily apply prephonologically and derive the correct results. So also for forms 13, 14, and 20. Form 21, *semsemgép,* falls into a similar category, although the vowel harmony rule has optionally applied to it. Reduplication could be analyzed as either preceding or following the harmony rule. If it precedes, all we have to do is to make a slight adjustment to the harmony rule to allow it to apply right to left iteratively.

What means, then, do we have to disambiguate the ordering relationship between reduplication and phonological rules in the CVC(1) reduplicated forms of 10-14, 16-17, and 20-21? If we can find some forms in which reduplication clearly precedes the phonology and other forms in which it clearly follows, and then identify some feature which is unique to each category, we would then be able to examine the ambiguous forms to see whether they possess one or the other of these unique features. If they do, we would then be able to place them confidently in one category or the other.

Examining the list of CVC(1) reduplicated forms, we see that two forms, 8 and 9, clearly belong to the category in which reduplication precedes the phonological rules, because in both these cases the glottal assimilation rule is fed by reduplication. There are two other forms, 18 and 19, which clearly follow the phonological rules. Comparing these two categories, we see that in 8 and 9, reduplication seems to be sensitive to morpheme boundaries, copying the first CVC of the root only. In 18 and 19, on the other hand, reduplication apparently ignores the presence of the morpheme boundary, copying the first CVC of the whole word.

We can now establish the criteria for disambiguating the remaining forms. Reduplication which is sensitive to morpheme boundaries (copying the root only) will be classified as prephonological reduplication. Reduplication which ignores morpheme boundaries (copying affix along with root) will be classified as postphonological. Applying these criteria to the ambiguous forms disambiguates all but one of them. Forms 10-12 fall into the prephonological category, and forms 14, 16-17, and 20-21 fall into the postphonological category. That leaves us only with #13, *siysiyêkan.* (#15 was disambiguated on the independent grounds that the syncope and metathesis rules precede the operation of the reduplication rule.) With this form, there are no identifiable features which would lead us

to classify it in one or the other categories, but the obvious parallel between the forms of 13 and 14 allow us to place it in the postphonological category.

We are now in a position to relate the prephonological and postphonological types of reduplication in Kankanaey to the evidence provided by Siegel (1974) that morphological operations apply both prephonologically and at word-level. Siegel divides English affixes into two classes: Class I, which is prephonological and is associated with the morpheme boundary, and Class II, which is word-level and associated with the word boundary. The word boundary (#) is further characterized as post-cyclic, and a double word boundary (##) as postphonological.

Given that Kankanaey has no cyclic rules, our analysis of the two types of reduplication is exactly parallel with Siegel's analysis of English affixes. Prephonological reduplication is sensitive to morpheme boundaries and thus corresponds with the English affixes of Class I. Postphonological reduplication ignores morpheme boundaries and may thus be classified as a word-level operation, again corresponding exactly with English affixes of Class II, which are word-level and post-cyclic.

6. SUMMARY

I have attempted to demonstrate in this paper that Kankanaey has two distinct types of CVC reduplication, one which is sensitive to morpheme boundaries and occurs prephonologically, and one which ignores morpheme boundaries and occurs postphonologically. Before arriving at the above ordering solution to the irregularities created by reduplicated forms, I first examined three alternative solutions – boundaries, exception features, and the Identity Constraint – and showed how each of them was inadequate to account for the Kankanaey data. I concluded that the ordering solution was the best one available on two grounds: first, on the internal grounds that it required no ad hoc adjustments or reordering of the phonological rules needed to account for ordinary forms in the language and that it allowed all forms to be derived in a straightforward, transparent manner; and second, on the independent, crosslinguistic grounds that the ordering of the two types of reduplication with respect to the phonology had an exact parallel in Siegel's analysis of the ordering of two types of English affixes.

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APPENDIX I

DISTINCTIVE FEATURES OF KANKANAEY PHONEMES

Except for the feature 'central', the distinctive features below are those proposed by Chomsky and Halle (1968). 'Central' is used here, because it simplifies the statement of the syncope rules and seems to capture the contrasting behavior of central and non-central vowels better than a feature such as 'front'.

	b	d	g	p	t	k	?	m	n	ŋ	s	l	w	y	i	e	a	o
syllabic (syl)	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+	+
sonorant (son)	−	−	−	−	−	−	−	+	+	+	−	+	+	+	+	+	+	+
coronal (cor)	−	+	−	−	+	−		−	+	−								
back (bk)	−	−	+	−	−	+		−	−	+			+	−	−	−	−	+
low	−	−	−	−	−	−	+	−	−	−	−	−	−	−	−	−	+	−
voiced	+	+	+	−	−	−												
nasal (nas)								+	+	+								
lateral												+						
strident											+							
central (cent)															−	+	+	−