The Role of Extraprosodicity in Prosodic Reduplication:

A case study of reduplication in Lakota

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1. Introduction[1]

A reduplicative affix is characterized by the property that it receives its phonemic content from the segmental content of the root word to which it attaches. In Lakota, the final syllable of the root is reduplicated, e.g. **wači** reduplicates as **wači-či**. Reduplication can reveal the underlying form of a lexical root. For instance, **sapa** 'black' reduplicates as **sap-sapa**. Note that the final [a] of **sapa** does not appear on the base of the reduplicated form. This indicates that the root which undergoes reduplication is actually **/sap/**.[2] This paper has two goals. First, I shall argue, contra Shaw (1980,1986,1989), that Lakota has only open syllables during lexical derivation. Word-final consonants are extraprosodically licensed, resulting in word-final codas postlexically. This accounts for the fact that codas may appear word-finally in Lakota, but not word-internally. Second, I shall show that extraprosodic segments are crucially involved in Lakota reduplication, and that a prosodic theory of reduplication can account for the reduplication of extraprosodic segments.

According to Marantz (1982) and McCarthy and Prince (1986), the phonemic melody of the root is copied and mapped onto the reduplicating template, deriving the reduplicated portion of the word. Because McCarthy and Prince (1986) propose that the template of a reduplicative affix is universally a prosodic unit, the association of the copied melodic segments to the reduplicating template will be governed by the syllable structure of the individual language. Given the theoretical underpinnings of prosodic reduplication, extraprosodic segments would not be able to map onto a prosodic reduplicating template, because extraprosodic segments are invisible to prosodic structure. Example (1) shows the difficulty encountered by a prosodically based theory of reduplication, when extraprosodic segments surface on a reduplicative suffix. Given my analysis of Lakota syllable structure, the final consonant of the root **/sap/** 'black' is extraprosodic (1a). Upon reduplication, the reduplicating template is suffixed to the prosodic tier of the base (1b). The entire phonemic melody of the base **/sap/** is copied (1c) and associated to the reduplicative affix (1d). However, the final /p/ of the copied melody cannot associate to the reduplicating template because a coda is not licensed by Lakota syllable structure. Moreover, the final /p/ of the base is no longer word-final once the reduplicative suffix is attached, so it can no longer be extraprosodically licensed. As unassociated segments, the final /p/ of the base and the final /p/ of the copy would both be deleted by Stray Erasure (1e) deriving the starred form ***sasa**, (1f). However, the reduplicated form that actually occurs is **sapsapa**.

(1)

a. root:	σ ex	
	sap	'black'
b. affixation of the reduplicative template:	σ	+ σ
c. copy melody:	sap	sap
d. association of melody copy to template:	σ	+ σ
	sap	sap
e. Stray Erasure:	sa	sa
f. final form:	*sasa	(sapsapa)

The appearance of an extraprosodic segment on a reduplicative affix would appear to be problematic for McCarthy and Prince's theory. Because the reduplicated forms in Lakota indicate that extraprosodic segments are crucially involved in Lakota reduplication, the relationship of extraprosodic segments to a reduplicating suffix must be explained.

In the first half of the paper, I shall discuss Lakota syllable structure and shall show that, by positing a syllable template which is open, the phonological changes that occur in reduplicated forms reflect syllabification constraints. In the second half of the paper I shall discuss the dynamics of the reduplication process. I shall expand on the Onset Rule proposed in McCarthy and Prince (1986), to preserve the final consonant of the base upon attachment of the reduplicative suffix. Furthermore, I shall show that extraprosodic licensing must be allowed to apply to the final segment of the melody copy, enabling it to surface as part of the reduplicative suffix. Thus, a root-final consonant will be preserved on both the base and on the reduplicative suffix, thereby deriving the correct derivation of the reduplicated forms in Lakota.

2. Lakota

Lakota is a member of the Mississippi River branch of the Siouxan Family. There are three primary dialects: Lakota (Teton clans), Dakota (Santee clans), and Nakota (Yankton, Assiniboine, and Stoney clans). This paper will focus on the Lakota dialect of the Teton Sioux, which is the most thoroughly described of the dialects. Lakota is primarily spoken in South Dakota on four reservations: Standing Rock, Pine Ridge, Rosebud, and Lower Brule. The phonemic inventory of the Lakota dialect is shown in (2).

(2)

Phonemic Inventory of Teton Lakota

Consonants						Vowels	
Stops						oral	
unaspirated	p	t	č	k		i	u
aspirated	p"	t"	č"	k"		e	o
glottalized	p'	t'	č'	k'		a	
voiced	b						
Fricatives						nasalized	
voiceless		s	š	x	h		
glottalized		s'	š'	x'		į	ų
voiced		z	ž	ɣ		ą	
Sonorants							
liquids		l					
nasals	m	n					
glides	w		y				

Following a brief description of reduplication in Lakota, I shall show that the phonological processes which affect reduplicated forms indicate that Lakota maintains an open syllable structure during the lexical derivation, although postlexically closed syllables may occur.

2.1. Reduplication

Before turning to a description of Lakota syllable structure, I will present a general overview of the form that reduplication takes in Lakota in order to give an indication of the pervasiveness of reduplication in Lakota morphology, as well as to provide examples of the regular phonological pattern which reduplication takes. According to Shaw (1980), reduplication applies to verbs, adjectives, adverbs, nouns, demonstratives, particles and clitics; although it is most productive with verbs and adjectives. Reduplication may have any one of the following semantic functions in Lakota, depending on the lexical category of the root: a repeated or iterative activity, a distributive state, intensification, or plurality of non-animate things. Regardless of its function, reduplicated forms all share the same formal property: the right-most portion of the word appears on the reduplicative suffix. The apparent departure from this pattern displayed in the reduplicated forms *šųk-šų́ka* 'dog-like' and *wag-wáka* 'to sprawl' will be accounted for in the following section.

(3)

lexical category	base		reduplicated form	
noun	*šų́ka*	'dog'	*šųk-šų́ka*	'dog-like'
adjective	*wašté*	'good'	*wašté-šte*	'very good'
	hąšká	'tall'	*hąšká-ška*	'are tall'
verb	*wačí*	'dance'	*wačí-či*	'to jump up and down'
	wáka	'to lie down'	*wag-wáka*	'to sprawl'
clitic	*niyá-šni*	'breathe-neg'	*niyá-šni-šni*	'all out of breath'
adverb	*hel*	'there'	*hélhel*	'here and there'
demonstrative	*le*	'this'	*léle*	'this right here'
pronoun	*tuwé*	'someone'	*tuwéwe*	'various people'

2.2. Lakota Syllable Structure

In this section, it will be argued that the Lakota syllable structure is open during the lexical derivation, although postlexically the constraints on syllable structure no longer hold, so that a coda may occur word-finally.[3] Although most lexical roots are vowel-final, some roots have been analyzed by Boas and Deloria (1940) and by Shaw (1980) as having root-final consonants in their underlying forms. Upon entering the lexical derivational cycles these roots must be syllabified. Since the syllable structure which I argue for does not allow a coda, I shall hold that the root-final consonant is preserved during the lexical derivation by extraprosodicity, in accordance with Itô (1986). It will be demonstrated that the phonological processes which affect the root-final consonant during the lexical derivation serve to preserve an open syllable structure. Examples from compounds will be provided in addition to reduplicated forms in order to show that these phonological processes are fully general in the language.

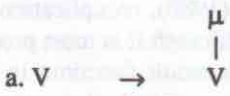
2.2.1. Syllabification

In showing that the maximal syllable is C^2V during the lexical derivation, and that root-final consonants are extraprosodically licensed, I shall assume the following three principles governing syllabification, following Itô (1986): Structure Preservation, Prosodic Licensing, and the Principal of Locality. Structure Preservation specifies that language specific syllable structure constraints must hold throughout the lexical derivation. The constraints on Lakota syllable structure which I propose will be reflected in an algorithm for constructing syllable structure which does not include a rule for linking a coda to the syllable node[4] and in constraints on the onset. The Principle of Prosodic Licensing specifies that all segments must be either syllabified or extraprosodic during all stages of lexical derivation. This presupposes that syllabification is continuous during each stage in the lexical derivation. Edge-segments may be

extraprosodic and therefore need not conform to syllable wellformedness restrictions during lexical derivation. Any segment that is not prosodically licensed or that is not an extraprosodically licensed edge-segment falls prey to Stray Erasure and is deleted. The Principle of Locality requires that syllable wellformedness is determined solely syllable-internally and is, crucially, **not** dependent on external information such as the phonemic structure of segments in the following syllable. I shall assume that syllabification takes place in the following manner for Lakota, following Hayes (1989):

(4) Rules for building syllable structure:

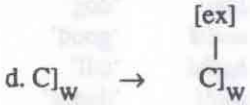
a. Moraify all sonorous segments that are [-cons].



b. Project a syllable node over each mora.[6]

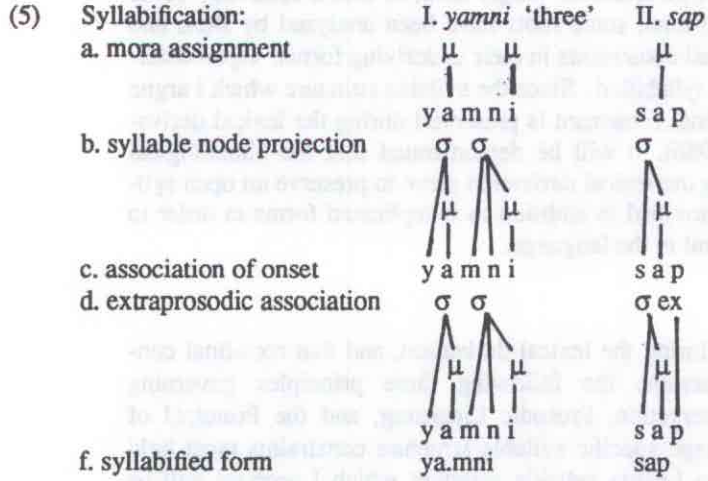
c. Associate all licensable onsets to syllable nodes.

d. Assign extraprosodicity to all word-final consonants.



Following Clements and Keyser (1983), these rules are intended to apply in a way which is consistent with syllable structure constraints provided in section 2.2.3. The following example shows the lexical syllabification of two Lakota stems following the rules for building syllable structure presented in (4). In column I of example (5) the stem is vowel-final. In column II of example (5) the stem is consonant-final. First a mora is assigned to each vowel (5a). Then a syllable node is projected over each mora (5b). Next, all possible onsets are associated to each syllable node (5c), subject to constraints on the onset discussed in section 2.2.3. Finally, word-final consonants are licensed by final extraprosodicity (5d). Ultimately, word-final vowel epenthesis will take place, so that the stem /sap/ will be resyllabified as **sa.pa**.

(5) Syllabification:



The realization of consonant-final stems when reduplicated is interesting because of the phonological processes which the stem-final consonant undergoes upon reduplication. In the following sections, I shall show that the phonological processes listed in (6) are motivated by the prosodic requirements of the

language.

(6)	a. Degemination:	/k"ak/	k"ak-k"ak	→	[k"ak"áka]	'to rattle'
	b. Cluster Simplification:	/xpeč/	xpeč-xpeč	→	[xpexpéča]	'lifeless'
	c. Dissimilation:	/šič/	šič-šič	→	[šikšíča]	'be bad'
	d. Epenthesis:	/čap/	čap-a	→	[čápa]	'beaver'

A stem-final consonant is subjected to the phonological processes (6a,c) when, upon reduplication or compounding, it is no longer on a word edge, but rather is followed by another consonant resulting in an unsyllabifiable sequence. Degemination (6a) and Cluster Simplification (6b) will be shown to be the result of Stray Erasure which applies to consonants which cannot otherwise be syllabified. Dissimilation (6d) is triggered by heteromorphemic clusters which cannot be syllabified as onsets, transforming them into syllabifiable onset sequences. Furthermore, it will be shown that Epenthesis (6d) is motivated by a tendency to optimize open syllables. Thus, these phonological processes ensure that all word-internal segments are syllabifiable and that an open syllable structure is adhered to.

2.2.2. Consonant-final Roots: Evidence from Stress, Reduplication, and Compounds

Boas and Deloria (1940) and Shaw (1980) have determined that, although nearly all words in Lakota are vowel-final, some roots are consonant-final in their underlying form. Because the characterization of these roots as being consonant-final is crucial to this paper, the evidence supporting their analysis will be reviewed in this section.

Evidence from reduplicated and compound forms indicates that there are two types of lexical roots which are distinguished in their underlying form: open syllable roots (CV stems) as in (7a,b), which may be one to two syllables in length, taking the form: $(C^2_0V)\ C^2_0V$; and consonant-final monosyllabic roots (CVC stems) as in (7c), which take the form: C^2_0VC.[7] However, when CVC stems are in word-final position they receive a final epenthetic **-a** during the lexical derivation, and ultimately surface with an open syllable form which resembles the disyllabic CV stem. For this reason, nearly all open-class words in Lakota have only open syllables upon reaching the postlexical stage.

(7)	a. CCV:	/mni/	mní	'water'
	b. CCVCCV:	/skokpa/	skokpá	'hollowed out'
	c. CCVC:	/ksap/	ksápa	'be wise'

Despite their surface similarity, consonant-final stems can be distinguished from bisyllabic vowel-final stems by stress placement and by their phonological behavior in various morphological environments. Firstly, stress is assigned to the second syllable of a word, as seen in (7a,b). However, CVC roots are stressed on the first syllable, as in (7c), indicating that these roots were monosyllabic at the time of stress assignment.[8] Based on this behavior, it has been determined that the word-final **-a** on CVC stems arises from epenthesis, which takes place after stress has been assigned (Shaw 1980). First the root is syllabified (8a) so that stress may be assigned to the second syllable (8b). Following Stress Assignment, the final **-a** is epenthesized to the consonant-final root (8c) resulting in seemingly divergent stress patterns (8d).

(8)

base:	*skokpa*	*ksapa*
a. Syllabification:		
b. Stress Assignment:	sko.kpá	ksáp
c. Epenthesis:	sko.kpá	ksápa
d. final form:	sko.kpá	ksá.pa

Secondly, evidence from reduplication shows that, while the final vowel appears on the base of the reduplicated forms of CV stems, it does not appear on the base of the reduplicated froms of the CVC stems, as seen by comparing (9a), columns I and II. However, -a does appear word-finally on both the root and its reduplicated form, as can be seen in (9c), columns II and III. Moreover, the evidence from reduplication is entirely consistent with the evidence from stress placement. The stems which are stressed on the first syllable (9bIII) are the same stems which reduplicate without a final vowel surfacing in the base (9aII). From this it can be concluded that the word-final vowel surfacing on CVC stems must not have been a part of the base at the time of both reduplication and stress assignment.[9]

(9)

Process	I. CV stem	II. CVC stem	III. CVC stem
root:	*hąska* 'tall'	*sap* 'are black'	*sap* 'black'
a. reduplication:	hąska-ska	sap-sap	
b. stress assignment:	hą.ská.ska	sa.psáp	sáp
c. epenthesis:		sapsáp-a	sáp-a
d. final form:	hą.ská.ska	sa.psá.pa	sá.pa

Thirdly, evidence from compounds corroborates the argument drawn from reduplication. When CVC stems enter into a lexical compound[10] the final -a only appears when the stem is in word-final position, as shown in (10b), which is consistent with the data from reduplication (10a). On the other hand, in syntactic compounds, the epenthetic -a also appears word-internally, as shown in (10c). Based on this behavior, Shaw (1986) places the derivation of syntactic compounds at a later level of the lexical derivation, after epenthesis has taken place.

(10)

Simple Root:		**Reduplicated Form:**
a. /šu̧k/	šu̧ka 'dog'	šu̧k-šu̧ka 'dog-like'
Compounded Forms:		
b. lexical:	šu̧k-mánitu (dog-wilderness)	'wolf'
c. syntactic:	šu̧kšu̧ka-waàyuta ((dog-redup)(look at))	'to look abjectly for a favor'

The following derivation shows how the above mentioned derivational processes can be ordered to account for the surface realization of words comprised of consonant-final stems. Reduplication (11a), Lexical Compounding (11b), and Stress Assignment (11c) all take place before the final -a is epenthesized (11d). However, the epenthesized -a does surface word-internally in syntactic compounds (11e) since this process occurs late in the lexical derivation.

(11)

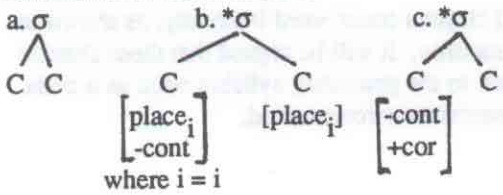
Derivation of Compounds			
Cycle	Process	Lexical	Syntactic
Base form:		*šųk* 'dog' *manitu* 'wilderness'	*šųk* 'dog' *waayuta* 'look at'
Level I	a. Reduplication:		šųkšųk
Level II	b. Lexical Compounding:	šųk-manitu	
	c. Stress Assignment:	šųk-mánitu	šųkšúk waáyuta
	d. Epenthesis:		šųkšúka
Level III	e. Syntactic Compounding:		šųkšúka-waàyuta

In this section evidence has been given supporting the analysis of root-final consonants to which a word-final vowel is epenthesized during the lexical derivation. The following sections will discuss the fate of the root-final consonant as it passes through the lexical derivation.

2.2.3. Onsets

Of the phonological processes which affect the stem-final consonant of a reduplicated or compound form, most govern the wellformedness of a derived consonant cluster. Given the proposed open syllable structure, all consonants must be syllabified as onsets, with the exception of those occurring word-finally. The onset allows maximally two consonants. The following constraints on the syllable onset clusters reflect the restrictions on Lakota onsets.[11] It should be noted that clusters containing glottalized or aspirated consonants do not occur word-initially, although they may arise during the lexical derivation as the second segment of a cluster.

(12) Constraints on Onset Clusters



d) *σ C' C"

e) *σ C" C'

f. *σ C' C'

g. *σ C" C"

The sonority hierarchy is reflected in onset clusters, such that the sonority of the segments rises to the syllable peak and subsequently falls off. Lakota onsets are somewhat unusual in that an onset need not rise in sonority; clusters such as *kp*, *pt*, and *kt* commonly occur. The fact that they occur word-initially, as shown in (13), indicates that they may be licensed as onset clusters.

(13)

pte	'buffalo'	*kte*	'to kill'
pč"eč"éla	'short'	*kč"a*	'loose'
psiča	'jump'	*kpa*	'to swell'

In the following section it will be shown that the phonological processes which affect derived clusters serve to ensure that they conform to constraints on permissible onsets. If the syllable structure were to allow a coda, on the other hand, these same processes could only be listed as rules, because the consonant

could be syllabified as a coda and would not need to conform to onset restrictions.

2.2.3.1. Coronal Consonants and Cluster Dissimilation

One method by which an unsyllabifiable sequence of consonants can be rectified is to change the phonetic features of one of the offending phonemes. Non-continuant coronal-initial clusters rarely occur in Lakota roots word-initially or word-internally,[12] although they may arise during the lexical derivation. The restriction against coronal consonants in cluster-initial position is reflected in two phonological processes: Coronal Dissimulation and Coronal Lenition, both of which serve to alter the phonetic features of an onset-initial coronal.

Coronal Dissimilation insures that coronal consonants do not co-occur with other coronal consonants. This reflects a more pervasive restraint against homorganic clusters (12b). If heteromorphemic coronal phonemes arise, the initial coronal consonant undergoes dissimilation of place so that the resulting consonant cluster is neither homorganic nor coronal initial, transforming it into a syllabifiable onset.

(14) **Coronal Dissimilation,** (Shaw 1980:338)
Any non-continuant coronal consonant will become [k] when followed by another coronal consonant.
{t,c,n,l} → k /__ + (+cor)

$$\begin{bmatrix} -\text{cont} \\ +\text{cor} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{cor} \\ -\text{ant} \\ -\text{son} \end{bmatrix} / \_\_ + (+\text{cor})$$

/zut/	zut-zut	→	[zuksúta]
/č"eč/	č"eč-č"eč	→	[č"ekč"éča]
/lila/	lil-lila[14]	→	[liglíla]

In some reduplicated and compound forms, liquid-initial clusters occur word-internally, as shown in (15). If these clusters were onsets, they would actually fall in sonority. It will be argued that these clusters arise in the postlexical phonology wherein the liquid can attach to the preceding syllable node as a coda. This will prove to be a second means by which coronal-initial onsets are circumvented.

(15)	k"ata	k"alk"áta	'to be warm'
	xiča	xilxíča	'to awaken someone'
	p"iča	p"ilp"íča	'to be rather good'
	čat-wašte (heart-good)	čalwášte	'good hearted'
	p"et-nakpakpa (fire-crackles)	p"elnákpakpa	'sparks'

The reduplicated and compound forms shown above arise from the application of a rule of Coronal Lenition. This rule reduces stem-final coronal consonants /t/ and /č/ to [l] before any morpheme boundary.[15] This not only results in word-final l's, but also in word-internal l's. If this rule were to apply during the lexical derivation, given the lack of a coda rule, the cluster-initial [l]'s would have to be syllabified as part of the following onset. Yet, this would violate the sonority hierarchy because the onset would be falling in sonority rather than rising. Shaw (1986), however, argues that Coronal Lenition is a postlexical rule, based on the fact that (a) "it is not crucially ordered before any lexical rule" and (b) "the rule is surface true" (Shaw 1986:185), indicating that Coronal Lenition takes place close to the surface level. These conditions do not hold for any other rule discussed in this paper.[16] Lakota syllable structure constraints

would not bar [l] from being licensed as a coda because, at the postlexical level, Structure Preservation no longer holds, so that codas are allowed.

(16) **Coronal Lenition** - Postlexical, (Shaw 1980:336)
The coronal consonants /t/ and /č/ will become [l] when they occur on any morphological boundary.
{t,č} → l / ____ (+, =, %, #) (where + is an affix boundary, = is a clitic boundary, % is a compound boundary, and # is a word boundary.)

$$\begin{bmatrix}-\text{son}\\-\text{cont}\\+\text{cor}\end{bmatrix} \rightarrow \begin{bmatrix}+\text{son}\\-\text{nas}\end{bmatrix} \; / \_\_\_ (+, =, \%, \#)$$

k"ata	k"at-k"at	→	k"alk"áta	'be warm'
ota	ot-ot	→	olóta	'many'

Example (17) shows the derivation of a reduplicated and a compounded word. During the lexical derivation Reduplication (17a) and Compounding (17b) result in a root-final /t/ appearing on a morphological boundary. Then, a word-final vowel is epenthesized (17c). During the postlexical phonology Coronal Lenition (17d) applies to weaken the stop to a liquid. Since this occurs in the postlexical phonology, the resulting liquid may attach to the preceding syllable node as a coda (17e). Note that a coronal preceding word-final epenthetic vowel does not undergo lenition, due to the fact that it is not a morpheme boundary.

(17)

Cycles	Process	Reduplicated	Compounded
root:		*k"at* 'warm'	*čat* 'heart' *wašte* 'good'
lexical	a. reduplication:	k"at-k"at	
	b. compounding:		čat-wašte
	c. epenthesis:	k"at-k"ata	
postlexical	d. Coronal Lenition:	k"al-k"ata	čal-wašte
	e. final form:		k"al.k"á.ta

It may be possible to motivate the rule of Coronal Lenition on prosodic grounds as well. It has already been noted that Lakota is somewhat unusual in that it allows onsets which are not rising in sonority and that lexical roots with coronal-initial clusters are rare. It is possible that Coronal Lenition has arisen as an attempt to break up these onset clusters. Sonorants tend have a preferred status for the coda; for this reason it is perhaps not unreasonable to find a rule that results in a coronal liquid which takes coda status in the postlexical phonology.

In this section I have shown that all derived coronal-initial consonant clusters undergo phonological processes which enable the cluster to conform to onset restrictions by altering the phonetic features of the initial coronal consonant. Although Coronal Lenition may produce liquid initial consonant clusters, since this rule applies postlexically where Structure Preservation no longer holds, the cluster initial [l] can be attached to the preceding syllable node as a coda and need not be syllabified as an onset.

2.2.3.2. Derived Clusters and Stray Erasure

Sequences of more than two consonants in a cluster do not occur word-initially nor word-internally. An algorithm for the construction of syllable structure which does not have a coda rule can account for this parallelism. The lack of a coda rule predicts that when reduplicated and compounded roots juxtapose a stem-final consonant with a consonant cluster, the stem-final consonant will be lost to Stray Erasure because there is no place for it to associate to the prosodic tier. Itô argues that during the lexical cycles edge-segments are universally extraprosodic. Allowing stem-final consonants to be extraprosodic accounts for their odd distributional trait: they only occur word-finally. Once these stems undergo reduplication,

however, the stem-final consonant of the base is no longer on the word edge. Thus, it can no longer be extraprosodic. If it cannot be absorbed into the onset of the following syllable it can not be syllabified. If so, it will fall prey to Stray Erasure as an unsyllabified consonant and it will be deleted. This presupposes Itô's principle of Prosodic Licensing: that "the output of every (phonological) cycle must be prosodically licensed and that Stray Erasure is invoked at the end of each cycle to eliminate unlicensed material" (Itô 1986:13). The analysis being argued for follows McCarthy and Prince's (1986) proposed analysis of Kamaiura, a language whose syllable structure is nearly identical to Lakota. "Syllable final consonants are licensed only word-finally, and so the rule of cluster simplification is apparently redundant with respect to a universal phonological condition -- Stray Erasure -- and the independently-needed syllabic wellformedness conditions of this language" (McCarthy & Prince 1986:43).

The algorithm for the construction of syllable structure proposed in section 2.2.1 predicts that the segment deleted by Stray Erasure will be the one furthest from the following syllable nucleus because it would be the last to associate to the onset. The Lakota data bears out this prediction: the root-final consonant of the base is deleted when juxtaposed with a following consonant cluster, as shown in (18a-d). Thus, Cluster Simplification and Degemination[17] will be shown to be the result of Stray Erasure.

(18) **Cluster Simplification:**

a. /ksap/	ksap-ksap-a	→	ksaksápa	'be wise'
b. /bles/	bles-bles-a	→	blebléza	'be sane'
c. [šu̧k-mni-ku]	(horse-water-?)	→	šu̧mníku	'to water horses'
d. [p"et-snis]	(fire-to fade)	→	p"esníza	'embers'

Degemination:

e. /sus/	sus-sus-a	→	susúza	'to have a slight crack'
f. /xux/	xux-xux-a	→	xuxúya[19]	'to thunder'

Example (19) shows how an open syllable structure predicts that Stray Erasure and the algorithm for constructing syllable structure will delete a root-final consonant when it is followed by a consonant cluster. Column I shows the derivation of a reduplicated form and column II shows the derivation of a compound. If the onset position is already full, the preceding root-final consonant is stray erased because it cannot be syllabified as an onset. I am assuming that association to the onset universally proceeds in a sequential manner, such that no segment will be skipped over. In this fashion syllable structure would prevent the outermost of a tri-consonantal sequence from being associated to the syllable node and its deletion would automatically be taken care of by Stray Erasure.

(19)

Process	Reduplicated form	Compound form
root:	I. *ksap* 'be wise'	II. *šųk* 'horse' *blok* 'male'
a. reduplication:	σ + σ k s a p k s a p	
b. lexical compound:		šųk- blok
c. resyllabification:	σ σ ex μ μ k s a p k s a p	σ σ ex μ μ š ų k- b l o k
d. stray erasure:	ksa-ksap	šų-blok
e. epenthesis:	ksaksáp-a	šųblók-a
f. final form:	ksa.ksá.pa	šų.bló.ka 'stallion'

In column I of the above example, the root-final /p/ of the base is no longer word-final once the reduplicating suffix is attached (19a). The same holds for the first element in the compound in column II, the root-final /k/ of the base is no longer word-final and cannot be extraprosodically licensed (19b). When resyllabification occurs, these consonants cannot be syllabified as an onset to the following syllable because the onset is already maximally satisfied (13c). Thus, they are exposed to Stray Erasure and are deleted (13d). Finally, word-final epenthesis occurs (13e), resulting in syllables which are uniformly open (13f). Note that these rules must proceed in an ordered manner for Coronal Dissimilation to bleed Coronal Lenition. Moreover, Coronal Dissimilation must take place before Stray Erasure. I am assuming that Stray Erasure applies at the end of each level in the lexical derivation.

In this section, it was argued that, where the root-final consonant is followed by a consonant cluster, it will be stray erased because it cannot associate to a syllable node and cannot be protected from Stray Erasure by extraprosodicity because it is not word-final. Moreover, the phonological rules that affect the root-final consonant in word-internal environments serve to make it a viable onset. Thus, it has been shown that these rules are prosodically motivated and that the universal convention of Stray Erasure accounts for both Cluster Simplification and Degemination.

2.2.4. Extraprosodicity

I have suggested that the behavior of root-final consonants in simple and compound forms, as well as in reduplicated forms, can be accounted for if they are extraprosodically licensed. In this section evidence supporting their extraprosodic status will be discussed. When an extraprosodic segment loses its position as an edge-segment it may associate to the following syllable node If, however, it cannot be syllabified and is left unassociated after resyllabification, it will be deleted by Stray Erasure. It will be shown that in Lakota, a root-final segment is preserved in word-internal environments by vowel epenthesis, or by a following morpheme which is either vowel-initial or has only one consonant in its initial syllable; otherwise it does not surface. These properties correspond to the expected behavior of an extraprosodic segment. Therefore, in the above mentioned environments it will be predicted that root-final consonants will surface in the postlexical phonology. Conversely, where a root-final consonant is followed by a morpheme which has a consonant cluster in its initial onset, it will fall prey to Stray Erasure and will not surface postlexically. Note also that there is a restriction on the root-final consonant slot in Lakota, such that no consonant clusters are allowed. Since only the final segment is universally extraprosodic, it is not surprising that no clusters occur in final position.

2.2.4.1. Lexical Roots

Epenthesis rules are characteristicly motivated by the need to syllabify an unsyllabifiable phonemic sequence. If morpheme-final consonants were true codas, however, then word-final -a epenthesis would not be motivated by prosodic requirements. Word-final Epenthesis was discussed in section 2.2.2, where it

was shown that consonant-final roots acquire a final epenthetic vowel during the lexical derivation. It is argued here that this serves to optimize the open syllable structure, as seen in (20a).

An extraprosodic segment can be saved in word-internal environments by a following vowel-initial affix. In lexical compounds, if the second member of the compound is vowel-initial or has only one consonant in its onset, the final consonant of the first member is retained, as shown in (20a-d). However, if the second member of the compound has a cluster onset, the root-final segment of the first member of the compound falls subject to Stray Erasure because it is no longer an edge-segment and cannot link to a following syllable node, as shown in the compounds in (22e,f).

(20)	a. č"ap	č"á.pa	'beaver'
	b. wič-o-ič"aɣe-ki (people-loc-grow up-det)	wi.čó.i.č"aɣe.ki	'the growth of the people'
	c. šu̯k-sake (horse-nail)	šu̯.ksá.ke	'horse hoof'
	d. č"ap-site (beaver-tail)	č"a.psí.te	'beaver tail'
	e. šu̯k-blok (horse-male)	šu̯.bló.ka	'stallion'
	f. p"et-snis (fire-to fade)	p"e.sní.za	'coals, embers'

The following example shows the derivation of lexical compounds whose initial element is a consonant-final root. Once a compound is formed, it must be resyllabified (21b) if possible, as stipulated in Itô (1986): all segments which are not extraprosodic edge-segments must be syllabified throughout the lexical derivation. As shown in (21c), columns II and III), a root-final consonant may be linked as an onset to the following syllable in the compound. If, however, the second element of the compound has a consonant cluster in its onset already, as shown in column IV, the root-final consonant of the initial element cannot be associated to a syllable node. With the application of Stray Erasure in (21c), the unassociated segment is deleted. In no other case does a root-final consonant get deleted. Finally, epenthesis occurs to syllabify the final extraprosodic segment (21d), bringing it into compliance with the open syllable structure.[20]

(21)

Process	I	II	III	IV
a. compounding:	*čap*	*wič-o-ičaγe-ki*	*cap-site*	*p"et-snis*
b. resyllabification:	σ ex μ č a p	σ σ σ σ σ σ μ μ μ μ μ μ w i č o i č a γ e k i	σ σ σ μ μ μ c a p s i t e	σ σ ex μ μ p" e t s n i s
c. stray erasure:				p"e-snis
d. epenthesis:	čapa			p"e-snisa
e. voicing:				p"e-sniza
f. resyllabification:	σ σ μ μ č a p a			σ σ σ μ μ μ p" e s n i z a
g. final form:	ča.pa	wi.čo.i.ča.γe.ki	ča.psi.te	p"e.sni.za

In this section it has been shown that the rules listed in (6) serve to produce words which only have open syllables upon reaching the postlexical level. Where the root-final consonant surfaces word-internally, the erstwhile extraprosodic segment can be associated to the onset of the following syllable node, for which it will not be Stray Erased.

2.2.4.2. Bound Morphemes

A small number of word-final consonants occur which do not trigger epenthesis, and consequently do not conform to an open syllable structure. However, these do not occur in lexical roots, rather they occur as a small number of clitics and closed-class morphemes. Bound morphemes, e.g., affixes and clitics, may be attached to roots in an established order.[21] Clitics are bound to the verb in a fixed post-verbal position. They are distinguished from the suffixes by being more losely bound to the root, such that stress can pass over an affix boundary but not over a clitic boundary. Shaw (1985) ultimately describes clitics as being "an outer layer of lexical suffixes" and puts them in a higher level of the lexical derivation. Assuming that stress assignment and vowel epenthesis occur at a lower level of the lexical derivation they do not affect clitics. The following clitics, [-'], [-p] and [-š], may occur in word-final position. Additionally, a few closed class morphemes, some of which are listed in (23), may surface with a word-final consonant. The glottal stop, [-'], serves as a declarative epistemic marker when it is attached to the final word of a statments. The clitic, **-š**, serves as an emphatic marker, as indicated by its use on connectives and on lexically independent pronouns (22), which are used for constrastive emphasis.

(22)

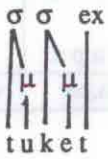
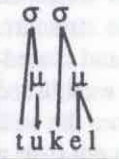
a. Pronouns:			b. Connectives:	
lexical	prefix	gloss		gloss
miš	mi-	'I'	naiš	'or'
niš	ni-	'you'	k"eš	'but'
iš	∅	'he'	tk"eš	'but'
ɥkiš	ɥk-	'we'		

A final [-p] occurs on the postposition **op** 'with' which is derived from from the verb **op"a** 'to join, participate'. Additionally, Boas and Deloria (1940) note that a number of verbs ending in **-tu**, which express spatial or temporal concepts, drop the ending when used in a subordinate clause, resulting in a word-final consonant:[22]

(23)	'anuktu	'anuk	'place on either side'	letu	lel	'here',
	toktu	tok	'be in some kind of condition'	hetu	hel	'there'
	'i-sak"iptu	sak"ip	'the place beside it'	katu	kal	'over yonder'
	č"okaptu	č"okap	'the middle'	tuktetu	tuktel	'where'.

Clitics are attached late in the lexical derivation. Since clitics only occur word-finally they are protected throughout the derivation by being extraprosodically licensed. Postlexically, structure preservation is suspended, lifting the restriction of open syllabicity and allowing them to associate to the word final syllable node as a coda, as shown in (24).

(24)

Cycles	Process:	*tk"e* 'but'	*tuktetu* 'where'
Lexical cycles:	apocope resyllabification		tuktet 
	clitic attachment resyllabification	tk"e-š 	
postlexical cycle:	Coronal Lenition resyllabification		tuktel 
final forms:		tk"eš	tu.ktel

Thus, the final consonant in lexical roots triggers epenthesis, optimizing the CV syllable structure. The word-final consonants that occur in bound- and closed class-morphemes do not trigger epenthesis because they have arisen later in the lexical derivation. These word-final consonants can be preserved from Stray Erasure during the rest of the lexical derivation by extraprosodic licensing. Postlexically they are allowed to attach to the final syllable node as a coda because Structure Preservation no longer holds.

In this section it has been argued that the phonological behavior displayed by the root-final consonants coincides exactly with that expected of an extraprosodic segment. It surfaces in word-internal environments when it is followed by a vowel or a single consonant because it can link to the onset of the following syllable. When it is followed by a consonant cluster, however, it does not surface because it is Stray Erased as it cannot associate to the following syllable. When it occurs word-finally, a vowel is epenthesized so that it surfaces as an onset to the epenthetic vowel. Word-final consonants that arize late in the derivation, following Epenthesis are preserved by final extraprosodicity.

2.2.5. Shaw's Analysis of Lakota Syllable Structure

Shaw describes Lakota as exhibiting syllable reduplication. Crucial to Shaw's analysis is the licensing of a coda. Although her proposed syllable structure would make the description of reduplicated forms in Lakota unproblematic for a prosodic theory of reduplication, I shall show that her characterization of the Lakota syllable is theoretically flawed. First, it will be shown that the coda licensing conventions which she proposes do not conform to Itô's Locality Principle. Second, it will be argued that because Shaw allows a

coda, the rules which affect derived consonant clusters cannot be motivated by prosodic considerations.

2.2.5.1. Licensing

In discussing coda licensing constraints, Shaw notes the uncharacteristically restricted environment of closed syllables. "All syllables preceding root-final position, not only in lexical roots but also in derivational and inflectional prefixes are open." (Shaw 1989:19). Thus, she states that a coda is only licensed when it occurs in stem- or word-final position. Shaw's licensing constraint, however, implies that syllabic licensing is dependent on morpheme structure.

A second licensing constraint proposed by Shaw states that a coda is licensed if it "conforms to the lexically-defined structural constraints on prenuclear (N"-dominated) constituents of the following syllable. If through morphological concatenation, a post-nuclear slot in a derived context cannot meet either of these conditions, then it will delete." (Shaw 1989:20). This condition implies that a coda is licensed if it can potentially be in the following onset cluster.

Neither of Shaw's licensing constraints, however, conform to Itô's Locality Constraint - that the syllable should not look beyond its borders for licensing. "[T]he wellformedness of a syllable or a metrical foot is determined solely within the syllable or foot and is crucially **not** dependent on information outside of that structure" (Itô 1986:7). This indicates that the syllable structure proposed by Shaw is theoretically flawed. Moreover, this coda licensing constraint does not account for the extreme paucity of consonant-final words in Lakota. Rather, by restricting coda licensing to stem- or word-final position, it predicts that the consonants which can occur in coda position should also surface word-finally. The fact that word-final consonants rarely surface on open-class lexical items is not accounted for by Shaw's syllable structure.

2.2.5.2. Phonological Rules

Shaw (1980) lists the following rules (25). Note that these rules instantiate the three possibilities for rectifying unsyllabifiable consonants: epenthesis, deletion, or alteration of phonetic features. However, if the syllable structure allows root-final consonants to be codas, the following rules cannot be prosodically motivated.

(25) a. **Stem Formation Rule** (Shaw 1980:34):
$\emptyset \rightarrow a / C$ ___ {=/#}, (Where [=] is a clitic boundary.)

/č"ep/	č"ep-a	→	[č"épa]	'fat'

b. **Consonant Cluster Simplification** (Shaw 1980:332):
$C \rightarrow \emptyset$ / ___ C C

/ksap/	ksap-ksap-a	→	ksaksápa	'be wise'
/bles/	bles-bles-a	→	blebléza	'be sane'
/xpeč/	xpeč-xpeč-a	→	[xpexpéča]	'lifeless'

c. **Degemination** (Shaw 1980:340):
$C_i \rightarrow \emptyset$ / ___ + C_i

/k"ok/	k"ok-k"ok-a	→	k"ok"óka	'sound of wood'
/xux/	xux-xux-a	→	xuxúya	'to thunder'
/k"ak/	k"ak-k"ak-a	→	k"ak"áka	'to rattle'

d. **Coronal Dissimilation**, (Shaw 1980:338):

$$\begin{bmatrix}-\text{cont}\\+\text{cor}\end{bmatrix} \rightarrow \begin{bmatrix}-\text{cor}\\-\text{ant}\\-\text{son}\end{bmatrix} \; / \_\_\_ + [+\text{cor}]$$

/zut/	zut-zut-a	→	zuksuta	'be upright'

/č"eč/	č"eč-č"eč-a	→	č"ekč"éča	'be fat'
/šič/	šič-šič-a	→	šikšíča	'be bad'

Shaw is not able to motivate word-final /a/ epenthesis via syllabification, because, for her, the coda is licensed in morpheme- and word-final position. She simply describes word-final epenthesis as a stem forming rule (25a). Shaw must also propose a rule of Consonant Cluster Simplification (25b), which deletes the first consonant of a triconsonantal sequence. Since Shaw allows most obstruents to be licensed in the coda, a sequence of three consonants would not be blocked by syllable structure constraints, as one consonant would be licensed in the coda and two would be licensed in the following onset. Similarly, Degemination (25c) cannot fall out of syllable structure constraints. Although Shaw acknowledges that Coronal Dissimilation (25d) appears to be motivated by the resyllabification of /č/ as an onset to the following syllable (see section 2.2.4.2), she must argue against such an analysis because her syllable structure allows the coronal consonant to be a coda. Moreover, Shaws rules do not capture the generalization that permissible word-internal clusters mirror word-initial clusters.

If codas are not allowed in Lakota syllable structure, Coronal Dissimilation and final vowel Epenthesis would be triggered by prosodic wellformedness. Cluster Simplification and Degemination would simply fall out of independently motivated onset restrictions and Stray Erasure. Shaw, on the other hand, must list these rules without being able to provide prosodic motivation for them.

2.3. Summary

I have argued for an open syllable structure in Lakota, where the stem-final consonants are extraprosodically licensed. Extraprosodic licensing not only accounts for the behavior of stem-final consonants in reduplicated forms, it also accounts for their behavior in compound forms. Liquid-initial consonant clusters do not violate syllable sonority because Coronal Lenition takes place postlexically. Since Structure Preservation no longer holds postlexically, the liquid can be linked to the preceding syllable node as its coda. Consonant-final clitics attach in the highest level of the lexical derivation and remain extraprosodically licensed as edge-segments at the word level. Postlexically, they, too, attach to the preceding syllable as a true coda. Given this analysis the following phonological processes can be motivated by syllable wellformedness: (1) word-final vowel Epenthesis, (2) Coronal Dissimilation, (3) Consonant Cluster Simplification, and (4) Degemination. Epenthesis and Dissimilation serve to make a syllabifiable sequence, while Cluster Simplification and Degemination simply fall out of Stray Erasure. Thus, it can be concluded that Lakota syllable structure specifies that syllables must be open during the lexical cycle. Universal extraprosodicity of word-final segments allows stem-final consonants to be preserved from Stray Erasure during the lexical cycles. Word-final consonants can be syllabified as codas postlexically, because Structure Preservation no longer holds during the postlexical cycle, so that language-specific syllabification rules no longer apply.

On the other hand, Shaw has proposed a closed syllable structure, licensing the root-final consonant as a coda when it is in stem- and word-final position, or when it can co-occur with the following onset. I have argued that both licensing conditions violate Itô's Locality Principle, because neither condition is based on syllable internal considerations. Moreover, Her first licensing constraint predicts the occurrence of word-final consonants, which are, in fact, extremely rare in Lakota. Finally, she is unable to provide prosodic motivation for epenthetic, dissimilatory, and cluster simplification process, all of which can be accounted for, given an open syllable structure, as removing an unassociated consonant or making it syllabifiable.

3. Prosodic Reduplication

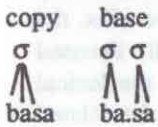
The reduplicated forms in the preceding section have been analyzed without close examination of how reduplication takes place. In this section I shall investigate the mechanics by which reduplication proceeds. Following McCarthy and Prince (1986), I shall assume that reduplication is prosodically driven and that the reduplicating template must be a prosodic unit.[23] This entails that the association of phonemic segments to the template must be prosodically driven. After giving a brief description of prosodic reduplication, I shall how that the extraprosodic licensing of a stem-final consonant in Lakota proves problematic for prosodic reduplication because the extraprosodic segment of both the base and the copy may surface in

the final form. I shall then demonstrate how, by expanding upon the Onset Rule proposed in McCarthy and Prince (1986), prosodically driven reduplication can preserve the final consonant of the base during reduplication. Finally, in order to preserve the final consonant of the copy for the reduplicating suffix, I shall show that extraprosodic licensing must be allowed to apply to the final consonant of the copied melody.

3.1. Prosodic Association

A reduplicating affix is a phonemically underspecified prosodic template onto which a copy of the phonemic material of the stem is mapped (Marantz 1982). McCarthy and Prince hold that association is driven by the reduplicating template which is characterized as a prosodic unit. For this reason the association of the phonemic segments of the copied melody to the reduplicating template will be governed by the syllabification rules of the language. In order to properly account for cross-linguistic reduplicating patterns, the melody of the entire root must be copied so that, in principle, any portion of its segmental content will be available for association to the reduplicating affix. Crucially, the hierarchical prosodic structure of the base is not copied along with the phonemic melody. This ensures that the prosodic parsing of the base does not influence the association of the phonemic melody to the reduplicating template. The Satisfaction Condition (McCarthy and Prince 1986) ensures that the reduplicating template draws its content from the melody to the full prosodic capacity of the template. For example, in a language which allows closed syllables, if the base consists of two open syllables, a reduplicating prefix with a syllabic template will draw the onset of the second syllable as its coda, as shown in the Ilokano progressive: ag.BAS.ba.sa 'be reading' (McCarthy and Prince 1986:13).

(26) The Satisfaction Condition:



In languages where the reduplicating affix is a prefix, the association of the melody to the template is from left to right (LR), (26). In languages such as Lakota, where the reduplicating affix is a suffix, the association of the melody to the template proceeds from the right to the left (RL) (27c). Thus, association universally proceeds from the edge inward.

(27)

root:	*gmigma*		'spherical'
a. affixation of the reduplicating template:		σ σ	+ σ
b. copy melody of the base:	gmi.gma		gmigma
c. association of melody to suffix:	gmi.gma	σ σ	+ σ gmigma
d. stray erasure:	gmi.gma		-gma
e. reduplicated form:	gmi.gma.gma		'are spherical'

First the reduplicating template is affixed to the prosodic tier of the base (27a). Then the segmental melody of the entire base is copied (27b). The association of the melody to the reduplicating template is governed by the syllable structure of the language, under the assumption that the template is a prosodic unit. The association proceeds from the edge inward; for a reduplicative suffix, association proceeds from the right to the left (27c). Finally, Stray Erasure deletes the unassociated portion of the copied melody (27d), deriving the reduplicated form of the word (27e).

The following example contrasts the derivation of a vowel-final root with a consonant-final root, illustrating the difficulty which arises in a prosodic theory of reduplication, when the reduplication of extraprosodic segments must be accounted for. Column I shows the reduplication of the vowel-final root.

In column II, a parallel derivation of a reduplicated consonant-final roots results in the starred form *sasa.

(28)

Process	I. *hąska*	'tall'	II. *sap*	'black'
a. affixation of the reduplicating template:	σ σ	+ σ	σ	+ σ
b. copy melody:	hą.ska	hąska	sap	sap
c. LR association of melody copy to template:	σ σ hą.ska	+ σ hąska	σ sap	+ σ sap
d. Stray Erasure:	hą.ska	-ska	sa	-sa
e. final form:	hą.ská.ska		*sasa	(sapsápa)

In column I of example (28) the reduplicating template is suffixed to the prosodic tier of the base (31a). The phonemic content of the entire stem is copied without its prosodic structure (28b). Association to the reduplicating template proceeds from the right to the left. The left-most syllable is associated to the Lakota reduplicating template because the template is a syllable node (28c). The unassociated segments of the melody are lost to Stray Erasure (28d), deriving the final form (28e). Column II of example (28) illustrates the inappropriate derivation of a consonant-final root. Although the entire melody is copied, including the final extraprosodic segment (28b), simple association of the copy to a prosodic template would not allow the final segment of the copy to associate to a syllable template because association is governed by the syllable structure of the language (28c). Moreover, due to the affixation of the reduplicative affix, the final consonant of the base is no longer word-final, in which case it cannot be extraprosodically licensed (28d). As the syllable structure for which I have argued has no coda slot available during the lexical derivation, the root-final consonant of the base and the final consonant of the copy should both be deleted by Stray Erasure as unassociated segments. Yet the Lakota data shows that both segments survive Stray Erasure. Hence, the surfacing of an extraprosodic segment on a reduplicating suffix must be accounted for by prosodic reduplication. In the following sections I shall show how the appearance of the final consonant of the base and the copy in the reduplicated form can be accounted for within a prosodically governed framework.

3.1.1. The Onset Rule

McCarthy and Prince have proposed an Onset Rule for prefixes which allows association to proceed beyond the reduplicating template to link segments of the copy to the prosodic tier of the base.[24] If the base is vowel-initial, McCarthy and Prince propose that the Onset Rule allows it to draw an onset from the melody copy during the association process once the reduplicating prefix has been satisfied. Thus, where the Onset Rule has applied, the copied melody shares prosodic association with both the prefix and the base.

McCarthy and Prince argue that the Onset Rule does not hold for all languages. For some languages, the juncture between the base and the reduplicating affix is opaque to the Onset Rule, in which case the base cannot draw from the phonemic melody of the copy to fill out an empty onset. However, for languages where the base-suffix juncture is transparent to the Onset Rule, segments of the copied melody may be linked to the onset of the initial syllable node of the base. Column I of example (29) shows McCarthy and Prince's (1986:15) analysis of prefixing reduplication in Oykangand, as described by Sommer (1981). The reduplicating prefix in Oykangand is a syllable. First, the reduplicating template is affixed to the prosodic tier of the base (29a). The melody is copied (29b), then the Left-Right association begins by associating to the reduplicating template. When the template has been satisfied, association continues rightward, linking the next segment of the copy to the onset of the base-initial syllable node (29c). Stray Erasure deletes all unassociated segments (29d). Since /g/ is associated to the prosodic tier, it surfaces in the final form (29e). Thus, they argue that the Onset Rule explains the appearance of /g/ on the reduplicating prefix, despite that fact that it could not associate to the reduplicating template.

(29)

Language: reduplicating template:	I. Oykangand prefix σ	II. Lakota suffix σ	
Process	*al.gal* 'straight'	*sap* 'black'	*ksap* 'be wise'
a. affixation of the reduplicating template:	σ+ σσ	σ +σ	σ +σ
b. copy melody:	algal algal	sap sap	ksap ksap
c. association: (+ Onset Rule)	σ + σ σ algal algal	σ +σ sap sap	σ +σ ksap ksap
d. Stray Erasure:	alg-algal	sa-psap	ksa-ksap
e. final form:	algalgal	sapsápa	ksaksápa

If the Onset Rule holds for prefixes as claimed by McCarthy and Prince, then the theory predicts that the same rule should hold for suffixes. I shall demonstrate how the scope of the application of the Onset Rule may be extended to apply to suffixing reduplication. In a language for which the base-suffix juncture is transparent to the Onset Rule, the Right-Left sweep would continue to map leftward after the phonemic material of the melody has been exhausted to draw unassociated phonemic material from the base to fill out the onset of the reduplicating syllable. This serves to satisfy the Satisfaction Condition for the reduplicating template.

Column II of example (29) shows how the scope of the Onset Rule could be extended to apply to the reduplicating suffix in Lakota, deriving the reduplicated form of /sap/ 'black'. After the reduplicating template is affixed to the prosodic tier of the base (29a), the entire phonemic melody of the base is copied (29b). The association of the copied melody to the reduplicating suffix proceeds in a Right-Left sweep until the phonemic material of the copy is exhausted. However, since the base-copy juncture is transparent to the Onset Rule, association is allowed to continue to draw unassociated phonemic material from the base to satisfy the reduplicating template (29c). This also serves to satisfy the Satisfaction Condition. The root-final consonant of the base is not lost to Stray Erasure because it is now linked to the reduplicating template and is allowed to affix to the base as a part of the reduplicating suffix (29d). For this reason the root-final consonant of the base surfaces in the final form (29e). Column III of example (29) shows that the Onset Rule would not apply to the reduplicated form of /ksap/ 'be wise' because the reduplicating template has already been satisfied by the phonemic material of the copy (29c). Since the root-final consonant of the base is no longer word-final it cannot be extraprosodically licensed. As an unassociated segment it will be deleted by Stray Erasure upon affixation (29d). For this reason it does not surface in the final form (29e)

In this section I have demonstrated that the Onset Rule should be allowed to apply to suffixing reduplication. I have shown that, in a language for which the juncture between the base and the copy is transparent, the Onset Rule can link an unassociated segment of the base to a reduplicating template which has not been satisfied by the phonemic material of the copy. Unassociated base-segments that would be available for linking to the reduplicating template are root-final segments which can no longer be extraprosodically licensed, because they are not word-final. I have demonstrated how word-internal root-final consonants can be saved from Stray Erasure during reduplication. Furthermore, I have shown that if the phonemic melody of the copy satisfies the reduplicating template, the morpheme-final consonant of the base will be Stray Erased as an unassociated segment.

3.1.2. Extraprosodic Licensing of Edge Segments on the Melody Copy

In this section I shall show that extraprosodic licensing must be allowed to apply to the melody copy in order to derive the reduplicated forms of consonant-final roots in Lakota. I shall make explicit the means by which these segments appear on a reduplicating suffix.

McCarthy and Prince briefly allude to reduplication in Kamaiura in which they offer an alternative analysis to that of Everett and Seki (1985) by proposing that Kamaiura has a prosodic template which is similar to the one that I have proposed for Lakota. They suggest that Kamaiura has a (C)V syllable

structure, but licenses word-final consonants through moraic extraprosodicity.[25] This refers to a type of prosodic extrametricality, where an unsyllabified edge-segment is allowed to occur during the lexical derivation. In this language, however, the base-suffix juncture is opaque to the Onset Rule. Upon affixation, the word-final consonant is no longer licensed by extraprosodicity, nor is it associated to the suffix even when the suffix is vowel-initial. Thus, it falls prey to Stray Erasure and does not appear in the final reduplicated form, as shown in (30), column I. However, McCarthy and Prince do not elaborate the means by which the final consonant of the copied melody is include in the reduplicating prefix in the Kamaiura example. In this section I shall make explicit how this takes place in Lakota by proposing that extraprosodicity be allowed to license the final segment of the melody copy, as shown in example column II.

(30)

Language	I. Kamaiura		II. Lakota	
Process	base	copy (opaque to O.R.)	base	copy (transparent to O.R.)
a. affixation of the reduplicating template:	σ σ + 	σ σ	σ + 	σ ex
b. copy base	apot	apot	ček	ček
c. associate copy to the template:	σ σ + 	σ σ 	σ + 	σ ex 
	apot	apot	ček	ček
d. Stray Erasure:	apo	-apot	ček	-ček
e. final form:	apoapt		čečéka	'stagger'

Although prosodic reduplication must be governed by the syllabification rules of the language, the Lakota data demonstrates that the stem-final consonant of the copy does surface in the reduplicated form. As the Right-Left association of the copied melody to the reduplicating Lakota template proceeds, the first segment encountered on a CVC stem will not be able to associate to a prosodic template because Lakota syllable structure does not allow a coda, as shown in (31). Yet association must be allowed to proceed to the following vowel.

(31)

lexical base:	*t"uk*	'hesitate'
a. affixation of the reduplicating template:	σ  t"uk	+ σ
b. copy melody	t"uk	t"uk
c. RL association: (+ Onset Rule)	σ +  t"uk	σ t"uk
d. Stray Erasure:	t"uk	t"u
e. final form:	*t"uktu	(t"u.kt"ú.ka)

Itô (1986) has proposed that word-final edge-segments are universally extraprosodic. This suggests that the edge-segment of the copy may be extraprosodically licensed since it is now on the word-edge. McCarthy and Prince hold that association cannot skip over an intervening segment, however, since extraprosodicity universally applies where ever it is able to, then it must apply before association takes place (32c). Once the final segment of the copy is licensed, R-L association is allowed to proceed (32d). No segments are lost to Stray Erasure because all are licensed, (32e). In this way the final segment of the copy is allowed to surface in the reduplicating suffix (32f).

(32)

a. affixation of the reduplicating template:	σ s a p	+ σ
b. copy melody:	sap	sap
c. extraprosodic licensing:	α + s a p	α ex s a p
d. association to template: (+ Onset Rule)	σ + s a p	σ ex s a p
e. Stray Erasure:		
f. final form:	sapsápa	'are black'

The Lakota data demonstrates that the final segment of the melody copy must be allowed to be extraprosodically licensed for it to surface in reduplicated forms, thus, conforming to the universal convention proposed by Itô - that word-final segments are universally extraprosodic. In this way the syllabification rules of Lakota are respected during reduplication. Thus, it has been demonstrated that the preservation of extraprosodic segments in the reduplicated forms as found in Lakota can be accounted for by a prosodic theory of reduplication. The expanded application of the Onset Rule can act to save the final consonant of the base and extraprosodic licensing of the final consonant of the melody copy will allow it to surface in the reduplicating suffix as well.

4. Conclusion

4.1. Lakota Syllable Structure

I have shown how, with an open syllable structure, the various phonological processes which take place upon reduplication in Lakota can be motivated by prosody. Consonant Cluster Simplification and Degemination automatically take place as a result of Stray Erasure. Coronal Dissimilation transforms hitherto unsyllabifiable cluster sequences into good onset clusters, and word-final Epenthesis is serves make stem-final consonants, which were preserved hitherto through extraprosodicity, into syllabifiable segments. Word-final clitic consonants are attached late in the lexical derivation, after epenthesis has applied, however they are preserved by extraprosodicity because they remain word-final. Post-lexically, Structure Preservation is suspended, and they are allowed to attach to the final syllable node as a coda. Coronal Lenition also occurs postlexically, so that the resulting liquids are allowed to attach to the syllable node as a coda as well.

Although the closed syllable structure proposed by Shaw would prove unproblematic for prosodic reduplication, the syllable structure on which she bases her reduplication rule is flawed. Shaw's coda licensing conditions violate the Locality Principle by making crucial reference to morpheme boundaries and to the following syllable. This results in consonants being licensed as a coda which never surface in the coda after the full derivational process has taken place. Similarly, it incorrectly predicts word-final consonants which never occur. Thus, the Lakota data is more efficiently accounted for by an open syllable structure and word-final extraprosodicity.

4.2. Reduplication

The open syllable structure that I have argued for in Lakota does prove problematic for McCarthy and Prince's theory of prosodic reduplication. McCarthy and Prince specify that the reduplicating template may only be comprised of prosodic units. For this reason, only syllabifiable segments can be associated to the reduplicating template. This would not permit the association of final consonants to the reduplicating template in Lakota. However, a back door has been left open for the languages which allow the boundary between the base and the copied melody to be transparent to the Onset Rule. I have shown how the application of the Onset Rule can be extended to include reduplicating suffixes in addition to prefixes. The Onset Rule would allow the continued edge-inward association of the copied melody segments for suffixes

to the prosodic tier, as it does for prefixes. This saves the root-final consonant of the base from Stray Erasure by enabling them to associate to the onset of the reduplicating template. I have shown that extraprosodic segments must be copied along with the rest of the melody. Although they cannot be associated to the reduplicating template, they must be allowed to undergo the usual rules of extraposodic licensing and syllabification, in which case the final consonant of the copy may be extraprosodically licensed, in accordance with with Itô's requirement that word-final segments are universally extraprosodic. Extraprosodic licensing applies before association to the reduplicating templated takes place, because Extraprosodic licensing universally applies wherever possible. Thus, the reduplicated forms of consonant-final roots in Lakota can be accounted for by McCarthy and Prince's theory of prosodic reduplication.

Notes

1. I would like to thank Barbara Levergood for her contagious enthusiasm during the many hours I spent in her office discussing the intricacies of theoretical phonology and mora theory. I also appreciate Margaret Langdon's guidance in working with a native American language. I am grateful to Jo Rubba for her time and care in going over early drafts of this paper. Finally, I would like to thank my son for putting up with a mother who had little time available for reading stories to him at bedtime.

2. Later in the lexical derivation a vowel is epenthesized word-finally to both the base and the reduplicated forms, giving **sap-a** and **sapsap-a**.

3. A rule of Coronal Lenition, which operates in the postlexical cycle, may produce word-internal closed syllables (see section 2.2.3.1). With the exception of the word-internal closed syllables brought about by this rule, the generalization that closed syllables only occur word-finally holds for all surface forms.

4. Once the lexical derivation is complete and the word enters the postlexical phonology, Structure Preservation no longer holds. For this reason closed syllables may occur postlexically in Lakota.

6. I am assuming that the syllabic nucleus is monomoraic based on the fact that, although sequences of vowels may occur within a root, they appear to be heterosyllabic as indicated by both stress assignment and reduplication. Stress assignment places stress on the second syllable (see section 2.2.2). When a bi-vocalic root is unprefixed, the second of two consecutive vowels is stressed (ia). It is argued in this paper that the final syllable is reduplicated during reduplication. When a bi-vocalic root is reduplicated, only the second vowel will surface on the reduplicative affix (ib).

(i)	a. /ia/	iá	iáa	'speak'
	b. /tąį/	tąí	tąíį	'show'

7. There is a restriction on on the set of phonemes that can occur in the root-final consonant slot: no consonant clusters, no phonemes containing laryngeal features (/h/, aspirates, ejectives, or voiced segments), and no bilabial sonorants are allowed. Shaw (1989:5) lists the set of consonants that can occur root-finally as being {p,k,č,s,š,x,l,n,y}.

8. There are two occasions when stress occurs on the first syllable instead of on the second syllable: (a) on unprefixed CVC stems and (b) on roots where the initial vowel has fallen subject to apocope or coalescence.

9. Some words do not undergo epenthesis and appear in the surface form with a word-final consonant. These will be discussed in section 2.2.3.2, where it will be shown that word-final consonants appear on clitics which are attached after epenthesis has taken place. Word-final consonants also appear on closed-class lexical items where apocope has taken place after epenthesis occurred.

10. Shaw (1986) distinguishes between lexical and syntactic compounds by stating that they occur at different levels of the lexical derivation. For this reason they are subject to different phonological processes. See Table 3 in the appendix.

11. See Tables 1 and 2 in the appendix for Boas's list of consonant clusters and Shaw's list of onset clusters.

12. There a gap in the restriction on coronal onset clusters (12c), although non-continuant coronal consonants rarely occur cluster-initially, a few lexical roots do have an initial /tk/ onset, as exemplified

by the word **tke** 'be heavy'. A dictionary count gives four entries for [tk] word-initial clusters, while, although there are only seven entries for word-initial [kt] clusters, the entries for [kp] and [pt] word-initial clusters is 54 and 69, respectively.

14. Although **lila** is not an underlying CVC root, it is reduplicated as if it were one, perhaps due to reanalysis. A voicing rule not discussed in this paper applies after Coronal Dissimilation, changing [k] into [g] due to the following sonorant.

15. Word-final Epenthesis does not trigger this rule, for which reason coronal stops followed by the word-final epenthetic vowel do not undergo lenition. Note that Coronal Dissimilation bleeds Coronal Lenition.

16. One unresolved problem with this analysis is that postlexical rules typically do not refer to boundaries.

17. Degemination of reduplicated forms (18e,f) indicates that the root-final consonant cannot be syllabified as an onset. However, Degemination does not appear to apply in compounds, as shown in (iia,b). Moreover, Cluster Simplification does not apply to some compounds either (iic).

(ii)	a. /č"ap-p"at/	(beaver-cut up)	→	[č"app"áta]	'to butcher beavers'
	b. /t"ok-k'u/	(enemy-return)	→	[t"okk'u]	'to give over an enemy'
	c. /p"et-mna/	(fire-smell)	→	[p"elmná]	'smell of fire'

Shaw groups compounds into two categories which occur at different levels in the lexical derivation; e.g., lexical and syntactic compounds. However, this data suggests that there is a cline of morphological transparency corresponding to the relative lexicalization of the word. Lexical compounds represent the most lexicalized compounds and syntactic compounds represent the least lexicalized compounds. Many compounds, however, seem to fall between the two extremes. The failure of Degemination and Cluster Simplification to apply in these compounds indicates that the morphological boundary is transparent enough to allow the root-final consonant to be extraprosodically licensed. Thus, the application of these phonological processes appears to correlate with the degree of lexicalization. For instance, the compound [nap-k"a] has two forms, the first of which has undergone metathesis: [nakp"á] "shirt cuff" and [napk"á] "sinews of the wrist". As the cluster [pk] never occurs root initially, it would appear that metathesis applies to the more lexicalized form of the compound, resulting in a more natural cluster (by Lakota standards).

19. Voiceless sibilants are voiced when the word-final -a is epenthesized, a common behavior which has sparked much controversy over the voice status of morpheme-final sibilants in underlying form.

20. Voicing (21e) has not been discussed in this paper. This rule voices root-final sibilants when they are followed by the epenthetic vowel. See Shaw (1980) and (1989) for a discussion of this rule.

21. Affixes are all monosyllabic, of the form: (C^2_0) V. Prefixes form the largest category which includes locatives, instrumentals, and several classes of pronouns. Suffixes form a smaller list which includes the subordinate clause marker -ya and the reduplicating morpheme. Clitics comprise a mixed bag of morphemes including the following: the animate plural marker **-pi**, the negative marker **-šni**, the future marker **-kta**, the diminutive marker **-la**, and the emphatic marker **-š**.

22. The demonstratives in (23) end with **-l** because only the **u** has dropped from **-tu**, leaving the word-final **t** in the environment of Coronal Lenition. If apocopy were to take place late in the lexical derivation, the resulting final consonant would be preserved by extraprosodicity until it reaches the postlexical level.

23. Although Marantz (1982) claimed that the most common type of reduplicating template is a CV skeleton, McCarthy and Prince (1986) argue that a CV reduplicating template essentially spells out the maximal prosodic unit without indicating which segments are obligatory and which are optional. For this reason they conclude that a CV skeleton obscures the reduplicating template's relationship to prosodic units. Based on these arguments I shall assume, along with McCarthy and Prince, that reduplication is prosodically driven and that a reduplicating template may only incorporate prosodic units such as a syllable or a foot.

24. This indicates that association is prosodically driven rather that skeletally driven since association does not stop when the reduplicating template has reached capacity.

25. McCarthy and Prince distinguish between two types of extrametricality: melodic extrametricality and templatic (prosodic) extrametricality. For the purposes of this paper I shall only be concerned with "templatic" extrametricality. Although there is no evidence indicating that the final consonant in Lakota is moraic, I believe that the syllable structure of the two languages is comparable.

5. Appendix

5.1. Possible Lakota Consonant Clusters

Table 1: Boas and Deloria (1940:5)

Consonant Clusters									
1/2	p	t	k	s	š	c	l	n	m
p	-	pt	-	ps	pš	pc	-	-	-
t	-	-	tk	-	-	-	-	-	-
k	kp	kt	-	ks	kš	kc	-	-	-
b	-	-	-	-	-	-	bl	-	-
g	-	-	-	-	-	-	gl	gn	gm
s	sp	st	sk	-	-	sc	sl	sn	sm
š	šp	št	šk	-	-	šc	šl	šn	šm
x	xp	xt	-	-	-	xc	xl	xn	xm

Table 2: Shaw (1989:7) Syllable Onset Clusters[26]

Syllable-Initial Clusters (L-dialect)											
1/2	p	t	č	k	s	š	x	l	n	m	w
p	-	+	+	-	+	+	-	+	+	-	-
t	-	-	-	+	-	-	-	-	-	-	-
č	-	-	-	-	-	-	-	-	-	-	-
k	+	+	+	-	+	+	-	+	+	+	+
s	+	+	+	+	-	-	-	+	+	+	+
š	+	+	-	+	-	-	-	+	+	+	+
x	+	+	+	-	-	-	-	+	+	+	+

5.2. Lexical Cycles

Table 4: Adapted from Shaw (1986:175)

Dakota Lexical Phonology

/underived lexical stem/

I.	Prefixation ya-Suffixation Reduplication	→ ←	Coronal Dissimilation Degemination Nasal spread
II.	Wa-Nominalization Lexical Compounding Nominal Derivation	→ ←	Dakota Stress Rule a-Deletion Continuant Voicing
III.	Cliticization Syntactic Compounding	→ ←	Ablaut Velar Palatalization
IV.	Postlexical: Syntax	→	Coronal Lenition

[26] A low level rule of stop voicing voices stops when they are followed by a sonorant in the onset. For this reason the /p/ and /k/ will be realized a [b] and [g] when followed by l, n, m, and w in a cluster.