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CHAPTER 3

On the Proper Characterization of 'Nonconcatenative' Languages

1. INTRODUCTION

Past theoretical analyses have claimed that nonconcatenative languages are phonologically special.[1] In these languages, a configuration such as C_iVC_i, where the two consonants are identical, may result from an autosegmental operation that spreads the root of a single underlying consonant over two C positions (see 1). This hypothetical type of spreading has been called 'long-distance consonantal spreading,' henceforth LDC-spreading. LDC-spreading is thought to proceed unobstructed by the intervening vowel because vowels and consonants are represented on different planes. This representational hypothesis is known as V/C planar segregation.

1. V/C planar segregation

Consonant plane		C		
Skeleton	X	X	X	(output: [C_iVC_i])
Vowel plane		V		

(example: Arabic radadtu 'I returned')

The effect of LDC-spreading is thus to create a copy of a segment over intervening segmental material, an effect similar to that found in the phenomenon of reduplication. Similarity notwithstanding, LDC-spreading and reduplication have been attributed to unrelated mechanisms of the theory. In LDC-spreading, copying is the apparent effect of double linking of a single consonant to two skeletal positions. In reduplication, copying literally creates a second instance of a consonant. The two mechanisms exist within different components of the grammar, LDC-spreading in the phonological and reduplication in the morphological component.

My goal in this chapter is to address this redundancy in a phonological theory which admits two distinct operations of segmental copying, and advocate its elimination by reducing LDC-spreading to the same formal mechanism underlying reduplication. Crucial to this reduction will be the notion of gradient violation of constraints in the framework of Optimality Theory of Prince & Smolensky (1993). I then examine the implications of this reduction for the typological distinction posited between concatenative and nonconcatenative languages. I argue that this distinction is not to be formally expressed in terms of the special phonological mechanisms of LDC-spreading and V/C planar segregation, but rather in terms of the special mode of reduplicative affixation employed in nonconcatenative languages. Reduplicative affixes in these languages are a-templatic, in the sense that there is no prosodic requirement imposed on the shape of the affixes. The identification of this type of affixation provides examples of an implicitly predicted but heretofore undocumented type of affixation in the theory of Prosodic Morphology.

This chapter relates to Articulatory Locality as follows. LDC-spreading is excluded by the proposed notion of locality in phonology: spreading between the two consonants in a CVC sequence must propagate through the vowel, which would completely obliterate the vowel. The argument in this chapter has two parts: (a) LDC-spreading must be eliminated for reasons independent of Articulatory Locality, and (b) this elimination has welcome consequences for phonological theory in general, and Prosodic Morphology in particular. The ensuing argument, then, provides independent support for Articulatory Locality.

2. CHAPTER ORGANIZATION

The chapter is organized as follows. Section 3 introduces the Optimality theoretic notion of correspondence, which has been successfully employed to characterize the cross-linguistic facts of templatic reduplication, and which will play a central role in the analyses throughout this chapter. Section 4 begins the main part of this chapter by considering the noted redundancy between the two copying mechanisms in Temiar, one of the main indigenous languages of Malaysia (Benjamin 1976). The specific choice of Temiar rests on three reasons. First, the language is notorious for the complexity of its copying patterns, and despite valiant attempts (McCarthy 1982, Broselow & McCarthy 1983), it had so far resisted a satisfactory account. Second, it has been argues that Temiar requires the full deployment of both copying mechanisms, LDC-spreading and reduplication. Finally, the facts of the language illustrate in a striking way the inadequacy of the derivational approach to copying, while at the same time demonstrating the type of affixation that I will argue to be the subcase of reduplicative affixation specific to nonconcatenative languages.

The main part of section 4 presents a unified analysis of segmental copying in the verbal morphology of Temiar. The analysis builds on an understanding of the basic prosodic and morphological properties of the language developed here for the first time. All instances of segmental copying are analyzed in terms of a single notion of correspondence. The full range of patterns emerges from the interaction of correspondence constraints with other constraints expressing independently established regularities of the language. Section 5 discusses previous analyses of the language, demonstrating in particular the superiority of the correspondence approach to copying over derivational alternatives.

Section 6 argues that the elimination of LDC-spreading and its geometric premise of V/C segregation is not only possible but in fact necessary. Reconstructing the original argument for having both LDC-spreading and reduplication in the theory, I expose the weaknesses of its premises and the conceptual problems they raise. I argue, in addition, that the theory admitting LDC-spreading and V/C planar segregation fails to explain the fact that whenever LDC-spreading has been claimed to apply, it spreads the whole consonant and never one of its individual features. These problems are resolved under the proposed unification since it is clear that segmental copying, as in reduplication, targets only whole segments, not individual features.

Section 7 develops the typological consequences of the elimination of LDC-spreading and V/C segregation. It begins by examining some basic patterns of segmental copying in Semitic. These languages were thought to provide another type of motivation for V/C segregation, due to the traditionally assumed distinct morphological status attributed to consonants and vowels. Irrespective of the status of this assumption, the same basic reduction of LDC-spreading to copying via correspondence extends to these languages as well. I conclude that the distinction between concatenative and nonconcatenative languages need not and should not be encoded in terms of the special phonological mechanisms of V/C segregation and LDC-spreading. Rather, the distinction is identified with a special type of reduplicative affixation employed in nonconcatenative languages, where reduplicative affixes are not specified for any prosodic target, their exact realization being determined by the constraints of the particular language. Section 8 concludes with a summary of the main arguments and results of the chapter.[2] Finally, as an excursion, in section 9, I further discuss some of the prosodic properties of Temiar and other South-East Asian languages. I suggest that some of these properties can be understood once we assume a new scalar conception of syllabic weight.

3. CORRESPONDENCE IN OPTIMALITY THEORY

Faithfulness in OT expresses the fact that related grammatical forms, such as Input/Output and Base/Reduplicant, tend to be identical. The Correspondence theory of McCarthy & Prince (1995a) gives formal content to the notion of faithfulness.[3] Correspondence defines a relation between two forms, as stated in (2) below.

2. Correspondence

Given two segmental strings S_1 and S_2, *correspondence* is a relation $\Re$ from the segments of S_1 to those of S_2. Segments α of S_1 and β of S_2 are referred to as *correspondents* of one another when $\alpha \Re \beta$.

A correspondence relation imposes a number of constraints requiring identity between the two segmental strings. Two basic correspondence constraints are given in (3) and (4) for the Base(B)/Reduplicant(R) correspondence relation.[4]

3. MAX^{BR}

Every segment of B has a correspondent in R.

4. DEP^{BR}
   Every segment of R has a correspondent in B.

Perfect correspondence is total reduplication, as in Axininca Campa **nata**-nata 'carry' (copied segments are boldfaced), which fully statisfies MAX^{BR} and DEP^{BR}. Deviations from perfection are found when, because of higher ranked constraints, the reduplicant copies less than the whole base, violating MAX^{BR}, or when the reduplicant contains segments which are not part of the base, violating DEP^{BR}. Both cases of violation correspond to well-attested phenomena, partial reduplication and prespecified reduplication respectively. In Temiar, for example, the simulfactive aspect form **c^1**a.c^{1}vc^2 derived from the biconsonantal verbal base c^{1}vc^2, copies only a single consonant of the base, causing two violations of MAX^{BR} because /v, c^2/ are not copied. Moreover, the output contains /a/ which is not part of the base, a violation of DEP^{BR}.

Other constraints evaluate the quality of the identity between correspondent segments over featural and prosodic dimensions, as in (5) and (6) respectively.

5. IDENT^{BR}(F)
   A segment in R and its correspondent in B must have identical values for the feature [F].

6. SROLE
   A segment in R and its correspondent in B must have identical syllabic roles.

Featural identity may be violated because of higher ranked constraints imposing specific demands on the featural make-up of a correspondent segment. In Temiar voiceless stops are nasalized to become more sonorous in coda position due to a constraint specific to codas, CODA-COND (Prince & Smolensky 1993, Itô & Mester 1993, Itô 1989). When a copy of the base-final consonant is affixed, as in yaap 'to cry' yɛ**m**.yaap, the consonant is thus nasalized: IDENT^{BR}(nasal) is violated because of the higher ranked CODA-COND.

SROLE in (6) is unviolated in Temiar and fully determines the choice of copied consonants. When a base consonant is copied and placed in onset position, it is the first consonant of the base that is chosen for copying, as in **c**^{1}a.c^{1}vc^2. But when the copied consonant is placed in coda position, as in c^1**ɛc**^{3}.c^{2}vc^3, the final consonant of the base is chosen for copying instead. Violations of SROLE are found, for example, in Ilokano plural reduplication pu.sa 'cat', **pus**-pu.sa 'cats', where /s/ is a coda in the reduplicant but an onset in the base.

In the following analysis I will show how to account for the entire range of copying patterns in the verbal morphology of Temiar using the same unitary notion of correspondence, hence extending its use to the domain of nonconcatenative languages. I will also argue that any derivational approach to the facts of Temiar relying on an interleaving of morphological and phonological operations is bound to miss significant generalizations, directly captured by the Optimality theoretic model via the parallel application of morphological and phonological constraints.

4. TEMIAR VERBAL MORPHOLOGY: A UNIFIED ACCOUNT OF COPYING

Temiar [tmɛɛr] is one of the main Austroasiatic languages of Malaysia. It belongs to the Mon Khmer family which, together with the Munda languages, comprise the Austroasiatic family (Ruhlen 1987, Thomas & Headley 1970). The Mon Khmer family includes eleven groups, one of which is the Aslian languages spoken in the Malaysian peninsula.[5] The Aslian branch is further divided into Northern, Central, and South Aslian languages. The Central Aslian subfamily includes about twenty languages. Grammatical descriptions of these languages are limited to Jah-Hut, Semai and Temiar. Of these three, Temiar has been described in the most detail, in Benjamin (1976), and will be the main focus of this chapter.[6]

Temiar has two main dialects, Northern and Southern. The description in Benjamin (1976) is based on the Northern dialect spoken in the Betis and lower Perolak valleys of the Kelantan region. This is also the dialect spoken by the Temiar announcers in the *Orang Asli* (Aslian Man) service of Radio Malaysia (Carey 1976). It should be noted that the speakers of this language call themselves *Senoi Serok*, meaning Inland or Hill People. To avoid confusion, I will continue to use the name Temiar employed by Benjamin and Diffloth, whose descriptions of Temiar and other closely related Aslian languages provide the sources of this analysis.

In the Austroasiatic branch of Mon Khmer, Aslian languages have the most developed morphological systems. In fact, the nonconcatenative morphology of Temiar has been characterized as extremely complex (McCarthy 1982). It includes a variety of intricate combinations of infixations and copies of consonants, found in particular in the two main aspects of the language, the simulfactive and the continuative. It is perhaps not an accident that the only thorough analysis of this morphology to date is that of McCarthy (1982). This section attempts a new approach to the verbal morphology of the language. Subsection 4.1 introduces its basic prosodic properties, discusses the verbal paradigms, and uncovers significant generalizations in the locus of affixation of the simulfactive and continuative morphemes. These generalizations will enable for the first time a unified analysis of segmental copying in the morphology of the two aspects, as presented in subsection 4.2. All segmental copying is induced by a correspondence relation holding between the segments of the base and the segments of the affix, obviating the mechanism of LDC-spreading, thought to be necessary in previous analyses of the language.

4.1 Basic Prosodic and Morphological Properties

The consonant inventory of Temiar consists of the sounds in (7a). The places of articulation of the consonants are, for each column in turn, bilabial, apico-alveolar (with contact slightly more towards the blade than in English), lamino-alveolar, dorso-velar and laryngeal respectively. As is typical of Mon-Khmer languages, Temiar has a large vowel system. The basic set of short oral vowels is given in (7b). Length is distinctive for all these vowels, and all oral vowels can be nasalized.

7. a. Consonants / b. Vowels

p	t	c		i	ʉ	u
b	d	j	g	e	ə	o
	s			ɛ	a	ɔ
m	n	ɲ	ŋ			
w	y					
	l					
	r					
			ʔ, h			

Temiar has two types of verbal bases, biconsonantal and triconsonantal, shown in (8), where I also give the CV pattern of the verb for future reference. The superscripts in the CV pattern indicate the relative order of consonants and '.' stands for syllable boundary.

8. a. Biconsonantal c^1vc^2 kɔɔw 'to call'
   b. Triconsonantal $c^1.c^2vc^3$ s.lɔg 'to lie down'

Biconsonantal bases consist entirely of one syllable. Triconsonantal bases are bisyllabic, exhibiting the special type of underlyingly voweless syllables found in Aslian (and Mon Khmer) languages. In s.lɔg the consonant /s/ is the onset of a syllable, called a *minor* syllable that has no phonologically specified vowel, as opposed to the final *major* syllable of the word, which does contain a phonologically specified vowel. Examples of words with one-consonant minor syllables are shown in (9a-c) (ignore for the moment the phonetic forms, which I discuss below). In (9a), **t**.lɛk, **t** is the onset of the minor syllable, followed by the major syllable lɛk. Morphological operations, involving infixations of consonants, can create closed minor syllables, consisting of two consonants as shown in (9d-f). In (9d), the minor syllable is **br** with /b/ as its onset and /r/ as its coda.

9. a. **t.**lɛk 'to teach' [tə.lɛk]
   b. **b.**huj 'guilty' [bə.huj]
   c. **s.**lɔg 'to lie down' [sə.lɔg]
   d. **br.**caaʔ 'to feed' [bɛr.caaʔ]
   e. **cb.**niib 'going' [cɛb.niib]
   f. **tʔ.**taaʔ 'old men' [tɛʔ.taaʔ]

According to Benjamin, phonetically minor syllables surface with two predictable vowel qualities. Open minor syllables are transcribed with the vowel [ə] as in (9a-c), and closed minor syllables with the vowel [ɛ] as in (9d-f) (but see discussion below). These minor vowels, then, are entirely predictable from context. This can be seen in the ways these vowels surface in different morphological variants of a word. In (10), showing part of the voice/aspect paradigm of s.lɔg 'to lie down', the minor syllable vowels [ə/ɛ] are freely substituted by other vowels provided by the morphology or by each other, conditioned apparently only by syllable structure in the latter case.

10. a. [sə.lɔg] 'to lie down'
    b. [sa.lɔg] 'to lie down-SIM.'
    c. [sɛr.lɔg] 'to lie down-CAUS.'
    d. [sə.rɛg.lɔg] 'to lie down-CONT.'

In (10b), when the vowel affix /a/ is added to the verbal base of (10a), the [ə] in the minor syllable of [sə.lɔg] changes to [a]. In (10c), when the consonant affix /r/ is added, the vowel [ə] changes to [ɛ]. Finally, (10d) shows the same alternation in the inverse direction, where the vowel [ɛ] of [sɛr.lɔg] turns to [ə].

Furthermore, there is evidence suggesting that Benjamin's categorical '[ə] in open/[ɛ] in closed syllable' transcription of minor syllable realizations may be an oversimplification of the range of possible vowel qualities. In the closely related Senoic languages, Semai and Jah-Hut, Diffloth notes that minor syllable vowels have various transitional qualities, depending on their context. For example, in Semai, /k.ʔɛɛp/ 'red centipede' is realized phonetically as [kɛʔɛɛp]. As Diffloth (1976a: p. 233) characteristically notes, "the main vowel ɛ: starts where /k/ ends and ends where /p/ begins; the glottal stop is superposed at some time during the utterance of the vowel." This 'anticipation' of the vowel of the major syllable Diffloth finds to be a characteristic of all Aslian languages. Diffloth also notes that minor syllables are realized phonetically with other transitional vowel qualities. For example, in the context of a labial consonant, the vowel of the minor syllable has a [u]-like quality, while in the context of palatal consonants it has a high front [i]-like quality.

It thus seems that the qualities of minor syllable vowels derive from context and not from some underlying specification of a vocalic target. I will thus assume that these vowels are not specified underlyingly, but are the phonetic realizations of a syllable with no phonologically specified vowel.[7] This is also the assumption in Diffloth's descriptions of two other Senoic languages, Semai and Jah-Hut, which are closely related to Temiar.

If the surface vowels of minor syllables are not specified underlyingly then their variation can be seen as a reflex of the articulatory transition between two consonantal gestures. The first is the gesture of the onset of the minor syllable and the second is the gesture of the following consonant, which can be either the coda of the minor syllable or the onset of the following syllable. In producing this consonantal sequence, the first gesture forms a constriction and then releases it before producing the constriction of the second gesture. In the transitional period between the onset of the release of the first gesture and the formation of the constriction of the second gesture, there is no complete obstruction in the vocal tract. This gives the effect of a vowel whose quality is highly dependent on the context.

Apart from the existence of minor syllables, the structure of Temiar syllables is simple. Every syllable must have an onset, and complex syllabic margins are not allowed. Thus in **t.**lɛk 'to teach', the first consonant is the onset of a minor syllable followed by a major syllable, and in **br.**caaʔ 'to feed', the first consonant is the onset and the second is the coda of the minor syllable. This simple syllabic structure can be captured by the two standard constraints of the basic syllabic theory of OT shown in (11) and (12). These two constraints are never violated in this language.

11. ONS
    Every syllable must have an onset.

12. *COMPLEX
    No more than one segment may associate to any syllabic margin.

Another prosodic property of Temiar is that major syllables appear always in the final position, bearing the word stress, and preceded by an optional sequence of minor syllables. This is a general property of the Mon Khmer family. Since stress in Mon Khmer is typically final, this property can be seen as a special case of a widely attested tendency of languages to reduce their vowel inventories in unstressed positions. Typical examples of inventory reductions from stressed to unstressed positions cross-linguistically include the seven to five vowel reduction of Italian, the six to four reduction of Rumanian, the five to three reduction in Sicilian, and the eight to six reduction in Turkish. In Temiar unstressed positions, corresponding to minor syllables, the vowel inventory is reduced to just two predictable qualities [ə/ɛ], i.e. no contrast among vowels in this position. The issue of how to express this generalization using current resources is a problem beyond the scope of this chapter. Here I will simply use the constraint 1-V in (13), as a cover name for the set of constraints that may lie behind the Temiar (and Mon Khmer) generalization (see section 9 for further discussion).

13. 1-V
    There is only one specified vowel (hence one major syllable) per word.

I now turn to the morphological properties of the verbal paradigms. There are two voices, active and causative. For each voice, there are three aspects, perfective, simulfactive, and continuative. The aspectual paradigm of the active voice is shown in (14).

14. Active Voice	Biconsonantal	Triconsonantal
a. Perfective	c^1vc^2	$c^1.c^2vc^3$
	kɔɔw 'to call'	s.lɔg 'to lie down'
b. Simulfactive	$c^1a.c^1vc^2$	$c^1a.c^2vc^3$
	ka.kɔɔw	sa.lɔg
c. Continuative	$c^1c^2.c^1vc^2$	$c^1c^3.c^2vc^3$
	kw.kɔɔw	sg.lɔg

The unmarked perfective aspect consists of the verbal base alone, (14a). This perfective is then the base for the formation of the two other aspects, the simulfactive and the continuative. The simulfactive aspect in (14b) is marked by the vowel /a/, and in the biconsonantal case, also by a copied base consonant. The continuative aspect in (14c) involves only copying of base consonants.

The aspectual paradigm of the causative voice is shown in (15).

15. Causative Voice	Biconsonantal	Triconsonantal
Base (Act. Perf.)	c^1vc^2 kɔɔw ‘to call’	$c^1.c^2vc^3$ s.lɔg ‘to lie down’
a. Perfective	$tr.c^1vc^2$ tr.kɔɔw	$c^1r.c^2vc^3$ sr.lɔg
b. Simulfactive	$t.ra.c^1vc^2$ t.ra.kɔɔw	$c^1.ra.c^2vc^3$ s.ra.lɔg
c. Continuative	$t.rc^2.c^1vc^2$ t.rw.kɔɔw	$c^1.rc^3.c^2vc^3$ s.rg.lɔg

The perfective aspect is formed from the corresponding active perfective base (repeated in 15 as the Base) by addition of the affix /tr/, (15a). This affix is subject to allomorphy, as shown in the case of triconsonantal bases, where it appears as an infixed /r/.[8] As in the active voice, the simulfactive and continuative are formed from the perfective base. The simulfactive is again marked by the vowel infix /a/, (15b), and the continuative by copying of various base consonants, (15c).

An important property of these paradigms concerns the locus of affixation of the simulfactive and continuative morphemes. In all simulfactive patterns the affix /a/ appears immediately to the left of the major syllable of the base, as shown by the forms enumerated in (16a). The continuative patterns have a copied consonant also immediately to the left of the major syllable of the base, as shown in (16b).

16. a. Simulfactives: $c^1\underline{a}.c^1vc^2$ $c^1\underline{a}.c^2vc^3$ $t.r\underline{a}.c^1vc^2$ $c^1.r\underline{a}.c^2vc^3$
    b. Continuatives: $c^1\underline{c^2}.c^1vc^2$ $c^1\underline{c^3}.c^2vc^3$ $t.r\underline{c^2}.c^1vc^2$ $c^1.r\underline{c^3}.c^2vc^3$

The generalization that stands out is that a new segment (/a/ or a copy of a consonant) appears in the rime position of the prefinal syllable. This is a robust property of the language, applying to all continuative and simulfactive forms. I propose to capture it with an alignment constraint, requiring that the right edge of an affix must be aligned with the left edge of the major syllable of the base. This major syllable, being stressed, is the head of the prosodic word (PrWd) in Temiar. The constraint can then be stated in the generalized alignment schema of McCarthy & Prince

(1993b), as in (17). This constraint applies throughout the verbal morphology of the simulfactive and continuative.

17. ALIGN(Affix, R, Head(PrWd), L)
    The right edge of an affix must be aligned with the left edge of the prosodic head of the base. (henceforth, α-HEAD)

Apart from this, there does not appear to be any particular prosodic requirement on how these affixes surface in the various outputs. The simulfactive is realized with the vowel /a/, and in the case of biconsonantals with a copy of a consonant of the base as well. The continuative, on the other hand, is always realized with a copy of at least one base consonant. The following analysis will show that the simulfactive and the continuative affixes are both reduplicative and specified as consisting of a single (segmental) Root node. The only difference between the two is that in the simulfactive the Root is phonologically specified to be the vowel /a/, while in the continuative it is not. This difference is illustrated in (18a) and (18b) respectively.

18. a. Simulfactive affix: Root
    |
    a

    b. Continuative affix: Root

    (no featural content)

It will be seen that the fact that in the continuative the Root is realized with a consonant follows from the interaction of independent constraints on the prosody of the language. In fact, all other differences between the simulfactive and continuative patterns will follow entirely from the interaction of the independently established prosodic regularities, expressed by *COMPLEX, ONS, and 1-V.[9]

I now briefly review the semantic distinctions encoded by the three aspects of the verbal paradigm. The continuative aspect of the verb indicates that the focus is on the action of the verb. This use is demonstrated best by contrasting the meaning of the continuative with that of the corresponding perfective.

19. Perfective versus Continuative

Perf.	na-<u>rec</u> ʔamboj	'he-eats pork (as opposed to other meat)'
Cont.	na-<u>reɲrec</u> ʔamboj	'he-is eating pork (as opposed to bathing or sleeping)'
Perf.	na-<u>səlɔg</u> babooʔ	'he-slept with a woman (he married her)'
Cont.	na-<u>sɛglɔg</u> babooʔ	'he-sleeps around with women'

The simulfactive has several uses. Among them, it indicates suddenness, intensity, or simultaneity in the action denoted by the verb.

20. Perfective versus Simulfactive

Perf.	ʔi-<u>gal</u>	'I-sat down'
Sim.	ʔi-<u>gagal</u>	'I-sat down suddenly'
Perf.	na-<u>səlɔg</u>	'he-went to sleep'
Sim.	na-<u>salɔg</u>	'he-went straight off to sleep'

Finally, causativization applies to both transitive and intransitive verbs. In the case of the latter the verb becomes transitive. Some examples of the causative are given in (21).

21. Perfective versus Causative

Perf.	tɔʔ ʔɪ-<u>səɲiil</u>	'not I-wake (I didn't wake up)'
Caus.	tɔʔ ha-<u>sɛrɲiil</u> yeh	'not you-cause-wake I (you didn't wake me up)'
Perf.	papəət na-<u>caaʔ</u> bər	'baby he-eats vegetables'
Caus.	ʔi-<u>bɛrcaaʔ</u> bər ma-papəət	'I feed vegetables to the baby'

The various Temiar paradigms thus appear to involve a rather complex set of consonant copies and affixations. Naturally, one wonders how productive these patterns are. Not all bases appear in all possible forms of every paradigm. Benjamin notes that $c^1.c^2vc^3$ bases "commonly lack perfective forms, or they exist only in the causative form" (1976: p. 168) and that it is hardly the case that every root exhibits all possible forms of every voice. This appears to be a property of other so-called nonconcatenative morphological systems. McCarthy (1979: p. 239), on Arabic, notes that it is "an idiosyncratic property of any root whether it can appear in a particular binyan." Aronoff (1994: p. 124) makes the same observation about the Hebrew Binyan system, noting that "few if any roots actually occur in all five major binyanim." Finally, Prunet (1995: p. 2) identifies this lack of full productivity as one of the main characteristics of Semitic morphology.

At least in Temiar, these limitations can often be ascribed to the semantic incompatibility of the stem with the aspectual category. Benjamin notes that, where the meaning allows, all these forms are productive, with the exception of the causative simulfactive which occurs in certain crystallized forms only, and usually with a non-transparent meaning (i.e. different than implied by the inflectional category). Even this form, however, frequently occurs in expressives (Benjamin 1976: p. 170), and is thus highly productive in ordinary conversation, stories and song lyrics. It seems safe to conclude, then, that when stems do not instantiate all possible patterns, the reasons are primarily semantic, and not related to the complexity of the form *per se*.

To sum up, the three basic properties of Temiar which will be crucial to the analysis are as follows: every syllable must have an onset (ONS), complex syllabic margins are not allowed (*COMPLEX), and every (output) word must contain only one specified vowel (1-V). Finally, the basic generalization about the locus of affixation in both simulfactive and continuative patterns is that the affix appears aligned with the left edge of the major syllable of the base (α-HEAD).

4.2 Segmental Copying Derived by Correspondence

This subsection presents a full analysis of the simulfactive and continuative aspects, in that order.[11] In the simulfactive forms of (22) there are two voices, active and causative. Each voice exhibits two possible patterns, one biconsonantal and one triconsonantal. Copies of consonants are shown in boldface.

22. ACTIVE	Biconsonantal	Triconsonantal
a. Base	c^1vc^2	$c^1.c^2vc^3$
	kɔɔw 'to call'	s.lɔg 'to lie down'
b. Simulfactive	$\mathbf{c^1}a.c^1vc^2$	$c^1a.c^2vc^3$
	ka.kɔɔw	sa.lɔg

CAUSATIVE	Biconsonantal	Triconsonantal
c. Base	$tr.c^1vc^2$	$c^1r.c^2vc^3$
	tr.kɔɔw	sr.lɔg
d. Simulfactive	$t.ra.c^1vc^2$	$c^1.ra.c^2vc^3$
	t.ra.kɔɔw	s.ra.lɔg

All simulfactive forms have a prefinal syllable with the vowel /a/, a clear violation of the constraint 1-V, expressing what is otherwise a family-wide generalization of Mon-Khmer languages that there be only one syllable with a fully specified vowel. This provides us with the first ranking argument of the analysis. Let us assume that the input of the simulfactive consists of the segmental expression of the aspect, namely, the vowel /a/, and the base. For example, in the case of an active triconsonantal base, the input will be as shown in the upper left corner of tableau (23) below.

23. Ranking argument: MAX^{IO} >> 1-V

Input: a, $c^1.c^2vc^3$	MAX^{IO}	1-V
a. $c^1.c^2vc^3$	*!	
b. ☞ $c^1a.c^2vc^3$		*

Constraint 1-V favors a candidate like (23a), where the input vowel /a/ does not surface in the output. This candidate, however, incurs a violation of MAX^{IO} which requires that every segment in the input must have a correspondent segment in the output. Candidate (23b) is in perfect correspondence with the input but incurs a violation of 1-V. The two constraints are thus in conflict. To choose the correct candidate, MAX^{IO} must dominate 1-V, i.e. MAX^{IO} >> 1-V. The prosodic regularity expressed by 1-V is thus violated under specific morphological conditions. It is nevertheless evident in the rest of the language and it will be shown to play an active role in the morphology of the continuative aspect.[12]

The output $c^1a.c^2vc^3$ is otherwise unremarkable. The vowel /a/ is simply prefixed to the major syllable of the base as required by α-HEAD. Similarly, the simulfactive of the causative voice, $c^1.ra.c^2vc^3$ in (22d) is formed from the corresponding causative base $c^1r.c^2vc^3$ in (22c) by affixation of /a/ according to the demands of α-HEAD. The only difference between the causative $c^1.ra.c^2vc^3$ and the active $c^1a.c^2vc^3$ is that the base of the former has one more consonant in its minor syllable, i.e. causative $c^1r.c^2vc^3$ versus active $c^1.c^2vc^3$. This causes the causative output to contain one more minor syllable, as in $c^1.ra.c^2vc^3$. An alternative output, $c^1ra.c^2vc^3$, with a complex onset is excluded because *COMPLEX is undominated. Moreover, c^1 or any other consonant of the causative base cannot be left unparsed because this would incur a violation of the undominated MAX^{IO}. It is easy to see that the other causative simulfactive output pattern of biconsonantals in (22d), $t.ra.c^1vc^2$ (whose initial /t/ will be discussed in section 9), is similar in all respects to $c^1.ra.c^2vc^3$.

Consider now the active simulfactive of biconsonantals $\mathbf{c^1}a.c^1vc^2$ in (22b). Affixation of /a/ here is accompanied by a copy of a base consonant. The constraint α-HEAD will require that /a/ be in a prefinal syllable, which is then required to have an onset because the constraint ONS is undominated. This then explains the presence of the new consonant in the output. There is therefore no need to attribute this consonant to some output template specific to the simulfactive, as had been assumed in previous analyses of these facts (McCarthy 1982, Broselow & McCarthy 1983), or to some prosodic requirement imposed on the shape of this particular affix.

The affix is thus only partially specified in the input as /a/ and its full surface realization is determined by the grammar of the language. It remains to be explained why the needed onset is a copy of a base consonant. I propose that, while partially specified, the simulfactive affix is also reduplicative, in the sense that there is a correspondence relation between it and the base. This correspondence relation is what dictates copying. More specifically, constraint DEP^{BR} requires that the onset of the prefinal syllable be a copy of a base consonant. Had the needed onset been a 'default' consonant, as in Ta.c^{1}vc^2, it would have no correspondent segment in the base, a violation of DEP^{BR}. The situation is depicted formally in tableau (24) below. Violations of DEP^{BR} are indicated not by the usual '*' but by the segment incurring the violation.

24. Active simulfactive of biconsonantals; copying induced by DEP^{BR}

Input: a, c^{1}vc^2	ONS	DEP^{BR}
a. a.c^{1}vc^2	*!	a
b. Ta.c^{1}vc^2		Ta!
c. ☞ **c^1**a.c^{1}vc^2		a

Since /a/ of the affix does not correspond to any base segment, there is a violation of DEP^{BR} for each one of these candidates. Candidate (24a) has affix /a/ prefixed to the major syllable of the word. No onset is provided for the prefinal syllable, however, which causes a fatal violation of ONS. Candidate (24b) provides an onset by epenthesizing an unmarked consonant /T/ with no correspondent in the base. This causes a second fatal violation of DEP^{BR}. Finally, candidate (24c) avoids a second violation of DEP^{BR} by copying a base consonant. ONS and DEP^{BR} are unranked with respect to each other.

For copying of the consonant to take place, however, an additional ranking must in fact be established. Creating a copy of a segment introduces another instance of the original segment, inheriting its markedness. Following Prince & Smolensky (1993), I will assume that segments have markedness characterized primarily by their place of articulation. Let PL/χ stand for a segment with χ place of articulation. The Markedness Hierarchy in (25) directly expresses the fact that coronals are less marked than other consonants by a ranking of the *PL/χ constraints.

25. Markedness Hierarchy
 *PL/Labial, *PL/Dorsal >> *PL/Coronal

Hence, for copying to take place, the markedness violation of the copied segment must never be serious enough to block copying of the consonant, epenthesizing an unmarked /T/ instead. In other words, the dependence requirement must be ranked higher than the markedness violation of the copied segment. Using the symbol $*PL/\chi^{MAX}$ for the highest constraint(s) in the markedness hierarchy, the ranking ensuring that copying is never blocked by the markedness of the copied segment is $\text{DEP}^{BR} >> *PL/\chi^{MAX}$ (which is in turn ranked higher than the constraint $*PL/\chi^{MIN}$, penalizing the least marked segment /T/).

Consider now the fact that in the rest of the simulfactive outputs, $c^1a.c^2vc^3$, $t.ra.c^1vc^2$, and $c^1.ra.c^2vc^3$, no copying takes place. In previous analyses, this had been taken as evidence that the simulfactive involves no reduplication at all and that the copying of the consonant in $\mathbf{c^1}a.c^1vc^2$ is the result of a completely unrelated mechanism, namely, LDC-spreading. A crucial tenet of OT, however, is that constraints are gradiently violable. In particular, MAX^{BR}, which requires that every segment of the base have a correspondent in the reduplicant, shows different degrees of violation: in $c^1a.c^2vc^3$ no segment of the base is copied, incurring four violations of MAX^{BR}. In $\mathbf{c^1}a.c^1vc^2$ only one consonant is copied, incurring two violations of MAX^{BR}. Some constraint(s) must then be forcing these violations.

As discussed above, copies of segments incur markedness violations. The more segments are copied the less optimal the output becomes. In Temiar copying is minimized. For example, in the biconsonantal simulfactive $\mathbf{c^1}a.c^1vc^2$, a consonant is required in the output because of the undominated ONS, but in $c^1a.c^2vc^3$ no consonant is required because the base already contains c^1, which can serve the role of the needed onset. Thus no copying takes place. If it did, as in the alternative output $c^1.\mathbf{c^2}a.c^2vc^3$, it would incur the additional violation $*PL/c^2$. MAX^{BR} must then be ranked lower than the markedness constraint of the least marked segment, $*PL/\chi^{MIN} >> \text{MAX}^{BR}$. This ranking has the effect of minimizing copying which takes place only when the presence of a new consonant is required by higher prosodic constraints of the language, in this case, ONS.

Two crucial rankings have thus been established. One is $\text{DEP}^{BR} >> *PL/\chi^{MAX}$, forcing copying instead of epenthesis of default consonants, and the other is $*PL/\chi^{MIN} >> \text{MAX}^{BR}$, minimizing the number of copied segments. Since, by definition $*PL/\chi^{MAX} >> *PL/\chi^{MIN}$, the overall ranking is $\text{DEP}^{BR} >> *PL/\chi >> \text{MAX}^{BR}$, where $*PL/\chi$ stands for any constraint of the markedness hierarchy.[13] Tableau (26) formalizes the preceding discussion in terms of the proposed constraints. Violations of DEP^{BR}, *PL/χ are indicated by the segment incurring the violation. Also, under the constraint *PL/χ, I only show the additional violations of markedness caused by copying or epenthesis (i.e. markedness violations caused by input segments are not shown).

26. Active simulfactive of biconsonantals

Input: a, c^1vc^2	ONS	DEP^{BR}	*PL/χ	MAX^{BR}
a. a.c^1vc^2	*!	a		***
b. Ta.c^1vc^2		Ta	T	***
c. ☞ **c^1**a.c^1vc^2		a	c^1	**
d. **c^1vc^2**.a.c^1vc^2	*!	a	c^1vc^2	
e. ☞ **c^2**a.c^1vc^2		a	c^2	**

Candidates (26a-c) have already been discussed in tableau (24). Candidate (26d) copies the whole base, satisfying MAX^{BR} completely but at the expense of violating higher ranked constraints.[14] Finally, candidate (26e) is so far predicted to be an alternative optimal output (at least in those cases where *PL/c^1 >> *PL/c^2).

I thus turn to the question of what determines the choice of the consonant to be copied, namely, the choice between the two possible candidates (26c) and (26e). Apart from DEP^{BR}, the copied consonants in these two candidates satisfy another constraint of correspondence theory, which requires that correspondent segments be featurally identical. This in fact is a constraint family, IDENT^{BR}(F), satisfied here for every feature F. The constraints IDENT^{BR}(F) thus cannot be involved in the choice between the two candidates. Aside from their featural composition, however, segments in the output come equipped with other prosodic properties such as their syllabic roles. I propose that this is the property of segments which determines the choice between the two candidates. Putting alternatives aside for the moment, the relevant constraint is SROLE, requiring that correspondent segments have identical syllabic roles.

Tableau (27) shows how SROLE determines the choice of the copied consonant. In (27a) the copied $\mathbf{c^2}$ is parsed as an onset while c^2 in the base is parsed as a coda. In (27b) both c^1 and its copy are parsed as onsets. In Temiar SROLE is never violated, and thus I will assume it is undominated.

27. Choice of copied consonant

Input: a, c^1vc^2	SROLE
a. $\mathbf{c^2}a.c^1vc^2$	*!
b. ☞ $\mathbf{c^1}a.c^1vc^2$	

Note that there is a potential alternative to the analysis just proposed in terms of the constraint shown in (28).

28. ANCHORING (McCarthy and Prince 1994b)
Correspondence preserves alignment in the following sense: the left/right peripheral element of the Reduplicant corresponds to the left (right) peripheral element of Base, if the Reduplicant is to the left/right of the Base.

ANCHORING is meant to capture a generalization about the copying and association rules of operational theories of reduplication (Marantz 1982, McCarthy & Prince 1986). The generalization is that reduplicative prefixes copy base material from the left edge of the base, while reduplicative suffixes copy from the right edge of the base. The continuative forms, however, provide the crucial evidence that this is not the relevant constraint in Temiar. When the copied consonant is placed in onset position, as in the simulfactive $\mathbf{c^1}a.c^1vc^2$, the copy starts from the leftmost segment of the base. But when the copied consonant is placed at the coda position, as in the continuative $c^1\mathbf{c^3}.c^2vc^3$, it is the rightmost segment of the base that is chosen for copying. This then shows that it is not the edge of the base that is crucial here but the prosodic role of the copied segment (i.e. in Temiar SROLE >> ANCHORING; in the Semitic patterns discussed in section 6, the inverse ranking will be at work).

Turning to the analysis of the continuative aspect, consider the four patterns, two for the active and two for the causative voice, shown in (29).

29.

ACTIVE	Biconsonantal	Triconsonantal
a. Base	c^1vc^2	$c^1.c^2vc^3$
	kɔɔw 'to call'	s.lɔg 'to lie down'
b. Continuative	$\mathbf{c^1c^2}.c^1vc^2$	$c^1\mathbf{c^3}.c^2vc^3$
	k**w**.kɔɔw	s**g**.lɔg
CAUSATIVE	Biconsonantal	Triconsonantal
c. Base	$tr.c^1vc^2$	$c^1r.c^2vc^3$
	tr.kɔɔw	sr.lɔg
d. Continuative	$t.r\mathbf{c^2}.c^1vc^2$	$c^1.r\mathbf{c^3}.c^2vc^3$
	t.r**w**.kɔɔw	s.r**g**.lɔg

It is clear from all four continuative outputs that the choice of the copied consonant(s), is determined by SROLE. There are two other interesting observations that can be made about these patterns, stated in (30).

30. a. Only consonants are copied (i.e. the base vowel is never copied).

b. The number of copied consonants varies. In the case of c^1vc^2 there are two consonants copied. In all other cases there is only one consonant copied.

Regarding (30a), consider the continuative of triconsonantals in s**g**.lɔg (derived from s.lɔg). Recall that the continuative affix is required, under α-HEAD, to be prefixed to the major syllable of the base. As in the case of the simulfactive, I will assume that the continuative affix is reduplicative. I argue here that the continuative affix should not be specified for any segmental content, being simply an empty Root node whose realization is determined by the grammar. Noting that the affix is invariantly realized with a copy of at least one base consonant, one might suggest that it should be some sort of a consonantal segment.[15] However, this fact follows independently from the regular prosody of the language. Indeed, if the affix was realized by a copy of a vowel, a second syllable with a vowel would be created, a violation of 1-V. The language evades this violation by realizing the affix with a consonant. (I argue below that the affix also lacks a prosodic target.)

The situation is expressed formally in tableau (31), where the segment realizing the affix is underlined, and boldfaced if it is a copy of some other segment. In the input shown in this tableau, α indicates the continuative affix, a Root node with no segmental content.[16]

31. Continuative of triconsonantals; 1-V in action

Input: α, $c^1.c^2vc^3$	1-V	DEP^{BR}	*PL/χ
a. $c^1\underline{\mathbf{v}}.c^2vc^3$	*!		v
b. $c^1\underline{T}.c^2vc^3$		T!	T
c. ☞ $c^1\underline{\mathbf{c^3}}.c^2vc^3$			c^3

Candidate (31a) realizes the affix with a copy of the base vowel /v/, a violation of 1-V, while (31b) fills it with a default consonant /T/, a violation of DEP^{BR}. Finally, (31c) avoids both violations by copying a consonant of the base.

Recall that 1-V is dominated by MAX^{IO}, and thus violated in all simulfactive outputs as established earlier in the analysis. In the case of the continuatives, on the other hand, 1-V plays an active role in determining the optimal candidate. This difference arises from the fact that the simulfactive is partially specified as /a/, while the continuative has no prespecified phonological content. It is thus left to the grammar to determine the content of the affix, and hence constraints determining the regular prosody of the language, like 1-V, play an active role in choosing the optimal candidate.

The second observation noted in (30b) highlights the difference between the two active continuative patterns in (29b), namely, the pattern for the biconsonantals $\mathbf{c^1c^2}.c^1vc^2$ and the pattern for the triconsonantals $c^1\mathbf{c^3}.c^2vc^3$. As in the corresponding simulfactives $\mathbf{c^1}a.c^1vc^2$ and $c^1a.c^2vc^3$, the biconsonantals copy one more consonant than the triconsonantals. This is because in the case of biconsonantals the affix must be realized as /...$\mathbf{c}.c^1vc^2$/ to satisfy the joint demands of α-HEAD and 1-V, and the prefinal syllable then needs an onset because ONS is undominated. This onset is provided by copying a base consonant for the same reasons as in the simulfactive, namely, DEP^{BR}. As in the case of the simulfactive of biconsonantals, $\mathbf{c^1}a.c^1vc^2$, the copied consonant is not part of some output template specific to continuative formation or part of some specification on the prosodic shape of the affix itself. It is instead required by ONS, an unviolated prosodic property of the language. The emergence of the biconsonantal active continuative form $\mathbf{c^1c^2}.c^1vc^2$ is expressed in tableau (32), evaluating the more relevant candidates.

32. Continuative of biconsonantals (affix realizations are underlined)

Input: α, c^1vc^2	ONS	DEP^{BR}	*PL/χ
a. $\varepsilon\underline{\mathbf{c^2}}.c^1vc^2$	*!		c^2
b. $T\varepsilon\underline{T}.c^1vc^2$		*!*	TT
c. $T\varepsilon\underline{\mathbf{c^2}}.c^1vc^2$		*!	Tc^2
d. $\mathbf{c^1}\varepsilon\underline{T}.c^1vc^2$		*!	Tc^1
e. ☞ $\mathbf{c^1}\varepsilon\underline{\mathbf{c^2}}.c^1vc^2$			c^1c^2

Candidate (32a) realizes the affix with a base consonant placed in the coda position of an onsetless syllable, causing a fatal violation of ONS (the phonetic minor syllable vowel [ε] is shown in this tableau to make clear that $\underline{\mathbf{c^2}}$ is placed in the coda position as required by α-HEAD). Candidates (32b-d) realize at least one of the consonants of the prefinal syllable by epenthesizing a segment T with no base correspondent. This causes at least one DEP^{BR} violation. The optimal candidate (32e) copies both consonants of the base, avoiding all DEP^{BR} violations. It is important to remember that the vowel [ε] is just the phonetic relization of a minor syllable. Also, two other relevant candidates need to be considered here. The first realizes the affix by spreading of the segmentally adjacent consonant ... $\underline{c}^1.c^1vc^2$, where the two instances of c^1 share the same Root. Temiar, however, disallows geminate consonants and this candidate can safely be ignored (depending on the representation of geminates in OT, this candidate may also incur a violation of undominated SROLE; see Itô & Mester 1993 for relevant discussion). The second is candidate $\mathbf{c^1}.c^1vc^2$, where $\mathbf{c^1}$ is in the onset position of the prefinal syllable. This candidate violates the undominated α-HEAD, because $\mathbf{c^1}$ being the onset of its minor syllable is separated from the consonant at the left edge of the major syllable by the empty nucleus node of the minor syllable.

Recall that in the triconsonantal output, $c^1\mathbf{c^3}.c^2vc^3$, the affix is placed at the position /... $\mathbf{c^3}.c^2vc^3$/ and realized with a consonant as established in tableau (31) above. The base includes another consonant, c^1, which can serve as an onset of the prefinal syllable, i.e. $c^1\mathbf{c^3}.c^2vc^3$, and thus no additional copying is necessary. The same applies to the other two continuative patterns of the causative voice, $t.r\mathbf{c^2}.c^1vc^2$ and $c^1.r\mathbf{c^3}.c^2vc^3$. Placement of the affix is determined by α-HEAD and its realization as a consonant by the regular prosody of the language, namely, 1-V.

This concludes the main part of the analysis. To sum up, the simulfactive and continuative affixes are both specified to be a Root node. The only difference between the two is that in the simulfactive affix the Root node is further specified as /a/. Moreover, the two affixes obey a common placement constraint α-HEAD. The surface shape of the affix-base combination emerges from the interaction of α-HEAD with the regular prosody of the language, that is, mainly the constraints ONS and 1-V. Copying of segments is induced by the correspondence constraint DEP^{BR}. The number of copied segments is minimized because the segmental markedness constraints *PL/χ are ranked higher than the other basic correspondence constraint MAX^{BR}. Two more constraints, IDENT^{BR}(F) and SROLE, require identity in terms of featural composition and syllabic role between correspondent segments.

Some further refinements in the ranking of correspondence constraints are made possible by certain regularities noted by Benjamin. The first regularity is that a voiceless stop in the first position of a medial consonantal cluster undergoes nasalization in Northern Temiar and voicing in Southern Temiar. The effects of this regularity become evident in the formation of the continuative, as shown in (33a-b) below, where a base-final voiceless stop is copied and placed in preconsonantal position.

33. Coda Nasalization/Voicing

	Verb	Surface form
a. Northern Temiar	yaap 'to cry'	y**m**.yaa**p**
b. Southern Temiar	ʔɔɔt 'to fast'	ʔ**d**.ʔɔɔ**t**

I will assume that a constraint on codas is involved here, requiring that coda consonants be above a certain sonority level, and hence causing unvoiced stops to become nasalized when they are in coda position: COD-COND (see Itô & Mester 1993 on the details of how to formalize constraints like this in OT). This constraint is now in conflict with IDENT^{BR}(F) which requires copied segments to be featurally faithful to their correspondents. The required rankings therefore are COD-COND >> IDENT^{BR}(nasal) for Northern Temiar and COD-COND >> IDENT^{BR}(voice) for Southern Temiar.

Another regularity is that nasals assimilate to the place of articulation of a following stop. Examples are given in (34a-b) with the nasal-stop clusters underlined. Benjamin notes that there are 'exceptions' to this regularity, as shown by (34c-d). All examples are from the Northern dialect.

34. <u>Verb</u> <u>Gloss</u>

Verb	Gloss
a. ka<u>nd</u>eeʔ	'we (they and I)' (emphatic)
b. c.r<u>ŋ.k</u>ub naʔ	'that lid' (affix /n/ with the base cr.kub)
c. p<u>n.p</u>ət	'to long for' (continuative of the stem pət)
d. g<u>n.g</u>r.lut	'spindly-ness' (expressive of the stem gr.lut)

The interesting fact about these 'exceptions' is that they are attested precisely when the nasal consonant is derived by a copy of a base consonant, nasalized due to the ranking COD-COND >> IDENT^{BR}(nasal). The non-homorganic /n/ is a nasalized copy of /t/ in the continuative of (34c) and the expressive of (34d).[17] Thus when a copied segment is placed in the context where assimilation would normally occur, the segment retains its place identity, remaining faithful in this respect to its correspondent in the base. Assuming that nasal place assimilation is imposed by a constraint NC (as is widely assumed by e.g. Padgett 1996 and many others), these facts motivate the ranking IDENT^{BR}(PL) >> NC.[18]

These further refinements in the the ranking of the correspondence constraints provide support for one of the main analytical choices of Correspondence Theory of McCarthy & Prince (1995a). In particular, the featural identity requirement must indeed be seen as a family of constraints IDENT(F) for every feature F. This is required because the featural correspondence constraints are ranked differently. Identity of place features is more important than identity of other features such as voicing and nasality.

Finally, I will briefly comment on the gestural interpretation of the above analysis. Reduplication or segmental copying in a gestural representation literally duplicates the gestures of a segment. Although, so far, the analysis has been assuming the standard formulation of correspondence theory, built on the assumption that segments are made up of features, this is by no means the only way to state the constraints of the theory. If gestures, instead of features, are the representational primitives, then the constraints translate readily to corresponding gestural variants. Constraints that refer to the level of the segment, such as DEP^{BR} and MAX^{BR}, have identical formulations under gestural primitives, because I assume that Root nodes organizing gestures into segments are present in the representation. The difference lies in constraints referring to properties of the subsegmental level. Here, a constraint such as IDENT^{BR}(F) translates into a constraint that requires identity in terms of the gesture or the gestural parameter implementing the feature F. For example, faithfulness to place is faithfulness to the gestural parameter of constriction location (CL), faithfulness to [continuant] is faithfulness to constriction degree (CD), faithfulness to nasality is faithfulness to a gesture of velic opening etc.

Viewing correspondence constraints from a gestural perspective allows for an interesting interpretation of the constraint SROLE, which plays a major role in the above analysis. The generalization observed above and which SROLE has captured succesfully is that the syllabic position of the affix determines the choice of the copied consonant. If the affix is placed in the onset, then an onset consonant must be copied, but if it is placed in the coda, then a coda consonant must be copied. Assuming gestural representations, a gesture of a segment in the onset of a syllable will also have a release, in contrast to a gesture of a segment in the coda which is unreleased both syllable- and crucially word-finally in Temiar. Hence, preservation of syllabic role amounts simply to preservation of the release characteristics of the target (copied) gesture. This interpretation of SROLE makes interesting connections to work by Steriade (1993) on the importance of release and closure in phonology.[19] Pursuing these points any further is however beyond the goals of this chapter.

The next two sections further motivate and justify the correspondence approach to copying, comparing it with alternatives which use the additional mechanism of spreading to create copies of segments. Section 5 focuses on evidence from Temiar. Section 6 discusses cross-linguistic evidence.

5. TEMIAR IN PREVIOUS ANALYSES

In this section, I consider previous analyses of the Temiar verbal aspect, addressing the substantive differences between the proposed optimality theoretic solution and those earlier analyses. The focus will be on the analyses presented in McCarthy (1982), briefly also considering the analysis of Broselow & McCarthy (1983) and Sloan (1988). The common characteristic of all previous approaches is their use of templates and association rules, which map underlying melodic sequences to these templates, parameterized for whether association proceeds left-to-right or right-to-left. For brevity, I refer to this general approach as the 'Template and Association Approach' (henceforth TA). This section aims to show that templates are not necessary and that association rules miss certain significant factual generalizations in the data.

The analysis of Temiar in the TA approach assumes that copying in the simulfactive and continuative patterns is the effect of two entirely different mechanisms, namely, "spreading" and reduplication, respectively. Specifically, the analysis of the simulfactive stipulates a prosodic template CVCV(V)C whose first vocalic position is occupied by the simulfactive affix /a/. In (35), I consider the derivation of the biconsonantal base kɔɔw 'to call.'

35. kɔɔw → [kakɔɔw]

```
                          a
                          |
Prosodic Template:    C   V   C   V   V   C
                      |  ⁄        |⁄      |
                      k           ɔ       w
```

The base melody kɔɔw is first associated in a left-to-right (LR) direction to the positions of this template. The empty templatic second C of CVCV(V)C which remains unassociated after this first association step, is filled by spreading of the base-initial consonant /k/, an instance of LDC-spreading applying over the intervening vowel /a/. LDC-spreading is allowed because of the geometry of the representation, namely, segregation of the affix /a/ and the segments of the base /kɔɔw/ to two different planes. This representation is a special case of the planar segregation hypothesis requiring that different morphemes lie on different planes, introduced in McCarthy (1979) and extended later to V/C planar segregation in McCarthy (1989).

The derivation of the continuative patterns ($\mathbf{c^1c^2}.c^1vc^2$ and $c^1\mathbf{c^3}.c^2vc^3$) is more involved and uses a disparate number of mechanisms, given in (36).

36. a. Morphemic template: [Root Root]
    b. Prosodic template: CCCVC
    c. Continuative Association Rule: Associate the *last* element in the *first* copy of the root with the *second* C-position of the prosodic template. After this rule is applied, association proceeds left to right.
    d. Morphological Opacity: All segments of the base must appear in the output.

I briefly illustrate the use of these mechanisms with an example, the continuative of the verb s.lɔg 'to lie down', sg.lɔg. The morphemic template [Root Root] in (36a) stipulates that the output must consist of two copies of the base melody, i.e. [slɔg slɔg]. The segments in these two copies must then be associated to the prosodic template CCCVC of (36b). The association procedure must begin with a special association step, stated in the continuative association rule (36c), which essentially stipulates that the final segment of the first copy of the base must be linked to the second C position in the prosodic template, giving CgCVC. Association of the rest of the segments is then initiated in the unmarked left to right direction, and an additional provision, called Morphological Opacity in (36d), is required to derive the correct output, shown in (37) below.[20]

37. s l ɔ g → [s g l ɔ g]

	Prosodic Template:	C C C V C
	Morphemic Template:	s l ɔ g s l ɔ g
	Output:	[s g l ɔ g]

The main problem with this account is the continuative association rule in (36c). This rule is ad-hoc because it makes reference to arbitrary templatic positions, by stipulating that the *last* element in the *first* copy of the root melody associates to the *second* position in the template. It also misses a generalization evident in all continuative patterns. The second consonant in the outputs $\mathbf{c^1c^2}.c^1vc^2$ and $c^1\mathbf{c^3}.c^2vc^3$ is a copy of the base-final consonant because it is in a coda position, just like the base-final consonant. On the analysis proposed in the previous section, the decision of which consonant to copy does not require any ad-hoc rule of association, but follows from the universal correspondence constraint SROLE, requiring identity between the syllabic roles of the copied segment and its correspondent in the base.

Considering the simulfactive and continuative patterns together, the argument against the parametric rule-based approach can be tightened further. The crucial fact is that when the copied consonant is placed in onset position, the first consonant of the base is chosen, as in the case of the simulfactive in (38a) below. However, when the copied consonant is placed in a coda position, the final consonant of the base is chosen instead, as in the case of the continuative in (38b). Any TA approach needs two different rules of association with incompatible directional settings.[21] This misses the generalization evident in both aspects, which is directly captured by the correspondence approach, requiring that copied segments must have identical syllabic roles as their correspondents.

38.	Aspect	Output	Direction of Association
	a. Simulfactive	$\mathbf{c^1}$a.c^1vc^2	Left to right
	b. Continuative	$c^1\mathbf{c^3}$.c^2vc^3	Right to left

Broselow & McCarthy (1983) also use a special association rule to derive the continuative forms, although the mechanics of their analysis are slightly different. In particular, derivation of the continuative /s g l ɔ g/ is executed in the following way. A reduplicative infix C is inserted in the context C_CVC, i.e. /s _ l ɔ g/. This infix induces copying of the melody of the base, and "autosegmental association is stipulated to proceed from right to left," yielding /s g l ɔ g/ (Broselow & McCarthy 1983: p. 39). Finally, Sloan (1988) analyzes the continuative as involving the prefixation of a minor syllable consisting of two consonants, CC, to the base. A copy of the base melody is then created and associated to the CC template. Here again, in both cases, the first step of the association procedure is stipulatory, employing a "Special Association Principle" which associates "the rightmost element of the copy to the affixal template" (Sloan 1988: p. 321). Without considering the details of these analyses, it is clear that a considerable amount of stipulation is involved, missing the important generalizations captured by the general notion of correspondence.

Finally, another problem with TA approaches is the statement of the templates themselves. The latter stipulate that the outputs of the simulfactive and continuative aspects are the templates Ca.CVC and CC.CVC respectively. As seen in section 4, however, the presence of the first consonant in the simulfactive template Ca.CVC is required because the prefinal syllable, created by prefixing /a/ to the base c^1vc^2, must have an onset. This first C position of the template is thus not arbitrary and should not be stipulated as such. Similarly, in the continuative output CC.CVC, the second C position is the realization of an affixal Root node aligned at the left edge of the final syllable of the base, a property common to all simulfactive and continuative patterns. Moreover, the first consonant position in the template is required because, as in the simulfactive, the prefinal syllable must have an onset. The interaction of affixation with independent prosodic requirements of the language, such as ONS and 1-V, derives the shape of templates that previous analyses had to stipulate. This result is in the spirit of an 'a-templatic' analysis, in the sense that no templates are needed to stipulate the shape of the output or of the affix. Other a-templatic analyses have been presented for Yawelmani by Archangeli (1991), and for part of Arabic and Akkadian by McCarthy (1993). I return to discuss further this property of the analysis in the typological consequences of the elimination of LDC-spreading explored in section 7.

6. ON THE NEED TO ELIMINATE LDC-SPREADING

In this section I argue that the proposed reduction of LDC-spreading to copying via correspondence is not only possible, but also necessary. In 6.1, I reexamine the traditional argument for the need for both reduplication and LDC-spreading in the theory. In 6.2, I present independent evidence for eliminating LDC-spreading.

6.1 The Apparent Need for Reduplication and LDC-Spreading

The only argument that I can reconstruct for the existence of two separate mechanisms for creating copies of segments is based on some data of Hebrew and Arabic discussed in McCarthy (1979, 1981).[22] This argument will be first illustrated with the Temiar data, turning to the original data next.

Consider the derivation of the simulfactive of biconsonantals, kakɔɔw from kɔɔw 'to call', which was argued to employ LDC-spreading, as shown in (39a) below. The consonant /k/ automatically spreads to fill the unassociated position of the second consonant in the CaCVC template. All previous analyses of the simulfactive had assumed that spreading, as opposed to a reduplicative mechanism, was involved here because, as shown by the other simulfactive patterns (e.g. $c^1a.c^2vc^3$), copying does not always takes place.

39. a. Simulfactive

```
        a
        |
C  V  C  V  V  C
|           |
k           ɔ     w
```

b. Continuative

```
*C  C  C  V  V  C
          |     |
          k  ɔ     w
```

Output: [kakɔɔw]   Intended output: [kwkɔw]

On the other hand, the continuative pattern, kwkɔɔw in (39b), shows that spreading cannot be involved here, because it would create line-crossing. Hence, the other mechanism devoted to copying segments, reduplication, needs to be invoked, which is why the morphemic template [Root Root] is postulated for the continuative. This template stipulates that a copy of the whole Root must be created. The segments in the two copies of the Root are then associated to the continuative prosodic template CCCVC by a complex set of mechanisms whose details were discussed in section 4.

Turning now to the original data, a similar situation to that of Temiar exists in Arabic and Hebrew (McCarthy 1979, 1981). McCarthy notes that some quadriliteral verbs in Arabic are of the pattern $c^1vc^2c^1vc^2$, e.g. zalzal 'to shake', waswas 'to whisper' (some shared semantic feature of repetitiveness is claimed to underlie this class). This pattern of copying is not productive in Arabic, but the traditional grammar of Hebrew includes two binyanim, known as the Pilpel and the related reflexive Hitpalpel, which show the same pattern. Compared to the first binyan of a biconsonantal root, these binyanim show the patterns in (40) below.

40. Root:	gl		šʕ	
Binyan I	gālal	'to roll (intrans.)'	šāʕaʕ	'to be smeared'
Pilpel	gilgēl	'to roll (trans.)'	šiʕāšaʕ	'to stroke'
Hitpalpel	hitgalgēl	'to roll oneself along'	hištaʕāsaʕ	'to indulge oneself'

The analysis given in McCarthy (1979, 1981) uses LDC-spreading to derive the form of the first binyan (e.g. spreading of /l/ in gālal), but whole root reduplication to derive the form of the Pilpel and Hitpalpel (consisting of two steps: copying of the root gl and then mapping of the two copies <u>gl</u>, <u>gl</u> to the templates CVCCVC, and hitCVCCVC respectively). The point is again that cases like those of the Pilpel and Hitpalpel cannot be analyzed using LDC-spreading because line-crossing would result, while cases like that of Binyan I appear to require LDC-spreading because triconsonantal roots show no copying at all (e.g. gadal 'to grow'). This has led to the conclusion that two substantially distinct mechanisms are at work: LDC-spreading, in the simulfactive of Temiar and the first binyan of Hebrew, and reduplication proper, in the continuative of Temiar and Pilpel and Hitpalpel of Hebrew.

The crucial assumption on which the above conclusion is based is that the simulfactive of Temiar and the first binyan of Hebrew must involve LDC-spreading because, in both cases, triconsonantal roots do not show any copying at all. As was seen in the Temiar analysis, however, the fact that no copying takes place in the simulfactive of triconsonantals ($c^1a.c^2vc^3$) can simply be seen as the extreme case of gradient violation of the constraint MAX^{BR}. In Temiar, MAX^{BR} is ranked lower than the segmental markedness constraints, copying occurs only when required by constraints ranked higher than the markedness constraints, namely, the undominated ONS (e.g. $\mathbf{c^1}a.c^2vc^3$).[23] Hence the impasse of previous approaches comes from a rigid notion of reduplication, based on inviolable conditions, and is resolved by adopting a view in which reduplication, and the grammar in general, is based on violable constraints, the essence of Optimality Theory.[24]

Also, note that the assumption that two distinct mechanisms of copying are involved is clearly suspect given the simple fact that the alleged cases of LDC-spreading are descriptively similar to the cases of reduplication proper in important ways. For example, in the simulfactive, spreading would be needed to fill an empty C slot in the template CVCVC. In the continuative, the same need to fill the template CCCVC would exist. In both cases there would be a mismatch between the size of the underlying melody (number of segments) and the size of the output (number of prosodic positions). However, in the continuative, copying would not automatically by induced by this mismatch, but would be arbitrarily stipulated as a property of the output by use of the morphemic template [Root Root]. If, as proposed in this chapter, the mechanism responsible for the effects of LDC-spreading in the simulfactive is identified as the same mechanism used in the continuative, this problem disappears. Copying of base segments in both the continuative and the simulfactive follows from the unitary notion of correspondence as a response to the common need to fill positions in the output.

To summarize, I have shown that the assumption that reduplication cannot be involved in the simulfactive of Temiar and other similar cases is based on the fact that in some simulfactive outputs no copying of segments takes place. This assumption fails to recognize the identical conditions under which reduplication and LDC-spreading apply. On the proposal of this chapter, this problem disappears because LDC-spreading is reduced to the same formal mechanism involved in reduplication, that is, copying induced by correspondence. As shown, the notion of gradient violation of constraints is crucial in achieving the unification of both instances of segmental copying. At the same time, by obviating LDC-spreading, this proposal solves an independent set of problems also present in the theory which permits this kind of spreading, a point to which I turn next.

6.2 The Exceptional Status of LDC-Spreading

Virtually all discussions of the locality of autosegmental spreading in the feature-geometric research program ignore LDC-spreading or treat it as exceptional (see, for example, Clements 1985, Clements & Hume 1995, NíChiosáin & Padgett 1993). The reason for this is that these discussions focus on concatenative languages, where vowels and consonants are generally assumed to lie on the same plane (see Steriade 1987a for arguments), and thus the geometric premise of LDC-spreading, V/C planar segregation, does not apply. This section shows that even in nonconcatenative languages, where V/C planar segregation is assumed, the existence of LDC-spreading is problematic.

Expanding on a point raised in chapter 2, consider that under V/C planar segregation, the two consonants in a C_1VC_2 sequence are adjacent, as shown in (41a).

41. a. V/C Segregation b. /nap/ → [map] c. /pad/ → [bad]

a.
V-Root
|
X X X
| |
C_1-Root C_2-Root

b.
V-Root
|
X X X
| |
[coronal] [labial]

c.
V-Root
|
X X X
|
[voice]

This representation, (41a), blurs the distinction between biconsonantal clusters and pairs of consonants separated by a vowel, since, in both cases, the consonants are adjacent. Consequently, V/C planar segregation predicts assimilations between the two consonants in a CVC sequence, which are of the same type as those found between the two consonants of a CC cluster. For example, it is known that place assimilation and voice assimilation are very frequent in CC clusters. According to the prediction of V/C segregation, then, the comparable assimilations in CVC sequences, two examples of which are shown in (41b) and (41c), should also be attested. However, such phenomena are not attested at all, in either concatenative or nonconcatenative languages, as noted by Clements (1985: p. 46).[25] Hence, V/C planar segregation admits undesirable expressive power, predicting unattested phenomena like those of (41b-c). A different way of stating the same problem is that LDC-spreading and its geometric premise of V/C planar segregation fail to explain why "spreading" in this configuration always spreads the whole consonant. If, as I have proposed above, putative cases of LDC-spreading in fact involve the same mechanism underlying reduplication, this problem disappears. As in reduplication, copying targets the whole Root of the segment and not its isolated features.

Next, I briefly consider another argument that has been brought in support of phonologically motivated V/C segregation. McCarthy (1989) has argued that V/C segregation is the representational manifestation of underspecified linear order between consonants and vowels in languages where sufficiently rich constraints on the shape of the output render this ordering predictable (e.g. Semitic, Yawelmani etc.). The crucial assumption on which this argument rests is that underlying representation must contain only unpredictable information. In recent literature, there has been considerable work undermining the validity of this assumption, however, especially in OT and Burzio's constraint-based framework

(Prince & Smolensky 1993: Chapter 9; Burzio 1994; Inkelas 1994; Itô, Mester & Padgett 1996; McCarthy 1995; see also Steriade 1995a). The basic idea emerging from this work is that properties of lexical forms are not the result of arbitrary conditions on these forms, such as the assumption of the underspecification argument above, but falls out of the interaction of universal constraints. The arguments for specification of predictable information cover the entire range of lexical specifications, ranging from underlying specification of predictable distinctive features (Smolensky 1993, Inkelas 1994; Itô, Mester & Padgett 1996) and prosodic information (Prince & Smolensky 1993, Burzio 1994, Inkelas 1994), to specification of consonant-vowel ordering in languages previously thought to be prime candidates for V/C planar segregation (McCarthy 1995).

In addition, many cases of languages that have been assumed to employ V/C segregation in the past have been reanalyzed or argued to provide no evidence for this representation. Most notably, Steriade (1986), in what can be seen as a precursor of the proposal in this chapter, argues for an alternative account of the Yawelmani facts (Archangeli 1985) that does not rely on V/C segregation and uses melody copying, instead of spreading, to derive multiple copies of segments. Sharvit (1994) and Bat-El (1994) present an analysis of Modern Hebrew segmental copying, using no LDC-spreading (and hence obviating V/C segregation in this respect). Finally, McCarthy (1995) provides a reanalysis of Rotuman metathesis without using V/C segregation.[26] Hence, McCarthy's (1989) original argument for V/C segregation, quite plausible within its contemporary setting, is considerably weakened by more recent work.

To summarize the main point of this section, I have shown that the theory which admits LDC-spreading and its geometric premise of V/C planar segregation falsely predicts the existence of unattested long-distance spreading of individual features between the two consonants in a CVC configuration. The present proposal that the alleged instances of LDC-spreading are actually copying resolves this problem. I thus conclude that LDC-spreading and, as a result, V/C planar segregation should be eliminated. The next section examines the typological distinction between concatenative and nonconcatenative languages in light of this conclusion.

7. TYPOLOGICAL CONSEQUENCES

This section has two goals. The first is to show that the proposal of this chapter to analyze LDC-spreading as copying naturally extends to cases of segmental copying in Semitic languages as well. The second is to argue that the distinguishing characteristic of segmental copying found in nonconcatenative languages should be identified with a special mode of affixation, namely, a-templatic reduplicative affixation, where a reduplicative affix is not specified for any prosodic target. This special type of reduplication corresponds to an implicitly predicted case of affixation in the theory of Prosodic Morphology, which however has not been documented thus far. Its identification in the languages examined below, then, provides support for the analyses presented herein and for the theory of Prosodic Morphology itself.

7.1 Further Analyses

Consider the well-known Semitic pattern $c^1v.c^2v\mathbf{c^2}$, which is found in Modern Hebrew denominal formation, as in kod 'code' kided 'to codify', and also in the first binyan of the biliteral Arabic verbs, by far the most populated binyan in the lexicon of Arabic (see McCarthy & Prince 1990b for the actual counts). I will first present an analysis of this pattern in Modern Hebrew denominal formation, turning to the discussion of the Arabic pattern next.

Following Bat-El (1994), I assume that the base for the denominal formation is the corresponding noun and that the shape of the output must consist of two syllables, [σ σ]. In addition, I assume that the output must end in a consonant, due to the general canon of the verbal stems of Semitic, called Final Consonantality in McCarthy & Prince (1990b), henceforth FINAL-C. Essentially, this constraint further specifies the shape of the bisyllabic output.

One difference between the denominal output, $c^1i.c^2e\mathbf{c^2}$, and the patterns of copying in Temiar, e.g. $\mathbf{c^1}a.c^1vc^2$, $\mathbf{c^1c^2}.c^1vc^2$, is that the Temiar copied consonant(s) appear to the left of the base, while in the Semitic pattern they appear to the right. This is because the aspectual morphology of Temiar is exclusively prefixational: affixal material is prefixed to the prosodic head of the base. In the Semitic pattern, on the other hand, I assume that the morphology is suffixational. Specifically, I assume that denominal verb formation involves an undomitated constraint requiring that an affix must be aligned with the right edge of the prosodic output, ALIGN(Affix, R, PrWd, R), henceforth ALIGN^{AFX}. This affix, as in the case of Temiar simulfactive, will be partially specified for the melody /ie/, and will also be reduplicative in the sense that there is a correspondence relation between it and the base.

Before discussing the choice of the copied consonant, consider first another interesting fact about denominal formation. The output verb does not contain the input base vowel, which has been replaced by the vocalism of the affix. This phenomenon, called 'Melody Overwriting' (McCarthy & Prince 1990a, Bat-El 1994), has apparently been treated as an idiosyncracy of Semitic, implemented as a rule which literally substitutes the vocalism of the base with the vocalism of the affix. A more principled account exists, however, in the case at hand. If all vowels in the input, /o/ of kod, and /i,e/ of the affix, surfaced in the output, then there would be a violation of the undominated templatic constraint, requiring that the output must consist of two syllables (e.g. as in $c^1v[c^2i\mathbf{c^1}e\mathbf{c^2}]$). The vowel of the base does not appear in the output in order to avoid this violation, hence the ranking [σ σ] >> MAX$^{BASE\text{-}IO}$. The fact that no affix vowel gives its place to the base vowel in the output simply motivates the further ranking MAX$^{AFFIX\text{-}IO}$ >> MAX$^{BASE\text{-}IO}$.

Turning now to the issue of the copied consonant, recall that ALIGN^{AFFIX}-R demands that the right edge of the affix be aligned with the right edge of the output. This constraint, together with FINAL-C, dictates that a copy of a consonant be at the right edge of the output. A relevant set of candidates is considered in (42) below. ANCHORING, it will be recalled, requires that the right peripheral element of the reduplicative affix correspond to the right peripheral element of the base. The final consonant in the output must be a copy of some base segment because of DEP^{BR}, not shown in the tableau. More copies of segments of the base are avoided due to the undominated bisyllabic limit on the size of the output, i.e. [σ σ] >> MAX^{BR}.

42. /c^1vc^2, ie/ → $c^1i.c^2e\mathbf{c^2}$

Input: c^1vc^2, ie	ALIGN^{AFX}	ANCHOR	SROLE
a. ☞ $c^1i.c^2e\mathbf{c^2}$			*
b. $c^1i.c^2e\mathbf{c^1}$		*!	*
c. $c^1i.\mathbf{c^2}ec^2$	*!		*
d. $c^1i.\mathbf{c^1}ec^2$	*!		

Candidate (42a) copies the rightmost segment of the base, incurring a violation of SROLE, while candidate (42b) copies the leftmost consonant, violating ANCHORING and SROLE. Candidates (42c-d) violate the undominated ALIGN^{AFX} because the rightmost affixal segment /e/ is not aligned with the right edge of the prosodic output.

An account in similar terms can be given for the alternative pattern, $c^1vc^2.\mathbf{c^1}v\mathbf{c^2}$, which is selected arbitrarily by some biconsonantal verbs of Modern Hebrew. This pattern is also found in the Pilpel and Hitpalpel of Classical Hebrew, and with a limited number of verbs in Arabic (e.g. zalzal 'to shake'), as discussed in section 6. I assume that verbs which follow this pattern conform to a bisyllabic prosodic target which is further specified to be a sequence of two heavy syllables (see Bat-El 1994 for an alternative analysis). All other constraints are as in the analysis given in text. The greater capacity of the prosodic target allows, in this case, for both consonants of the base to get copied.

In the above analysis I have assumed that the base of denominal formation is the corresponding noun form. This is by no means a necessary assumption. A similar analysis could be given if we assumed, following tradition, that the input to denominal formation consists of the consonantal root /c^1c^2/ and the vocalic affix /ie/. The only difference would be that constraints which make reference to the base must now refer to the consonantal root instead. For example, ANCHORING would now require that the right element of the affix correspond to the right element of the root. Everything else would remain the same. Such an analysis would be applicable, for example, in the case of the $c^1vc^2v\mathbf{c^2}$ pattern found in the biliteral verbs of the Arabic first binyan, e.g. sama**m**. I return to this point in the discussion of the OCP below.

It should be pointed out, however, that the role of the traditional concept of a consonantal root like /c^1c^2/, a peculiarity of Semitic languages, has been significantly reduced in recent analyses in the framework of Prosodic Morphology (McCarthy & Prince 1986 et seq.). Specifically, Bat-El (1994) argues that Modern Hebrew morphology, in fact, need make no reference to such a concept. All morphology is word based and no mapping operations of consonantal roots to templates are needed.[27]

Also, the analysis of the Arabic broken plurals in McCarthy & Prince (1990a) makes no reference to consonantal roots. Most importantly, McCarthy (1993) presents a significant revision of the earlier analysis of the Arabic verbal morphology of McCarthy (1979, 1981). In the new analysis, there is only a single remaining case where reference to a consonantal root is required. This is the case of first binyan of biliteral and triliteral verbs, <u>samam</u>, <u>faʕal</u>, respectively, which are still formed from the traditionally assumed consonantal roots /sm/ and /fʕl/, mapped onto an iambic template (with a required final consonant).[28] McCarthy argues that there are no other templates and hence no other mapping operations of a consonantal root to a template. All other surface forms of the verb derive from the basic first binyan form by affixation, and in some cases by circumscription of a prosodically defined subconstituent of the base. This analysis constitutes, as McCarthy (1993) notes, a significant departure from the earlier analyses in McCarthy (1979, 1981), where a different template was posited for every binyan. Note that the mere existence of a morphological distinction between consonants and vowels in Semitic does not in itself entail a representational distinction in terms of V/C segregation. Vowels and consonants are already distinct by virtue of being different classes of sounds. The morphology may just as well make reference to that distinction directly. Hence, in the output pattern c^1i.c^2e$\mathbf{c^2}$ discussed around tableau (42) above, the affix is purely vocalic, /ie/, and the characteristic 'peculiarity' of Semitic languages in intercalating vowels and consonants in their output forms follows from appropriate constraint ranking as argued, requiring no geometric devices.

A final point relates to the role of the Obligatory Contour Principle in Arabic (McCarthy 1979: p. 238). As is well-known, Arabic has an absolute prohibition against the so-called 'geminate' roots beginning with two identical initial consonants, as in *sasam, although it appears to allow roots ending with two identical consonants, as in samam (Greenberg 1950, McCarthy 1979, 1986, 1988). This skewed distribution is explained in McCarthy (1979: p. 263) on the basis of two assumptions. First, underlying forms are subject to the OCP, which prohibits roots with two adjacent identical consonants (*ssm, *smm). Hence, the underlying form of samam must be sm. Second, in mapping this biconsonantal root to a triconsonantal CVCVC template, a rule of rightward LDC-spreading spreads the final consonant to give samam. Clearly, this analysis is not available under the present proposals for two reasons. The first reason is that in OT constraints applying strictly on underlying forms, such as the original conception of the OCP noted in McCarthy's first assumption above, are not part of the grammar. The second reason is that I have argued that LDC-spreading, the mechanism employed under McCarthy's second assumption above, should be eliminated from phonological theory.

An alternative explanation for the skewed distribution of the geminate roots is available in the present context, however. This explanation rests on one key aspect of McCarthy's original proposal, which was that the OCP applies only for identical segments within a morpheme (McCarthy 1979: p. 237). The important shift in perspective is that the OCP will be viewed as constraint that applies on the output instead of the underlying form. Recall that the $c^1vc^2v\mathbf{c^2}$ pattern is derived by suffixation of a reduplicative affix which induces copying of the /c^2/ consonant, whose placement at the end of the word follows jointly from the two constraints ALIGN$^{\text{AFFIX}}$-R and FINAL-C discussed earlier. The crucial point is that the two instances of /c^2/ will not incur an OCP violation because the first instance of /c^2/ is part of the root and the second instance of /c^2/ is part of the reduplicative suffix, two different morphemes in the output. Turning to the non-permitted $c^1vc^1vc^2$ pattern, the only way that this pattern could surface would be from a triconsonantal root with two identical first consonants (i.e. $c^1c^1c^2$), because there is no corresponding reduplicative prefix to create a copy of /c^1/. The output form $c^1vc^1vc^2$, then, would incur a violation of the OCP, because the two instances of /c^1/ would have to be part of the same morpheme. Assuming that the OCP is undominated, that violation would be fatal and the null parse would be preferred (see Prince & Smolensky 1993 for a discussion of null parse).

To sum up, the main analysis of Semitic copying proposed in this section requires no use of V/C segregation or LDC-spreading. This result further secures the conclusion that LDC-spreading and V/C segregation can and should be eliminated as previous sections of this chapter have demonstrated. Putative cases of LDC-spreading are thus literally copying, the same phenomenon found in the reduplicative morphology of many languages (Ancient Greek, Diyari, Panopean etc.). It follows, then, that the distinction between concatenative and nonconcatenative languages is not statable in terms of the special phonological mechanisms of V/C segregation and LDC-spreading, but must rather be expressed differently, a task that I take up next.

7.2 A-templatic Affixation

In the theory of word formation, the program of Prosodic Morphology (McCarthy & Prince 1986 et seq.) has established as one of its central claims that grammatical categories are often expressed by invariant prosodic shapes or templates. These templates are made out of the units of prosody, namely syllables, feet, and prosodic words. As McCarthy & Prince (1995b) show, there are two well-documented species of templatic specification of morphological constituents: templatic specification of the affix and templatic specification of the base.

Templatic specification of the affix is found in ordinary reduplication, where the reduplicative affix is specified for an invariant shape corresponding to some unit of the prosodic hierarchy. For example, as shown below, two reduplicative affixes of Ilokano are specified to be a light syllable in (43a) and a heavy syllable in (43b) respectively (data drawn from McCarthy & Prince 1995b).

43. a. Affix σ_{μ}	Base	si + σ_{μ} + base	Gloss ("filled with")
	bu.neŋ	si-**bu**-bu.neŋ	"carrying a buneng"
b. Affix $\sigma_{\mu\mu}$	Base	$\sigma_{\mu\mu}$ + base	Gloss (plural)
	pu.sa	**pus**-pu.sa	"cats"

Examples of templatic specification of the base were seen in the analyses of the Semitic patterns above, where a bisyllabic requirement was imposed on the shape of the output in the case of Modern Hebrew denominals. Another case of base templaticism is found in Yawelmani, where the shape of the surface form is determined by a set of prosodic templates applying to some initial part of the stem (Archangeli 1991), as shown in (44). The initial templatically specified part of the stem is in boldface and the given forms abstract away from regular rules of epenthesis, closed-syllable shortening, and rounding harmony (c' is a glottalized c. Data drawn from McCarthy & Prince 1995b).

44.	$\underline{\sigma_{\mu\mu}}$	$\underline{[\sigma_{\mu}\ \sigma_{\mu\mu}\ ]^{\text{Iamb}}}$	Gloss
CV shape	CvvC	CvCvv	
Biconsonantal	**c'uu**m	**c'umuu**	'devour'
Triconsonantal	**hii**wt	**hiwii**t	'walk'

In the forms under $\sigma_{\mu\mu}$, a bimoraic parse is imposed on the first syllable of the output, while in the forms under $[\sigma_{\mu}\ \sigma_{\mu\mu}\ ]^{\text{Iamb}}$, an iambic parse is imposed instead (see McCarthy 1993 for other examples of templatic specification of the base from the noun and verbal morphology of Arabic).

As expected, there are also cases where the morphology specifies no template at all, a special mode of prosodic morphology, known as a-templatic prosodic morphology (Archangeli 1991, McCarthy & Prince 1990b). In the Ethiopian Semitic language Chaha, for example, verbal bases in the morphological category called jussive surface in two forms CCəC or CəCC, as shown in (45), where yä is an agreement prefix (data drawn from McCarthy 1993).

45. Root	Jussive Verb	Gloss
a. gfr	yägfər	'release'
b. nks	yänkəs	'bite'
c. srt	yäsərt	'cauterize'
d. trx	yätərx	'make incision'

The choice between the two forms is entirely predictable from the regular syllabification of the language. The jussive morphology then specifies no template on the surface form of the verb. Other examples of a-templatic base specification can be found in Yawelmani (McCarthy & Prince 1995b), Arabic and Akkadian (McCarthy 1993).

So far, then, the literature on prosodic morphology has documented the following three cases of prosodic specification or lack thereof:

templatic specification on the affix (as in ordinary reduplication), templatic specification of the base (as in Semitic, Yawelmani etc.), and no templatic specification of the base (as in Chaha). A fourth case is therefore predicted to exist, namely, no templatic specification of the affix. This is precisely the common characteristic of affixation in the analyses of the Temiar aspect and of the Semitic patterns discussed above. The reduplicative affixes in these analyses have no prosodic requirement on their shape, although they may be partially specified segmentally. For example, the simulfactive of Temiar and the denominal affix of Modern Hebrew are specified as /a/, /ie/, respectively. No prosodic constraint is imposed on the shape of these affixes, however. Similarly, in the continuative of Temiar, no prosodic template is imposed on the affix, and in addition the affix also lacks segmental specification. Reduplicative affixation of this type is therefore one specific mode of word formation among those expected according to the theory of Prosodic Morphology. Indentifying examples of this mode of affixation here supports the specific analyses presented in this chapter and the program of Prosodic Morphology itself.

Lack of prosodic specification on the part of the reduplicative affix explains a descriptive dissimilarity between ordinary reduplication and reduplication of the sort discussed in this chapter. In ordinary reduplication, the affix is realized as a contiguous string of base segments parsed in some prosodic unit (syllable, foot, or prosodic word), which is arbitrarily specified by the morphology (e.g. σ_{μ}, $\sigma_{\mu\mu}$ affixes of Ilokano). On the other hand, the reduplicative affixes discussed in this chapter are realized with copies of isolated segments of the base, in various shapes and quantities. For example, the simulfactive of Temiar copies one or none of the consonants of the base, while the continuative affix copies one or two consonants of the base. The elusive realization of these affixes is simply a consequence of their lack of a prosodic target. Without a prosodic template of their own, matters of realization of these affixes are left to be determined by constraints regulating the prosody of the language (ONS and 1-V in Temiar), or of the particular morphological category involved ([σ σ] in Semitic).

8. SUMMARY AND CONCLUSION

I have argued that in the phonological component of the grammar there is no place for an operation that spreads a consonant over a vowel (LDC-spreading), with its geometric premise of V/C planar segregation. The theory admitting these two mechanisms fails to explain why LDC-spreading always targets whole segments, predicting unattested spreading of individual features over a vowel. I have proposed to replace LDC-spreading with the same formal mechanism underlying reduplication, namely, correspondence-induced segmental copying, which is independently needed in the theory. What was formerly seen as LDC-spreading is now literally copying. Copying, as in reduplication, targets the whole segment, not its individual features. Hence, the excessive power that the theory admitting LDC-spreading and V/C planar segregation would have is avoided, while at the same time the obvious redundancy between LDC-spreading and reduplication is eliminated.

Temiar is a nonconcatenative language for which both LDC-spreading and reduplication were considered necessary to account for its intricate patterns of copying. I have shown that using the notion of Correspondence in Optimality Theory it is possible to provide a unified account of the copying patterns in the verbal morphology of the language. Copying of segments is induced by a correspondence relation holding between the segments of the base and the segments of a reduplicative affix. Constraints requiring the featural (IDENT(F)) and prosodic identity (SROLE) between correspondent segments evaluate the quality of this correspondence relation. The interaction of these constraints with others expressing general prosodic regularities of the language suffices to account for the full range of patterns.

I have shown that any derivational approach to the facts of Temiar is bound to miss significant generalizations directly captured by the Optimality theoretic approach. The choice of the copied consonants is one such important generalization. It was shown that a derivational approach would require two separate association rules with incompatible directional parameter settings. In the Optimality theoretic approach, on the other hand, the choice of the copied consonant(s) is determined by a single universal constraint, SROLE, and not by language-particular rules of association. In this and other respects, the facts of Temiar support the Optimality theoretic conception of phonology-morphology interaction, where the parallel application of phonological and morphological constraints determine the form of the output.

The proposal to replace LDC-spreading with copying via correspondence was shown to apply to some of the basic patterns found in Semitic languages as well. I have also argued that the distinction between concatenative and nonconcatenative languages cannot be encoded in terms of the mechanisms of LDC-spreading and V/C planar segregation. Phonologically speaking, there is nothing special to nonconcatenative languages. The descriptive dissimilarity between the types of segmental copying found in nonconcatenative languages and those found in ordinary reduplication follows from the mode of affixation. Nonconcatenative segmental copying is simply a-templatic reduplicative affixation, where the reduplicant is not specified for any prosodic target. This type of reduplicative affixation, in fact, corresponds to an implicitly predicted case of affixation in the theory of Prosodic Morphology.

Relating the results of this chapter to the central thesis of this dissertation, we saw that pursuing the implications of Articulatory Locality in Prosodic Morphology has surprising and welcome consequences for the theory.

9. EXCURSUS ON MINOR SYLLABLES

In the analysis of Temiar verbal morphology in section 4, I employed a constraint 1-V which prohibits words with more than one vowel and thus disallows copying of base vowels in the morphology of the language. In introducing 1-V, I pointed out that this constraint is meant as a cover name for the set of constraints that are likely to underlie this salient generalization of Temiar and many other South-East Asian languages. In this section, I introduce a conception of syllable weight that will helps us in better understanding this property of South-East Asian languages.[29]

In terms of their syllabic composition, the canonical word structure in South-East Asian languages consists of a heavy syllable which is optionally preceded by a voweless syllable made up of one or two consonants. Examples are shown in (46) from three different languages: Kammu (Svantesson 1983), Temiar (Benjamin 1976), and Burmese (Wheatley 1987). The words in the first three rows are monosyllabic. In the following rows, words consist of a major syllable preceded by a minor one. Data are drawn from the primary sources cited earlier for Kammu and Temiar, and from Green's (1995) discussion of Burmese (who cites Wheatley 1987 along with some other sources).

46.

Kammu		Temiar		Burmese	
ŋar	'cold'	kɔɔw	'to call'	mɛʔ	'crave'
maam	'blood'	caaʔ	'to feed'	mye:	'earth'
klaʔ	'husband'	gal	'to sit down'	ʃauʔ	'address'
tr.ʔoʔ	'to crow'	sə.lɔg	'to lie down'	kə.lɛʔ	'be wanton'
p.cuur	'to lower'	tə.lɛk	'to teach'	θə.yɔ:	'mock'
k.toŋ	'egg'	cɛb.niib	'going'	k^hə.louʔ	'knob'

For the words in (46b), also called 'sesquisyllabic' (Matisoff 1978), I follow the individual sources in the way minor syllables are transcribed. For example, although Svantesson notes that there is a transient schwa-like vowel in the minor syllable of p.cuur 'to lower', he does not transcribe it. Benjamin, on the other hand, chooses to transcribe minor syllables consisting of only one consonant as [Cə], and those consisting of two consonants as [CɛC] (see the discussion of this transcription in section 4). For Burmese, which only allows minor syllables with one consonant, Green always transcribes minor syllables with a schwa. Putting aside these differences in individuals' preferences in transcription, it is generally accepted that the qualities of the surface vowels in minor syllables are not phonologically specified. To simplify matters, in what follows I will just use CC for biconsonantal minor syllables, and C for monoconsonantal minor syllables.

With a few exceptions, minor syllables have not received any serious consideration in the literature. By far the most relevant previous discussion of such syllables is that of Shaw (1993) who was first in attempting to incorporate minor syllables into the moraic model of syllables (Hyman 1986, Selkirk 1980, McCarthy & Prince 1986, Hayes 1989, Itô 1989). For Semai and Kammu, Shaw proposes that monoconsonantal minor syllables be assigned no mora, and that biconsonantal minor syllables be assigned one mora, as shown in (47b). Two other proposals about the prosody of minor syllables are shown in (47) for completeness. In (47a), I show the representations assumed in Sloan (1988), who discusses the morphology of some languages with minor syllables (Kammu, Semai and Temiar), but she is not concerned with what the prosodic structure of these syllables is. Finally, Green (1995), discussing aspects of Burmese prosody, assigns one mora to the minor syllables, which in Burmese can only consist of one consonant, as in (47c) below.

47.

a. Sloan 1988	b. Shaw 1993	c. Green 1995
σ σ	σ σ	σ
C CC	C Cμ	Cμ
	C	ə

Sloan does not relate her representations to the moraic model, making it hard to evaluate any predictions of her proposal. Shaw's and Green's proposals, on the other hand, assign minor syllables the same weight as light CV syllables, which are also monomoraic. This, however, fails to capture a salient generalization in all these languages: CV light syllables are not found in underived items and are patently avoided in morphological derivations. For underived words, I pointed out earlier that the canonical prosodic structure is that of a major syllable optionally preceded by a minor syllable (see 46 above): words of the shape CV.CV(:)C, in which all vowels are fully specified, are not found, in contrast to words of the shape C.CV(:)C and CC.CV(:)C which are very frequent in these languages. In morphological action there are various ways in which the creation of CV syllables is avoided. One specific example in discussed below.

In Burmese, when a compound word is formed by concatenating two other words, the major syllable of the first word is reduced to a minor syllable in the output, and the second constituent word appears intact. Examples are shown in (48) below (data are from Green 1995). The compound, then, conforms to the prosodic canon of a major syllable preceded by a sequence of minor syllables. If C minor syllables were monomoraic as simple CV syllables are, there would be no explanation for why the output in (48a) is not [ca.bo:], where only the moraic coda is left unparsed in the output. Under the pressure of faithfulness constraints, such an output would be preferable. The conclusion is that the prosody of the language treats CV syllables and minor syllables, C, differently.

48.

Word$_1$		Word$_2$		Compound	
a. caŋ	+	po:	→	cə.bo:	'floor + insect, bug'
b. ɳa:	+	ʔu:	→	ɳə.ʔu:	'fish + egg: fish-spawn'
c. θwa:	+	ye:	→	θwə.ye:	'tooth + juice: saliva'
d. kəla:	+	pye:	→	kə.lə.bye:	'Indian + country: India'
e. təmiŋ	+	ye:	→	tə.mə.ye:	'rice + water: rice-water'

To sum up, there are at least three types of syllables which are treated differently by the prosody of these languages. There are minor syllables like the C of Burmese and CC of Temiar and Kammu, which do not have the same distribution as CV syllables. The latter do not even occur in the languages examined and are patently avoided when morphological action takes place. There are also major syllables which can be either CV: or CVC. Hence, a three way distinction between syllable types seems to be necessary: C or CC minor syllables, CV syllables, and major syllables (CVC, CV:). As seen above, this distinction is not captured by assignining to the minor syllable C in Burmese the weight of one mora.

The question, then, is: what is the weight of minor syllables? I propose that minor syllables lie at the lower end of a prominence scale of syllabic weight, a scale which incorporates more than the binary light-heavy distinction. This scale is shown in (49) below at the bottom of the prosodic hierarchy (McCarthy & Prince 1986 et seq.). Minor syllables consisting of just one consonant are the lightest. They have minimal prominence. These syllables are followed by CC minor syllables, CV syllables and so on. I have not indicated a weight distinction between CVC syllables and CV: syllables because so far in my limited survey of South-East Asian languages I have not encountered any evidence for such a distinction. It is likely though that such a distinction will eventually be necessary.

49. Scalar conception of syllabic weight

PrWd
|
Ft
|
σ

CV:C > {CV:, CVC} > CV > CC > C

Of course not all languages employ the whole repertoire of weight distinctions. Burmese, for example, does not have CC minor syllables but as shown earlier it does exhibit a distinction among the 'major' syllables CVC, CV:, the CV syllable, and the 'minor' C syllable. Temiar, on the other hand, illustrates the distinction between the two types of minor syllables, CC and C, missing in Burmese, while collapsing the distinctions at the other end of the scale: {CV:C, CV:, CVC} > CV > CC > C (see Gafos 1996).

Though the proposal for a scalar weight scale is in its current form tentative, it seems promising in that it provides a simple way to interpret certain phenomena in a principled way. In particular, consider a prediction of this proposal, that if weight is scalar, we expect that some prosodic constraints are relativized according to the weight scale. For example, the Parse-σ-to-Ft constraint of Prince & Smolensky (1993), requiring that syllables be parsed into feet, could be relativized according to weight so that an unfooted heavier syllable incurs a worse violation than an unfooted lighter syllable. This is shown in (50) below.

50. Weight relativized Parse σ-to-Ft hierarchy
    Parse-CV:/CVC-F >> Parse-CV-F >> Parse-CC-F >> Parse-C-F

In other words, we expect that syllable parsing into feet respects the weight prominence of syllables. This prediction is borne out in a variety of languages. To give a few examples, Cohn & McCarthy (1994: p. 21) discussing the prosody of Indonesian propose a constraint Non-Foot(ə) which states that schwa-headed syllables have no metrical projection. Burzio (1994) argues that in English word-final position there is a class of 'weak' syllables consisting of consonants followed by a liquid (CL) or consonants followed by high vowels "which simply may or may not be metrified" (p. 68). Finally, Kager (1990) proposes an analysis of Dutch stress which assumes that the Dutch schwa lacks a weight element. Rather than reflecting language-particular prosodic properties, these individual proposals support the prediction that footing of syllables respects the weight prominence of the syllables. Note also that the behavior of liquids and high vowels in English indicates that the sonority of segments plays a role in the prominence of the syllables in which they belong. In general, we expect syllables with more sonorous segments, and hence more acoustic energy, to be heavier than syllables with less sonorous segments (Burzio 1994, Gordon 1996).

Based on this scalar conception of weight it is now possible to better understand the prosodic structure of words in South-East Asian languages. Feet in these languages must be monosyllabic (cf. Green 1995); this is the minimal structure of a foot because one syllable is the minimum number of syllables per foot. I take syllables outside the monosyllabic foot not to be footed but to be directly parsed into the prosodic word. This is shown in (51). The constraint on the top of this structure, LX≈PRWD (Prince & Smolensky 1993: p. 101) requires that every lexical word must correspond to a prosodic word. The rest of (51) shows the structure within this prosodic word.

51. Weight structure of South-East Asian word

LX≈PRWD

σ Ft

Lighter prefinal syllable

due to *Parse σ-to-Ft* σ

The unfooted syllables incur violations of the weight-relativized Parse-σ-to-Ft hierarchy. To minimize the Parse-σ-to-Ft violations, these syllables tend to be less prominent, lying on the lighter side of the weight scale. Hence the canonical South-East Asian word structure, where a 'minor' syllable precedes a 'major' syllable. This is the generalization that 1-V is meant to capture.

Let me now discuss briefly the allomorphy of the causative affix, which was left unaccounted for in the analysis of section 4. In the perfectives of the causative voice shown below, the causative affix is realized as /tr/ in the case of the perfective of biconsonantal bases, i.e. $c^1r.c^2vc^3$, but as /r/ in the case of triconsonantal bases, i.e. $c^1r.c^2vc^3$.

52. Causative Voice	Biconsonantal	Triconsonantal
Base (Act. Perf.)	c^1vc^2	$c^1.c^2vc^3$
	kɔɔw 'to call'	s.lɔg 'to lie down'
Perfective	$tr.c^1vc^2$	$c^1r.c^2vc^3$
	tr.kɔɔw	sr.lɔg

This allomorphy is driven by prosodic requirements. Assuming that underlyingly the affix is /tr/, the alternative candidate for a triconsonantal base, $c^1.tr.c^2vc^3$, with full expression of the affix, has one more minor syllable than $c^1r.c^2vc^3$. According to the assumption that minor syllables are not parsed into feet, this extra minor syllable causes an additional violation of a constraint in the Parse-σ-to-Ft hierarchy (Parse-C-to-F). For convenience, let us call this constraint *MINOR. To avoid the extra violation of *MINOR, part of the causative affix /tr/ may be left unparsed. In particular, /t/ will remain unparsed because /r/ is a more sonorous segment and thus a better coda than /t/. Also, affix allomorphy is preferred to base allomorphy. In terms of constraint ranking this means, MAX^{Base} >> *MINOR >> $\text{MAX}^{\text{Affix}}$ (cf. McCarthy & Prince 1994a).

To summarize, I have proposed a conception of syllabic weight as a scale incorporating the following distinctions of prominence, from heaviest to lightest: CV:C > {CV:, CVC} > CV > CC > C. I have argued that some constraints of the grammar in fact reflect this scale of weights. This proposal allows us to better understand the basic prosody of Temiar and other South-East Asian languages, while at the same time capturing generalizations about syllabic parsing that apply to other unrelated languages as well. I leave further exploration of this proposal for future research.

NOTES

1. A first version of this chapter was circulated as Gafos (1995c). On the core idea of the chapter, the elimination of long-distance consonantal spreading, the article published as Gafos (1988 a) offers detailed analyses, further justification of the correctness of this elimination, and discussion of its most direct implications for morphophonology. Other works building on the main result of Gafos (1988a) includes Rose (1997, to appear) and Berent, Everett & Shimron (submitted). Further implications for the notion of template in reduplicative morphology have been explored in the article published as Gafos (1998b).

2. This chapter makes no claims about the representation of true geminate consonants, generally assumed to involve double linking between two skeleton-adjacent positions. It is only long-distance geminates that I argue should not be represented as doubly linked structures. See Itô & Mester (1993) on the status of true geminates in OT.

3. On the motivation for revising the original OT PARSE/FILL conception of faithfulness in Prince & Smolensky (1993) and McCarthy & Prince (1993a), see McCarthy & Prince (1995a) and McCarthy (1995).

4. It is to be kept in mind that an independent set of the same constraints holds for the Input/Output correspondence relation, namely, MAX^{IO} and DEP^{IO}. For extensions of correspondence theory to faithfulness relations between output forms see Benua (1995), Flemming & Kenstowicz (1995), and McCarthy (1995) (cf. Burzio 1994).

5. See Jenner (1969) on Khmer, Svantesson (1983) on Kammu, and Henderson (1952) on Kambodian.

6. See Diffloth (1976b,c) for brief descriptions of Semai and Jah-Hut respectively. It is clear from these descriptions that the morphologies of Jah-Hut and Semai are very similar to that of Temiar. Finally, Nicole Kruspe at the University of Melbourne, currently involved in fieldwork on the South Aslian language Semelai, informs me of the close similarities of this language to Temiar.

7. Southeast Asianist James Matisoff who introduced the term 'sesquisyllabic' (meaning, one and a half syllables, Matisoff 1978) for words like s.lɔg 'to lie down' also agrees with this interpretation of minor syllable vowels (p.c., May 20, 1995).

8. This allomorphy will not be dealt with in this chapter. It is discussed in an excursus in section 9.

9. The alignment constraint on the placement of the affixes in Temiar essentially requires that the Root node of the affix be in the rime position of the prefinal syllable. Hence, in operational terms, the aspectual morphology of Temiar can be seen as the addition of a mora to the base. Lombardi & McCarthy (1991) have argued on the basis of cross-linguistic evidence that the "theory must recognize an operation of mora prefixation" (1991: p. 61). This operation is found in two Muskogean languages, Choctaw and Alabama, and also in two Austronesian languages Balangao and Keley-i. In these languages, as in Temiar, the added mora is also realized with segmental material of the base.

10. These data also show the effects of a nasalization rule turning voiceless stops to nasals in preconsonantal position. In the particular example, reɲrec, the copied /c/ nasalizes to /ɲ/ before /r/. This alternation in combination with another rule of nasal assimilation will be discussed in the analysis of the continuative aspect.

11. Parts of the analysis presented in this section have appeared in Gafos (1995a,b).

12. Compare this to a parametric theory of unviolable conditions and repair strategies, where constraints are either "on" or "off" for the whole language (Paradis 1988). In such a theory this situation cannot be coherently characterized. ONS, for example, is "on" for every syllable in Temiar, i.e. it is never violated. Other constraints, however, like 1-V may be violated under certain conditions.

13. *PL/χ is, in other words, the encapsulation of the Markedness Hierarchy. See Prince & Smolensky (1993: §8.4).

14. A variant of this candidate, $\mathbf{c^1v.c^2}$a.c^1vc^2, avoids the onsetless syllable but causes a fatal violation of another undominated constraint, SROLE, to be introduced below.

15. This, in fact, has been suggested in the analysis of Broselow & McCarthy (1983).

16. I assume, of course, a superordinate constraint that requires empty Root nodes in the input to be filled with segmental material, technically $\text{FILL}^{\text{Segment}}$ or $\text{FILL}^{\text{Place}}$ of Prince & Smolensky (1993), section 9.1.2.

17. Expressives in Temiar and other Aslian languages employ similar types of affixation and copying as found in the verbal morphology of the language (see Diffloth 1972, 1976a,b).

18. Compare this with Makassarese (McCarthy & Prince 1994b), which has the same constraint on place assimilation of nasals, but the reduplicated form bulam-bulaŋ 'months' (where m corresponds to ŋ) shows that the inverse ranking is involved, i.e. NC >> IDENT(PL).

19. See Saussure's informative discussion of the terms 'adduction', 'abduction' in the appendix on physiological phonetics of his *Cours de linguistique générale* (Saussure 1986: pp. 50 ff.).

20. The motivation for Morphological Opacity (MO) is that after the application of the Continuative Association Rule there are only three available C positions in the template CgCVC but five unassociated consonants underlined in the melodic sequence s l ɔ g s l ɔ g. MO thus excludes possible outputs like s g s ɔ g, where/l/ remains unassociated. Notice that MO is a constraint on the output of the derivation, and essentially a predecessor of MAX^{IO}, one of the undominated constraints of the OT analysis proposed earlier.

21. An alternative mode of association in the TA model does not help either. Yip (1988) has proposed an edge-in linking mode, in which the segments at the edges of a copied melody are first linked to the positions at the edges of a template. One of the continuative patterns, $\mathbf{c^1c^2}$.c^1vc^2, suggests edge-in linking, assuming that the template is some sort of

reduplicative heavy syllable. However, edge-in linking does not help in $c^1\mathbf{c^3}.c^2vc^3$, where only one consonant gets copied.

22. It should be mentioned that the arguments in this section, especially those against the distinction between reduplication and LDC-spreading in McCarthy (1979, 1981), are not meant to underscore weaknesses in the specific analyses in question but rather the limitations of the general framework those analyses presupposed, which obscured the similarities between LDC-spreading and reduplication.

23. For the Hebrew patterns, it will be shown in section 7 that the size of the bisyllabic template imposed on the output, rather than the segmental markedness constraints, determines the number of copied segments.

24. This argument is inspired by Padgett's work, especially the discussion in his 'Feature Classes' theory of featural organization. The idea there is that constraints that require the spreading of a feature class, while mentioning the class as a whole in their statement, spread its individual members. If the class spreading constraint is violable, it becomes possible to spread less than the totality of the features in the class, widening the empirical coverage of the theory by capturing phenomena of 'non-constituent' spreading. Such phenomena were problematic for past rigid notions of class spreading, where classes of features had to spread as a whole. See Padgett (1995, 1996) for details.

25. Place features of consonants, it has been argued, spread over vowels in the case of consonant harmony systems, where the harmonizing features are usually those classified under the coronal place of articulation (Shaw 1991). This does not affect the argument in the text. Even under traditional assumptions, consonant harmony does not require V/C planar segregation but instead employs tier segregation, where the Roots of vowels and consonants are on the same plane but their features may lie on different tiers. In contrast, in past theories LDC-spreading requires V/C planar pegregation, because "spreading" targets the whole segment. For consonant harmony see chapter 5.

26. Other less known languages thought to employ V/C segregation include Ainu (Itô 1984), Sierra Miwok (Smith 1985), and Gtaʔ (McCarthy

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1982). Their use of V/C segregation has also been controversial as discussed in Steriade (1986) for Ainu and Sierra Miwok, and Odden (1987) for Gtaʔ.

27. The analysis presented here is similar to that of Bat-El (1994) in this respect. It differs, however, from it in one significant respect. Her rule of 'Melody Overwriting,' a peculiar aspect of Semitic morphology, is shown here to be the effect of a simple constraint ranking MAX$^{AFFIX\text{-}IO}$ >> MAX$^{BASE\text{-}IO}$, requiring that the segmental content of an affixal formative be expressed fully in the output to the expense of the full expression of base segmental material, due to the bisyllabic constraint on the output. This same idea extends straightforwardly to other cases of Arabic morphology as well. For example, the passive of katab 'wrote', kutib, is derived by affixation of /ui/ under the ranking MAX$^{AFFIX\text{-}IO}$ >> MAX$^{BASE\text{-}IO}$, forcing 'replacement' of the vocalism of the base by the vocalism of the affix.

28. The analysis above then essentially shows that the single case in Arabic where LDC-spreading was thought to apply can be analyzed without this mechanism.

29. The ideas in this section have been presented at the 1996 GLOW workshop on Weight Effects (Gafos 1996).