Allomorphy in Yaqui Reduplication*

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In this paper I show that the three reduplication types used to express habitual action in Yaqui (light syllable, disyllable, and mora affix) are not predictable based on the underlying prosodic shape of the root. I give an Optimality Theoretic account of each reduplication type, as well as a fourth type which is a heavy syllable reduplicant that triggers gemination at the onset of the base. I conclude with a discussion of the implications of the Yaqui facts for recent discussions of diachrony and reduplication generally, as well as for reduplication across the Uto-Aztecan language family more specifically.

1.0. Introduction

Yaqui[1] is a language of the Taracahitic group of Southern Uto-Aztecan spoken primarily in Sonora, Mexico and in Arizona, USA. As in many Uto-Aztecan languages, reduplication serves a variety of functions in Yaqui. This paper describes the multiple patterns of reduplication that occur in Yaqui verbs. These reduplication patterns vary both as to semantic function and to prosodic shape: some shapes serve multiple functions and the same function can be served by multiple shapes. I refer to this variation, in a theory-neutral way, as reduplicative allomorphy. Spaelti (1997) distinguishes between two kinds of multiple pattern reduplication: different reduplication patterns used to distinguish different semantic functions ("duplemes") and different

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[1] Yaqui is also known as Hiaki and Yoeme.

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reduplication patterns, prosodically determined, used to serve the same semantic function ("alloduples"). Spaelti also recognizes mixed systems, of which Yaqui is apparently one. Thus, his distinction will play only a minor role in the laying out of our discussion here, and I will conflate the two under the more general rubric of "reduplicative allomorphy".

This paper will focus mainly on the three variant allomorphs of Yaqui reduplication which are used to signal habitual action: light syllable reduplication, disyllabic (foot) reduplication, and morphological gemination, as well as the pattern of marked heavy syllable reduplication (previously "secondary reduplication") which is a marked variant of the light syllable reduplicant and is used as a non-habitual morpheme. As we will see, the reduplicative allomorphs are not entirely predictable based on the underlying prosodic structure of the roots which take them, and there is no one-to-one mapping between the shape of the reduplicants and the semantic functions which they serve. See Harley and Amarillas (this volume) for a more thorough discussion of the multiple semantic functions which Yaqui reduplication can serve.

Although this paper is focused on the Yaqui language, some of the argumentation to be employed below crucially relies on facts from related Uto-Aztecan languages, and I will bring up cross-linguistic examples when they are relevant. Specifically, it is a major claim of this paper that the variant reduplication patterns of Yaqui are derived from variant reduplication patterns in previous stages of Uto-Aztecan.[2] Thus, one of the themes that will permeate our discussion below will be the influence of diachronic factors in synchronic analyses of reduplication phenomena, and in Yaqui reduplicative allomorphy in particular.

This paper is structured as follows. After briefly reviewing some of the relevant background phonology of the Yaqui language in Section 2, I will illustrate each of the allomorphic reduplication patterns in Section 3. As I hope will be clear in the following discussion, these allomorphic patterns are not fully predictable based on underlying form, and multiple allomorphs are used to serve the same semantic functions in some cases. Thus, these patterns pose a variety of puzzles for both formal and functional theories of reduplication, which will be discussed in Section 4. Section 5 will conclude.

2.0. Phonological background of Yaqui

The phoneme inventory of the Arizona dialect[3] of the Yaqui language is given in Tables 1 and 2 (adapted from Escalante 1985):

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[2] In fact, because of the distribution of the allomorphic patterns of reduplication across the Uto-Aztecan language family, it is possible to reconstruct four distinct patterns of reduplication for Proto-Uto-Aztecan. I refer the curious reader to Haugen (2002) for a more full discussion of the pan-Uto-Aztecan implications of the Yaqui-specific data to be presented here.

[3] The major phonemic difference between Arizona Yaqui and Sonora Yaqui is the presence of /b/ instead of /v/ in Sonora Yaqui. The feature [+/- vce] is only included for the stops in Table 1 because of the contrast at the labial place of articulation in that category. All symbols used are to be interpreted with their standard values.

Table 1: Arizona Yaqui Consonants

	Labial	Alveolar	Alveo-palatal	Velar	Glottal
stops: [-vce]:	p	t		k	'
[+vce]:	b^w				
fricatives:	v	s			h
affricates:			ch		
nasals:	m	n			
glides:	w		y		
lateral:		l			
flap:		r			

Table 2: Arizona Yaqui Vowels

	Front	Central	Back
High:	i ii		u uu
Mid:	e ee		o oo
Low:		a aa	

There are several important issues to note about the background phonology of Yaqui before proceeding to the reduplication data. First, Yaqui marks prominence through pitch accent, or high tone. This occurs on the first or second mora of the word, in isolated words (Demers, Escalante and Jelinek 1999). I will follow the analysis of these facts given by Demers et al. and assume that tone is aligned to the left, attaching to the first available mora of the word. Those words which have initial moras without high tone have initial moras that are lexically extrametrical—and thus the tone is assigned to the first available mora (i.e. the second mora of the word). Syllable weight is not a factor in assigning high tone, and high tone assignment is not a result of other aspects of phonological environment. This is demonstrated by minimal pairs such as those given in (1):

(1) a. téeka 'sky' a'. teéka 'lay down'
b. káate 'build a house' b'. kaáte 'walk (pl.)'

These minimal pairs show that tone is not conditioned by phonological environment, and therefore must be lexically specified.

With the assumption that there is lexical extrametricality for certain words (about a third of the total in the language, according to Demers et al.), tone assignment proceeds regularly in the rest of the language through the assignment of tone on the leftmost available mora.

The assignment of the tone is predictable in Yaqui reduplication. For words with the tone on the first mora, the reduplicated mora gets the tone, and the base vowel shortens (the reduplicant appears in bold):

(2) a. káate → **ká**kate 'is building a house'
b. wáate → **wá**wate 'is remembering'

For words with tone on the second mora, the reduplicant does not get the tone, but the tone does shift to the first mora of the base, keeping the tone on the second mora of the output form, and leaving the base with a long vowel:

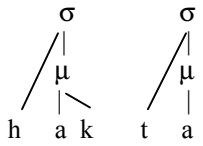
(3) a. kaáte → **ka**káate 'they are walking'
b. waáta → **wa**wáata 'is wanting'

As should also be clear from (2) and (3), the assignment of the tone does not determine the prosodic shape of the reduplicant, which surfaces in each of these cases as a single syllable, but there are other cases, mentioned below, where first or second syllable tone can yield reduplicant forms of CVCV or as single consonant gemination (from the onset of the second syllable to the coda position of the first syllable). However, in the marked heavy syllable reduplication forms, which as we will see below always involve two moras, the reduplicant always receives the high tone.

Since the tone facts are predictable, given the analysis of Demers et al., I will omit them from my discussion below, and I will also usually not mark tone on the forms that I am discussing, although in most cases the tone is on the first mora.

Finally, we must consider the properties of syllable weight in the language. Demers et al. propose that coda consonants are not generally moraic in Yaqui. I will adopt this assumption. The structure that they propose for the Yaqui syllable is given for the word *hakta* 'inhale' in (4):

(4)



Below we will see cases of gemination that occurs for morphological purposes in Yaqui (e.g. in what has been referred to as "secondary reduplication"). Consistent with Demers et al.'s analysis of these facts, we will adopt the position that in these cases the coda consonant *is* moraic, the gemination being triggered by some morphological operation which requires a heavy syllable.

Having reviewed the phonological backdrop of Yaqui, we can now turn to the focus of this paper: the allomorphs of Yaqui reduplication.

3.0. The Allomorphs of Yaqui Verbal Reduplication

The most common function of reduplication in Yaqui verbs is the expression of habitual action, although the semantics of reduplication is often largely

dependent on the meaning of the verb root (see Harley and Amarillas this volume).[4]

Previous literature has made a distinction between two types of reduplication in Yaqui, which, following Escalante (1985), have been referred to as "primary" and "secondary" reduplication (Escalante 1985, Martínez Fabián 1995, Demers et al. 1999, Molina et al. 1999). Primary reduplication typically reflects habitual action, and secondary reduplication indicates some other semantics, typically iterative or continuative action, but sometimes reflecting idiosyncratic meanings. These terms should not be taken as assuming any theoretical status for the reduplication forms that they refer to, other than the fact that the roots which undergo secondary reduplication are most often a subset of the roots that undergo primary reduplication, and that the forms which undergo secondary reduplication are much less common in the language as a whole.

Since in this paper I will be introducing two additional reduplication patterns (disyllabic reduplication and mora-affixation), I will abandon the traditional bipartite division implicit in the terms "primary" and "secondary". What these terms do indicate is that the primary reduplication forms, i.e. full syllable reduplicants, are the usual unmarked reduplication forms, as in ***bwi****.bwi.ka* from *bwiika* ('to sing'), and that secondary reduplication adds a phonological twist to the primary reduplicant, as in ***bwib****.bwi.ka* ('be a professional singer'). I will refer to these as light syllable reduplication and marked heavy syllable reduplication, respectively. These patterns will be discussed more fully in sections 3.1 and 3.2. Section 3.3 will discuss disyllabic reduplication (e.g. *kúpikte* → ***ku.pi****.ku.pik.te* 'blink eyes') and section 3.4 will discuss mora affixation/morphological gemination (e.g. *máveta* → *ma****v****veta* 'receive').

3.1. Syllable reduplication

First and foremost, I should point out that Yaqui exhibits a pattern of reduplication which has repeatedly been claimed not to exist: the pattern of so-called "syllable-copy". Following a typological generalization first proposed by Moravcsik (1978:311-312), the usual claim is that reduplicants are affixes of some specific prosodic shape, such as a light or heavy syllable, and that as such they do not target prosodic units of the base for copying. A recent, typical example of such a discussion is provided by McCarthy and Prince (1998):

> On the face of it, the idea that reduplication involves affixing a template[5] may seem surprising, since a natural, naïve expectation is

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[4] Two related issues in verbal reduplication which go beyond our discussion are the possibilities of reduplicating verbal tense/aspect/mood suffixes, as well as the behavior of internal reduplication in compounds (e.g. *teki-panoa* → *teki-****pa****-panoa* from Nahuatl *teki* 'work' + *-panoa* 'to pass' (Dedrick and Casad 1999). It should also be noted that C. Martínez Fabián reports (p.c.) that even such compounds can show variability in form, however, since he has heard the latter form also reduplicated as *teki-pa****n****-noa*.

[5] A "template" is defined as a morphological category being realized as a prosodic category: mora, syllable, foot, etc. (McCarthy and Prince 1993). It can be defined as a constraint of the form "RED=σ_{μ}", for instance, in which case the reduplicant would have to be a light syllable.

> that reduplication involves an operation like "copy the first syllable", as illustrated in [5]:
>
> [5] "Copy first syllable," hypothetically
>
> | | | |
> |---|---|---|
> | ta.ka | → | *ta*-ta.ka |
> | tra.pa | → | *tra*-tra.pa |
> | tak.pa | → | *tak*-tak.pa |
>
> Moravcsik (1978) and Marantz (1982) observe that syllable copying, in this sense, does not occur. Rather, reduplication always specifies a *templatic target* which is affixed to the base, and is satisfied by copying elements of the base. (286, emphasis in original)

What is at issue here for McCarthy and Prince is the importance of prosody in the definition of a reduplicant, rather than strict copying of a string of consonants (C's) and vowels (V's), as had been proposed by Moravcsik (1978) and Marantz (1982). Yaqui does provide support for the prosodic account of reduplication, although it refutes the specific content of the "no-such-thing-as-'syllable-copy'" rhetoric which has infiltrated much work within Optimality Theory (OT) and elsewhere. To see this clearly, consider the data in (6) and (7):

(6)	a. vu.sa	**vu.**vu.sa	'awaken'
	b. chi.ke	**chi**.chi.ke	'comb one's hair'
	c. chu.pa	**chu**.chu.pa	'grow (t.v.)'
	d. he.wi.te	**he**.he.wi.te	'agree'
	e. ko.'a.rek	**ko**.ko.'a.rek	'wear a skirt'
(7)	a. vam.se	**vam.**vam.se	'hurry'
	b. chep.ta	**chep.**chep.ta	'jump over'
	c. chuk.ta	**chuk**.chuk.ta	'cut with a knife or saw'
	d. hit.ta	**hit**.hit.ta	'make a fire'
	e. bwalkote	**bwal**.bwal.ko.te	'soften, smooth'

In (6) we have a series of words whose forms are (minimally) of CV.CV- form, and in whose reduplicant shapes are CV- (i.e. ***vus**.vu.sa). In (7) we have a series of words whose forms are (minimally) CVC.CV-, and whose reduplicant shapes are CVC- (i.e. ***va**.vam.se). Although what Moravcsik, Marantz, and McCarthy and Prince specifically deny is the *operation* of syllable-copy (which would be anathema to more recent assumptions in OT), in earlier derivational accounts of reduplication (e.g. those works of Moravcsik, Marantz, and McCarthy and Prince 1986) it would be difficult to separate the operation itself (i.e. "copy the first syllable") from the pattern resulting from such an operation (i.e. a reduplicant which is a copy of the first syllable of the base). The examples in (6) and (7) show unequivocally and indubitably that what is being copied in Yaqui is the first syllable of the verb root, i.e. that "syllable-copying" can and does take place.

What is surprising in the context of these data from Yaqui is that such a reduplication pattern should be so surprising. McCarthy and Prince (1986) had previously noted that reduplicative bases could be limited to the first foot of a word, as illustrated by such data from Yidin^{y} as *kin.tal.pa* → ***kin.tal****.kin.tal.pa* (****kin.ta****.kin.tal.pa*) and *mu.la.ri* → ***mu.la.****mu.la.ri* (****mu.lar.****mu.la.ri*). In considering such a limitation at the syllable level, however, they invoke facts from Ilokano to show that "reduplication does not in general *copy* a prosodic constituent of the base", but rather, "[what is] copied is the base's segmental melody" (p. 10). For instance, Ilokano /*basa*/ 'read' reduplicates as ***bas****.ba.sa* (****ba****.ba.sa*). The reduplicant is required to be a heavy syllable, and it copies as much of the base as necessary to fulfill this heavy syllable requirement, whether the segments respect their syllabic position within the base or not. In Yaqui, as we see with ***vu****.vu.sa* and ***vam****.vam.se*, the requirement that the reduplicant be a certain size, in this case a light syllable (where coda consonants are not moraic), can interact with the copying from a prosodic constituent of the base: i.e. the reduplicant copies *no more than* the first syllable, although it copies the entire first syllable.

As I have already mentioned, one of the sources of the erroneous generalization is Moravcsik's typological survey of reduplication patterns from around the world. As part of the Stanford Project on Language Universals in the 1970's, Moravcsik examined reduplication in a number of languages, including, interestingly, the Uto-Aztecan language Tohono O'odham (formerly Papago). As it turns out, none of the languages in Moravcsik's survey had "syllable-copy" reduplication. If, by a quirk of historical circumstances, Moravcsik had looked at Yaqui instead of Tohono O'odham,[6] then she would not have come up with this particular generalization.[7] This is not a critique of Moravcsik's conclusions, which were true with respect to the languages that she looked at, but it does show the limitations of the survey method of deriving universal statements.

Nevertheless, although linguists have been believing an empirically empty claim for all these many years, the fact that this kind of data exists is not a problem for prosodic approaches to reduplication such as Optimality Theory. There are a number of ways that one could approach this issue within a constraint-based theory. One is to simply stipulate that the base is the first syllable of the input root, and the constraint MAX-BR ("no partial reduplication", Kager 1999) will require fully copying that first syllable. Although this directly instantiates the heretofore unallowable notion of a rule of "syllable-copy", at

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[6] From the perspective of comparative Uto-Aztecan linguistics it is also interesting to note that Tohono O'odham has a particularly non-characteristically Uto-Aztecan reduplication pattern (although it might be characteristically Tepiman) involving syncope in the reduplicative base. See Fitzgerald (2000) for a recent analysis of Tohono O'odham reduplication, and Barragan and Haugen (2002) and Haugen (2002) for a discussion of the contrasts between O'odham and other Uto-Aztecan languages.

[7] From the perspective of a review of McCarthy and Prince (1986)'s citation of Moravcsik, it should be pointed out that a crucial aspect of Moravcsik's generalization is that "the only phonetic properties that partial reduplication rules may refer to are consonantality and vowelhood" (312)); i.e. Moravcsik was viewing reduplication as a copying of sequences of C's and V's, and not the appearance of C's and V's in specific prosodic constituents, as was being promoted by McCarthy and Prince.

least it does so by means of constraints. Another possibility would be to require positional faithfulness of segments in reduplicant-base correspondence. Such a constraint is offered by McCarthy and Prince themselves:

(8) STRUC-ROLE$_{BR}$: The structural role of segments in the reduplicant are identical to the structural roles of segments in the base (McCarthy and Prince 1993).

This constraint has the effect of requiring that consonants which are onsets in the base also be onsets in the reduplicant, and that codas in the base be codas in the reduplicant, as illustrated for Yaqui in (9) and (10) (this constraint would be violated in languages such as Ilokano). We will assume for the sake of illustration that there is a template that defines the reduplicant, although we will return to this problematic issue below:[8]

(9) RED1 = σ_μ >> STRUCT-ROLE$_{BR}$ >> MAX-BR

/ RED1 + vusa /	RED1= σ_μ	STRUC-ROLE$_{BR}$	MAX-BR
a ☺ **vu** vusa			sa
b. **vus** vusa		*!	a
c. **vusa** vusa	*!		

(10) RED1 = σ_μ >> STRUCT-ROLE$_{BR}$ >> MAX-BR

/ RED1 + vamse /	RED1= σ_μ	STRUC-ROLE$_{BR}$	MAX-BR
a **va** vamse			mse!
b. ☺ **vam** vamse			se
c. **vamse** vamse	*!		

In (9), we see that the crucial ranking of STRUC-ROLE$_{BR}$ over MAX-BR correctly rules out ****vus**.*vu.sa*. STRUC-ROLE$_{BR}$ plays no role in (10) since there are no violations, and MAX-BR correctly selects ***vam**.*vam.se* over ****va**.*vam.se*.

It would be nice if this was all there was to say about the issue of "syllable-copy" reduplication in Yaqui, since OT handles these data without much fuss. However, there is an added complication: there are exceptions to this picture, wherein it is not always the case that the full first syllable is copied. What compounds this complication is the fact that there is not necessarily dialectal agreement over which forms do or do not have full syllable copy (i.e. this variation is probably idiolectal). Consider Table 3:

[8] The symbols that will be used in tableaux are as follows: ☺ = correctly chosen output candidate; ❽ = incorrectly chosen output candidate; ☹ = a candidate that should be chosen (i.e. the correct output candidate) but is not in a particular tableau.

Table 3: Dialectal and/or Idiolectal Variation in Reduplicant Shape

Base-form	Gloss	Reduplicated Form in Sonora Yaqui	Reduplicated Form in Arizona Yaqui
hak.ta	'inhale'	**hak**.hak.ta	**hak**.hak.ta
huk.te	'choke on liquids'	**huk**.huk.te	**hu**.huk.te
b^{w}ak.ta	'take out of a container'	**b^{w}a**.b^{w}ak.ta	**b^{w}ak**.b^{w}ak.ta

As we see in Table 3, there are cases where the same coda consonant copies in different dialects, and others where it does not, and there does not seem to be any phonological conditioning environment to predict when it does or it does not copy. No rearranging of constraints will be able to account for the inconsistent realization of the reduplicants attested in Table 3. (It should also be noted that although there is variation as to whether a syllabic reduplicant will copy a coda consonant, there are *no* cases in the language where an onset of the second syllable copies into the coda position of the reduplicant: i.e. there are no forms like ***vus**.vu.sa).

The inconsistent realization of the reduplicant seems to play no role for our constraint STRUC-ROLE$_{BR}$, although it does for MAX-BR:

(11) Arizona Yaqui

/ RED1 + hukte /	RED1 = σ_{μ}	STRUC-ROLE$_{BR}$	MAX-BR
a ☹ **hu** hukte			kte!
b. ☻ **huk** hukte			te
c. **hukte** hukte	*!		

(12) Sonora Yaqui

/ RED1 + hukte /	RED1 = σ_{μ}	STRUC-ROLE$_{BR}$	MAX-BR
a **hu** hukte			kte!
b. ☺ **huk** hukte			te
c. **hukte** hukte	*!		

Regardless of STRUC-ROLE$_{BR}$, the optimal output should be ***huk***.*hukte* in both dialects, given the constraint MAX-BR. We want to copy as much of the base as possible without violating a higher-ranked constraint.

It seems that a possible solution to the problem raised by both the issue of not violating structural roles and by the issue of having different reduplicants with bases containing the same structural roles is to make more clear what it is that actually constitutes the base in each instance. As we noted before introducing (8) above, we have been assuming that the entire input word is the base, and it has been on this assumption that we have been tabulating violations of MAX-BR. This is the usual first assumption in discussions of reduplicants and bases, and is an idea that goes back at least as far back as Marantz (1982). In that work, Marantz proposed the derivational full-copy model of reduplication, where the reduplicant is an affix with a prosodic melody but no featural content.

On this account, the entire input word is copied, linked to the C's and V's of the affix as far as possible, and then the stray material not required by a reduplicative template is erased. In OT terms nothing is actually "erased", but the base material not copied by the reduplicant counts as violations of MAX-BR. The winning candidate is the one that optimally maximizes the copying of material in the base while maintaining the structure imposed by the higher-ranked well-formedness constraints, such as the reduplicative template.

In order to solve the puzzle observed in Table 3, at this point we need merely to specify that the base of monosyllabic habitual reduplication is the first syllable of the verb root,[9] unless otherwise specified, and the reduplicant must match this in order to be faithful. Anything not in the domain of the first syllable of the word is beyond the scope of the base, and copying more or less would be a violation of DEP-BR or MAX-BR, respectively. For the CV-copy cases such as those in (11), a further lexical stipulation could indicate that this base does not include the coda consonant on those specific words.[10] Thus, the dialect variation observed in Table 3 is reduced to differences in lexical specification: for Arizona Yaqui, *b*^{w}*akta* has an extrametrical coda consonant lexically marked, and in Sonora Yaqui, *hukte* has a coda consonant that is lexically marked. Both dialects have the same patterns, although there is variation in which verb roots fall into the different classes in the two different dialects.

The reanalysis of the base and its effects on the assessment of MAX-BR violations are shown in (13) and (14) (the base is indicated with an underscore). With this modification of definitions, STRUCT-ROLE$_{BR}$ loses its purpose. Since it would only come into play when MAX-BR is violated, STRUCT-ROLE$_{BR}$ is an extraneous constraint, insofar as it would have to be ranked very low any way in order to account for gemination in the marked heavy syllable cases that we will see below (in these tableaux FAITH-BR is used as a cover constraint for both MAX-BR and DEP-BR).

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[9] Hagberg (1993) comes to a similar conclusion regarding reduplication in roots with lexical stress in Mayo. Similar proposals have been made for foot-level bases in Yidin^{y} (McCarthy and Prince 1986), but these effects at the syllable-level seem to be much more rare, given the apparently false belief that has hitherto held that such things do not exist.

[10] For the cases in (18), it would appear that this lexical specification could be a result of the reanalysis of some kind of inflectional morphology, where the *–k-* is sometimes analyzed as inflectional, and thus extrametrical, and other times not and therefore it is part of the domain of reduplicative copying. We will return to this issue below in the section on disyllabic reduplication, which also usually involve a *–k-*. However, the uncopied coda consonant is apparently not always a *–k-*, since Escalante (1990) reports that he reduplicates *hapte* 'stand up (pl.)' as ***ha****hapte*, and *yepsa* 'arrive' as ***ye****yepsa* (the last example contrasting to what is reported in Molina et al. (1999): *ye****e****p.sa*). Thus, these words will have to be lexically specified anyway, and inter-speaker variation can be attributed to different lexical specifications for cognate roots in different grammars.

(13)

/ RED1 + vusa /	RED1 = σ_{μ}	FAITH -BR	STRUC-ROLE$_{BR}$
a. **vusa** vu.sa	*!	sa	
b. **vus** vu.sa		s!	
c. ☺ **vu** vu.sa			

(14)

/ RED1 + vamse /	RED1 = σ_{μ}	FAITH -BR	STRUC-ROLE$_{BR}$
a. **vamse** vam.se	*!	se	
b. ☺ **vam** vam.se			
c. **va** vam.se		m!	

Candidates (13a) and (14b) are ruled out because they exceed the syllable-with-a-single-mora template. FAITH-BR serves to rule out any candidate in which the reduplicant has less than the base, as in (14c), or in which the reduplicant has more than is contained in the base, as in (13b). With the assumption that the base is the first syllable of the root (with the possibility that a coda consonant is extrametrical), these two constraints are able to account for the monosyllabic habitual reduplication pattern that we have seen so far. We are left, however, with the issue of how the base gets to be limited to this first syllable. This problem is not unique to Yaqui.

Haugen (2001) examined the reduplication pattern of Mayo, as described by Hagberg (1993), and proposed the use of alignment constraints to limit the base of a certain class of words ("the accented class") to the first syllable, and the base in other words to the entire first foot. The facts of Mayo reduplication are given in (15). The light and heavy syllable reduplicant alternation is cognate to the unmarked and marked heavy syllable reduplication patterns found in Yaqui and other Uto-Aztecan languages, but, according to Hagberg, the previous semantic distinctions between these two reduplicants are being lost in younger generations. This is leading to a certain degree of free variation between the two reduplication patterns without the attendant semantic distinction that holds for older speakers. This kind of morphological reduction and concomitant development of variability is typical in language loss situations (Campbell and Muntzell 1989), of which Mayo seems to be a case, even more so than Yaqui (see Moctezuma 1998 for discussion on this point and the various factors and effects involved).

(15) Mayo Reduplication Patterns (Hagberg 1993)

Accented Words (lexical stress on 1st syllable)

	Stem	RED1=σ_{μ}	RED2=$\sigma_{\mu\mu}$	Unattested	Gloss
a.	yú.ke	yú.yu.ke	yúy.yu.ke	*yúk.yu.ke	'rain'
b.	tí.we	tí.ti.we	tít.ti.we	*tíw.ti.we	'be ashamed'
c.	chí.ke	chí.chi.ke	chít.chi.ke	*chík.chi.ke	'comb'
d.	wóm.te	wó.wom.te	wóm.wom.te	*wów.wom.te	'be frightened'
e.	nók.wa	nó.nok.wa	nók.nok.wa	*nón.nok.wa	'known language'
f.	nó.ka	nó.no.ka	nón.no.ka	*nók.no.ka	'know language'

Unaccented Words (no lexical stress)

	Stem	RED1=σ_{μ}	RED2=$\sigma_{\mu\mu}$	Unattested	Gloss
g.	b^wa.ná	b^wa. b^wá.na	b^wan. b^wá.na	*b^wab. b^wá.na	'cry'
h.	b^wi.ká	b^wi. b^wí.ka	b^wik. b^wí.ka	*b^wib. b^wí.ka	'sing'
i.	om.té	o.óm.te	om.óm.te	*o'.'óm.te	'hate'
j.	si.mé	si.sí.me	sim.sí.me	*sis.sí.me	'go (sg)'
k.	no.ká	no.nó.ka	nok.nó.ka	*non.nó.ka	'speak'

As is clear from (15), in the accented class, the reduplicant in the heavy syllable copies only from the first syllable, and must receive gemination of the onset of the stem in order to be heavy (***non****.no.ka* and not ****nok****.no.ka*), just like Yaqui. In the unaccented class, however, the reduplicant freely copies into the second syllable (***nok****.no.ka* and not ****non****.no.ka*). What is particularly interesting here is that there is an opacity in the assignment of the base in Mayo, since the accent predicts how far into the stem the base will be (the base is coterminous with the right edge of the accented syllable in the unreduplicated form), but the accent shifts under reduplication, even shifting to the reduplicant in the reduplicated words of the accented class. Haugen (2001) proposed a suite of alignment constraints operating distinctly over reduplicant size, accent-assignment, and base-assignment, in order to circumvent the problem of opacity which is troublesome to a non-derivational theory such as OT.

However, Haugen, Hicks Kennard and Kennedy (2002) illustrated a variety of other cases where it appears that the reduplicative base is only a prosodic sub-string of the stem, but were able to provide accounts not appealing to the constraint-based assignment of the base in every case, including Mayo. Nevertheless, the approach of defining the base in a prosodic way by means of constraints would have little to say about the variation in Yaqui seen in Table 3, and we will provisionally (and heavy-heartedly) leave the definition the reduplicative base as a lexical fact specific to particular lexical items. We will return to this point in section 4, after we see that other aspects of reduplication, namely the various other allomorphs, are also going to have to be somehow listed lexically: different verbs fall into different classes, which presumably are based on some historical factors as yet undetermined.

Getting back to other aspects of Yaqui syllabic reduplication, there are still other quirks to account for, which are introduced by the data in (16) (all forms here have first mora accent):

(16) Yaqui Monosyllabic Reduplication = 'habitual action'

a.	b^{w}ii.ka	'sing'	**b^{w}i**.b^{w}i.ka	'sings'
b.	b^{w}aa.na	'cry'	**b^{w}a**.b^{w}a.na	'cries'
c.	vaa.ne	'irrigate'	**va.**va.ne	'irrigates'
d.	pat.ta	'cover'	**pat.**pat.ta	'covers'
e.	'a.mu.se	'go hunting'	**'a**.'a.mu.se	'hunts'
f.	'i.vak.ta	'hug someone'	**'i.**'ivak.ta	'hugs'
g.	tee.ka	'lay it across'	**te**.te.ka	'lays across'
h.	wi.u.ta	'tear it down'	**wi.**wi.u.ta	'tears down'
i.	vui.te	'run'	**vui**.vui.te	'runs'

There are a few things to note about the data in (16). As mentioned in section 2, underlyingly long vowels with first mora accent shorten in both the base and the reduplicant (16a, b, c, g). Coda consonants in the first syllable generally copy along with the rest of the first syllable (16d and examples above). Diphthongs can be distinguished from heterosyllabic vowels according to whether or not they copy in reduplication (e.g. 16h vs. 16i). Finally, what appear to be candidates for underlyingly "true geminates" (Hayes 1986), such as *patta* in (16d), are probably better analyzed as heterosyllabic consonant clusters, due to morphological considerations. The *–(t)a* and *–(t)e* suffixes are reflexes of transitivity (*–(t)a* marks transitivity and *–(t)e* marks intransitivity) (Escalante 1990, Jelinek 1998), and thus the gemination reflects concatenative morphology, resulting in "fake geminates" (Hayes 1986) (but see footnote 15 below).

Suggesting that the reduplicant is defined by a light syllable template would allow us to rule out long vowels in both the reduplicant and the base, as in the reduplicated form of *b^{w}iika*, which appears as ***b^{w}i.b^{w}i.ka***.[11] On the full model of reduplication (McCarthy and Prince 1995), there is a constraint that holds over identity of vowel length from input to the output (17), as well as between base and reduplicant (18):

(17) MAX-WEIGHT$_{IO}$: Input weight identity is preserved in the output.

(18) IDENT-WEIGHT$_{BR}$: Base and reduplicant weight are identical.

[11] As mentioned in section 1, only those forms which do not have lexically extrametrical first moras undergo the vowel shortening. Since I am not discussing the predictable assignment of tone, it is more interesting to this discussion to account for the apparent back-copying that occurs in the base in these forms rather than the absolutely faithful bases that we see with cases found in (3). A constraint ranked higher than MAX-BR could preserve the long vowel in the base, while allowing the copying of only the first mora in the reduplicant.

As we see with the case of ***b*^{w}*i.b*^{w}*i.ka*, input vowel length can be violated, and this is captured by ranking IDENT-WEIGHT$_{BR}$ over MAX-WEIGHT$_{IO}$. This ensures that the base-reduplicant identity is more important than input-base (weight) identity. The relevant tableau is given in (19):

(19) RED1 = σ_{μ} , IDENT-WEIGHT$_{BR}$ >> MAX-WEIGHT$_{IO}$

/b^{w}iika+RED1/	RED1 = σ_{μ}	FAITH -BR	IDENT-WEIGHT$_{BR}$	MAX-WEIGHT$_{IO}$
a. **b^{w}ika**.b^{w}i.ka	*!	ka		
b. **b^{w}ik**.b^{w}i.ka		k!		
c. **b^{w}ii**.b^{w}ii.ka	*!			
d. **b^{w}i**. b^{w}ii.ka		i!	μ	
e.☺ **b^{w}i**. b^{w}i.ka				μ

However, all of this might be irrelevant, since the use of reduplicative templates has recently fallen under fire. Hendricks (1999), for example, demonstrates a variety of reduplication patterns which are not prosodic, such as "bare-consonant" reduplication of the kind found in Semai "expressive minor reduplication", where *cʔɛt* 'sweet' reduplicates as ***ct-****cʔɛt*. The reduplicant here, of the shape CC, is not a prosodic unit under standard views of the prosody hierarchy. However, if we abandon the reduplicative template we can force the reduplicant to be of the shape CC via what Hendricks has called "compression", where the alignment of the stem to the left is ranked above MAX-BR. The particular segmental content of the reduplicant, which copies the first and last segment of the reduplicant, is brought about by ranking ANCHOR-LEFT ("the left edge of the reduplicant corresponds to the left edge of the base") and ANCHOR-RIGHT ("the right edge of the reduplicant corresponds to the right edge of the base") above the constraint aligning the stem to the left. Other approaches to limiting the size of the reduplicant include aligning the reduplicant to the left edge of some prosodic unit, such as a light syllable or a heavy syllable, which would yield the results of RED1 and RED2 in the Mayo data above.

Then again, that the size of the reduplicant surfaces as an artifact of what the base is in Yaqui is perhaps the best argument, in and of itself, to just go ahead and lexically define the base instead, as has been tentatively advocated here. This will serve us well when we see full foot reduplication below: if there are differently-sized bases in different classes of words, then a highly-ranked MAX-BR will allow for full copy of these bases. Better yet, as we will see in our discussion of disyllabic reduplicants, it is usually the case that the root is disyllabic, and in monosyllabic reduplication, the root is usually monosyllabic. That is, we usually see full copy of the root, and we need only make lexical limitations on the exceptions to this generalization.

In the meantime, however, we will turn to the marked heavy syllable reduplication which piggy-backs on the light syllable reduplication pattern that we have by now (nearly) exhausted.

3.2. Marked Heavy Syllable Reduplication

Marked heavy syllable reduplication also involves reduplication of one syllable, but with the added attribute of gemination from the onset of the base into the coda of the reduplicant. Examples are given in (20):

(20) Marked Heavy Syllable Red. = 'iterative or continuative action', or idiosyncratic meaning

a.	b^{w}ii.ka	'sing'	**b^{w}ib**.b^{w}i.ka
b.	b^{w}aa.na	'cry'	**b^{w}ab**.b^{w}a.na
c.	tee.ka	'lay it across'	**tet**.te.ka
d.	va.hu.me	'swim'	**vav**.va.hu.me
e.	tuu.ke	'flicker out'	**tut**.tu.ke
f.	ye.na	'smoke (tobacco)'	**yey**.ye.na
g.	'om.te	'get angry (i.v.)'	'**o**'.'om.te

The semantics of these are at this point ungeneralizable, but they usually refer to iterative or continuative action, or involve some idiosyncratic meaning (see section 4.2): the semantic properties of "secondary reduplication" would be a fruitful topic for future research.

As is the case for Mayo (discussed above), this marked type of reduplication seems to be disappearing for some speakers, especially in the Arizona dialect. For the late Fernando Escalante, a linguist and native speaker of Arizona Yaqui, this pattern was fully productive (Eloise Jelinek, personal communication). However, some other speakers of the Arizona variety differ as to whether, and if so to what extent, this pattern is productive in their idiolects.

The forms which do take the marked heavy syllable reduplication pattern can have first or second mora accent, although the first syllable of the reduplicated word (i.e. the heavy syllable reduplicant) is always accented. This is consistent with Demers et al. (1999)'s analysis of tone-assignment as being on the first available mora of the word, with second mora accent occurring where there is otherwise lexical extrametricality on the first mora of a root. In the cases of marked heavy syllable reduplication, the first syllable always contains two moras, thus it always receives the high tone.

Although it might be unexpected to have segmental "overwriting" on forms with word-medial consonant clusters, this is apparently possible with such forms as (20g), where the heavy syllable reduplicant for *'om.te* is realized as ***'o'***.*'om.te*. Contrast this with its cognate in Mayo (15i), whose light syllable default reduplication form is ***'o***.*'om.te*, and whose heavy syllable reduplicant is ***om***.*om.te*. (The light syllable reduplicant for this cognate in Yaqui is, as in Mayo, ***'o***.*'om.te*--one of the few forms which do not copy the coda of the first syllable). This contrast is one of the strongest pieces of evidence that coda consonants are not generally moraic in Yaqui, and the copying of the coda does not count as a violation of whatever restricts the usual reduplicant to a light syllable. However, when a heavy syllable is needed for the exponence of some morphological element, this can only be brought about via gemination. I will argue below that this gemination occurs as a reflex of "the emergence of the unmarked" due to the ranking of markedness constraints in Yaqui phonology.

To summarize, on the traditional analysis, Yaqui exhibits evidence of two different but related reduplication patterns, and two different reduplicants (or in Spaelti's terms, "duplemes") can be motivated by the different forms and semantics exhibited in (16) and (20), although only a few words may exhibit this systematic alternation anymore.

The effects of these alternations are shown in the examples given in (21):

(21) Primary and Secondary Reduplication in Action

21a.	/b^{w}iika/ 'to sing'		
		aapo b^{w}iika	'he is singing'
	"PRIMARY" RDP	aapo **b^{w}i.**b^{w}ika	'he sings'
	"SECONDARY" RDP	aapo **b^{w}ib.**b^{w}ika	'he sings (professionally)'; or 'he is a professional singer'
21b.	/nooka/ 'to speak'		
		aapo nooka	'he is speaking'
	"PRIMARY" RDP	aapo **no**.noka	'he speaks' or ('he is a speaker')
	"SECONDARY" RDP	aapo **non**.noka	'he gossips'

The gemination seen in the marked heavy syllable reduplication is considered by Demers et al. (1999) to be a case of lengthening to meet the requirement of an additional mora in the reduplicant. They propose two templates for the two reduplication patterns exhibited by (8): a light syllable and a heavy syllable, respectively. In other words, in order to fill out the heavy syllable requirement of the morpheme expressed as the secondary reduplicant, the coda consonant is moraic (whereas codas are usually not moraic in Yaqui). I will show below that this resulting consonantal moraicity, gemination, comes about through the interplay of markedness constraints. As discussed in Haugen (2002), other Uto-Aztecan languages with a marked heavy syllable pattern realize this additional mora via the other plausible mechanisms, available because of surface markedness, of mora-addition. These are vowel lengthening (as in Tohono O'odham marked plurals,[12] e.g. *ñem* 'liver' → ***ñe:.****ñem* (Hill and Zepeda 1994) and unmarked consonant (i.e. glottal stop) epenthesis (as in Guarijío, e.g. *ku.ci.ta* 'son, daughter' → ***ku'****.ku.ci.ta* (Miller 1996)).

We will delay the theoretical aspects of this discussion until section 3.4, to bring it into focus only after we discuss mora affixation, which usually shows the same phonological process (i.e. gemination to meet some morphological requirement) occurring. However, it is worth noting at the present time that, as we saw above in the accented class in Mayo, the base for marked heavy syllable reduplication has to be the first syllable in Yaqui (and perhaps as well as, by implication, Nahuatl and Guarijío), otherwise we would expect to see copying into the second syllable of the base (****bwik****.bwi.ka*) in order to meet the heavy

[12] Tohono O'odham reduplication is interesting in several regards, not the least of which is the fact that it has marked heavy syllable reduplicants of both the geminating kind (for distributivity) and the vowel-lengthening kind (for "marked human plurals"). See Fitzgerald (this volume) for further discussion of the former, and Hill and Zepeda (1994) for the latter.

syllable requirement on the reduplicant and the maximal copying of the base required by MAX-BR.

This gemination can be considered an effect of "the emergence of the unmarked", where certain phonotactic constraints which are violated in reduplicative bases are tolerated because of Input-Output faithfulness, but are illegitimate in reduplicants because of the crucial ordering of the phonotactic markedness constraint over Base-Reduplicant faithfulness: i.e. FAITH-IO >> phonotactic constraint >> FAITH-BR. In the case of Yaqui, this markedness constraint might be something of the nature of *LONG-V, which requires vowels to be short. In Tohono O'odham marked plurals, where the heavy syllable reduplicant in marked plurals is met via the lengthening of the vowel, it could be *LONG-C (i.e. no gemination).[13] We will return to this point below at the conclusion of section 3.

3.3. Disyllabic Reduplication

The third kind of reduplication is of a disyllabic CVCV- foot, as shown in the examples in (22):

(22) Disyllabic Habitual Reduplication: RED = $\sigma_\mu\sigma_\mu$

a. kupikte	'blink eyes'	**kupi**.kupikte
b. chihakta	'splash it'	**chiha**.chiakta
c. chitohte	'slipping'	**chito**.chitohte
d. chivehta	'spread	**chive**.chivehta
e. chu'akta	'glue, paste'	**chu'a**.chu'akta
f. halahte	'gasp for air'	**hala**.halahte
g. harahte	'crack (lips)'	**hara**.harahte
h. hasohte	'breathe hard'	**haso**.hasohte
i. hechite	'scratch'	**hechi**.hechite
j. kamukta	'take drink (hold liquid in mouth)'	**kamu**.kamukte
k. kalakte	'fold, pile things up (such as clothing)'	**kala**.kalakte
l. kinakte	'squint, grimace'	**kina**.kinakte
m. kitokte	'contract (body)'	**kito**.kitokte
n. koakta	'turn it'	**koa**.koakta
o. kohakte	'revolve, chip off'	**koha.**kohakte

[13] Because our primary focus here is on Yaqui, the Tohono O'odham picture has been somewhat simplified. Fitzgerald (this volume) discusses Tohono O'odham distributive reduplication, which shows heavy syllable reduplicants created via gemination, just like heavy syllable reduplication in Yaqui and the accented class of Mayo. Thus, Tohono O'odham actually has two kinds of marked heavy syllable reduplicants: the long vowel plurals used for a semantic class of marked humans (and nouns with semantic extensions from that class), as well as the distributive in nouns and verbs. That is, Tohono O'odham is so rich with allomorphy of the "dupleme" sort, where different kinds of reduplication mark different semantic functions, that other constraints would have to be invoked in order to eliminate homophony between reduplicants. This would be an interesting domain to explore but goes beyond our purposes in this paper.

Most of the forms in (22) are trisyllabic, but there is variation as to whether the first two syllables are of the form CV.CV- (e.g. *he.chi.te*) or are CV.CVC- (e.g. *ka.lak.ta*). It should also be recalled that not all trisyllabic forms reduplicate with disyllables, however, since we have already seen forms such as *í.vak.ta* reduplicating as ***i.'***i.vak.ta* and we will see forms like *má.ve.ta* reduplicating as *ma**v**.ve.ta*. As should have been clear from our previous discussion of (16) above, the majority of the verbs there were disyllabic, and the reduplicant in those cases was monosyllabic. In contrast, most of the forms in (22) are trisyllabic, and the reduplicants here are disyllabic. However, there are exceptions to both cases: *'a.mu.se* reduplicates as ***'a**.'a.mu.se*, etc. As mentioned above, the *–(t)a* and *–(t)e* endings are typically derived in Yaqui, in that they usually correspond with a verb's transitivity. Additionally, Martínez Fabián (1995, personal communication) analyzes the *–k-* as inflectional morphology, which would also explain its extrametricality with regards to reduplication if we assume that the base for copy is the verb root. Therefore, if we regard the base as being the entire root of the verb, excluding the transitivity-marking morpheme and the *–k-*, then reduplication can be argued to copy the entire root in disyllabic reduplication and in some monosyllabic reduplication with a *–(t)a* or *–(t)e* ending, such as *chep.ta* and *pat.ta*.[14] However, the transitivity-marking morphology is not as robust in the monosyllabic cases, and there are exceptions to how much actually gets copied in non-monosyllabic cases: *í.vak.ta* reduplicates as ***'i**.'i.vak.ta*, and *wí.u.ta* reduplicates as ***wi**.wi.u.ta*.[15]

Because the reduplicant in monosyllabic reduplication is light even if it has a coda consonant, it is not possible to unify the two separate cases as instances of foot-reduplication. Despite the apparent predictability of the reduplicant in most verbs, the lists of exceptions will have to lead to some degree of lexical-specificity in the disyllabic reduplication cases, just as there was for the syllabic reduplication cases above.

I should note here, however, that in this case there is also a potential argument (as first pointed out in Barragan and Haugen 2002) for a semantic class among the verbs of (22): verbs of body functions or body movements. Hill and Zepeda (1994) argue for a remnant of a nominal classification system in Tohono O'odham, which finds its exponence in variable reduplication patterns among nouns in that language. I will not pursue this here, but finding some explanation as to why some roots, and their reduplicants, are longer in such verbs may be worthy of future investigation, as would any semantic extensions which may lead to similar reduplication patterns for other roots as well.

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[14] The copying of *–k-* in some disyllabic roots (e.g. *hakta*) could be explained as reanalysis, which is apparently variable among different speakers and dialects (see Table 3).

[15] Additionally, considering the *–(t)a* and *–(t)e* elements as synchronically productive transitivity markers might be problematic in itself, since there are some exceptions where intransitive verbs end with *–ta* and transitive verbs end with *–te*, and not all verbs even have one of these markers when we otherwise might expect that they would. However, Jelinek and Escalante (2000) do propose that they are the reflex of a functional head corresponding with voice, thus possibly giving morphosyntactic justification for delimiting the reduplicative base to the verb root.

3.4. Mora Affixation/Morphological Gemination

For specific technical reasons internal to Correspondence Theory (McCarthy and Prince 1995), what I consider here to be the final "allomorph of Yaqui reduplication" might actually turn out to not be reduplication at all in the sense of Base-Reduplicant Correspondence, although in the intuitive sense it does involve the repeating or copying of elements in a verbal base. This is the phenomenon of mora affixation, which typically leads to morphological gemination or consonant doubling. Some examples appear in (23):[16]

(23) Mora Affixation

a.	b^{w}atania	'burn (food)'	b^{w}a**t**.tania
b.	chitonia	'plaster it'	chi**t**.tonia
c.	e'eria	'save up'	e**'**.'eria
d.	etapo	'open up'	e**t**.tapo
e.	hichike	'sweeping'	hi**t**.chike
f.	hima'ako	'cut wood'	hi**m**.ma'ako
g.	hine	'use as a cover'	hi**n**.ne
h.	hinepo	'uncover, unveil'	hi**n**.nepo
i.	hisika	'cut hair'	hi**s**.sika
j.	hovoa	'get full'	ho**v**.voa
k.	huha	'sting'	hu**h**.ha
l.	kakae	'be sweet'	ka**k**.kae
m.	maveta	'receive'	ma**v**.ve.ta

Here again, there does not seem to be a predictable phonological environment requiring the expression of habitual action to be gemination. Some words are disyllabic (e.g. *hi.ne*), some words are quadrisyllabic (e.g. *hi.ma.'a.ko*), and some are trisyllabic, even with the *–ta/-te* morphology (e.g. *ma.ve.ta*) which might incorrectly lead us to expect forms like ***ma.ve.*****ma.ve.ta* or even ****ma*****.ma.ve.ta*.

At this point it is important to discuss an apparent difference between the Sonoran and Arizona varieties of Yaqui: the membership of certain words in certain classes differs among speakers when it comes to which class a particular verb might belong to. Some speakers of Yaqui apparently allow for ***hi****.hi.ne* or ***i.va****.i.vak.ta*, and some speakers waver as to which they regard as the correct form. Also, I have been told that *hi****m****.ma'ako* is a more conservative usage than more marginally acceptable ***hi****.hi.ma.'a.ko*, but also that there may be some slight meaning variation between the two (the first being emphatic, the second

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[16] All of the words in (23) have an initial sequence of CV.CV-. The one form of which I am aware which is of the initial sequence CVC.CV- is *yepsa* 'arrive', which appears with vowel-lengthening: *yeep.sa*. This can be explained with the same analysis as morphological gemination (mora-insertion, to be discussed below), but with the caveat that the language does not allow such complex codas and therefore requires vowel-lengthening. The process of mora-addition is the same, however, and it is left to the markedness hierarchy of the language to decide what the optimal output should be, as per standard assumptions in Optimality Theory.

being more habitual, but the action not necessarily occurring in the present). The examples in (23) can all be found in the dictionary compiled by Molina et al. (1999).

The conclusion that I think must be drawn here is that there is probably some kind of paradigm-leveling occurring for these and (most likely) other forms. I think that it is clear that, historically speaking, it has been the case that gemination of these forms has existed along side monosyllabic reduplication in other words. At the synchronic state of the language, however, there is some variability among speakers as to which specific verb roots belong to which specific classes. That is, these facts once again show us some degree of idiolectal variation and lexical specificity of the preferred reduplicant shape for specific roots.

As for the theoretical treatment of such word-internal consonant doubling, it might at first be tempting to suggest that the gemination in these forms results from reduplication, but this should not be the case if the "base" is the first syllable of the verb root, or even the full verb root as under more standard assumptions. The reason for this is that reduplication requires that a reduplicant be anchored to (i.e. have identity with) some edge of the base (assuming that we know what the base is). In this case, this left edge should be the left edge of the first syllable of the root (or equivalently, the left edge of the entire root): *m*-. In this instance the reduplicant should also be -*m*-, leading incorrectly to the reduplicant: **ma**__**m**__*.*ve.ta*.[17]

If we abandon the reduplication assumption (i.e. abandon the notion of base-reduplicant correspondence), and posit simply a bare mora affix (as proposed for other languages by Samek-Lodovici 1992), then the correct output emerges: *ma*__**v**__*.ve.ta*.[18] A Samek-Lodovici-style analysis relies crucially upon the interaction of alignment constraints and well-formedness (markedness) constraints. I assume here that it is the result of the interaction of such constraints that leads to gemination in order to give featural content to the bare mora affix, as it was in the case of heavy syllable reduplication above. Given different constraint rankings, the morphological addition of an extra mora could also be realized by vowel lengthening (as in the marked plurals of Tohono O'odham) or epenthesis of some phonologically unmarked consonant (as with epenthesis of glottal stop in Guarijío).

As for alignment constraints, if we align the mora affix, which we will name HAB3 (HAB1 and HAB2 being the reduplicative allomorphs corresponding to light syllable and CVCV- reduplicative allomorphs, respectively) to the left, then it

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[17] Another possibility would be that the base is actually the *second* syllable of these words, giving us the appropriate left edge anchoring (e.g. ma.[ve]$_B$.ta). However, this is undesirable because I suspect that having the base be limited to even the first syllable stretches the credulity of conservative phonologists, and in this case there is not even morphological justification (such as root-hood) for making such a move.

[18] Formally, we know that reduplicating the input of */maveta/* could yield possible phonological outputs of the Yaqui language, such as ***ma****.ma.ve.ta* or ***ma.ve****.ma.ve.ta*. However, I am assuming here that affixing a reduplicative morpheme to this root would trigger some violation of the morphology of the language, such as would be the case if an English speaker were to pluralize the root *child* with the plural endings *–s*, *–i*, *–ae*, etc. That is, the violation would be morphological, and not strictly phonological.

will be a prefix. We will also assume that there is a highly ranked constraint LICENSE-μ, which requires that moras be attached to syllables.[19] We will assume that DEP-σ_{IO} is highly-ranked, so inserting a new syllable to license the bare mora would be dispreferred to attaching the mora to a syllable that is already in place. If we rank the markedness constraint *LONG-V over *CODA, then we will force gemination, as shown in (24):

(24) Morphological Gemination: *LONG-V >> *CODA

/HAB3+maveta/	ALIGN (HAB3,L,Wd,L)	LICENSE-μ	*LONG-V	*CODA
a. **a** ma.ve.ta		!		
b.☺ ma**v**.ve.ta	ma			*
c. ma**a**.ve.ta	ma		*!	
d. ma.ve**t**.ta	mave!			
e. ma.ve**e**.ta	mave!			

Candidate (24a) shows a candidate whose mora is unlicensed, and is ruled out by LICENSE-μ. Neither (24d) nor (24e) are optimally aligned to the left, and they are ruled out. (24c) has a long vowel and is rejected by *LONG-V, and (24b), despite its *CODA violation, is the optimal candidate. One candidate not considered here would be *m**a**a.ve.ta*, where the moraic affix is inserted as the first mora of the base syllable, in the maximal possible left-alignment. However, in this particular instance this candidate would also be ruled out by *LONG-V, although it might also be possible to rule out such a candidate through a better articulated constraint on moraic licensing.

To see that this approach also works with marked heavy syllable reduplication, consider the tableau in (25), where the base is assumed to be the first syllable (marked with an underscore) and the reduplicant does not actually include the second mora of the syllable in which the reduplicant appears (thus it is not in bold):

(25) Marked Heavy Syllable Reduplication: *LONG-V >> *CODA

/RED2+vahume/	ALIGN (RED2,L,$\sigma_{\mu\mu}$,L)	*LONG-V	FAITH-BR (MAX / DEP)	*CODA
a. **va** va.hume	*!			
b. **va**a va.hume		*!		
c.☺ **va**v.va.hume				*
d. **vah** va.hume			*!	*
e. ☹ **va**' va.hume				*

By now we have abandoned the approach of positing a template to force the reduplicant to appear in a heavy syllable, but we can achieve the same result by means of an alignment constraint requiring that the heavy syllable reduplicant (RED2) is aligned to the left edge of a heavy syllable. The crucial difference

[19] Haugen (2002) discusses the intriguing pattern of reduplication in Tübatulabal, where the prefixal reduplicant surfaces as a copy of only the first vowel of the base, leaving open the possibility that it is a reduplicative moraic morpheme which is not licensed by a syllable.

between this alignment constraint and a template constraint is that the latter actually requires both edges of a reduplicant to be aligned to the edge of a prosodic unit—see Hendricks (1999) for discussion. Candidate (25a) violates this alignment and is summarily ruled out. Candidate (25b) has a self-defeating long vowel, and candidate (25d) shows correspondence with an element of the root which is not part of the base, violating FAITH-BR. As we also see in (25), however, there is no way so far to force gemination over epenthesis of some other consonant, such as a glottal stop (25e) (25d is intended to be a candidate which copies more of the root than the first syllable, violating DEP-BR).

For this reason we will have to add an additional constraint to the mix in order to force gemination. Such a constraint would be DEP-IO, disallowing epenthesis. It is not clear that such a constraint would have to be crucially ordered with respect to any of the other constraints that we have been discussing, but it would be out-ranked by other constraints in other contexts in the language where epenthesis does occur. For our purposes here, though, we can add it anywhere.

(26) Marked Heavy Syllable Reduplication: *LONG-V >> *CODA

/RED2+vahume/	ALIGN (RED2,L,$\sigma_{\mu\mu}$,L)	*LONG-V	FAITH-BR (MAX / DEP)	DEP-IO
a. **va** vahume	*!			
b. **va**a vahume		*!		
c.☺ **va**v.vahume				
d. **vah** vahume			*!	
e. **va'** vahume				*!

Another possible approach to the Yaqui data that I have not taken here would be to use faithfulness to underlying weight identity to derive the correct result in the realization of the extra mora in morphological gemination and in marked heavy syllable reduplication, using constraints such as (27) and (28):

(27) IDENT-WEIGHT-IO-C: Underlying consonant weight is retained in the output.

(28) IDENT-WEIGHT-IO-V: Underlying vowel weight is retained in the output.

However, since I am approaching these data from a comparative Uto-Aztecan perspective and have noted various similarities among the various reduplication patterns across the family, the markedness approach is more amenable to explanation of the crosslinguistic variations observed in these patterns.[20] Accordingly, it is the markedness approach that I advocate here.

Adding one final markedness constraint causing the avoidance of gemination (informally *LONG-C), the full typology of marked heavy syllable reduplication patterns is given by the constraint rankings in (29). The ultimate result of adding an additional mora will depend on the ranking of the three constraints

[20] An additional piece of (Yaqui-internal) evidence for the markedness approach is the case of words in the mora-affixation class which show vowel-lengthening, e.g. *yepsa* 'arrive' → *yeepsa*, which can be derived by ranking a markedness constraint outlawing complex consonant clusters (e.g. *CCC) over *LONG-V.

*LONG-V, *LONG-C and DEP-IO. The most important factor will be the least marked (i.e. lowest-ranked) constraint: the winning candidate will be the one that violates that constraint but not the higher ranked constraints.

(29) Typology of Markedness in Uto-Aztecan "Marked Heavy Syllable Reduplication"

Constraint Ranking	Result	Example Language
DEP-IO, *LONG-V >> *LONG-C	gemination	Yaqui
DEP-IO, *LONG-C, >> *LONG-V	vowel lengthening	Tohono O'odham ("marked plurals")
*LONG-V, *LONG-C >> DEP-IO	epenthesis ([ʔ] or [h])	Guarijío

As should be clear from the discussion above, the long vowel examples from Tohono O'odham are a bit simplified here for the point of discussion: this language actually has at least two patterns of heavy syllable reduplication. This could easily be accounted for by allowing the second least-marked constraint to be violated in favor of a more highly-ranked constraint prohibiting homophony (e.g. DISTINCT MORPHEME). In such a case, with multiple morphemes operating under the same constraint hierarchy and delivering distinct optimal candidates, the winning candidate would reveal the "emergence of the *least* marked", since what is unmarked (e.g. long vowel or geminate consonant) may be relative to other morphemes in the language.

Approaching these same data from a faithfulness/identity approach, it would be difficult to capture the cross-linguistic generalizations this nicely. Although it is true that these languages probably share a single historical ancestor and that to some extent there may be some argument for some degree of cross-linguistic identity among the inputs of languages with a common background, the markedness approach advocated here does not depend at all on etymological congruence in particular roots among these languages. Indeed, no systematic effort has yet been made to isolate and compare roots and their reduplication patterns across the Uto-Aztecan family, although this would be a useful and doubtlessly illuminating task.

3.5. Summary of Reduplicative Allomorphy in Yaqui Verbs

Yaqui verbs exhibit several patterns of reduplicative allomorphy. In the most common instances of reduplication, the reduplicative morpheme indicates habitual action of the inflected verb. There are three possible phonological shapes for the habitual reduplicant, none of which are entirely determined by the phonological context of the root in question. These patterns are light syllable reduplication, disyllabic or full-root reduplication, and mora-affixation. Since the roots that take these patterns can be grouped into various classes, it is assumed here that there is some historical precedence for the existence of these classes. I have alluded to work (e.g. Barragan and Haugen 2002, Haugen 2002) which demonstrates that each of these patterns can be reconstructed for earlier stages of Uto-Aztecan, and presumably the three classes in Yaqui correspond in some way to the earlier distinct reduplicative morphemes in the pre-Yaqui ancestor language, but the meanings have largely merged to one general function in Yaqui: habitual action. A more specific documentation of why particular verb roots fall into specific classes would be a fruitful venture, but

this is left for future investigation. However, in light of the social context of ongoing language shift, and the separation of Arizona Yaquis from their homeland in Sonora, it would not be surprising if the Arizona dialect was more variable than the Sonoran dialect, given the propensity for the development of variability in language loss situations, of which the Arizona case is currently more severe than that of Sonora.

In addition to the three allomorphs of Yaqui habitual action, there is also the pattern of heavy syllable reduplication that is a marked variation on the light syllable pattern. This pattern, which involves gemination of the onset of the base into the coda of the reduplicant, emerges from the same arrangement of markedness constraints that yields gemination in the class of mora-affixation.

4.0. Further Theoretical Issues: Diachronic Approaches to Reduplication

We have already discussed a variety of theoretical issues brought about by the reduplication data from Yaqui. In this final section we will turn to the issue of reduplicative allomorphy more generally from two differing perspectives: those of diachrony and constraint-ranking in Optimality Theory and grammaticization of "reduplicative grams" in grammaticization theory.

4.1. Diachronic Issues in Optimality Theory

Patterns of reduplicative allomorphy in other languages have been discussed at length by Spaelti (1997), among others. As mentioned above, Spaelti divides reduplicative allomorphs into two classes: "duplemes" and "alloduples". Duplemes are reduplicants which share a consistent shape-meaning relationship. Alloduples are reduplicants which serve the same semantic function but have variant shapes brought about through prosodic or other phonological factors. Spaelti gives an extended survey of the latter kind in the Austronesian language Nakanai. This language is limited to (C)V syllables, and stress consistently falls on the penultimate vowel. Depending on the phonology of the base (which Spaelti argues to be the main stressed [final] foot), the reduplicants appear as one of several different shapes: $C_1V_1C_2V_2$- (if C_2 is [l] or [r]), $V_1C_2V_2$-, V_1V_2-, C_1V_1-, V_1C_2-, V_1C_1-, V_1C_1-, $C_1V_1V_2$-, C_1V_2-. Among the more interesting cases are $C_1V_1V_2$- reduplicants in $C_1V_1C_2V_2$ roots (e.g. ***go.e.****go.ve*), and C_1V_2- reduplicants in $C_1V_1C_2V_2$ roots (e.g. ***pa.****pi.ta*). In these patterns the most sonorous vowel is copied; if V_2 is more sonorous, then V_1 is skipped (reduplication does not copy more than one obstruent).

There are several differences between Yaqui and Nakanai. First, Yaqui is apparently a mixed system, where it does not make much sense to talk about distinguishing duplemes from alloduples, even though many roots can reduplicate in multiple ways for various functions. Second, Yaqui is not a stress-based language, and it has a more complicated syllable structure. In Nakanai, it appears that the various alloduples can be affected by V1 and V2 sonority. However, Spaelti only appeals to this in order to identify *which vowel* gets copied, not how large the reduplicant will be. The factors leading to reduplicant size were largely prosodic, but as the data presented in this paper suggest, this is largely not a factor in many instances of Yaqui reduplication: *máveta, ívakta*, *kínakta* → *mán****v****.veta*, ***i****.'í.vak.ta*, ***ki.na****.kí.nak.ta*, etc. However,

in the cases of syllable vs. disyllable reduplication, the difference is often (though not always) found to be morphological in nature: the base is the root, and it gets fully copied.

As was discussed above in section 3.4, the heavy syllable reduplication data from Yaqui, and other Uto-Aztecan languages, gives support to a prosodic and markedness approach to reduplication, as provided by Optimality Theory. Such data would be problematic for theories of reduplication, such as Raimy (2000)'s modular-derivational theory, where reduplication is an operation which makes no reference at all to prosody. Although Raimy attempts to derive prosodic templates for reduplicants, it is not clear that his theory will be able to derive prosodic bases, such as the first foot of the root in Yidin^{y} or the first syllable in most cases of habitual reduplication in Yaqui.

In addition, the allomorphs of reduplication investigated here might shed some light on the nature of the morphological status of reduplicative morphemes. Raimy proposes that reduplicative morphemes occur as the secondary exponents of morphosyntactic features, via the agglutination of a Ø-morph which triggers a phonological rewrite rule which alters the precedence structure of the base form (i.e. triggering reduplication of some part of the stem). Curiously, this approach sneaks process-based morphology into the piece-based morphological theory that Raimy assumes: Distributed Morphology. However, I think that the historical stability of the reduplicative allomorphs that have been examined in this paper is good evidence for viewing reduplicative morphemes as *pieces*, although these pieces usually get their phonological content from the base rather than the input.[21]

Exactly *how* reduplicants function as morphemes is an interesting but puzzling question. One aspect of the allomorphy in Yaqui reduplication that seems to be clear is that the most common pattern is full copying of the root, which accounts for most of the syllabic and disyllabic reduplicants. Assuming some notion of the Paninian principle of only specifying special cases, we can propose that in the default case the reduplicative base is the root. In some cases of trisyllabic forms with monosyllabic bases, we can count these as exceptions with lexically-marked first-syllable bases. For roots with mora affixation, there is no base, but instead these roots are prefixed with the bare mora morpheme which, given the constraint hierarchy of this language, triggers the gemination (or vowel-lengthening in words with word-medial consonant clusters).

Although the specific marking of every word in the lexicon not in the default class may be complicated and complicating, I do have to say that it has an intuitive cognitive plausibility, and it has to be done in other well-known cases such as suppletion in English strong verbs and in German plurals. And like English strong verbs and German plurals, the specific classes of the allomorphs of Yaqui reduplication are no doubt an artifact of the history of the language, since each of the allomorphs has some reflex within the larger context of Uto-Aztecan. And also like English strong verbs and German plurals, the indeterminacy of the form from independent grammatical principles leads to

[21] Whether there is a relation between input and reduplicant is an empirical question. Fitzgerald (2000) argues from evidence from Tohono O'odham that this relation does in fact exist. Even if so, it is still the case that input-reduplicant identity is relatively rare compared to base-reduplicant identity.

some instances of disagreement and variation which could probably be traced to variable acquisition.

4.2. Grammaticization of Reduplicative Morphemes

Since it is a fundamental claim of this paper that the various reduplicative allomorphs in Yaqui have some basis in historical changes from Proto-Uto-Aztecan to modern Yaqui, it is appropriate to consider the Yaqui evidence in light of a recent proposal on the nature of grammaticization of reduplicative morphemes put forth by Bybee, Perkins, and Pagliuca (1994). The work of Bybee et al. comes from the background of grammaticization theory, which holds that grammatical (functional) morphemes develop from lexical morphemes through historical paths brought on by semantic and phonological erosion. Bybee et al. point out that reduplicative morphemes pose a potential problem for their theory of grammatical morpheme development because they challenge "the principle that all grams develop from a fuller lexical source, since it is not possible to trace a reduplicative gram back to a single word or even a specific phrase" (p.166). However, they suggest that their theory can in fact be applied to reduplicative morphemes, if we consider the "fullest, most explicit form of reduplication, total reduplication, to be the originating point for all reduplications, with the various types of partial reduplication as reductions and thus later developments from this fullest form" (p.166).

Bybee et al. illustrate this perspective with data from a variety of languages, of which perhaps Trukese is the most relevant to our discussion here. In Trukese, there are three distinct types of (prefixal) reduplication (i.e. three different "duplemes"): total reduplication (with the meaning of iterative or continuative), syllable reduplication (with the meaning of habitual), and initial consonant doubling (which acts as an intransitivizer). The central crux of their argument is that the fuller reduplicant shape must have been the oldest, with the smaller and smaller reduplicants being later developments along a semantically plausible path of development. They state that "the modern situation in Trukese suggests that reduplication can grammaticize more than once in the history of a language, and that forms produced by successive waves of grammaticization can co-exist, although the form and meaning of each one identifies its age" (p. 173).

As we have seen in Yaqui habitual reduplication, with three reduplicative allomorphs (all formally similar to the semantically variant reduplicants in Trukese) serving the same semantic function, the appeal to the "semantics" to determine the age would be impossible. Although it certainly seems plausible that more full reduplicants may eventually reduce to smaller ones, perhaps along the semantic lines proposed by Bybee et al. for Trukese, the Yaqui data show clearly that it is not the case that the development of the reduplicants is necessarily evident at every stage of a language.

What I assume has happened in Yaqui is that this language descended from another language which *did* have (at least) three reduplicative morphemes (duplemes), each serving a different semantic function, and perhaps even grammaticizing in a way similar to what Bybee et al. propose. However, over time, perhaps due to contact with other language groups or other extralinguistic factors, the semantic distinctions which had once been made began to be lost (or more likely, were shifted to other ways of being expressed), and the

reduplicative morphemes began to merge into what was perhaps the most common usage: habitual action (yielding not-entirely-phonologically-predictable "alloduples"). Although Bybee et al.'s discussion of the grammaticization of reduplicative morphemes was clearly intended to be suggestive and tentative (they referred to it as "sketchy and tentative" (173)), the Yaqui data challenge the one conclusion that they did draw from their stratified probability sample:[22] namely, that their study "does show a clear association of meaning with form which reflects the diachronic development of reduplicative grams" (p. 173).

The Yaqui allomorphs of reduplication, in the synchronic state of the language, show anything but a clear association between meaning and form reflecting the diachronic development of the reduplicative allomorphs. However, they do offer a particularly interesting and valuable resource for the possible reconstruction of the Proto-Uto-Aztecan system, from which the paths of grammatical change could then possibly be deduced.

5.0. Conclusion

Detailed examination of the facts of reduplication in Yaqui reveals that the patterns of reduplication are more complicated than is expressed by the received "primary/secondary" distinction. In addition to the light syllable/marked heavy syllable reduplication opposition, there are two additional patterns of reduplication: disyllabic foot (or full root) reduplication and mora-affixation. The allomorphy that occurs in Yaqui reduplication is not entirely conditioned by the phonological or metrical environment of the root, so there must be a good deal of lexical specification for which lexical root goes with which allomorph, and in some instances in what the reduplicative base actually is for particular roots. Although the ideology behind linguistic theorizing generally maligns "it-must-be-lexical" as an explanation, there are certain aspects of languages where this is the only reasonable explanation to have. One positive aspect of the analysis of the data presented here is that there is historical attestation of similar patterns, and similar allomorphic patterns, in related Uto-Aztecan languages.

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[22] Interestingly, as in Moravcsik (1978), Tohono O'odham was chosen to represent the Uto-Aztecan family (as well as, apparently, Kiowa-Tanoan).

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