REDUPLICATION IN SANSKRIT: AN ANALYSIS OF THE INTENSIVE

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1. INTRODUCTION

Sanskrit is a language with a rich grammatical tradition which goes back beyond the grammar of Pāṇini (4th century B.C.). A morphologically and phonologically complex language, it is still of theoretical interest today. Indeed, in recent years both McCarthy and Prince (1986) and, in passing, Marantz (1982) have looked at certain aspects of Sanskrit reduplication to demonstrate certain tenants of their theoretical models. However, these analyses have ignored certain problematic features of Sanskrit which complicate any attempt for a simple, neat analysis. Steriade (1988) attempts to grapple with these problems and in the process comes up with her own "full copy" reduplication model to account for the complex syllable transfer phenomena found in what most generative linguists would refer to as instances of partial reduplication.

In Sanskrit, reduplication is involved mainly in the formation of verbal stems expressing tense and aspect. It is found in five places:

root	full grade	zero grade	root gloss
(1) to form the present stem of one class of verbs (the 3rd. conjugation)			
hu:	juhoti	juhvati	'sacrifice'
da:	dada:ti	dadaṭi	'give'
(2) the perfect			
budh	bu-bodh-a	bu-bodh-ur	'awake'
piś	pi-piś-e	pi-piś-re	'adorn'
(3) the aorist			
druv	adudruvat		'run'
jan	aji:janat		'beget'
(4) the desiderative			
stu	tuṣṭu:ṣa-		'praise'
gam	jiga:miṣa-		'go'
(5) the intensive			
ved/vid	ve-vet-ti	ve-vid-ati	'know'
bodh/budh		bo-budh-ya-te	'awaken'

Generally speaking, reduplication involves the prefixing of a monosyllabic reduplicative prefix to the root. In the first four types listed above, this prefix is a light syllable with a CV-form, or, in the terms of Prosodic Morphology, a core syllable, σ_C (as noted by McCarthy and Prince, 1986). The intensive, however, differs from the others in that it involves the prefixation of a heavy syllable. Although most of the processes involved are relevant to all five verbal formations, the generation of this heavy syllable entails a number of considerations not found in the other four. This paper will look at the intensive from two different theoretical perspectives: the first, an extended Marantzian model; the second, Prosodic Morphology (McCarthy and Prince, 1986; 1990). In doing so, it will examine a number of points which will be of considerable theoretical interest within the paradigm of each model and to phonological theory in general.

2. ABLAUT IN SANSKRIT

Before examining the formation of the intensive, it is important to discuss certain general phonological features of Sanskrit, in particular the very productive process of ablaut in the stem vowel. The following example shows the three ablaut grades of the root vowel in *√vid* 'know'.

(6)	*√vid*	*veda*	*vaidya*

Ablaut can be seen as a case of vowel weakening or strengthening, depending on one's stand-point. The Indian grammarians saw it as a case of strengthening. They took the weak form or zero grade - *vid-* as being the base form and from that derived the full or normal grade *(guṇa)* - *veda* - and the strong or extended grade (*vṛddhi*) - *vaidya*. However, western philologists and linguists have viewed the *guṇa* or full grade form as being basic in many cases where it was not for the Indian grammarians. Assuming the traditional Indian analysis, the alternations involved in ablaut are as follows:

zero grade	normal grade	strong/extended grade
i	e [ai]	ai [a:i]
u	o [au]	au [a:u]
a	a	a: [aa]
ṛ	ar	a:r
ḷ	al	a:l

Traditionally Sanskrit is seen as having 5 short vowels - *a, i, u, ṛ, ḷ* - of which the first four have long counterparts. In addition, there are the long vowels *e, o,* and the diphthongs *ai, au*. Phonologically, *e* and *o* are seen as being surface representations of underlying *ai* and *au* , while *ai* and *au* are the surface forms of underlying *a:i* and *a:u*, respectively. There is evidence in the language for such a distinction, particularly the behaviour of these vowels in sandhi when followed by a vowel, where *e > ay, o > av, ai > a:y, au > a:u*. Thus, Sanskrit can be seen as having an underlying 3 vowel system, [± length], and with additional syllabification of *r* and *l* . This assumption was basic to the analyses of McCarthy and Prince (1986) and Steriade (1988). It will also be assumed in the analyses of the intensive presented here.

3. THE INTENSIVE

The intensive is found mostly in the older Sanskrit language - i.e. Vedic Sanskrit - and much less in the later, classical language.[1] It intensifies the verb or lends it a frequentive aspect. Formally, it involves the prefixation of a heavy, monosyllabic reduplicative prefix to the root. Roots in Sanskrit are almost always monosyllabic. They may have or not have a consonant onset and/or coda, and may have both initial and final clusters. The initial clusters are of increasing sonority with the exception of sibilant + obstruent clusters. Final clusters, on the other hand, are of decreasing sonority. The reduplicative prefix takes the form of

$$\begin{array}{ccc} C & V & V \\ & | & \\ & [a] & \end{array} \qquad \text{or} \qquad \begin{array}{ccc} C & V & C \\ & | & \\ & [+\text{son}] & \end{array}$$

where the coda consonant can only be a sonorant: i.e.(r̥,*l*, nasals). The onset is obligatory. These features can be seen in the data given in (7)-(13) below:[2]

	root	full grade	zero grade	
(7)	ved/vid	(vai-vaid-ti)	ve-vid-vaḥ	
		ve-vet-ti	ve-vid-i:-ti	'know'
	bodh/budh		(bau-budh-ya-te)	
			bo-budh-ya-te	'awaken'
(8)	ves/vis	ve-veṣ-	ve-viṣ-	
	pat	pa:pat-	pan-i-pat-	'fall'
(9)	mard/mr̥d	mar-mard-	mar-mr̥d-	'crush'
	kr̥ṣ	car-ka:rṣ-	carkr̥ṣ-	'plow'
	pan		pan-i-pṇ-at	'admire'
	gam	jaN-gam-	gan-i-gam-	'go'
	cal	cal-cal-i:-ti		'move'
(10)	kri:d		ce-kri:d-	'play'
	krand	kani-krand-	kani-krad-	'roar'
(11)	stan	tan-stan-		'thunder'
	skand	kan-skand-		'leap'
(12)	svap/sup	sa:-svap-	so-sup-	'sleep'
	grah/gr̥h	ja:-grah-	jar-i-gr̥h-	'seize'
(13)	yaj/ij	ya:-yaj-		'offer'
	vac/uc	va:-vac-		'speak'

As can be seen from these examples, when the prefixed syllable has no coda (i.e. is an open syllable) the vowel in the prefix must be long (i.e. full/ extended grade) as in *ve-vid*, *bo-budh-*, *pa:pat-*.

The Indian grammarians would simply say that the root vowel or syllabic sonorant takes its guṇa, or in the case of *a*, its *vṛddhi* form. When followed by a [+son] consonant the vowel is short *a* as in *mar-mard-*, *cal-cal-*, *jaNgam-*

Any attempt to analyse these data in a modern generative framework is complicated by changes in the root due to reduplication and other phonological processes which make it difficult to arrive at the underlying root vowel. Steriade (1988) chooses the full grade as the underlying form. She bases this on the general observation (supported by Thumb, 1957; MacDonnel, 1928) that the strength of the root vowel in most cases of reduplication is a function of accent. When the accent is on the root, the root vowel is found in the full grade. When the accent is not on the root, then the root vowel is in the weak or zero grade, as in *vevidmáḥ*. In effect, this means that the root is strong in the singular in all three persons of the active, but is weak in all other forms of the active and all forms of the middle, where the accent falls on the conjugational suffixes. This conjugational pattern holds in the intensive, even though the accent is often on the prefix (MacDonell, 1968; Burrow, 1973).[3] Thus, following this tendency, Steriade derives the zero grade forms from a syncope rule applying in inherently unstressed environments. As can be noted in *ve-vid-i:-ti* in (7), the root is sometimes followed by an epenthetic i: which also results in the root vowel being in the zero grade (in all probability due to a resulting shift in stress).

As stated, the reduplicative prefix has only [+son] consonant codas, which means that the root codas in (7) and (8) are not reduplicated; i.e. *√pat > pa:pat*. As for the syllabic consonants in (9), we must either speak of a change due to an epenthesis of *a* and subsequent desyllabification of the sonorant (*mṛd. > mard*) or of the deletion of a by syncope and the subsequent syllabification of the resonant (*mar > mṛd*). This does not, however, alter the form taken by the vowel of the prefix.

In the case of roots with complex onsets, the least sonorant member of the onset cluster reduplicates - e.g. in *√krand* it is the obstruent *k* which is reduplicated, not the sonorant *r* (kan-i-krand). Similarly the sibilant in *svap* in (11) is reduplicated rather than the glide *v* (*sa:svap*);[4] whereas in the sibilant + obstruent onset clusters in (11), it is the obstruent which is copied (*tan-stan*). In cases where the root has a complex coda, the first member of the cluster will be copied when it is [+son] - e.g. *kan-i-krand.*, *mar-mard.*

As seen in the case of *kan-i-krand*, a further peculiarity of the intensive is the epenthetic *i* which is sometimes inserte between the prefix and the root when prefix ends in a nasal or liquid.

There are also some cases, such as those in (12), where the alternating grade of the root vowel appears to affect the vowel of the prefix:

svap/sup	sa:-svap-	so-sup-	'sleep'
grah/gṛh	ja:-grah-	jar-i-gṛ-	'seize'

As mentioned above, all reduplicative prefixes must have an onset. The effect of this obligatory onset condition can be seen in the case of glide-initial/onsetless roots like *yaj/ij* in (13). Only the form of the root with the onset undergoes intensive formation - i.e. *ya:yaj* but not **i:yij*. Indeed, roots with vocalic onsets, such as *√ad* 'eat' do not form the intensive.

4. A SEGMENTAL ANALYSIS

We will now look at the intensive from the perspective of several models of reduplication. First we will see how a strict phoneme-driven Marantzian analysis can account for the intensive data. The forms of the prefix that we have seen in (7) to (13) are essentially CVC and CaV (assuming that [a:] is [aa] and [e] and [o] are underlyingly [ai] and [au]). Since in all cases the vowel after the initial C in the CVC prefix is [a], we can can prespecify the vowel in both cases and form the templates CaC and CaV. Allowing for the association of the prespecified vowel [a] with a corresponding root vowel, we can then derive forms like *veved-* and *mar-mard* directly from the full grade of the root, as shown in the derivational representation below:

```
CVV  +  CVVC                               CVC + CVCC
|||     ||||                               |||   ||||
vaid    vaid --> vai-vaid                  mard  mard --> mar-mard
             --> veved
```

Forms where the root is in the zero grade (e.g. *vevid-*, *marmr̥d*) would then have to be derived from these forms by a further [a] deletion rule (vowel weakening) applying in unstressed environments. This rule is required in any case to account for root forms in cases where the root vowel *a* is lost due to syncope (e.g. *√pan --> pan-i-pn-*).

However, the CaC template will copy unwanted [-son] codas resulting in incorrect forms like **patpat* instead of the desired *pa:pat*. Here, the final C of the template will incorrectly link with the final C of the root, *t* as shown below:

```
 [a]
  |
CVC  +  CVC
|||     |||
pat     pat --> *pat-pat
```

This could be avoided by putting feature prespecifications on the coda consonant; i.e. the template would be

```
C a C.
    |
  [+son]
```

The most difficult problem for any analysis of the intensive is resolving the problem of association of consonants, both in the onset and in the coda. With prespecification of the final C of the CaC template as [+son], the finals no longer pose a problem for a phoneme-driven analysis. The resonants in *mar-mard, calcal, jangam* will be associated, while the obstruents in verbs like *pat (pa:pat)* and *svap (sa:svap)* will not.

However, as they are, the two templates are still not able to account for the data. The most intractable problem for a phoneme-driven Marantzian model is that of sibilant initial complex onsets. In roots with sibilant + obstruent clusters the obstruent is copied as the onset of the prefix. However, when the sibilant is followed by a glide, semivowel, or liquid, the sibilant is copied. These two scenarios can be seen in (14) below.

```
(14)   stan           tan-stan-        'thunder'
       svap/sup       sa:-svap-        'sleep'
```

In the case of the roots with sibilant + obstruent clusters in (11), any CVC template will incorrectly associate the initial sibilant. This is demonstated in the following representation:

```
 [a][+son]
   |  |
C  V  C     +    CCVC
|  |  /
stan             stan --> *san-stan
```

It is not possible to prespecify the initial C of the template to exclude the association of initial sibilants, since, as seen in *sa:svap* in (14), initial sibilants are associated when they are followed by a consonant of lesser sonority. This requires a phoneme driven model to include the foreign notion of extrametricality. Therefore, on this point alone, we must assume that a strict phoneme-driven analysis is inadequate to deal with the intensive.

Modifying the segmental model to allow for such a template driven process, we might posit a notation such as that below:

```
   C     V    C
   |     |    |
[>son]   a  [+son]
```

Here, the feature specification [>son] is seen as indicating that the template will seek out the least sonorant member of the onset. Note that for the [>son] element to be restricted merely to the onset without bringing in the notions of onset and rime into ourformalism, it would be necessary to stipulate, as does Kiparsky (1986; cited in Steriade, 1988) that the first V in the template will associate first, and only then, once the template is thus linked to the copy, the first C. Even though this allows us to avoid using notions of prosodic syllable structure in a theory where they are not at home, the template posited above is a substantial extension of the Marantzian model. However, it can still be seen in purely segmental terms: the template will seek out the least sonorant member of all consonants before the first vowel.

It is tempting when we view our two templates to draw the conclusion that, since the final consonant and vowels are both [+son], we can collapse the two templates into one:

```
   C     V     X
   |     |     |
[>son]   a  [+son]
```

This would generate most of the desired forms in (7)-(13). Even forms exhibiting lengthening of *a* in the prefix, such as *pa:pat* and *sa:svap*, can be generated by a rule linking the [+son] X with the already associated [a], thereby lengthening it :

```
C V X-     CGV
| |/
svap-      svap  -->  sa:svap (after stray erasure)
```

Here, the first consonant is associated, then the prespecified V associates with *a*. As the final X [+son] finds no other segment with which it can associate, it too associates to the first sonorant segment on its left, resulting in the lengthening of the a, giving the correct form *sa:svap*. Alternatively, if we wished to avoid permitting two elements of the template to associate with one segment of the copy, we could posit an extra rule inserting [a] into the unlinked [+son] X slot.

However, this template would not work in the case of roots where the onset cluster has a [+son] second member and a vowel other than a. This is the case in the roots like *kri:d* in (10). Since the prespecified V [a] could not find a V with which it could associate, the X [+son] would associate with the first sonorant element, which in the case of *kri:d* would be the *r* in the onset. After the required insertion of the prespecified [a], this would yield the incorrect form *car-kri:d* instead of the desired form *ce-kri:d-*,[5] as shown below:

```
 [a] [+son]
  |  /
C V X      CRVVC
|  /
| /
kriid-     kriid   ----->  *kar-kriid
                   ----->  *car-kri:d
```

Thus, it seems that it is necessary to posit two templates:

```
    C   V   V          and          C   V   C
    |   |                           |   |   |
[>son] [a]                      [>son] [a] [+son]
```

These two templates will cover all the cases in (7)-(13), including the cases in (13), where the form of the prefix is dependent on the grade of the root vowel. In such cases, both alternatives can be generated by applying the CVV template for each grade of the root vowel. This is shown below:

```
     sa:svap                                       sosup

[>son][a]                                   [>son][a]
    \  |                                        \  |
     C V V       CGVC                            C V V      CVC
     |  \|                                       | |/
     s v a p-    svap -----> saasvap             s u p-     sup ------> sosup
```

In the derivation of *sa:svap*, the final V cannot associate. Thus, to derive the long *a:* we must still posit an insertion rule whereby unlinked V slots of the template are filled with an epenthetic [a]. In addition, roots of this type would have to be marked in the lexicon as having only the CVV prefix. Otherwise, the modified C V C[+son] template might apply and to get the long vowel in the prefix, a less natural rule inserting [a] into the then unlinked C[+son] slot of the template would have to be posited.

It should be noted that when we posit such [a] insertion into empty V template slots or permit the association of unlinked Vs of the template with the already linked V, we will have to have some sort of ordering of the application of templates. The CVC template must apply first; otherwise, for roots with [+son] consonant codas the CVV template could apply first, resulting in the non-association of the desired [+son] consonants and the incorrect lengthening of the root vowel *a*. Thus, for the root *√krand* we would get **kaa-krand* instead of the correct *kar-(i)-krand*. This can be seen in the following derivational representation:

```
 [a]
  |
C V V      +      CCVCC
| |/
krand-            krand   --> *kaa-krand
```

Here, the modified CVC template must apply to ensure that the nasal is associated and the correct form *kan-i-krand* derived. If the CVC template is applied first and cannot be satisfied (i.e. can find no [+son] consonant), then by default the CVV template will apply. This will result in the correct derivation of all the forms discussed in this paper.

Thus, a modified, template-driven, segmental model can account for the intensive data, but only with a radical innovation permitting the template to find the least sonorant of the initial clusters of the copy. This can only be accomplished when it is assumed that the V nucleus of the template is first linked to the V nucleus of the copy. The problems presented by differing lengths can also be solved by this model by either assuming the association of unlinked V slots with an already linked V (which here is always *a*) or by positing an epenthesis rule to insert [a] into the empty V slot, thus giving the long vowel.

5. A PROSODIC ANALYSIS

We will now analyse the same phenomena within the framework of Prosodic Morphology (McCarthy and Prince, 1986, 1990). As we will see the problems we have already encountered above also tax the mechanisms of this theory.

Sanskrit has basically two types of syllables: 1) light, monomoraic syllables (σ_{μ}), which can be either V or (C)CV; 2) heavy, bimoraic syllables ($\sigma_{\mu\mu}$), which can be (C)CVV(C) or (C)CVC(C). Syllables with a long vowel and consonant coda could also be analysed as being superheavy syllables, but this is not germane to our discussion here. Since our reduplicated prefix is a heavy CVV or CVC syllable the obvious template would seem to be $\sigma_{\mu\mu}$.

5.1. The $\sigma_{\mu\mu}$ Template

If we posit $\sigma_{\mu\mu}$ as our template, we can derive the heavy, bimoraic syllables of the prefix by having the full grade of the root (the rime of which begins with either VV or V[+son, -syllabic]) as the underlying form; i.e. *vevid-* will be derived from *vaid.* The zero grade forms of the root would then be derived by a vowel weakening rule (syncope of *a*) applying to root vowels in unstressed environments. This can be seen in the following derivational representations for *veved-*/ *vevid*:

```
σμμ  +  σμμ                          σμμ   +   σμμ
|||                                  |||
vaid-   vaid --> vai-vaid            vaid-     vaid --> vai-vaid
             --> veved-                             --> vai-vid (weakening)
                                                    --> vevid-
```

However, this means that for forms like *pa:pat-*, which have a long *a:* in the reduplicative prefix, but only a short *a* in the full grade of the root, we must posit an underlying long vowel for which there is no other motivation. Thus, to get the form *pa:pat*, the root must be *pa:t*, even though there is no independently motivated rule of vowel shortening in stressed syllables which could give the desired short vowel in the root. Otherwise, if the base were *pat*, the result of reduplication would be the incorrect form **pat-pat*, as shown below:

```
σμμ  +  σμμ
|||     |||
pat     pat   --> *patpat
```

One possible way to circumvent this problem would be to circumscribe all [-son] coda consonants as extrametrical, in which case the root could be with a short vowel (i.e. *pat*). The first mora of the template would associate with the short root vowel, while, due to the extrametricality of the coda obstruent, the second mora would have no melodic material with which it could associate. Thus, the unassociated mora of the template would associate with the already linked *a*, making it long. This is shown below:

```
σμμ      +    σμμ
||/
pa(t)         pat    --> paa-pat
```

However, even with extrametricality of final consonants, the template will not be able to account for the differences in the vowel of the prefix in roots like *svap* --> *sa:svap*/*sosup*, where the form of the prefix varies according to the grade of the root vowel (the root vowel *u* of the latter being the product of syncope of *a* and subsequent vocalization of the glide *v*). The $\sigma_{\mu\mu}$ template will generate the long vowel in sa:svap (ignoring the problem of the initial cluster), but assuming the underlying base for the second form, *so-sup*, is *svap*, there is no way to generate the [o] in the prefix (*so-*). Since the only vowel in the melody is *a*, it will be associated and then lengthened, giving *aa (a:)*. Indeed, even if we allow roots like *svap/sup* to form the intensive on both the zero and strong grade bases, it will be impossible to derive *so-sup* from the zero grade: The [p] being extrametrical, both mora of the template would associate with the [u], giving the incorrect form **su:-sup-*.

```
σμμ     +     σμμ
| |/
su(p)   +     sup --> *su:sup
```

One possible way to overcome this difficulty is to posit a melodic overwriting rule (McCarthy and Prince, 1990). Since the first mora of the prefix is necessarily always associated with an [a], the rule would write this segment into the first mora of the template after association has occurred. It is thus possible to generate the different prefix vowels in *sa:svap/sosup*. Here, one would have to assume that this type of roots can form the intensive on both grades of the root. In the case of *sa:svap*, the template would associate the *a* of the copy of the full grade root to both mora, resulting in the long *a:* rime of the prefix. In the case of *sosup*, the base would be the zero grade of the root *sup*. Here, both mora of the template would associate the *u*. Then the first mora of the template would be overwritten with *a*, giving the desired *au (o)*. The derivations of these two forms are shown below.

```
σ  μ  μ   +   σμμ                            σ  μ  μ   +   σμμ
s v a(p)      svap                           s u p         sup
    a                                          a
                   --> saa-svap                                  --> sau-sup
                   --> sa:svap                                   --> sosup
```

Indeed, one might be able to posit the zero grade as the base for the entirety of intensive formation and then employ the above-mentioned melodic overwriting rule to "write in" an [a] in the first mora of the template. This would also be dependent on the above-mentioned circumscription operation defining all [-son] root final elements as extrametrical. The derivation of *ve-vid* demonstrates the application of this template.

```
σμμ       +   σμμ
v i(d)    +   vid ------> vai-vid
  a
```

However, even with this analysis, one would have to derive forms like *sa:svap* from the full grade of the root. Furthermore, the vowel deletion rule first posited to derive the weak grade of the root in unaccented environments is required for cases where the root vowel [a] is deleted in unaccented environments (e.g. *pan-i-pn-at*). Thus., it would seem that the full grade should be taken as the base.

In any case, with melodic overwriting, the bimoraic syllable template seems to be able to deal with the intricacies of vowel qualities in the rime of both the root and the prefix. With the extrametricality of final obstruents, it is also capable of accounting for the reduplication of only [+son] consonants. It fails, however, on one critical point - the correct association of onset clusters.

According to McCarthy and Prince (1986) only a core syllable template is able to skip consonants in initial clusters when it associates with material from the melody. Thus, if the template were simply a bimoraic syllable, the entire CC onset cluster would have to be copied. This means that the notion of extrametricality must be invoked to ensure that the sibilants in the sibilant+obstruent clusters found in (11) (e.g. *stan*) are not copied. This can be achieved by excluding the sibilant from the domain of operation by means of partial prosodic circumscription (McCarthy and Prince, 1990). First, factoring from the left, a positive circumscription operation would locate the first obstruent of the onset, which would be the edge defining the base of the intensive operation. This will define the initial *s* in roots like *stan* as being extrametrical. This will isolate the base *tan*, which allows the association of the desired initial consonant of the prefix (*tan-stan*). This can be seen from the following representation:

```
    σμμ     +    σμμ
    |||
 (s)tan          stan   --> tanstan
```

Should the application of positive circumscription not find the desired [-son, -cont] element in the onset, then the default is the normal operation and association of the template, which would correctly associate the sibilant in sibilant+sonorant clusters, as in *sa:svap*.

However, no form of prosodic circumscription would resolve the difficulties presented by the [+son] second members the complex onsets in (10) and (12) (e.g. *krand*, *svap*). According to the tenents of Prosodic Morphology, only peripheral segments can be extrametrical (McCarthy and Prince, 1990). Thus, since there is no recourse to extrametricality to exclude the second member of onset clusters, the $\sigma_{\mu\mu}$ template would necessarily associate both consonants of this type of onset cluster. This would make possible the derivation of incorrect forms like the following:

```
   σμμ      +    σμμ
  /|||
 kran(d)        krand   ----> *kran-i-krand
```

One is therefore forced to conclude that a $\sigma_{\mu\mu}$ template cannot account for the Sanskrit intensive.

5.2. The σ_C Template

One way around the intractable problem of the initial clusters might be to posit a σ_C template operating on a zero grade base of the root. Here, it is no longer critical that the coda obstruents be extrametrical. Since the core syllable in Sanskrit is (C)V, coda obstruents will never be associated.

Furthermore, a σ_C template associates the first consonant and then is able to skip over subsequent onset consonants to associate the rime vowel. This is once again complicated by the problem of sibilant+obstruent clusters, but this can be resolved by the partial circumscription mechanism discussed earlier which enables only initial sibilants followed by obstruents to be defined as being extrametrical (and not those followed by a [+son] consonant, as in *svap --> sa:svap*). The greater problem is deriving the correct vowel in the prefix, as we will see below.

Intensive formation with a σ_C template for the reduplicative prefix will involve reduplication of the zero grade base of the root with subsequent insertion of an epenthetic [a] after the first C of the prefix as an intensive marker. An epenthetic [a] will also be inserted before the first vowel in accented roots. This can be seen in the derivation of *veved- (vai-vaid)*:

```
 σC      +    σμμ
/|
vid-         vid  --> vivid
                  --> vaivid (Int. [a] epenthesis) (unaccented root)
                  --> vaivaid (accented root - [a] epenthesis)
```

As the σ_C template will associate with only the first vowel of the root, it is necessary to assume that the intensive always has as its base the zero grade of the root. Otherwise, for roots having *e (ai)* or *o (au)* as their full grade, the *a* of the underlying diphthong will be associated and not the desired *i* or *u*. This can be seen below:

```
 σC      +     σμμ
/|
vaid-          vaid  --> *va-vaid
                     --> *vaa-vaid ([a] epenthesis)
```

However, this analysis will not work for roots with a short [a] vowel followed by a [+son] consonant like *gam, cal, krand*. In these cases, the σ_C template, requiring a CV melody, will be unable to associate the desired [+son] root coda consonant. This can be seen in the derivation of √krand below:

```
 σC       +     σμμ
/\
krand-         krand -->    *ka-krand
                     -->    *kaa-krand ([a] epenthesis)
```

One possible way out of this dilemma is to assume that underlyingly these coda sonorant consonants, including the nasals, are actually syllabic sonorants. These would be reduplicated and then following the application of [a] epenthesis would desyllabify.[6] Historically, it may be correct that the nasals and some of the liquids were originally syllabic, but synchronically there are no syllabic nasals in Sanskrit and verbs like *cal* 'move' and *car 'move'*do not behave as if they have an underlying syllabic sonorant as their nucleus. Moreover, both *cal* and *gam* have the same form in both the accented and unaccented forms of the root. Thus, this analysis is untenable.

The only recourse left is to assume that there are two templates, One of these would be the σ_C template, which would have as its domain of operation the zero grade of the root with subsequent [a] insertion as discussed above. The second would be a $\sigma_{\mu\mu}$ template for roots with a coda containing a liquid or nasal. However, if we are forced to accept $\sigma_{\mu\mu}$ as one of our templates, we would once again be faced with the insoluble problem of association presented by the obstruent/ sibilant + resonant onset clusters exemplified by *kan-i-krand*. Thus, it must be concluded that, without some changes or additional constraints, Prosodic Morphology does not at present have the mechanisms to deal with the Sanskrit intensive.

6. SUMMARY AND DISCUSSION

Intensive formation in Sanskrit is a complicated process which cannot easily be described by either segmental or prosodic templatic theory. Of the perspectives we have approached this from, it is clear that a strict phoneme-driven (Marantzian) analysis will not account for the intensive data. Although it is capable of generating the correct rimes of the prefix, it fails to associate the correct member of the initial sibilant+obstruent consonant clusters. Indeed, due to the problem of the initial clusters, for a segmental theory of reduplication to describe intensive formation, it must be modified to allow for template-driven association. Therefore, the greater part of the discussion of the intensive data revolved around two different template-driven analyses - one segmental, the other prosodic. These two analyses will now be reviewed and contrasted.

Both analyses required two different templates to account for the complexities of association in both the rime and the onset of the prefix. In the modified segmental analysis, the CaV template was required to derive the prefix vowels, while the second CaC template was required for the reduplication of [+son] coda consonants (e.g. *tan-stan*). In the prosodic analysis, one template (σ_C) was required to ensure correct association of initial clusters, the other ($\sigma_{\mu\mu}$) was once again necessary to associate [+son] coda consonants.

Both analyses were able to resolve the complexities of proper association in the rime of the prefix. In the segmental analysis, this was done by the prespecification of the first V of both templates, as well as the final C of the CVC template. The vowel length and quality could be derived by either an epenthesis rule for unassociated V slots, or, in another solution, double association of two V slots with one vowel of the copy. The σ_C prosodic template was able to accomplish the same thing by the positing of a subsequent [a] epenthesis rule.

The non-association of [-son] final consonants posed no real problem to either theory. In the segmental analysis, [-son] consonants were excluded from reduplication by prespecifying the final C of the template as [+son]. In the prosodic analysis, this could be resolved through the use of the σ_C template or/and by defining [-son] coda consonants as extrametrical.

The greatest challenge posed to both theories was that of correct association of the least sonorant element in the case of roots with initial consonant clusters. In a segmental analysis, obstruent+resonant clusters posed no problem since the segmental template would naturally associate the first member of the cluster, which would be the less sonorant. The greater problem was that of sibilant-initial clusters. This could only be resolved through a radical innovation within the segmental theory which would allow for associating the first C of the template with the least sonorant consonant before the first V. Prosodic Morphology, however, was able to resolve the problem of sibilant-initial clusters through the mechanism of partial circumscription, but not that of the obstruent+resonant clusters. In order to generate the [+son] coda of the prefix of some roots, the $\sigma_{\mu\mu}$ template must be retained. However, within the present framework of Prosodic Morphology, the $\sigma_{\mu\mu}$ template cannot simply associate the obstruent member of the onset cluster and then skip over the [+son] member. Therefore, the theory fails to account for the reduplication of forms like *kan-i-krand*. The $\sigma_{\mu\mu}$ template is required to associate the nasal coda of the prefix, but by definition must incorrectly associate the entire *kr* onset. Thus, the $\sigma_{\mu\mu}$ template would in some cases have to be permitted to have a fairly ad hoc special constraint restricting its onset to a single melody segment. This means that for Prosodic Morphology to adequately describe Sanskrit intensive formation, there must be a redefinition of the properties of one of its major prosodic categories, the syllable, in terms that would necessarily be segmental. Alternatively, there must be an extraordinary, language-specific constraint barring the copying of more than one consonant by the $\sigma_{\mu\mu}$ template.

7. CONCLUSION

Neither a template-driven segmental analysis, nor a purely prosodic analysis can account for intensive formation without some innovation or extension of the theories that underlie them. In the case of the segmental analysis, a multivalant sonority scale must be built into the template. In the same fashion, in a prosodic analysis, either the $\sigma_{\mu\mu}$ bimoraic syllable template must be redefined to restrict association to only one melodic onset element, or there must be an ad hoc constraint on the copying of non-initial [+son] onset consonants. If such special mechanisms or conditions are allowed, then both analyses will be able to adequately describe the complexities of the intensive. Then, the argument must necessarily revolve around which theory most contradicts its basic tenents in making these innovations or accommodations. This will be the subject of further research.

NOTES

1 A few remarks on the Sanskrit language would be in order here. Sanskrit has a long recorded grammatical history and the language has been frozen in time for over 2000 years with very little change. In this time the grammarians and scribes have had ample time to "regularize" the language. Therefore, the grammarians give forms which, though seemingly theoretically possible, do not appear in extant texts. Thus the best source for data is from the Vedas, which have been well preserved. This is particularly important in the case of the intensive, which is no longer productive in the classical language.

2 The majority of the forms in (8)-(13) have been been taken from Steriade (1988). Although Steriade notes the difference between forms attested to in the texts and those found only in the grammatical literature, she chooses to include the latter. For the reasons given above, however, they have been excluded from this analysis.

3 Indeed, Burrow (1973) notes that in most verbs, in the case of the three singular persons the accent is on the reduplicative prefixes, and sometimes in the dual and plural as well, although here the accent also can fall on the suffixes. Moreover, he points out that generally speaking, accent in the Vedas is not completely stable.

4 In Sanskrit, the *v* is generally regarded as a semivowel (i.e. *w*).

5 A dissimilation rule applies here whereby the first velar stop of two adjacent, velar-stop-initial syllables palatizes; e.g. caka:ra (perfect of √*kṛ* 'do').

6 Steriade (1988) assumes this for roots having nasal codas.

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