Infixing Reduplication in Pima and its Theoretical Consequences

1 Introduction

Pima reduplication offers an interesting analytic puzzle, the solution of which bears on a number of important issues in the theory of reduplication. In this paper I will present the Pima data, provide an analysis within the framework of Optimality Theory (OT; Prince and Smolensky 1993), and address the theoretical implications of this analysis. I will argue that a particular set of reduplicative patterns that previous scholars have analyzed as prefixing reduplication plus syncope in the base can be analyzed simply as infixing reduplication. Moreover I will show that these two analyses have very different theoretical ramifications. At stake are the flexibility with which a grammar is allowed to pick out which segments get copied in reduplication and the nature of the distinction between the base and the reduplicant.

1.1 Overview

Reduplication in Pima occurs at the left edge of the word and is used to mark plural forms of nouns, adjectives, adverbs, verbs and even some determiners.[1] Pima Reduplication is particularly interesting because the amount of material that appears twice in the pluralized forms varies between a single consonant and the initial CV sequence. I will refer to these two patterns of reduplication C-Copying and CV-Copying respectively.

(1)	a.	C-Copying:	má.vit	‘lion’	mám.vit	‘lions’
	b.	CV-Copying:	hó.d̪ai	‘rock’	hó.ho.d̪ai	‘rocks’

I use the term ‘copying’ here simply to reference the material that appears twice in reduplicated forms and not to indicate an assumption about which substring of the surface form is the reduplicant. The variation between these two patterns of reduplication is conditioned by a handful of phonotactic restrictions, many of which show their effects only in the context of reduplication. These will be discussed in section 2.

[1] Distributives are also marked with reduplication. For nouns this indicates that there are multiple kinds of the noun. Plural and distributive reduplication show a similar dichotomy with respect to how much material is copied. For reasons of space, I won’t discuss the distributive here.

	gloss	sg.	pl.	dist.
C-Copying:	cake	t͡ʃɨ́.mait̪	t͡ʃɨ́t͡ʃ.mait̪	t͡ʃɨ́.ʔɨt͡ʃ.mait̪
CV-Copying:	drum	tám.boɹ	tá.tam.boɹ	tá.ʔa.tam.boɹ

Fitzgerald (1999) and Struijke (2000) have presented analyses of similar patterns of reduplication in Tohono O'odham and Lushootseed respectively. They claim that reduplicative patterns like (1a) arise from the prefixation of a CV reduplicant accompanied by a process of syncope in the base that is specially licensed in the context of reduplication. In this paper I will argue that this pattern should instead be treated as an instance of reduplicative infixation. In (2) I present these two analytical possibilities. Reduplicants are underlined and in boldface.

(2) a. Prefixing + syncope in the base:
m a v i t̪ $_{sg.}$ → **m a** m v i t̪ $_{pl.}$

b. Infixation:
m a v i t̪ $_{sg.}$ → m a **m** v i t̪ $_{pl.}$

These two analyses entail significantly different assumptions about the nature of the distinction between the base and the reduplicant. Specifically, pursuit of the analysis as prefixation+syncope in the base requires that Correspondence Theory (CT; McCarthy and Prince, 1995) be extended with a new dimension of faithfulness so that the deletion of material from the base can be licensed just in case a faithful copy of that material has been preserved in the reduplicant. Struijke (2000) dubs this new correspondence relation 'existential faithfulness'. The infixation analysis, on the other hand, does not require existential faithfulness but does require a theory of infixation that allows a copy of the initial consonant be infixed after the first vowel of the stem.

In this paper I will show that existential faithfulness represents an extension of Correspondence Theory in that it allows the generation of a strict superset of the languages that can be generated under McCarthy and Prince's original formulation of CT. The two central questions are then, whether or not patterns like those observed in Pima reduplication truly require that the theory be extended in this way and whether or not the consequences of this extension of the theory are desirable. I will argue that the answer to both of these questions is negative. In section 2 I show that an analysis of Pima reduplication as a process of infixation can readily account for the C-Copying pattern without the need for a revision of Correspondence Theory. In section 3 I show, first, that the existential faithfulness analysis of Pima is problematic in that it must rely on templatic constraints to control the size of the reduplicant, and second, that the addition of existential faithfulness to Correspondence Theory is, in general, problematic in that it predicts a range of odd an unattested reduplicative patterns.

1.2 Background on Pima; Data Sources, Phonemes, and Stress

Pima is a Uto-Aztecan language spoken on the Gila River Reservation and the Salt River Reservation in central Arizona. The data presented here comes from the generous assistance of my Pima consultant Mr. Virgil Lewis in field work carried out from Fall 2000 through Winter 2002. Much guidance in collecting this data was taken from the Tohono O'odham/Pima-English dictionary by Saxton, Saxton, and Enos (1983). Tohono O'odham (also known as Papago) and Pima are closely related and mutually intelligible but in many cases they diverge in their lexicons and in the specifics of certain phonological processes. While these differences are surely worth attention, they will not be discussed here. The phonemic inventory of Pima is as follows:

	Bilabial	Labio-dental	Dental	Alveolar	Palato-alveolar	Palatal	Velar	Glottal
Plosive	p b		t̪ d̪	d			k g	ʔ
Nasal	m			n		ɲ		
Lat. Flap				ɺ				
Fricative		v		s	ʃ			h
Approx.						j	w	
Affricates				t͡ʃ d͡ʒ				

Vowels:

	Front	Central	Back
High	i	ɨ	u
Mid			o
Low		a	

A couple of notes are in order here. The high front vowel [i] has many allophones, it surfaces variously as [i] as in *kwi* 'tree', [ɪ] as in *ʃa:lɪv* 'pants', [e] as in *t͡ʃeɲ* 'mouth' and [ɛ] as in *dɛtaʃ* 'today'. This variation is conditioned primarily by the preceding consonant, for more on this issue see Lyon (2001). What I write as [ʃ] sometimes sounds like the retroflex fricative [ʂ], for more on this see Avelino and Kim (2003). Finally, what I write as [ɨ] sounds a bit further back, but not quite like [ɯ], for more on this see Jackson (2003).

Stress in Pima is extremely regular, almost always occurring on the initial syllable. However, there are exceptional words of Spanish origin with stress on the second syllable (e.g. *ma.ɺó.ma* 'acrobat'). In this paper I will only mark stress if it deviates from the regular pattern.

2 Conditioning the size of the reduplicant

In this section I will present a set of phonotactic restrictions that condition the variation between the C-Copying pattern and CV-copying pattern of reduplication. I will argue that the C-Copying pattern (e.g. *mavit* → *ma**m**vit*) is the default mode of reduplication in Pima and that the CV-Copying pattern (e.g. *hohodai* → *ho**ho**dai*) should be seen as a deviation from the regular C-Copying pattern that is tolerated in order to avoid the creation of phonotactically illicit sequences. Finally, I will show that this state of affairs can be readily modeled as variation in the size of an infixed reduplicant.

A small set of relatively common phonotactic restrictions condition the variation between C-Copying and CV-Copying. Many of these phonotactic restrictions are 'emergent' in the sense of McCarthy and Prince (1995). That is, they are not active in the language at large but rather show their effects only in the context of reduplication. Many researchers have observed that reduplicated forms often show less marked structure than unreduplicated forms (see for example, McCarthy and Prince 1986, Shaw 1987, Steriade 1988, and many others). McCarthy and Prince (1995) dub this phenomenon The Emergence of the Unmarked (TETU) and show how it can be analyzed under Correspondence Theory. I will hold off on the technical details of the Optimality-Theoretic analysis for the time being and begin by describing the factors that condition the variation between the two patterns of reduplication.

The restrictions at work here are (i) a dispreference for laryngeal codas, (ii) a ban on palatal nasals that precede consonants, and (iii) a requirement that coda clusters be of falling sonority. Furthermore, while complex onsets are tolerated in the language at large, they are neither created nor copied in reduplication.

To begin, consider words for which neither the C-Copying pattern nor the CV-Copying pattern of reduplication would lead to a violation of the phonotactic restrictions listed above. In such cases, where the initial consonant can surface as the coda of the first syllable without creating an illicit coda or coda cluster, C-Copying is observed. Words showing this pattern of reduplication are presented in (3).

(3)

gloss	sg.	pl.	unattested: CV-Copying
‘scorpion’	nak.ʃɨɺ	nank.ʃɨɺ	*na.nak.ʃɨɺ
‘quail’	ka.kai.t͡ʃu	kak.kai.t͡ʃu	*ka.ka.kai.t͡ʃu
‘cardinal’	si.puk	sis.puk	*si.si.puk
‘earlobe’	nak	nank	*na.nak
‘lion’	ma.vit	mam.vit	*ma.ma.vit
‘moon’	ma.ʃad	mam.ʃad	*ma.ma.ʃad
‘packrat’	ko.son	kok.son	*ko.ko.son
‘cake’	t͡ʃɨ.mait̪	t͡ʃɨt͡ʃ.mait̪	*t͡ʃɨ.t͡ʃɨ.mait̪
‘cocoon’	kos.vuɺ	koks.vuɺ	*ko.kos.vuɺ
‘lower skull’	kuʃ.va	kukʃ.va	*ku.kuʃ.va
‘rust’	ve.gio.mi	vep.gio.mi	*ve.pe.gio.mi
‘barrel’	va.ɺin	vap.ɺin	*va.pa.ɺin
‘trunk’	va.ʃa	vap.ʃa	*va.pa.ʃa

Note that the hypothetical reduplicative forms marked as unattested in (3) actually show less-marked syllable structure than the attested forms in that they have fewer codas and coda clusters. This suggests that C-Copying is the default reduplicative pattern that is used when its results won’t violate the phonotactic restrictions that condition reduplication. The reduplicated forms *koks.vuɺ* ‘cocoons’ and *kukʃ.va* ‘lower skulls’ show that the fricatives ‘s’ and ‘ʃ’ behave exceptionally with respect to the sonority generalization in that they are licit even after the relatively more sonorous ‘k’. Another point of interest in (3) is the [v]→[p] alternation in the reduplicated forms of the last three words. This alternation is completely productive in Pima reduplication, occurring even in the pluralization of relatively recent borrowings like *va.ɺin* from Spanish *baril*. If Pima reduplication is analyzed as a process of infixation this alternation can be characterized as the emergence of an unmarked segment in the reduplicant. On the other hand, if the reduplicant is analyzed as a prefix the [v]→[p] will have to be analyzed as a change in the base that is somehow licensed by reduplication.

Laryngeal codas are generally not permitted in Pima. If the initial consonant of the word is laryngeal, then the initial CV sequence is copied so that both copies of the laryngeal consonant surface as onsets. This is illustrated in (4).

(4)

gloss	sg.	pl.	unattested: C-Copying
‘rock’	ho.d̪ai	ho.ho.d̪ai	*hoh.d̪ai
‘lima bean’	ha.voɭ	ha.ha.voɭ	*hah.voɭ
‘blacksmith’	hi.ɭo	hi.hi.ɭo	*hih.ɭo
‘dress’	ʔi.put	ʔi.ʔi.put	*ʔiʔ.put
‘circle’	ʔo.ɭas	ʔo.ʔo.ɭas	*ʔoʔ.ɭas
‘wart’	ʔu.pu.ɭik	ʔu.ʔu.pu.ɭik	*ʔuʔ.pu.ɭik

The hypothetical reduplicative forms marked as unattested in (4) show how the dispreferred laryngeal codas would have been created if C-Copying had occurred. Note, however, that there is an exception to the dispreference for laryngeal codas in cases where an initial glottal stop can geminate with a glottal stop in the onset of the second syllable (e.g. *ʔaʔag*$_{sg.}$→*ʔaʔʔag*$_{pl.}$ ‘horns’).

Palatal nasal codas are not created by reduplication. Thus, whenever the singular form begins with the palatal nasal, the initial CV sequence is copied so that both copies of the palatal nasal surface as onsets. This is illustrated in (5).

(5)

gloss	sg.	pl.	unattested: C-Copying
‘liver’	ɲu.matʃ	ɲu.ɲu.matʃ	*ɲuɲ.matʃ
‘night hawk’	ɲɨ.pod	ɲɨ.ɲɨ.pod	*ɲɨɲ.pod
‘disaster’	ɲɨ.d͡ʒig	ɲɨ.ɲɨ.d͡ʒig	*ɲɨɲ.d͡ʒig
‘legendary monstrous snake’	ɲɨ.big	ɲɨ.ɲɨ.big	*ɲɨɲ.big

It should be noted that the restriction responsible for this pattern is not simply a ban on palatal nasal codas. Palatal nasals do occur as codas outside of reduplication as in *totoɲ* ‘ant’, and *huːɲkus* ‘cornstalk’. Furthermore, Palatal nasals are also disallowed before non-high vowels. For the sake of brevity I won’t go into that restriction here.

Sonority reversals and plateaus in coda clusters are not generally created in reduplication. Thus, whenever copying the initial consonant alone would create such a cluster the initial consonant-vowel sequence copied. This is illustrated in (6).

(6)

gloss	sg.	pl.	unattested: C-Copying
‘dog’	gogs	go.gogs	*goggs
‘cape’	mon.d͡ʒuɹ	mo.mon.d͡ʒuɹ	*momn.d͡ʒuɹ, *mom.nd͡ʒuɹ
‘joint’	namks	na.namks	*nanmks, *nan.mks
‘horse collar’	biʃp	bi.biʃp	*bibʃp
‘mountain lion’	gev.ho	ge.gev.ho	*gegv.ho, *geg.vho
‘lizard’	vat͡ʃ.ɹo	va.pat͡ʃ.ɹo	*vapt͡ʃ.ɹo, *vap.t͡ʃɹo
‘candle’	kan.d͡ʒɨɹ	ka.kan.d͡ʒɨɹ	*kakn.d͡ʒɨɹ, *kak.nd͡ʒɨɹ
‘lentil’	ɹan.d͡ʒɨ.ki	ɹa.ɹan.d͡ʒɨ.ki	*ɹaɹn.d͡ʒɨ.ki, *ɹaɹ.nd͡ʒɨ.ki

Coda clusters with sonority plateaus are allowed outside the locus of reduplication (e.g. *totpk* ‘purr’) but they are not generally created by reduplication. Note, however, that there are a few exceptions to this generalization involving sequences of obstruents that occasionally surface as coda clusters in reduplication (e.g. *tok.dot*$_{\text{sg.}}$→ *totk.dot*$_{\text{pl.}}$ ‘spider’) and furthermore that the cluster [ɹn] isn’t created reduplication despite its decline in sonority (e.g. *ɹan.d͡ʒɨ.ki*$_{\text{sg.}}$→ **ɹaɹn.d͡ʒɨ.ki*$_{\text{pl.}}$). These facts, together with the exceptional behavior of [ʃ] and [s], show that the set of conditions governing Pima coda clusters are a bit complicated. For the purposes of the current analysis I will use the simple, and somewhat vague, generalization that coda clusters in pima must show sufficient decline in sonority to be licit. This topic is worthy of more research but since the simple sonority generalization will suffice for the current analysis it will not be discussed further here. It is important to note that the restriction at work here isn’t simply a ban on triconsonantal clusters in reduplication, this is evidenced by the fact that such clusters may be created in reduplication when the sonority restrictions are respected, for example: *nak.ʃiɹ*$_{\text{sg.}}$→ *nank.ʃiɹ*$_{\text{pl.}}$ ‘scorpion’.

Though onset clusters are rare in Pima there are a few words that contain them (e.g. *spuɹvam* ‘alfalfa, *ʔo.vis.pɹa* ‘bishop’, and *tɹogi* ‘truck’). When a word that begins with an onset cluster is reduplicated both the C-Copying and CV-Copying patterns can occur, with one interesting twist. It is always the second member of the cluster that is copied in reduplication not the initial consonant. Modulo this factor we see the regular phonotactic conditioning of the variation between C-Copying and CV-Copying. These patterns are illustrated in (7a) and (7b).

(7a) gloss	sg.	C-Copying	CV-Copying
‘truck’	tɺo.gi	tɺoɺ.gi	*tɺo.ɺo.gi -*unattested*
‘nail’	kɺa.vo	kɺaɺ.vo	*kɺa.ɺa.vo -*unattested*

(7b) gloss	sg.	C-Copying	CV-Copying
‘tramp’	tɺam.ba	*tɺaɺm.ba -*unattested*	tɺa.ɺam.ba
‘an iron’	pɺan.dʒa.kud	*pɺaɺn.dʒa.kud -*unattested*	pɺa.ɺan.dʒa.kud

In (7a) the reduplicant copies only the rightmost consonant of the initial cluster, this is the C-Copying pattern. In (7b) the rightmost consonant of the cluster and the following vowel are copied so as to avoid the creation of an illicit coda cluster, this is the CV-Copying pattern. The fact that the entire onset is not copied shows that reduplication does not create complex onsets.

The phonotactic restrictions presented to account for cases of CV-Copying in the data discussed so far are summarized in (8).

(8) <u>General restrictions:</u>
- no laryngeal codas

<u>Restrictions active only in reduplication:</u>
- coda clusters should fall in sonority
- palatal nasal codas are dispreferred
- complex onsets are dispreferred

To summarize the generalizations made up to this point, it seems that C-Copying is preferred unless copying the initial consonant alone would create a coda or coda cluster that violates one of the phonotactic restrictions in (8), in which case the initial CV sequence is copied.

Interestingly, when we turn to the consideration of forms with diphthongal nuclei in the initial syllable, these preferences seem to be reversed. That is, when the initial syllable contains a diphthong, the initial CV sequence is copied even though there are several ways that the initial consonant alone could be copied without violating any of the phonotactic restrictions listed in (8). The reduplication of words with diphthongs in the stem-initial syllable is illustrated in (9).

(9)

gloss	sg.	pl.	unattested: $C_1V_1.C_1V_2$…	($C_1V_1V_2C_1$.…)
'firefly'	t̪ai.vig	t̪a.t̪ai.vig	*t̪a.t̪i.vig	(*t̪ait̪.vig)
'party'	piast̪	pi.piast̪	*pi.past̪	(*piapst)
'firecracker'	kui.tas	ku.kui.tas	*ku.ki.tas	(*kuik.tas)
'burn'	mɨi	mɨmɨi	*mɨ.mi	(*mɨim)
'pet'	ʃoi.ga	ʃo.ʃoi.ga	*ʃo.ʃi.ga	(*ʃoiʃ.ga)
'thorn'	hoi.pat	ho.hoi.pat	*ho.hi.pat	(*hoih.pat)
'worker'	pion	pi.pion	*pi.pon	(*piopn)
'soul'	doa.kag	do.doa.kag	*do.da.kag	(*doad.kag)
'twin'	kua.di	ku.kua.di	*ku.ka.di	(*kuak.di)
'cry, wail'	ʃoak	ʃo.ʃoak	*ʃo.ʃak	(*ʃoaʃk)
'iron'	vai.nom	va.pai.nom	*va.pi.nom	(*vaip.nom)
'trench'	vai.ka	va.pai.ka	*va.pi.ka	(*vaip.ka)

In (9) I give, for each form, two unattested plural variants in which only the initial consonant is copied. That is, either, the diphthong in the first syllable could be split among two syllables, each starting with a copy of the initial consonant (e.g. *t̪ai.vig*$_{\text{sg}}$→**t̪a.t̪i.vig*$_{\text{pl.}}$), or the copies of the initial consonant could flank the diphthong (e.g. *t̪ai.vig*$_{\text{sg}}$→**t̪ait̪.vig*$_{\text{pl.}}$). The fact that neither of these alternatives surfaces seems to indicate that CV-Copying is the preferred reduplication pattern when the initial syllable of the stem contains a diphthong.

The facts presented so far lead to an apparent contradiction. Words with complex nuclei in the initial syllable and words simple nuclei seem to necessitate opposite assumptions about which pattern of reduplication is the 'default' in Pima. To simplify the initial generalization I'll set aside the unattested plural forms with the **$C_1V_1V_2C_1$.**… pattern -those in parentheses in (9). I'll get back to these shortly. Considering just the unattested plural forms using the **$C_1V_1.C_1V_2$**… pattern, the apparent contradiction can be resolved by appealing to the following pair of facts. When the initial syllable has a simplex nucleus, copying the initial CV sequence will increase the number of syllables in the word, but copying C alone will not. For example:

(10) C-Copying: *ma.vit*$_{\text{sg.}}$ → *mam.vit*$_{\text{pl}}$ -plural form has two syllables
CV-Copying: *ma.vit*$_{\text{sg.}}$ → **ma.ma.vit*$_{\text{pl}}$ -plural form has three syllables

On the other hand, when the initial syllable contains a diphthongal nucleus, either pattern of reduplication will yield output forms with the same number of syllables. For example:

(11) C-Copying: *t̪ai.vig*$_{sg.}$ → **t̪a.t̪i.vig*$_{pl.}$ -plural form has three syllables
CV-Copying: *t̪ai.vig*$_{sg.}$ → *t̪a.t̪ai.vig*$_{pl}$ -plural form has three syllables

These observation suggest the following characterization of Pima reduplication: The reduplicant copies as much of the base as possible while respecting the emergent phonotactic restrictions and increasing the number of syllables minimally or not at all. This generalization also explains why Pima reduplication is only partial, never copying more than a single syllable.

Returning now to the hypothetical plural forms with the **$C_1V_1V_2C_1$**… reduplicative pattern (e.g. **t̪ait̪.vig*$_{pl.}$), we see a significant difference between the infixing and prefixing analyses of Pima reduplication. Under the infixation analysis, the dispreference for such forms follows readily from requirement that the infixed reduplicant occur as close as possible to the left edge of the word. Under the prefixing analysis, on the other hand, since the reduplicant is invariably a prefix, some constraint(s) must prevent the diphthong from occurring in the prefixed reduplicant. As straightforward as this sounds, I will show In section 2.2 that the addition of existential faithfulness to the theory, which is required by the syncope analysis, actually makes it quite difficult to impose this restriction on the reduplicant without resorting to templatic constraints.

Now that the basic patterns are laid out I will turn to the formal analysis of Pima reduplication. There are three basic issues to be resolved in the analysis of any system of reduplication: the amount of material that the reduplicant copies (size), the placement of the reduplicant (location), and the selection of which base material is copied (content). I will treat each of these issues in turn.

2.1 Deriving the size of the reduplicant

Various strategies have been proposed in Optimality Theory for deriving the size of reduplicants. One strategy is the direct imposition of prosodic templates on the reduplicant using constraints that require the reduplicant to be a particular prosodic constituent such as a syllable or a foot (see Prince and Smolensky 1993, McCarthy and Prince 1993, et seq.). Several researchers, however, have pointed out that the existence of templatic constraints in OT gives rise to a range of problematic typological predictions. McCarthy and Prince (1995) discuss a problem pointed out by René Kager and Philip Hamilton whereby templatic constraints interact with B/R-Faithfulness in such a way as to yield bizarre and improbable reduplicative patterns. Prince (1996) calls this interaction the Kager-Hamilton Conundrum (KHC). I will return to this issue in section 3, where I discuss the prefixation analysis of Pima reduplication.

As an alternative to templatic analyses, McCarthy and Prince (1994) assert that template-like effects in reduplication can and should be derived from general properties of morphology, phonology and their interface. To this end they outline Generalized Template Theory, (GTT). For the current purposes this strategy can be implemented by minimizing the reduplicant with a markedness constraint ranked in the Emergence of the Unmarked ranking. The constraints used here are just the members of the MAX family of constraints in Correspondence Theory, these are listed in (12).

(12) a. **INPUT/BASE-MAX : (I/B-MAX)**
Every segment in the input must have a correspondent in the base.

b. **INPUT/REDUPLICANT-MAX : (I/R-MAX)**
Every segment in the input must have a correspondent in the reduplicant.

c. **BASE/REDUPLICANT-MAX : (B/R-MAX)**
Every segment in the base must have a correspondent in the reduplicant.

In order to drive the minimization of the pima reduplicant any markedness constraint that prefers output forms with fewer syllables can be used. This scheme for minimizing reduplicant size is represented in (13).

(13) Reduplicant size restriction via TETU

I/B-MAX >> *Size Restrictor* >> I/R-MAX, B/R-MAX

Perhaps the most conceptually simple constraint that will produce the desired effect is the direct penalization of every syllable in the output.

(14) ***STRUCTURE-σ : (*STRUC-σ)** [2]
Assigns one violation per syllable in the output. (Zoll 1993, 1994)

[2] Given its "nihilistic" nature *STRUC-σ will, in some cases, prefer candidates that don't reduplicate anything at all. To avoid such an outcome some researchers have employed the constraint REALIZE MORPHEME which demands that each morpheme in the input have some observable exponent in the output (cf. Samek-Lodovici 1993, Hewitt 1995, Rose 1997, Gafos 1998, Walker 1998, and Kurisu 2001). Since this issue is orthogonal to the investigation at hand, I will exclude from consideration here candidates in which the surface form is identical to the unreduplicated form.

Ranking *STRUC-σ in TETU fashion, below I/B-MAX but above B/R-MAX, will leave bases and unreduplicated forms unaffected, but will ensure that reduplication increases the syllable count of the word only minimally or not at all.

*STRUC-σ is just one of many constraints that could be used to restrict reduplicant size in the ranking scheme in (13). Alternatively, Mester and Padgett (1994), and Spaelti (1997) use the constraint ALL-σ-LEFT to minimize reduplicants. ALL-σ-LEFT demands that each syllable in the word occur at the left edge. Given this demand, the reduplicative affix will be minimized in order to reduce the number of syllables by which each non-initial syllable is misaligned from the edge of the word. As another alternative, following Struijke's (2000) analysis of Lushootseed, the constraint *UNSTRESSED-VOWEL could be used to penalize syllables occurring outside of the stressed initial position. As yet another alternative, we might impose an Output-Output constraint demanding that the singular plural forms of a word have the same number of syllables. Basically, any constraint that is better satisfied by outputs with fewer syllables can effectively minimize the size of the Pima reduplicant. Henceforth, I will use *STRUC-σ for its conceptual simplicity.[3]

The simplest cases are those in which the size restrictor can reduce the reduplicant to a single consonant unfettered by the phonotactic restrictions. For example:

(15)

RED+nak 'earlobes'	I/B-MAX	*STRUC-σ	B/R-MAX
a. ☞ na**n**k		*	ak
b. na.**na**k		**!	k
c. **na**.nak		**!	k
d. nak.**nak**		**!	
e. **nak**.nak		**!	
f. ∅	*!		

The factors which give rise to reduplicants larger than a single consonant are a variety of fairly ordinary markedness constraints. Two of these constraints are presented in (16) and (17):

(16) ***COMPLEX ONSET : (*CPLX ONS)**
Complex onsets are dispreferred. (Prince and Smolensky 1993)

[3] Gouskova (2003a, 2003b) has claimed that the effects of *STRUC constraints can always be replicated with other constraints. This is true in the analysis of Pima where any one of a number of size restricting constraints could serve to minimize the reduplicant. Using the example of *STRUC-Foot, she also claims that *STRUC-***x*** entails the existence of unattested languages where segmental deletion occurs just in case the number of units of type ***x*** can be reduced. But Pima could be seen as an instance of just such a language. That is, the effect of *STRUC-σ is to reduce reduplicants to a single consonant (violating B/R-MAX) just in case this yields an output with fewer syllables.

(17) ***LARYNGEAL CODA : (*LAR]$_\sigma$)**
Laryngeal codas are dispreferred. (c.f. McCarthy 1998, which uses *ʔ]$_\sigma$ for Arabic)

*CPLX ONS and *LAR]$_\sigma$ must be ranked in TETU fashion, below I/B-Faithfulness but above B/R and I/R-Faithfulness, in order to restrict the shape of reduplicants but leave unreduplicated forms and bases unaffected. Crucially, these constraints must also dominate *STRUC-σ in order to select CV-Copying over the syllable-minimizing C-Copying pattern. This is illustrated in (18).

Phonotactics >> **Size Restrictor**

(18)

RED + h o d̪ a i 'rocks'	*LAR]$_\sigma$	*CPLX ONS	*STRUC-σ
a. h o **h** . d̪ a i	*!		**
b. h o . **h** d̪ a i		*!	**
c. ☞ h o . **h o** . d̪ a i			***

Candidates (a) *ho**h**.d̪ai* and (b) *ho.**h**d̪ai* are less marked than the winner with respect to *STRUC-σ. They are, however, ruled out because they violate of *CPLX ONS and *LAR]$_\sigma$. This scenario is a bit of a reversal of typical TETU effects in that the emergent constraints serve to make the reduplicant larger rather than smaller. That is, the reduplicant obeys the emergent constraint, not at the expense of B/R-MAX, but rather, at the expense of the size restrictor.

Complex onsets are tolerated outside of reduplication, as evidenced by forms like *tɭampa* 'tramp', and forms with the stative prefix '*s-*' such as *sgigivkim* 'tremulous'. To allow such forms to surface *CPLX ONS must be dominated by Input/Base-Faithfulness constraints.

(19)

tɭampa 'tramp'	I/B-MAX	*CPLX ONS
a. ☞ tɭampa		*
b. tampa	*!	

When forms with initial clusters are reduplicated, it is the second consonant of the cluster that is copied. Modulo this factor both the C-Copying and CV-Copying patterns occur. For example, *tɭo.gi* 'truck' pluralizes as *tɭo**ɭ**.gi* 'trucks' showing the C-Copying pattern, while *tɭam.pa* 'tramp' pluralizes as *tɭa.**ɭa**m.pa* 'tramps' showing the CV-Copying pattern. I'll hold off on the full analysis of these forms until sections 2.2 and 2.4 where I introduce the constraints that derive the placement and content of the reduplicant. The immediately relevant fact is that even when an extra syllable is added by reduplication the onset cluster isn't copied (e.g.**tɹa.**tɹa**m.pa* ‘tramps’). This follows naturally if *CPLX ONS dominates B/R-MAX as illustrated in (20).

(20)

RED + tɹampa ‘tramps’	*CPLX ONS	*STRUC-σ	B/R-MAX
a. ☞ tɹa.**ɹa**m.pa	*	***	t mpa
b. tɹa.**tɹa**m.pa	**!	***	mpa

Another factor which conditions the size of the reduplicant is the dispreference for coda clusters of constant or rising sonority. To capture this the following constraint can be used:

(21) **SONORITY SEQUENCING PRINCIPLE : (SSP)** [4]
Sonority must show sufficient decline towards the syllable margin, sonority plateaus and reversals are not allowed. (Jesperson 1904, Selkirk 1984, Clements 1990, etc.)

If SSP is ranked above *STRUC-σ then the grammar will select CV-Copying over C-Copying when necessary to avoid a marked cod a sequence. This is illustrated in (22).

(22)

RED+ kan.dʒɨɹ ‘candles’	*CPLX ONS	SSP	*STRUC-σ
a. ☞ ka.**ka**n.dʒɨɹ			***
b. ka**k**n.dʒɨɹ		*!	**
c. ka**k**.ndʒɨɹ	*!		**

I am using SSP here as a cover term for the set of sonority restrictions on Pima codas. In general this restriction blocks sonority reversals and sonority plateaus. However, [s] and [ʃ] seem to be licit following any consonant and [ɹm] doesn't seem to show sufficient sonority decline to be acceptable as a coda cluster. Candidates that obey the SSP by infixing the reduplicant deeper into the word (e.g. *kan**k**.dʒɨɹ*) will be ruled out by a left alignment constraint on the reduplicant. I will get to this in the next section. Like the ban on complex onsets, the SSP must be ranked below Input/Base-Faithfulness since coda clusters of non-falling sonority are licit outside of reduplication, as in *totpk* ‘purr’.

Reduplication in Pima never creates sequences in which a palatal nasal occurs before a consonant. The restriction can be represented by the following constraint:

---

[4] I am incorporating aspects of the Minimal Distance Principle into this constraint (Selkirk 1984; Clements 1990, etc.). While the specifics of what constitutes ‘sufficient’ decline in Pima are interesting I won't get into them here.

(23) ***ɲC** : the palatal nasal may not occur before a consonant.

Ranking *ɲC above *STRUC-σ correctly predicts that CV-Copying will be used whenever the stem begins with a palatal nasal because copying the initial ɲ alone would create a ɲC sequence.

(24)

RED+ɲumat͡ʃ ‘livers’	*ɲC	*STRUC-σ
a. ☞ ɲu.**ɲu**.mat͡ʃ		***
b. ɲu**ɲ**.mat͡ʃ	*!	**

Like the SSP and the ban on complex onsets *ɲC must be ranked below Input/Base-Faithfulness since [ŋC] sequences do occur outside of the context of reduplication, as in *hu:ɲkus* ‘cornstalk’

Now that the basic phonotactic constraints have been described, I’ll return to the cases of C-Copying. Whenever none of the phonotactic constraints are at stake, only the initial consonant is copied thereby creating a form with fewer violations of *STRUC-σ. This is illustrated in (25).

(25)

RED+nakʃɨɺ ‘scorpions’	*CPLX	*LAR]$_{\sigma}$	SSP	*STRUC-σ	B/R-MAX
a. na.**na**k.ʃɨɺ				***!	kʃɨɺ
b. ☞ na**n**k.ʃɨɺ				**	akʃɨɺ

There is one final matter to be addressed in the conditioning of the size of the reduplicant. The constraint *STRUC-σ penalizes phonological material only one syllable at a time. Thus, when a syllable is added in reduplication the constraint B/R-MAX should force the copying of enough material to fill out the largest syllable possible. And yet, this does not occur: *hi.ɺo* ‘blacksmith’ reduplicates as *hi.**hi**.ɺo*, and not **hi.**hiɺ**.ɺo* despite the fact that intervocalic geminates are allowed in Pima. This fact can be explained with the following constraint:

(26) **NOCODA**: Syllables may not have codas. (Prince and Smolensky 1993)

Ranking NOCODA above B/R-MAX correctly rules out candidates in which the onset of the second syllable of the word is reduplicated as well. This is illustrated in (27).

(27)

RED+hiɺo ‘blacksmiths’	*STRUC-σ	NOCODA	B/R-MAX
a. ☞ hi.**hi**.ɺo	***		ɺo
b. hi.**hiɺ**.ɺo	***	*!	o

Since codas are perfectly acceptable outside of the context of reduplication NOCODA will have to be dominated by Input/Base-Faithfulness. Moreover, since reduplication actually creates a coda in many cases of C-Copying, *STRUC-σ must also dominate NOCODA.

(28)

RED+mavit 'lions'	*STRUC-σ	NOCODA	B/R-MAX
a. ma.**ma**.vit	***!	*	vit
b. ☞ ma**m**.vit	**	**	avit

Lastly, the data involving forms with diphthongs in the stem-initial syllable needs to be considered. In these forms, the reduplicant always occurs immediately after the first of the two vowels (e.g. *pion*$_{sg}$ → *pi.**pi**on* $_{pl}$). The constraints that are responsible for determining the placement of the reduplicant will be discussed shortly. For the moment, let's take as a given, that the reduplicant always occurs immediately after the first vowel of the stem, and continue to focus only on the issue of reduplicant size.

Inserting the reduplicant immediately after the first vowel of the stem, so that it 'splits' the diphthong, will result in an increase in the syllable count regardless of whether the infixed reduplicant is a single consonant or a CV sequence. If an increase in the number of syllables is inevitable, then B/R-MAX will be free to express the preference for copying the relatively-larger CV sequence rather than a lone C. This is illustrated in (29).

(29)

RED+kuadi 'twins'	*STRUC-σ	B/R-MAX
a. ☞ ku.**ku**a.di	***	adi
b. ku.**k**a.di	***	uadi!

Now that the infixation analysis has been shown to explain the cases of C-Copying it is reasonable to ask whether or not infixation is motivated for the analysis of CV-Copying as well. In section 2.3 I will argue against the 'mixed' hypothesis, whereby Pima reduplication is analyzed as infixing in the C-Copying cases but prefixing in the CV-Copying cases. Accepting, for now, the infixation analysis, the explanation of the behavior of diphthongs needs one further promissory note. If a copy of the initial C were placed *after* the diphthong (e.g. **kua**__**k**__*.di*), it would be possible to produce a reduplicated form with relatively fewer *STRUC-σ violations. This is illustrated in (30).

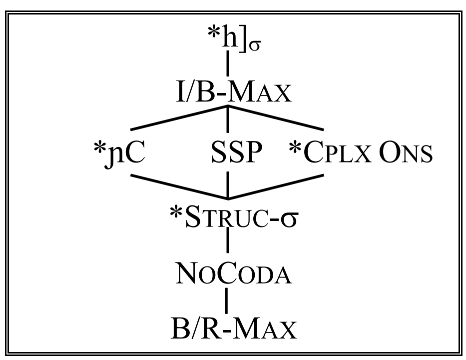
(30)

RED + kuadi ‘twin’	*STRUC-σ	B/R-MAX
a. ku.**ku**a.di *-attested form*	***!	adi
b. ku.**k**a.di	***!	uadi
c. 💣 kua**k**.di	**	uadi

I attribute the failure of candidates like *kua**k**.di* to an independent aspect of the grammar, namely to the principles that determine where the reduplicant is placed. In section 2.2 I will present a ranking of constraints under which the reduplicant is invariably placed immediately after the first vowel in the stem. In such a scenario, whenever the stem has a diphthongal nucleus in its initial syllable the reduplicant will split the diphthong and thus will inevitability lead to an increase in the syllable count. At which point, the initial vowel of the diphthong may as well be copied in the reduplicant since doing so doesn’t contribute any additional *STRUC-σ violations.

In summary, the conditioning of the size of the reduplicant in Pima can be explained as the interaction of the size restrictor *STRUC-σ with phonotactic restrictions: *CPLX ONS, SSP, *LAR-COD, and NOCODA. By ranking the size restrictor and many of the phonotactic constraints in TETU fashion, between I/B-MAX and B/R-MAX, it is ensured that the restrictions they impose will affect only the reduplicant and never the base or underived forms. The rankings justified so far are diagrammed in (31).

(31)



2.2 Analysis of the location of the reduplicant

Many languages have affixes which vary in their location, sometimes occurring at the edge of the word and sometimes inside it. McCarthy & Prince's (1993) analysis of *-um-* affixation in Tagalog illustrates how this can be accounted for in OT by ranking a phonotactic restriction above the constraint demanding left alignment of the affix.[5] In (32) I give data from Schachter and Otanes (1972) that illustrates this pattern.

(32)	**gloss**	**affixed form:**	**explanation:**
	'teach'	**u.m**a.ral	- perfect left alignment of the affix is possible
	'write'	s**u.m**u.lat	-***um**.su.lat violates NoCoda or Onset

Other languages have affixes which constantly occur as infixes. For example, the reduplicative affix in Maŋarayi always surfaces word internally: *ɟalwaji*→ ***<u>ɟalw</u>****alwaji* '(very) muddy' (Merlan 1982). This pattern has been analyzed with a range of assumptions about which substring of the output is the reduplicant and with a range of mechanisms designed to derive the placement and size of the reduplicant (cf. Merlan 1982; Davis 1988; McCarthy and Prince 1986, 1993b, 1995a; Kurisu and Sanders 1999). Here I will follow the proposal of Kurisu and Sanders (1999) that anchoring constraints on stem edges should be used to derive infixation. For Pima, a highly ranked anchoring constraint that demands that the initial mora of the stem coincide with the initial mora of the word will guarantee that the left-alignment of the reduplicant places the infix immediately after the first vowel of the stem. Following McCarthy and Prince (1995) the anchoring and alignment constraints can defined as follows:

(33) **Anchor-$\mu_{1(\text{Stem-Wd})}$: (Anchor-μ_1)**
The first mora of the stem must coincide with the first consonant of the word.

(34) **Align-L-Red$_{\text{Wd}}$: (Red-L)**
The left edge of the reduplicant must occur as far left as possible in the word.
-*evaluated gradiently*: one violation per segment between Red and the left edge

With this apparatus in place, we can now explain why the infixed reduplicant always splits diphthongs in the stem-initial syllable even though this move incurs an extra *Struc-σ violation. If Red-L dominates *Struc-σ then the reduplication process can't produce a form with fewer syllables at the expense of embedding the infix deeper into the word. This is illustrated in (35).[6]

[5] Zuraw 2003, and others, have argued that the Tagalog 'vowel initial' cases actually begin with a glottal stop (or that the initial glottal stop is epenthetic). Either way, as she points out, the Anchor-L$_{(\text{Stem-Wd})}$ >> Red-L scheme presented below will generate infixation while the use of NoCoda or Onset to phonotactically drive infixation will fail because of additional facts having to do with complex onsets (on which see also Orgun and Sprouse 1999).
[6] The constraint Contiguity must also be dominated by Red-L or else the reduplicant will simply occur as a suffix.

(35)

RED + kuadi 'twins'	ANCHOR-μ_1	RED-L	*STRUC-σ	B/R-MAX
a. ☞ ku.**<u>ku</u>**a.di		**	***	adi
b. ku.**<u>k</u>**a.di		**	***	uadi!
c. kua**<u>k</u>**.di		***!	**	uadi
d. **<u>ku</u>**.kua.di	*!		***	adi
e. **<u>ku</u>**.ka.di	*!		***	adi
f. **<u>kua</u>**k.di	*!		**	di

This ranking explains why only CV-Copying is observed in forms with diphthongal nuclei in the initial syllable. That is, since the reduplicant must occur immediately after the first mora it will always split a diphthong and thus B/R-MAX will be free to demand copying of the relatively larger CV sequence without incurring extra *STRUC-σ violations. The assumption that something like ANCHOR-μ_1 rules out the prefixing candidate (d), which is homophonous with the winning candidate (a), is necessary to rule out candidates like (f) which fare best with respect to every other constraint in (35). Note also, that candidates like (f) can't be ruled out by phonotactic constraints like *DIPHTHONG because such constraints would select candidates like (b) or (e) where diphthongs are 'repaired' in reduplication. I will return to this issue in section 3.3 when I present and argue against the prefixing analysis of Pima reduplication.

Characterizing the stem-anchoring constraint as anchoring of the initial mora rather than the initial consonant is necessary to explain why forms with initial consonant clusters show both C-Copying and CV-Copying. If only the initial consonant were anchored, we would expect that only the CV-Copying pattern would occur in forms with initial clusters since the reduplicant could split the initial cluster and thereby achieve better leftward alignment. By anchoring the initial mora we allow C-Coping to occur in forms with initial clusters. This is illustrated in (36).

(36)

RED + tɺogi 'trucks'	ANCHOR-μ_1	RED-L
a. ☞ tɺo**<u>ɺ</u>**.gi		***
b. t**<u>ɺo</u>**.ɺo.gi	*!	*

Anchoring of the initial mora is also respected in reduplication of forms with the stative prefix (e.g. *s-t͡ʃuk*$_{\text{sg.}}$ → *s-t͡ʃu**<u>t͡ʃ</u>**k*$_{\text{pl.}}$ 'black'). Anchoring of the initial mora explains why the satisfaction of RED-L doesn't lead to gemination of the initial consonant or infixation of a -VC- reduplicant immediately after the initial consonant of the stem. This is illustrated in (37).

(37)

RED+mavit 'lions'	ANCHOR-μ_1	RED-L
a. ma**m**.vit		**
b. m**m**a.vit	*!	*
c. m**a.v**a.vit	*!	*

In summary, this section has shown how anchoring of the stem-initial mora can force a left aligned reduplicant to occur as an infix immediately after the first vowel of the stem. Before turning to the analysis of the factors that determine the content of the reduplicant I'll consider one alternative hypothesis about the location of the reduplicant.

2.3 Against the mixed hypothesis

Accepting the infixation analysis for the cases of C-Copying, we still might entertain the hypothesis that the cases of CV-Copying involve prefixation. In order to allow variation between prefixation and infixation we would have to discard the ANCHOR constraint and elevate the size restrictor above RED-L so that the alignment constraint could be violated just in case infixation of a single consonant allowed better satisfaction of the size restrictor.

(38)

RED+hoḓai 'rocks'	*STRUC-σ	RED-L
a. ☞ **ho**.ho.ḓai	***	
b. ho.**ho**.ḓai	***	**!
RED+mavit 'lions'	*STRUC-σ	RED-L
c. **ma**.ma.vit	***!	
d. ☞ ma**m**.vit	**	**

But, this makes the wrong predictions for words with diphthongal nuclei in the initial syllable.

(39)

RED+kuadi 'twins'	*STRUC-σ	RED-L
a. **ku**.kua.di	***!	
b. 💣 kua**k**.di	**	***

Attempting to save the mixed-prefixing/infixing hypothesis by appeal to general phonotactic constraints will not work. Consider, for example, a ban on closed-heavy syllables. Ranking *VVC]$_\sigma$ above *STRUC will select the correct output in (40). But this predicts that reduplication will 'repair' words in which the singular from happens to violate the phonotactic constraint.

(40)

RED+ʃoak 'wails'	*VVC]$_σ$	*STRUC-σ	RED-L
a. **ʃo**.ʃoak *-attested form*	*!	**	
b. 💣 ʃo.**ʃ**ak		**	**

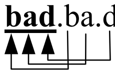
The general problem here is that if *STRUC-σ dominates RED-L forms like *kua**k**.di* must be ruled out. But, any phonotactic constraint ranked high enough to do this must also dominate RED-L and thus will erroneously predict that the reduplicant will be placed so as to minimize violations of the phonotactic constraint. Given this fact, it will be quite difficult to get an invariable initial CV-reduplicant without resorting to templatic constraints. I'll return to this issue in section 3.

2.4 Selecting reduplicant content by positional B/R-Faithfulness

When a reduplicative CV affix occurs as an infix it could conceivably copy the material that precedes or follows it. Thus far, I have given no constraints that express a preference for either *ʔu.**ʔu**.pu.ɺik*$_{\text{pl.}}$ or *ʔu.**pu**.pu.ɺik*$_{\text{pl.}}$ as a plural from for *ʔu.pu.ɺik*$_{\text{sg.}}$ 'wart'. Typically the content of the reduplicant is determined by constraints which demand that the reduplicant copy the portion of the output that has been designated as the 'base'. Pursuit of the infixing analysis of Pima reduplication will require an examination of how the base is delineated. It is to this issue that I will turn in this section.

Marantz (1982) generalized that the copying observed in reduplication tends to exhibit "edge-in association"; that is, the material that gets copied in the reduplicant tends to start at the edge to which the affix is attached and proceed into the word.

(41) **bad**.ba.du.pi - *edge-in association*



Though Marantz described edge-in association as a tendency, some subsequent researchers have, tacitly or explicitly, treated edge-in association as an inviolate principle that is used to select the 'base' in reduplication (e.g. McCarthy and Prince, 1996: 74; Kager 1999:202, Nelson 2003).

In Correspondence Theory, constraints of B/R-MAX family demand that the reduplicant copy material from the substring of the output that has been designated as the base. The assumption that edge-in association is an inviolate principle leads Kager (1999: 202) to define the base as "the output string of segments to which the reduplicant is attached, more specifically: for reduplicative *prefixes,* it is the *following* string of segments; for reduplicative *suffixes* the *preceding* string of segments" [Kager's emphasis].

The main problem with the hypothesis of universally inviolate edge-in association is the existence of many languages in which the reduplicant does appear to be adjacent to the material that it copies. Attempts have been made to explain away many cases of nonlocal reduplication. For example, McCarthy and Prince (1996) note that absolutive reduplication in Chukchee, e.g. *nute* → *nute**nut*** 'land', could be analyzed as local reduplication, rendered apparently nonlocal by deletion of the final vowel. Nelson (2003) elaborates this argument extending this line of reasoning to a range of other apparent counterexamples to edge-in association claiming that "[w]rong side reduplication exists only superficially, so far as it results coincidentally from the application of an independently motivated process". This strategy will not, however, extend to Chkchee's sister-language Koryak, in which the amount of material that intervenes between the two surface copies may be an entire syllable. This is illustrated in (42) with data from the Handbook of Indian Languages (Bogoras 1969: 689-691).[7]

(42)	**gloss**	**stem**	**reduplicated absolute form**
	'oil'	mítqa	mítqa**mıt**
	'fire'	qanga	qánga**qan**
	'shell-fish'	kílka	kílka**kil**

Weimer and Weimer (1970, 1974) give several examples from the New Guinean language of Yareba in which the base and reduplicant seem to be quite distant. Yareba is strictly CV, thus an epenthetic glide [y] is inserted as an onset before vowel initial suffixes. In cases of reduplication, a copy of the initial consonant occurs stem finally to act as an onset before vowel initial suffixes.

(43)	**gloss**	**singular**	**plural**
	'reveal it!'	boroy-a	boro**b**-a
	'break it!'	fomuy-a	fomu**f**-a
	'go through the hole!'	doroy-a	doro**d**-a

Martin and Mauldin's (2000) Creek Dictionary contains many pluralized adjectives in which the base and reduplicant are separated by a fairly large span of segments. Moreover, aside from the minimization of reduplicants, there don't seem to be independent phonological processes that could lead to the nonlocality of the base and reduplicant seen in Creek reduplication.

[7] There are not independent phonological processes in Koryak that would delete the entire final syllable.

(44)

gloss	**singular**	**plural**
'sweet'	cámp-iː	cam**<u>ca</u>**p-íː
'crooked'	fayátk-iː	fayat**<u>fa</u>**k-íː
'soft'	lowáck-iː	lowác**<u>lo</u>**.k-iː

The issue of nonlocal reduplication is worthy of a paper unto itself. But for now, rather than attempting to explain away every case of nonlocal reduplication, it seems simpler to abandon the premise that some independent and invariable mechanism picks out the base and instead allow constraint interaction alone to determine which material is copied in reduplication. To allow this we can generalize the notion of the base as follows:

(45) **<u>The base generalized</u>**
Everything in the output that isn't the reduplicant is the base.[8]

Use of this definition of basehood entails quite a departure from a theory in which the analytical work is done in two stages: (i) picking out some substring as the base, and then (ii) using B/R-ANCHORING constraints to force copying from one edge of that string. Under the definition in (45), the material that the reduplicant is obliged to copy can be determined solely by the action of the B/R-MAX family of constraints. For example, Nelson (1998, 2000) suggests that patterns of reduplication in which the stressed syllable is copied can be captured via a B/R-MAX constraint demanding that the stressed rhyme be preserved in the reduplicant. Following this strategy we can recast all of the B/R-ANCHOR constraints as instances of the B/R-MAX family. For example, edge anchoring could be recast as follows:

(46) **B/R-MAX-EDGE-*X* : (B/R-MX-E$_X$)**
The edge of the prosodic or morphological constituent ***X*** in the base must have a correspondent in the reduplicant.

Subsuming the work of the base selection mechanism and the anchoring constraints under the effects of the B/R-MAX family of constraints is especially appealing given that the latter are already independently needed in the analysis of reduplication.

As an added benefit, this proposal offers an explanation of why reduplicants tend to copy salient elements like edges, stressed syllables, and stems. Given Beckman's (1995) insight that

[8] Alternatively, we might suppose that the base is whatever is in correspondence with the input. This alternative won't explain why epenthetic segments often get copied in reduplication, so I'll use the definition in (47).

salient positions are often subject to the most stringent faithfulness constraints, the tendency to copy such material follows readily as the expression of positional faithfulness in the domain of Base/Reduplicant-Correspondence. The positional B/R-MAX constraint for Pima is given in (47).

(47) **B/R-MAX-(initial onset) : (B/R-MX-O_1)**
The initial onset of the stem must be copied in the reduplicant.

Incorporating this constraint into the analysis developed so far will yield a system in which the reduplicant is obliged to copy the initial onset of the stem. This requirement must dominate *STRUC-σ because the latter could be better satisfied if the reduplicant were allowed to avoid laryngeal codas by copying the onset of the second syllable rather than the stem-initial onset.[9]

(48)

RED + hoḓai 'rocks'	B/R-MX-O_1	RED-L	*STRUC-σ
a. ho.**<u>ho</u>**.ḓai		ho	***
b. ho**<u>d</u>**.ḓai	*!	ho	**
c. h**<u>o.d</u>**o.ḓai	*!	h	**

B/R-MX-O_1 must be dominated by *COMPLEX ONSET because, when the stem begins with a cluster, the entire cluster is not copied in the reduplicant. To guarantee that it is the second consonant of the complex onset is copied in the reduplicant we can use the following constraint.

(49) LOCALITY: **(LOC)**
Only segments that are themselves in a B/R correspondence relation may intervene between pairs of corresponding segments in the base and reduplicant.
For $x, x' \in S_1$ such that $x \mathcal{R} x'$ if y lies between x and x' then $\exists y' \in S_1$ such that $y \mathcal{R} y'$.

There are several ways that we could define LOCALITY. This definition will suffice for the task at hand but see Steriade (1988, 1995), Nelson (2002, 2003) and others for further discussion of locality. Ranking LOCALITY below *STRUC-σ, will ensure that the second member of the initial cluster is copied but will allow locality violations to occur in the cases of C-Copying. This is illustrated in (50).

[9] Note here that positional-B/R-MAX constraints aren't vacuously satisfied by forms that simply fail to reduplicate anything at all. This property will, in some cases, obviate the need to use REALIZE MORPHEME constraints to prevent size restrictors from blocking reduplication altogether.

(50)

RED + tɹogi 'trucks'	*CPLX ONS	B/R-MX-O$_1$	*STRUC-σ	LOCALITY
a. ☞ tɹo**ɹ**.gi		*	**	*
b. tɹo**t**.gi		*	**	**!
c. tɹo.**ɹo**.gi		*	***!	
d. tɹo.**tɹo**.gi	*!		***	

The cases of CV-Copying in forms with initial clusters then follows naturally from the action of the phonotactic constraints that dominate *STRUC-σ. This is illustrated in (51).

(51)

RED+tɹampa	I/B-MAX	ANK-STEM-μ$_1$	SSP	*CPLX ONS	B/R-MX-ONS$_1$	RED-L	*STRK-σ	LOCALITY	B/R-MAX
a. ☞ tɹa.**ɹa**m.pa				*	*	***	***		t mpa
b. tɹa.**tɹa**m.pa				**!		***	***		mpa
c. tɹa**ɹ**m.pa			*!	*	*	***	**	*	t ampa
d. t**ɹa**.ɹam.pa		*!		*	*	*	***		t mpa

Bringing together the constraints that derive the size, placement, and content of the reduplicant, we can now review the complete account of Pima reduplication. First, whenever it is possible to minimize the number of *STRUC-σ violations by copying a single onset consonant, without violating the phonotactic restrictions, C-Copying is observed. This is illustrated in (52).

(52)

'lions' RED + mavit	*LAR]$_σ$	I/B-MAX	B/R-MX-O$_1$	ANCHOR-μ$_1$	*ŋC	SSP	*CPLX	RED-L	*STRUC-σ	NOCODA	B/R-MAX	CONTIG
a. ☞ ma**m**.vit								ma	**	**	avit	*
b. ma.**ma**.vit								ma	***!	*	vit	*
c. mav.**m**it								mav!	**	**	avit	*
d. m**m**a.vit							*!	m			avit	*
e. **ma**.ma.vit				*!					***	*	vit	
f. m**a.v**a.vit			*!					m	***	*	m it	*
g. ma**v**.vit			*!					ma	**	*	ma it	*
h. ma.vi.t**it**			*!					mavit	***	*	mav	

Second, an additional *STRUC-σ violation is tolerated whenever copying the initial consonant alone would give rise to a phonotactically illicit sequence. In such cases CV-Copying occurs. This is illustrated in (53).

(53)

‘lima beans’ RED + hod̪ai	*LAR]$_\sigma$	I/B-MAX	B/R-MX-O$_1$	ANCHOR-μ$_1$	*ŋC	SSP	*CPLX	RED-L	*STRUC-σ	NOCODA	B/R-MAX	CONTIG
a. ☞ ho.**ho**.d̪ai								ho	***		dai	*
b. ho.**hod**.d̪ai								ho	***	*!	ai	*
c. hod̪.**h**ai								hod!	**	*	odai	*
d. h**h**o.d̪ai							*!	h				*
e. **ho**.ho.d̪ai				*!					***		dai	
f. h**o.d**o.d̪ai			*!					h	***		h ai	*
g. ho.d**o.d**ai			*!					hod	***		h ai	*
h. ho**h**.d̪ai	*!							ho	**	*	odai	*

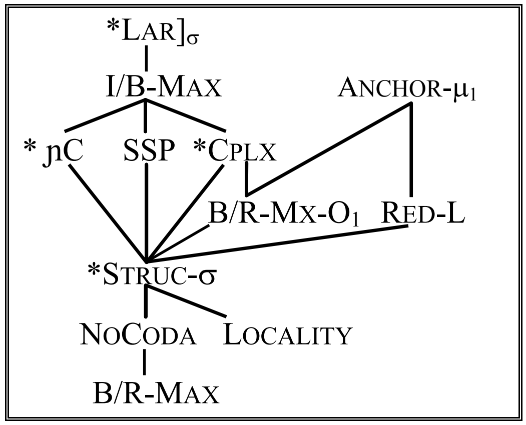
Lastly, when the stem initial syllable contains a diphthong, ANCHOR STEM and RED-L force the reduplicant to occur immediately after the first vowel of the stem. In this case, an increase in the number of syllables is unavoidable so B/R-MAX prefers copying of the initial CV sequence. This is illustrated in (54).

(54)

‘twins’ RED + kuadi	*LAR]$_\sigma$	I/B-MAX	B/R-MX-O$_1$	ANCHOR STEM	*ŋC	SSP	*CPLX	RED-L	*Struc-σ	NOCODA	B/R-MAX	CONTIG
a. ☞ ku.**ku**a.di								ku	***		adi	*
b. ku.**k**a.di								ku	***		uadi!	*
c. kua**k**.di								kua!	**	*	uadi	*
d. kua.di**k**								kuadi!	**	*	uadi	
e. k**k**ua.di							*!	k	**		uadi	*
f. **ku**.kua.di				*!					***		adi	
g. k**ua.d**ua.di			*!					k	***		k i	*
h. kua**d**.di			*!					kua	**	*	kua i	*

Combining all of the ranking arguments given for the constraints that derive the size, the location, and the content of the reduplicant the following picture of the grammar emerges.

(55)



In summary, I have shown that the reduplicative patterns of Pima can be readily analyzed under the assumption that the reduplicant is an infix. This pattern of infixation follows directly from the ranking of independently motivated anchoring and alignment constraints. Moreover, the infixing analysis has the advantage that it is able to capture the variation between C-Copying and CV-Copying without recourse to any reduplication specific-mechanisms other than the Emergence of the Unmarked ranking.

In this analysis I adopt of a more general definition of basehood that allows positional B/R-Faithfulness constraints to determine reduplicant content. This is, if anything, a simplification of the theory in that it obviates the need for an invariable external mechanism to delineate the base and allows the content of the reduplicant to be derived more transparently from the constraint ranking.

3 Conundrum revisited: the prefixation+syncope analysis

In this section I will present and argue against the prefixation+syncope analysis of Pima reduplication. Under analysis as prefixation the cases of CV-Copying are straightforward:

(56) Prefixation of a CV reduplicant:
h o d̪ a i → **h o**-h o d̪ a i

The cases of C-Copying, on the other hand, will require significantly more explanation. Two mechanisms will be needed. First, some mechanism must guarantee that the prefixal reduplicant surfaces with an invariant CV shape. Second, some mechanism must license the deletion of material from the base just in case that material has been copied in the reduplicant.

(57) Prefixation of a CV reduplicant + syncope in the base:
m a v i t → **m a**-m v i t

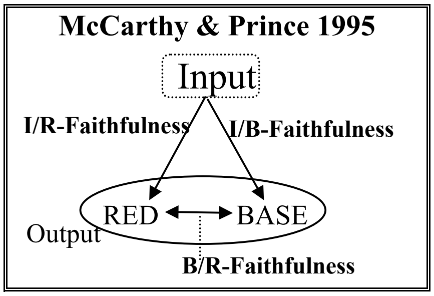
In order to derive its shape, Fitzgerald (1999) imposes a templatic constraint on the reduplicant in Tohono O'odham which demands that it be smaller than or equal to a light (CV) syllable. Furthermore, in order to allow reduplication to license syncope in the base in cases like this, Fitzgerald (1999) and Struijke (2000) propose that Correspondence Theory be amended with existential faithfulness.

Existential faithfulness constraints are novel in that they are able to be satisfied in two different ways. Like standard faithfulness constraints, they are satisfied if an input segment has a faithful correspondent in the base. But unlike standard faithfulness constraints, existential faithfulness constraints are also satisfied if an input segment has a faithful correspondent in the reduplicant. Since an existential faithfulness constraint can be satisfied by faithful preservation of underlying material anywhere in the output, a highly ranked existential version of MAX-VOWEL will allow deletion of a vowel in the base, provided that a faithful correspondent of that vowel is preserved in the reduplicant.

3.1 Existential Faithfulness

In McCarthy and Prince's 1995 model of Correspondence Theory there are three dimensions of correspondence: Input/Base-Faithfulness, Base/Reduplicant-Faithfulness, and Input/Reduplicant-Faithfulness. The schematization in (58) will make it easier to see the contrast between M&P's model and several proposed revisions that I will examine in this section.

(58)

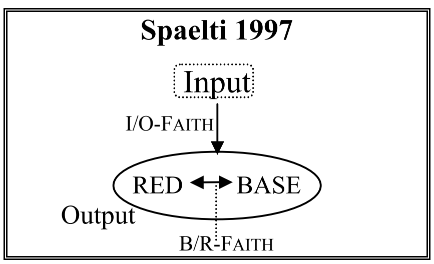


In this model, markedness constraints that are generally active in the language must be ranked above Input/Base-Faithfulness constraints because unreduplicated forms are considered to be bases.

If a markedness constraint shows its effects only in reduplication it must be ranked below Input/Base-Faithfulness but above Base/Reduplicant-Faithfulness. In this way, the appearance of the effects of a particular constraint only in context of reduplication is attributed to an asymmetry between faithfulness for bases and for reduplicants.

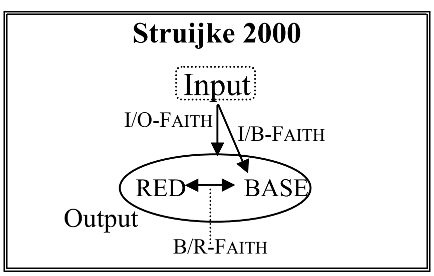
Several researchers have proposed that the McCarthy and Prince's (1995) model of CT should be revised so that it includes a more general dimension of Input/Output-Faithfulness that simply requires each input segment to have some faithful correspondent somewhere in the output. Below I give schematic illustrations of three such proposals.

(59)



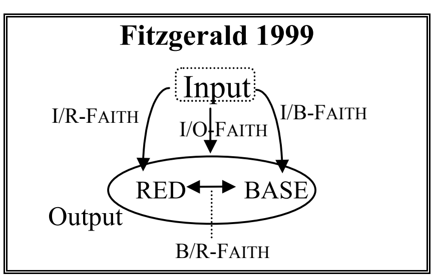
Spaelti (1997) merges the Input/Base and the Input/ Reduplicant dimensions of correspondence into one general existential I/O-Faithfulness relation but leaves Base/Reduplicant correspondence intact.

(60)



Struijke (2000) supplants the Input/Reduplicant correspondence relation with an existential I/O-faithfulness relation, but leaves Input/Base and Base/Reduplicant correspondence intact.

(61)



Fitzgerald (1999) adds an existential I/O dimension of correspondence to McCarthy and Princes (1995) model of Correspondence Theory leaving all of the original faithfulness relations intact.

In the interest of brevity I will not explore the differences among these three proposals here. The relevant factor for the discussion at hand is the common innovation offered by these proposals: the introduction of a general correspondence relation between the input and the entire output string. This dimension of faithfulness can be generally defined as follows:

(62) **Existential Faithfulness (∃-Faith)**

Each segment of the input must have all of its specifications preserved in some correspondent (or correspondents) somewhere in the output form.

For the purposes of this discussion I will consider in detail the model proposed in Struijke (2000). Struijke's model supplants the Input/Reduplicant dimension of faithfulness with a general Input/Output dimension of faithfulness, which I will refer to henceforth as ∃-Faith. Since this revised model still contains the Input/Base dimension of faithfulness, the TETU effects of McCarthy and Prince's original model can still be generated. In addition to the 'classic' TETU ranking, this new model will generate an entirely new type of emergence of the unmarked effect.

Under the Emergence of the Unmarked Ranking, in the original formulation of CT, the reduplicant will suffer a reduction in faithfulness at the hands of an emergent markedness constraint. Since the emergent constraint is only able to affect the reduplicant I will refer to this as the unilateral-TETU ranking. The unilateral-TETU ranking is available in both the original formulation of CT and in CT amended with ∃-Faith.

(63) **Unilateral-TETU rankings**

i) M&P's 1995 CT: **I/B-FAITH** >> *Constraint-X* >> **B/R-FAITH, I/R-FAITH**

ii) CT with ∃-Faith: **I/B-FAITH** >> *Constraint-X* >> **B/R-FAITH**

In a system with existential faithfulness, under the ranking in (ii), unilateral-TETU effects will occur regardless of the relative ranking of the ∃-Faith constraints.

The crucial innovation offered by existential faithfulness is the availability of a ranking under which *either* the base *or* the reduplicant (but not unreduplicated forms) can show the effects of an emergent markedness constraint. Since the effects of the emergent constraint are not restricted to the reduplicant I'll call this a bilateral-TETU ranking. This is illustrated in (64).

(64) **<u>Bilateral-TETU rankings</u>**

i) M&P's 1995 CT: -none-

ii) CT with ∃-Faith: **∃-FAITH** >> *Constraint-X* >> **IB-FAITH, BR-FAITH**

Under this ranking *Constraint-X* will have no effect in unreduplicated forms where each segment has only one chance to surface faithfully. In reduplicated forms, on the other hand, since some segments have two correspondents (one in the base and one in the reduplicant), *Constraint-X* will have a chance to reduce the markedness in one of the two correspondents without violating ∃-Faith. In this fashion, the bilateral-TETU ranking will license the deletion of marked segments in the base if they are preserved faithfully in the reduplicant.

The analyses made possible by the introduction of existential faithfulness are intuitively appealing. It seems reasonable that grammars might respond to the surface redundancy created in reduplication by reducing the markedness of a redundant element. But giving grammars this power by means of existential faithfulness gives rise to serious difficulties in controlling the size and content of the reduplicant. These difficulties come in two forms and I will address each in turn. First, in section 3.2 I will show that any constraint used to block the effects of an emergent markedness constraint in the bilateral-TETU ranking must be ranked high enough to affect the base itself. This is problematic because, unless the constraint is specific to the reduplicant (i.e. a template), it can run amok and deform the base. Second, in section 3.4 I will show that, under the bilateral-TETU ranking, non-templatic constraints generate several anomalous typological predictions previously thought to be restricted to analyses with templatic constraints.

3.2 Why templates cannot be removed from the prefixation+syncope analysis

In Fitzgerald's (1998) analysis of Tohono O'odham the C-Copying pattern is analyzed as instance of syncope in the base that is motivated by a drive to close the stressed initial syllable and thereby satisfy the Stress-to-Weight principle.

(65) **STRESS TO WEIGHT PRINCIPLE : (SWP)**[10]
Stressed syllables must be heavy.

In order to allow syncope to close the stressed initial syllable just in case reduplication has occurred, Fitzgerald introduces a correspondence constraint requiring every input segment to

[10] Coining of the SWP is sometimes attributed to Prince (1990). In fact, he argues for the Weight-to-Stress principle, which demands that heavy syllables be stressed. Also, see Hayes (1995) on the interaction of weight and stress.

have a correspondent somewhere in the output (essentially ∃-**MAX**) . In (66) I give a constraint that is functionally equivalent to the one used in Fitzgerald's analysis.

(66) ∃-**MAX-V**
Each underlying vowel must have a correspondent in the output.

Using ∃-MAX, unreduplicated forms will not use syncope to close initial light syllables because deletion of the vowel in the second syllable would violate ∃-MAX-V. This is illustrated in (67).[11]

(67)

ʔupuɹik 'algae'$_{sg.}$	∃-MAX-V	SWP	I/B-MAX-V
a. ☞ ʔu.pu.ɹik		*	
b. ʔup.ɹik	u!		u

Reduplicated forms, on the other hand, will be able to use syncope to close the stressed initial syllable without violating the existential faithfulness constraint. This is illustrated in (68).

(68)

RED+mavit 'lions'	∃-MAX-V	SWP	I/B-MAX-V
a. ☞ **ma**m.vit			a
b. **ma**.ma.vit		*!	

Complications arise when we consider the need to rule out candidates in which the initial syllable is closed by simply copying more of the base.

(69)

RED+nakʃiɹ 'scorpions'	∃-MAX-V	SWP	I/B-MAX-V	B/R-MAX-V
a. **na**nk.ʃiɹ *-attested form*			a!	kʃiɹ!
b. 💣 **nak**.nak.ʃiɹ				ʃiɹ

This example is especially illuminating. Note that both of the candidates in (69) equally satisfy the SWP but the unattested candidate (b) is better in almost every way. Candidate (b) is less marked since it doesn't have a coda cluster and it is more faithful since it better satisfies I/B-MAX and B/R-MAX and it preserves the relative prosodic roles of [n] and [k] as onset and coda respectively (for more on this latter point see Marantz 1982 and Steriade 1988). The only thing wrong with (b) is that it is longer and thus gets more violations of size restricting constraints like *STRUC-σ. Candidates like (b) are ruled out in Fitzgerald's analysis of Tohono O'odham by virtue of a templatic constraint demanding that the reduplicant be no larger than CV. Before

[11] Throughout this section I will use Pima data to illustrate the various analytical possibilities.

presenting her solution I will discuss other aspects of the prefixation+syncope analysis that make it difficult to derive the desired reduplicant shape with general phonotactic constraints.

Obviously, the effects of the template can't be replicated by simply elevating NOCODA since it would rule out the very cases of C-Copying that we are trying to account for. This is illustrated in (70).

(70)

RED+mavit 'lions'	NOCODA	SWP	I/B-MAX-V
a. **na**nk.ʃiɺ *-attested form*	*!		*
b. **nak**.nak.ʃiɺ	*!		
c. 💣 **na**.nak.ʃiɺ		*	

Replacing the SwP with *STRUC-σ, and ranking it above NOCODA will predict that CV will be copied and that syncope will occur as a means to best satisfy both *STRUC-σ and NOCODA.

(71)

RED+mavit 'lions'	*LAR]$_\sigma$	*STRUC-σ	NOCODA	I/B-MAX-V
a. ☞ **ma**m.vit		**	*	*
b. **ma**.ma.vit		***!	*	
c. **mav**.ma.vit		***!	*	
RED+hod̪ai 'rocks'	*LAR]$_\sigma$	*STRUC-σ	NOCODA	I/B-MAX-V
a. ☞ **ho**.ho.d̪ai		***		
b. **hod̪**.ho.d̪ai		***	*!	
c. **ho**h.d̪ai	*!	**	*	*

In order to avoid predicting syncope in unreduplicated forms, *STRUC-σ must be used in the bilateral-TETU ranking, below ∃-MAX but above I/B-MAX. But, under this ranking, when the initial syllable contains a diphthong, syncope should occur to minimize *STRUC-σ violations.

(72)

RED+kuadi 'twins'	∃-MAX-V	*STRUC-σ	I/B-MAX-V
a. **ku**.kua.di *-attested form*		***!	
b. 💣 **kua**k.di		**	**
c. **kua**.ku.di		***!	*

Regardless of the constraints used to motivate syncope, candidate (b) is just the kind of output that is to be expected under existential faithfulness. This candidate succeeds in creating a heavy stressed syllable, eliminates a diphthong in an unstressed syllable, and minimizes the syllable-count of the output by eliminating redundant segments. The most plausible way to prevent the generation of candidates like (b) would be to claim that some overriding markedness constraint can emerge to block C-Copying. In fact, this won't work: because *STRUC-σ dominates I/B-MAX-V, any constraint that blocks the effects of *STRUC-σ must also, by transitivity, dominate I/B-MAX-V. Thus, if some general phonotactic restriction like *DIPHTHONG were introduced block syncope its presence would then erroneously predict the use of syncope to repair input stems that happen to contain diphthongs. This is illustrated in (73).

(73)

RED+kuadi 'twins'	*DIPHTHONG	*STRUC-σ	I/B-MAX-V
a. **ku**.kua.di *-attested form*	*!	***	
b. 💣 **ku**.ka.di		***	*
c. **kua**k.di	*!	**	**

Replacing *DIPHTHONG, with a more specific constraint, say a ban on closed syllables with diphthongal nuclei (i.e. $*VVC]_\sigma$), runs afoul of much the same problem.[12] Whenever the singular form happens to contain the banned $VVC]_\sigma$ sequence it will be 'repaired' by reduplication.

(74)

RED+piast 'parties'	$*VVC]_\sigma$	*STRUC-σ	I/B-MAX-V
a. **pi**.piast *-attested form*	*!	***	
b. 💣 **pi**.past		***	*

These problems are merely specific instances of a more general problem inherent to the bilateral-TETU ranking. Consider the schematization in (75), in which I refer to the constraint that causes syncope simply as SYNCOPATE (e.g. SWP, *UNSTRESSED-VOWEL, *STRUC-σ, etc.), and to the constraint that blocks syncope as BLOCKER (e.g. NOCODA, *DIPHTHONG, $*VVC]_\sigma$, etc.).

(75) **Syncope in Bilateral-TETU Schematized**

∃-FAITH >> BLOCKER >> SYNCOPATE >> I/B-FAITH >> *Constraint-X* >> B/R-FAITH

↑ bilateral-TETU ↑ unilateral-TETU

Since syncope affects the base but only occurs in the context of reduplication, SYNCOPATE must be ranked in the bilateral-TETU ranking, below ∃-FAITH but above I/B-FAITH. But, since syncope is blocked in some cases, SYNCOPATE must be dominated by BLOCKER. Thus, by the transitivity of domination BLOCKER must also dominate I/B-FAITH. Herein lies the problem.

[12] This is another variation on the problem with the mixed-prefixing/ infixing hypothesis discussed in section two.

Unless the effects of BLOCKER can somehow be restricted to the reduplicant, then BLOCKER should also apply to the base, which can erroneously lead to more syncope. Fitzgerald avoids this problem in her analysis of Tohono O'odham by using a templatic constraint as the blocker.

(76) **$\textbf{RED}_{CV}$**
The reduplicant is a CV (light) syllable. (Fitzgerald 1999)

Since the effects of the templatic constraint are restricted to the reduplicant there is no risk that its ranking above I/B-FAITH will lead to more syncope in the base. Fitzgerald's analysis is actually a bit more complicated because there are cases in which she assumes that the templatic constraint is overridden by other factors. See Fitzgerald (1999) for the full details.

My intent here is not to claim that no syncope analysis is possible without templates. Surely, constraints could be formulated or rankings found where syncope did not overapply. My goal is to point out that general phonotactic constraints can't be used to restrict the application of syncope when the constraint that causes syncope is ranked in the bilateral-TETU ranking. This is because any constraints used to block syncope must themselves be powerful enough to affect the base. Templatic constraints don't have this problem because their effects are restricted to the reduplicant. They do, however, come with a range of other problems.

3.3 The trouble with templates

As noted in section 2, McCarthy and Prince (1995) describe a scenario in which templatic constraints and B/R-Faithfulness can conspire to yield bizarre and unattested reduplicative patterns. Whenever B/R-MAX and a templatic restriction on the reduplicant both dominate I/B-MAX, vacuous satisfaction of B/R-MAX will, allow the templatic constraint to back-copy its restriction onto the base and force truncation. This is the Kager-Hamilton Conundrum.

(77)

RED + $\sigma_1\ \sigma_2\ \sigma_3$	RED=σ	B/R-MAX	I/B-MAX	I/R-MAX
a. $\underline{\boldsymbol{\sigma_1}}\ \sigma_1\ \sigma_2\ \sigma_3$		*!*		**
b. ☠ $\underline{\boldsymbol{\sigma_1}}\ \sigma_1$			**	**
c. $\underline{\boldsymbol{\sigma_1}\,\boldsymbol{\sigma_2}}\ \sigma_1\ \sigma_2$	*!		*	*
d. $\underline{\boldsymbol{\sigma_1}\,\boldsymbol{\sigma_2}\,\boldsymbol{\sigma_3}}\ \sigma_1\ \sigma_2\ \sigma_3$	*!*			

The triumph of (b) in (77) illustrates how the existence of templatic constraints makes the odd typological prediction that there should be languages where unreduplicated words can be of any length but where reduplicated words are truncated to a pair of identical syllables.

McCarthy and Prince (1995) take this as evidence that the conception of reduplicative templates is flawed and that reduplicative templates *per se* do not exist. Rather, they assert that any template-like effects observed in reduplication should be derived from general properties of morphology and phonology and their interface. This is the prime motivation for the introduction of Generalized Template Theory. In this section I will show how problems like the KHC can arise without templates when non-TETU strategies are used to restrict the size of the reduplicant.

Any size restriction strategy requiring that the reduplicant be a specific size or of a specific prosodic category will suffer the same problems as templates. For example, disjoining alignment constraints so that both edges of the reduplicant are aligned to the edges of a particular prosodic constituent will act just like a template. Consider the alignment constraints in (76).

(78) a. **ALIGN RED-LEFT σ-LEFT : (RED-LT$_\sigma$)**
The left edge of the reduplicant must be aligned to the left edge of a syllable.

b. **ALIGN RED-RIGHT σ-RIGHT : (RED-RT$_\sigma$)**
The left edge of the reduplicant must be aligned to the right edge of a syllable.

Taking the disjunction of these two constraints (and specifying that each of the disjuncts refers to the same syllable) yields a constraint that is satisfied when the reduplicant is coextensive with a single syllable. Though the theoretical machinery is different, this has the same effect as the constraint RED=σ. Thus this approach will give rise to the KHC.

(79)

RED + $\sigma_1\ \sigma_2\ \sigma_3$	RED-LT-$\sigma_i \vee$ RED-RT-σ_i	B/R-MAX	I/B-MAX	I/R-MAX
a. $\underline{\sigma_1}\ \sigma_1\ \sigma_2\ \sigma_3$		*!*		**
b. ☠ $\underline{\sigma_1}\ \sigma_1$			**	**
c. $\underline{\sigma_1\ \sigma_2}\ \sigma_1\ \sigma_2$	*!		*	*
d. $\underline{\sigma_1\ \sigma_2\ \sigma_3}\ \sigma_1\ \sigma_2\ \sigma_3$	*!			

Surprisingly, this same problem crops up in strategies for restricting the size of reduplicants that use mechanisms which seem very different from templates.

3.4 The trouble with INTEGRITY

Spaelti (1997) notes that if the constraint INTEGRITY is ranked above B/R-Faithfulness the reduplicant will be minimized in order to reduce the number of segments in the output that share a common input correspondent. McCarthy and Prince (1995) define INTEGRITY as in (80) below:

(80) **INTEGRITY (INTEG)**
No element of S_1 has multiple correspondents in S_2.
For $x \in S_1$ and $w, z \in S_2$, if $x \mathcal{R} w$ and $x \mathcal{R} z$, then $w = z$.

If $\mathbf{S_2}$ refers to the entire output string then INTEGRITY will be violated whenever an input segment has correspondents in both the base and the reduplicant. Thus, if INTEGRITY is highly ranked then each output segment will surface in either the base or the reduplicant but not in both. This tug-of-war between the base and the reduplicant can lead to truncation whenever INTEGRITY dominates B/R-MAX. A hypothetical instance of this scenario is illustrated in (81).

(81)

RED + badupi	INTEGRITY	B/R-MAX	I/B-MAX	B/R-DEP	I/R-MAX
a. badu**<u>badupi</u>**	ba! du		pi	pi	
b. badupi**<u>pi</u>**	pi	b! adu			badu
c. badu**<u>du</u>**	du	b! a	pi		dupi
d. ☠ ba**<u>ba</u>**	ba		dupi		dupi (!)
e. ☠ ba**<u>badupi</u>**	ba		dupi	dupi (!)	

The selection of either candidate (d) or (e) will fall to the relative ranking of B/R-DEP and I/R-MAX with the former preferring (d) and the latter preferring (e). Candidate (d) illustrates another instance of KHC-like truncation. Interestingly, the selection of candidate (e) represents a new type of problem in which the bulk of the underlying material is obliged to surface in the reduplicant rather than in the base. I call this new problem the RED-Shift since it results in the majority of the input material being 'shifted' into the reduplicant.

In and of itself the RED-Shift candidate might not seem totally outrageous. Indeed, the surface form of (e) in (81) looks like reduplicative prefixation. We might think of this as an odd, yet harmless, alternative assumption about which portion of the output is the reduplicant and which portion of the output is the base. But, problems arise when we consider how unilateral-TETU would be expressed under the RED-Shift ranking. Imagine, for instance, a language with initial stress, and a right aligned reduplicant, where unstressed vowels reduce to schwa in the reduplicant. In such a language all unstressed vowels would reduce to schwa in the context of reduplication but no where else. A hypothetical instance of such a case is presented in (82).

(82)

RED + badupi	INTEG	B/R-MAX	I/B-MAX	I/R-MAX	B/R-DEP	I/B-IDENT	*UNSTRESSED MARGIN-V	B/R-IDENT
a. bádu**badupi**	bad! u		pi		pi		****	
b. bádupi**pi**	pi	b! adu		badu			***	
c. bádu**du**	du	b! a	pi	dupi			**	
d. bá**ba**	ba		dupi	d! upi			*	
e. bá**badupi**							*! **	
f. ☠ bá**bədəpə**	ba		dupi		dupi			*

It might seem that existential faithfulness could come to the rescue at this point since the problematic predictions involve forms in which specifications in the input are totally lost in the output. But this is not the case. Existential faithfulness will only prevent the loss of features and segments if the relevant existential faithfulness constraints are dominant in a given grammar. But since existential faithfulness constraints aren't universally dominant the predictions remain.

The constraint INTEGRITY was originally conceived to penalize segmental fission. The problematic predications arise only when it is extended to reduplication. These predictions can be eliminated if INTEGRITY is redefined so that it penalizes segmental fission but doesn't penalize the multiple correspondence that arises through reduplication. This can done by modifying the constraint so that it penalizes multiple correspondence except in cases where the correspondents belong to different morphemes. A redefined version of Integrity is presented in (83).

(83) **INTEGRITY** -*redefined*
If an element of S_1 has multiple correspondents in S_2 they must be in different morphemes.
For $x \in S_1$ and $w, z \in S_2$, if $x \mathcal{R} w$ and $x \mathcal{R} z$, then $w = z$ or $w \in \boldsymbol{m}_1$, $z \in \boldsymbol{m}_2$ and $\boldsymbol{m}_1 \neq \boldsymbol{m}_2$.

This redefinition of INTEGRITY won't predict truncation and the RED-Shift. However, since the redefined version of the constraint doesn't penalize multiple correspondence in reduplication it will no longer be able to act as a size restrictor on reduplicants.

3.5 The trouble with CONTIGUITY

Any ranking scheme for minimizing the size of the reduplicant that uses constraints that are not in an a priori ranking below base faithfulness can lead to the KHC and the RED-Shift. Another example of such a system comes from Hendricks (1999). Hendrix restricts the size of the reduplicant through the competition of alignment constraints like the ones in (84).

(84) a. **ALIGN-RED-L$_{PRWD}$ (RED-L)**
The left edge of the reduplicant must be aligned to the left edge of the prosodic word.

b. **ALIGN-STEM-L$_{PRWD}$ (STEM-L)**
The left edge of the stem must be aligned to the left edge of the prosodic word.

Hendricks calls this the COMPRESSION model because it will minimize the size of the reduplicant by squeezing it between the edge of the stem and the edge of the word. When RED-L dominates STEM-L the reduplicant will be a prefix. If STEM-L in turn dominates B/R-MAX the reduplicant will be reduced so that the stem will occur as close as possible to the left edge of the word.

In order to achieve the minimization of the reduplicant the constraint demanding OUTPUT CONTIGUITY must dominate B/R-MAX. Following McCarthy and Prince's (1995) definition we can define OUTPUT CONTIGUITY as follows:

(85) **OUTPUT-CONTIGUITY : (O-CONTIG)**
The output exponent of an input morpheme must be a contiguous string.

Ranking O-CONTIG above B/R-MAX will ensure that the reduplicant is minimized while the converse ranking will simply yield a reduplicant that is a circumfix (candidate b in (86)).

(86)

RED + badupi	RED-L	STEM-L	O-CONTIG	B/R-MAX
a. ☞ **ba**badupi		**		dupi
b. **ba**badupi**dupi**		**	*!	
c. **badu**badupi		***!*		pi
d. badupi**ba**	******!			

But, because there is no a priori ranking among alignment, contiguity and B/R-MAX this model will predict languages in which the vacuous satisfaction of B/R-MAX leads to truncation.

(87)

RED + badupi	RED-L	STEM-L	O-CONTIG	B/R-MAX	I/B-MAX
a. ☠ **ba**ba		**			dupi
b. **ba**badupi		**		a! dupi	
c. **ba**badupi**dupi**		**	*!		

Because the reduplicant must occur at the left edge of the word (the effect of RED-L), and it may not be interrupted (the effect of O-CONTIG), and the stem must occur as far left as possible (the effect of STEM-L), the reduplicant will be a single-syllable prefix. At this point the stem will be truncated to a single syllable (candidate (a)) in order to vacuously satisfy B/R-MAX.

This problem is not restricted to reduplication. In any instance of infixation, if O-CONTIG dominates I/B-MAX then satisfaction of O-CONTIG can lead to truncation of the stem. This is illustrated in (88) with a reduplicative infix.

(88)

RED + badupi	STEM-L	RED-L	O-CONTIG	I/B-MAX	B/R-MAX	I/R-MAX	B/R-DEP
a. ba**badupi**dupi		ba	*!				
b. ba**ba**dupi		ba	*!		dupi		
c. badupi**pi**		badu!			badu		
d. ☠ ba**ba**		ba		dupi		dupi (!)	
e. ☠ ba**badupi**		ba		dupi			dupi (!)

Again, the choice between the truncation candidate (d) and the RED-Shift candidate (e) will fall to the relative ranking of I/R-MAX and B/R-DEP. Consider in (89) another case where unilateral-TETU interacts with the RED-Shift to generate bizarre reduplicative patterns. If the markedness constraint *UNSTRESSEDVOWEL is ranked in the unilateral-TETU ranking, below I/B-MAX but above B/R-MAX, in a language with initial stress and a right aligned reduplicant, then syncope will occur throughout the word in the context of reduplication but nowhere else.

(89)

RED + badupi	STEM-L	RED-L	O CONTIG	I/B-MAX	*UNSTRESSED VOWEL	B/R MAX	I/R MAX	B/R DEP
a. **bá**.ba.du.pi	ba!				*****	dupi	dupi	
b. bá.du.pi.**ba**		bad! u			*****	dupi	dupi	
c. bá.**ba.du**.du.pi		ba	*!		******	pi	pi	
d. bá.**ba.du.pi**		ba		dupi	****!			
e. bá.**ba.du**		ba		dupi	**!		pi	
f. bá.**ba**		ba		dupi	*		dup! i	
g. ☠ bá**b.dup**		ba		dupi	*		ai	dup

Under this ranking *UNSTRESSEDVOWEL should show normal unilateral-TETU effects. But, since the bulk of the output occurs in the reduplicant rather than in the base syncope occurs throughout the bulk of the word. Thus, while candidate (d) simply shows the RED-Shift, candidate (g) shows the RED-Shift with concomitant syncope in the reduplicant.

The main source of the problem here is the constraint O-CONTIG. In any instance of infixation O-CONTIG will prefer truncated candidates over those which are simply interrupted.

We can remedy this problem with strategy similar to the one used for the constraint INTEGRITY. If CONTIGUITY is redefined so that when the contiguity of two segments in an input morpheme $\boldsymbol{m}_1$ is interrupted by material belonging to another morpheme $\boldsymbol{m}_2$ there is no violation then the problematic predictions will be eliminated.[13]

(90) **CONTIGUITY -** *redefined*
If x and $y \in \boldsymbol{m}_1$ are adjacent in S_1 and have correspondents x' and y' respectively in S_2 then any element z occurring between x' and y' in S_2 must belong to $\boldsymbol{m}_2$, $\boldsymbol{m}_1 \neq \boldsymbol{m}_2$

This redefined version of CONTIGUITY won't be violated by the infixation of a morpheme, reduplicative or otherwise. As such the competition of alignment constraints can still lead to infixation but will not lead to the KHC or the RED-Shift. This is illustrated in (91).

(91)

RED + badupi	RED-L	STEM-L	CONTIGUITY	B/R-MAX	I/B-MAX
a. ☞ **<u>ba</u>**badupi**<u>dupi</u>**		**			
b. **<u>ba</u>**badupi		**		d! upi	
c. **<u>badu</u>**badupi		***!*		pi	
d. badupi**<u>ba</u>**	******!			dupi	
e. **<u>ba</u>**ba		**			d! upi

Since CONTIGUITY is no longer violated when the reduplicant interrupts the base (or when the base interrupts the reduplicant) rather than being compressed (truncated) morphemes that are competing for alignment at the same edge will simply interrupt each other. While this eliminates the KHC and RED-Shift it also eliminates COMPRESSION as a method of minimizing reduplicants.

As I have illustrated in this section, problems like the KHC and the RED-Shift can arise whenever a constraint that restricts the size of the reduplicant is ranked above the constraints that protect the content of the base. In order to eliminate these problematic predictions for the constraints INTEGRITY and CONTIGUITY I have suggested revisions that render them incapable of restricting the size of reduplicants. This leaves us in need of a reduplicant size restricting strategy free from these problems. Fortunately, the KHC and RED-Shift can be totally avoided if all restrictions on the size and content of the reduplicant are derived via standard prosodic and phonotactic constraints in the unilateral-TETU ranking.

[13] CONTIGUITY will still govern the placement of epenthetic segments since they have no morphemic affiliation.

3.4 Existential Blues

Even if templates are eliminated, and size restrictors are limited to general prosodic and phonotactic constraints, the addition of existential faithfulness to the theory can bring about just the sort of tug-of-war between the base and reduplicant that causes the RED-Shift.

Whenever a size restrictor occurs in a bilateral-TETU ranking, below ∃-MAX but above I/B-MAX, it will ensure that input material surfaces either in the base or in the reduplicant but not in both. Consider, for instance, a hypothetical language that allows only CV syllables where ∃-MAX is ranked above I/B-MAX which is in turn ranked above B/R-MAX. Under this ranking the reduplicant will be minimized. This is illustrated in (92).

(92)

RED + b a d u p i	∃-MAX	*STRUC-σ	I/B-MAX	B/R-MAX
a. ☞ **<u>b a</u>** b a d u p i		****		****
b. **<u>b a d u</u>** b a d u p i		*****!		**
c. **<u>b a</u>** b a	****!	**	****	
d. **<u>b a d u p i</u>** d u p i		*****!	**	
e. **<u>b a d u p i</u>** p i		****	*!***	

However, if the ranking of I/B-MAX and B/R-MAX is inverted then the RED-Shift will occur. This is illustrated in (93).

(93)

RED + b a d u p i	∃-MAX	*STRUC-σ	B/R-MAX	I/B-MAX
a. **<u>b a</u>** b a d u p i		****	*!***	
b. 💣 **<u>b a d u p i</u>** p i		****		****

Under this ranking, the best satisfaction of ∃-MAX and *STRUC will come when underlying material surfaces in either the reduplicant or the base but not in both. This is essentially the same as the effects of the original definition of INTEGRITY. Thus it come as no surprise that the RED-Shift arises in the same way that it did before.

One possible response to this problem would be to assert that the malady lies not in the existential faithfulness constraints themselves but rather in the unrestricted ranking of the Base/Reduplicant and Input/Base correspondence constraints. But alas, the very ranking that causes the RED-Shift under existential faithfulness, (B/R-Faith >> I/B-Faith), is independently necessary to account for the attested cases where changes to the reduplicant are reflected back onto the base. (see McCarthy and Prince 1995 for many such cases).

These problems with bilateral-TETU offer yet another illustration of how deviation from the unilateral-TETU rankings of the original formulation of Correspondence Theory leads to predictions in which constraints intended to affect the reduplicant can run amok and deform the base. These predictions are, of course, eliminated if we stick with McCarthy and Prince's (1995) formulation of Correspondence Theory which does not allow bilateral-TETU.

This is not to say that it is impossible to analyze Pima reduplication with existential faithfulness. Indeed, the ranking in (92) will correctly generate Pima-like minimization of the reduplicant. However, given that reduplication in Pima (and Tohono O'odham) can be analyzed without existential faithfulness, and given that existential faithfulness gives rise to some troubling typological predictions, the crucial question is whether or not there are any languages that truly necessitate that Correspondence Theory be amended with existential faithfulness.

4 Conclusions

The goals of this paper have been twofold. First, I have endeavored to provide an account of Pima reduplication that illustrates how several emergent phonotactic restrictions condition the variation between the C-Copying and CV-Copying patterns of reduplication. Second, I have examined the ramifications of different assumptions about the relative designation of the base and the reduplicant and the typological implications of several mechanisms for restricting the size of the reduplicant.

Analyzing Pima reduplication as a process of infixation provides an account of the variation between the C-Copying and CV-Copying reduplicative patterns as the result of conflict between a size restrictor (*STRUC-σ) and several phonotactic restrictions (SWP, NOCODA, *ɲC, and *LAR CODA). The fact that the size restrictor and many of the phonotactic constraints do not affect the base or (unreduplicated words) is explained by placing the constraints in the unilateral-TETU ranking offered by McCarthy and Prince's original 1995 formulation of Correspondence Theory. Of central importance is the fact that the infixation analysis is capable of generating the C-Copying vs. CV-Copying dichotomy using only general markedness constraints without recourse to templatic constraints or existential faithfulness.

The generalization of the KHC and RED-Shift problems to a range of analyses in which the size of the reduplicant is conditioned by means other than unilateral-TETU provides further support for the thesis of Generalized Template Theory. Specifically, that the content and size of the reduplicant can and should be modeled with general phonotactic and prosodic constraints as an instance of the (unilateral) Emergence of the Unmarked.

Despite the intuitive appeal of existential faithfulness and the fact that it allows a wider range of analyses, including the ability to generate syncope in the base, I have concluded that the existential faithfulness analysis of Pima reduplication should be rejected on two grounds. First, under the existential faithfulness analysis, constraints designed to block syncope must also dominate I/B-Faith. Thus, unless these constraints are reduplicant-specific, they will also affect the base. This leaves no clear way to control the reduplicant without resorting to templatic constraints. Second, and more importantly, augmenting Correspondence Theory with existential faithfulness and thus bilateral-TETU makes the typological problems previously associated with templates unavoidable since any size restrictor in the bilateral-TETU ranking can lead to the KHC or the RED-Shift.

In order to pursue the infixing analysis of Pima reduplication I have adopted the Stem-Anchoring strategy of Kurisu and Sanders (1999). Furthermore, in this analysis I have proposed a generalized theory of the base under which the content of the reduplicant follows from positionally indexed members of the B/R-MAX family of constraints rather than from the action of some independent principle of base selection. This innovation decouples reduplicant placement and content thereby allowing the content of the reduplicant to be selected by the interaction of rankable constraints in the standard Optimality Theoretic fashion.

References

Avelino, Heriberto and Sahyang Kim. 2003. Variability and Constancy in the Articulation and Acoustics of Pima Coronals. In *BLS Proceedings* (in press)…

Beckman, Jill. 1998. *Positional Faithfulness*. Doctoral dissertation, University of Massachusetts, Amherst.

Boas, Franz. 1947. Kwakiutl Grammar with a Glossary of the Suffixes, ed. by Helene Boas Yampolsky. *Transactions of the American Philosophical Society. New Series, Vol. 37, part 3*. Philadelphia. 201-377.

Bogoras, Waldemar. 1969. “Chukchee” In: Handbook of American Indian Languages. F. Boas, ed. Bureau of American Ethnology Bulletin 40, Part 2. Washington: GPO. pp 631-903.

Clements, G.N. 1990. The role of the sonority cycle in core syllabification. In John Kingston and Mary E. Beckman, eds., *Papers in Laboratory Phonology I: Between the Grammar and Physics of Speech*. Cambridge: Cambridge University Press, 283-325.

Fitzgerald, Colleen. 1997. *O’odham Rhythms.* PhD Dissertation, University of Arizona.

Fitzgerald, Colleen. 1998. Vowel hiatus and faithfulness in Tohono O’odham reduplication. Ms., State University of New York at Buffalo.

Fitzgerald, Colleen. 1999. *Unfaithful bases and syncope in Tohono O'odham reduplication*. Paper presented at WCFL. University of Arizona, Tucson.

Fitzgerald, Colleen. 2000. Vowel Hiatus and Faithfulness in Tohono O'odham Reduplication *Linguistic Inquiry*. v# 713-722.

Gouskova, Maria. 2003a. Syncope: Prosody or *Struc? Paper presented at *The 77th Annual Meeting of the Linguistics Society of America*. Atlanta, GA.

Gouskova, Maria. 2003b. Economy of Representation in OT. Paper presented at WCCFL 12, San Diego, CA.

Hayes, Bruce. 1995. *Metrical Stress Theory: Principles and Case Studies*. Chicago: University of Chicago Press.

Hendricks, Sean. 1999. *Reduplication without Template constraints: a study in bare-consonant reduplication*. PhD. dissertation, University of Arizona.

Jackson, Eric. 2003. Phonetic properties of Pima Vowels. Unpublished Ms. UCLA.

Jespersen, Otto. 1904. *Lehrbuch der Phonetik*. Leipzig: Teubner.

Kager, René. 1999. Optimality Theory. Cambridge.

Kisseberth, Charles. 1973. "Cyclical Rules in Klamath Phonology," *Linguistic Inquiry* 3, 3-34.

Kurisu, Kazutaka and Nathan Sanders. 1999. Infixal nominal reduplication in Maŋarayi. Phonology at Santa Cruz 6: 47-56.

Lyon Suzanne. 2001. Conditioning of pima high front vowels. Unpublished Ms. UCLA.

Marantz, Alec. 1982. Re Reduplication. *Linguistic Inquiry* 13:3, 435-482.

Martin, Jack B., and Margaret McKane Mauldin. 2000. *A Dictionary of Creek / Muskogee, with notes on the Florida and Oklahoma Seminole dialects of Creek*. Lincoln / London: University of Nebraska Press.

Mester, Armin, and Jaye Padgett. 1994. "Direct Syllabification in Generalized Alignment." Phonology at Santa Cruz 3. 79-85.

McCarthy, John. 1993. 'Template Form in Prosodic Morphology.' In *Papers from the 3rd Annual Meeting of the Formal Linguistic Society of Mid-America,* L. Stran, ed. 187-218

McCarthy, John. 1998. Sympathy & Phonological Opacity. Ms. University of Massachusetts. Rutgers Optimality Archive ROA-252.

McCarthy, John. 2000. Faithfulness and prosodic circumscription. In Joost Dekkers, Frank van der Leeuw and Jeroen van de Weijer (eds.), Optimality Theory: Phonology, syntax, and acquisition, Oxford: Oxford University Press.

McCarthy, John, and Alan Prince. 1986. Prosodic Morphology. Ms., University of Massachusetts, Amherst and Brandeis University. [Issued in 1996 as Technical Report #32, Rutgers University Center for Cognitive Science.]

McCarthy, John and Alan Prince. 1990. Foot and Word in Prosodic Morphology: The Arabic Broken Plural. *Natural Language and Linguistic Theory* 8, 209-283.

McCarthy, John, and Alan Prince. 1993. 'Generalized Alignment.' in *Yearbook of Morphology 1993*, Geert Booij & Jaap van Marle, eds. Dordrecht: Kluwer. 79-153

McCarthy, John, and Alan Prince. 1994a. The emergence of the unmarked. *NELS* 24: 333-379.

McCarthy, John, and Alan Prince. 1994b. Two lectures on prosodic morphology. Handouts of lectures at OTS/HIL workshop on Prosodic Morphology, Utrecht University, July 1994.

McCarthy, John. & Alan Prince. 1995. 'Faithfulness and Reduplicative Identity.' In *University of Massachusetts Occasional Papers in Linguistics [UMOP] 18: Papers in Optimality Theory,* J. Beckman, L. Walsh Dickey & S. Urbanczyk, eds. GLSA UMass, Amherst. 249-384.

McCarthy, John & Alan Prince. 1996. Prosodic Morphology 1986. Technical Report 32, Rutgers University Center for Cognitive Science.

Nelson, Nicole. 1998. "Right Anchor, Aweigh." Ms., Rutgers University.

Nelson, Nicole. 2000. Stressed rhyme faithfulness: a case study of Nancowry. In *WCCFL 19 Proceedings*, ed. Billery and Lillehaugen. Sommerville, MA: Cascadilla Press. 329-342.

Nelson, Nicole. 2003. "Wrong side reduplication is epiphenomenal: evidence from Yoruba" To appear in: *Studies in Reduplication* [tentative title], ed. Bernhard Hurch. Mouton de Gruyter.
Orgun, Cemil Orhan and Ronald L. Sprouse (1999). From MPARSE to CONTROL: deriving ungrammaticality. *Phonology* 16, 191-224.
Prince, Alan. 1990. "Quantitative Consequences of Rhythmic Organization." In M. Ziolkowski, M. Noske, and K. Deaton (eds.), *Papers from the 26th Regional Meeting of the Chicago Linguistic Society*, vol. 2, The parasession, 355–398.
Prince, Alan. 1996. 'Aspects of Mapping under OT.' Handout from the talk given at the University of California, Santa Cruz. October 11, 1996.
Prince, Alan and Paul Smolensky 1993/2002. Optimality Theory: Constraint Interaction in Generative Grammar. Technical Report CU-CS-696-93, Department of Computer Science, University of Colorado at Boulder; and Technical Report TR-2, Rutgers Center for Cognitive Science, Rutgers University / ROA 537-0802.
Saxton, Dean, Lucille Saxton, and Susie Enos. 1983. *Papago/Pima - English*, *O'otham - Mil-gahn; English-Papago/Pima, Mil-Gahn -O'otham Dictionary.* Second ed., ed. by R. L. Cherry. Tucson: University of Arizona Press.
Selkirk, Elisabeth O. 1984. On the major class features and syllable theory. In M. Aronoff and R.T. Oerhle, eds., *Language Sound Structure: Studies in Phonology Dedicated to Morris Halle by his Teacher and Students*. Cambridge: MIT Press, 107-113.
Shaw, Patricia. 1987. Non-conservation of melodic structure in reduplication. In *Papers from the 23rd Annual Regional Meeting of the Chicago Linguistic Society, Part Two: Parasession on Autosegmental and Metrical Phonology,* 291–306. Chicago Linguistic Society, University of Chicago, Chicago, Ill.
Spaelti, Philip. 1997. *Dimensions of Variation in Multi-Pattern Reduplication.* Doctoral Thesis. University of California Santa Cruz.
Struijke, Caro. 1998. Reduplicant and output TETU in Kwakwala: A new model of correspondence. Ms., University of Maryland, College Park.
Struijke, Caro. 2000. Why Constraint Conflict Can Disappear in Reduplication. ROA number 373-01100.
Struijke, Caro. 2000. *Existential Faithfulness: A Study of Reduplicative TETU, Feature Movement, and Dissimilation*. PhD dissertation, University of Maryland, College Park.
Steriade, Donca. 1988. Reduplication and syllable transfer in Sanskrit and elsewhere. *Phonology* 5. 73-155
Urbanczyk, Suzanne. 1996. Patterns of Reduplication in Lushootseed. Doctoral dissertation, University of Massachusetts, Amherst.
Weimer, Harry and Natalia Weimer. 1970. "Reduplication in Yareba." *Pacific Linguistics* A 23: 37-44.
Weimer, Harry and Natalia Weimer, compilers. 1974. *Yareba language.* Dictionaries of Papua New Guinea, 2. Ukarumpa: Summer Institute of Linguistics. 524 p.
White, Robin Barbara Davis. 1973. *Klamath Phonology.* PhD dissertation, University of Washington.
Yu, Alan C. L. 2002. 'Washo internal reduplication revisited.' Ms., University of California, Berkeley.
Zoll, Cheryl 1993. Ghost Segments and Optimality. In *The Proceedings of the 12th West Coast Conference on Formal Linguistics*, eds. Erin Duncan, Michele Hart, and Philip Spaelti, 183-199.
Zoll, Cheryl 1994. Subsegmental Parsing: Floating Features in Chaha and Yawelimani. Phonology at Santa Cruz 3.
Zuraw, Kie. 2003. Infixation in Tagalog: markedness vs. similarity. Handout for a talk given at University of California, Berkeley.

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