Minimizing RED: Nasal Copy in Mbe

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1. Introduction

In this paper, I argue that a nasal agreement phenomenon in Mbe (Benue-Congo, Nigeria; Bamgbose 1971) is a case of reduplication in which material is copied as a nasal coda to a CV prefix with place features linked to the following onset; if place-linking fails, no copy occurs. I demonstrate that this account has important analytical implications for Mbe and more generally, for the theory of reduplication in Optimality Theory (Prince & Smolensky 1993). First, the place-linked nasal status of the copied segment is independently-motivated by conditions on Mbe syllable structure. Second, the size restriction on the reduplicant can be obtained through an atemplatic alignment constraint, AllSyllableLeft, utilized in a ranking producing The Emergence of the Unmarked (acronymically TETU; McCarthy & Prince 1994b; size-restrictor ranking after Spaelti 1997 building on McCarthy & Prince 1994a; Prince 1996). Further, I show that alternative templatic approaches to the size restriction are insufficient.

Also addressed is the issue of prespecification in reduplication. Analyzing prefixes exhibiting nasal agreement in Mbe as reduplicative would seem to require admitting prespecified segments in reduplication; however, evidence from Mbe morphology is adduced to show that what appears to be prespecified material in fact belongs to a separate prefix. The analysis thus supports the claim that fixed segmentism in reduplication is not prespecified but is either phonologically-determined (i.e. default) or morphologically-determined (termed 'melodic overwriting' by McCarthy & Prince 1986) (McCarthy & Prince 1986, 1990; Urbanczyk 1996a, b; Alderete et al. 1996; Spaelti 1997). A proposal is introduced to eliminate the emergence of prespecified material in reduplicative affixes from an extension of the Root-Affix Faith metaconstraint (McCarthy & Prince 1994a, 1995).

For comments and suggestions on this work thanks to Jaye Padgett, Junko Itô, Armin Mester, John McCarthy, Diamandis Gafos, Akin Akinlabi, John Alderete, Sharon Rose, Philip Spaelti, Suzanne Urbanczyk, the UCSC phonology group, and WCCFL audience members. This work was supported by SSHRC fellowship 752-93-2397 and NSF grant SBR-9510868 to Itô & Mester and it benefitted from discussion in meetings for NSF grant SBR-9420424 to McCarthy.

2. Nasal Agreement in Diminutive Nouns

Mbe exhibits a remarkable nasal agreement phenomenon, whereby a nasal occurs in the coda of certain prefixes only when the stem contains a nasal. The data and description are from a series of papers by Bamgbose (1966, 1967a, b, c, 1971). I begin by examining nasal agreement in the formation of diminutive nouns and then relate it to a similar effect in imperative verbs.

Singular diminutive nominals are usually formed with a prefix of the form [kɛ-] (see second column in (1)). Vowel harmony produces a [ka-] variant before syllables containing [a] (1e). In their non-diminutive form, nouns occur with a prefix marking number category (singular or plural; see first column in (1)). Mbe is a 'class' language with seven primary nominal classes. The class to which a noun belongs determines which number category prefix it will take as well as the form of syntactic agreement markers in verbs and in concord markers. Comparison of the two columns in (1) reveals that tonal changes also take place in diminutive formation. The diminutive tonal patterns are complex and will not be analyzed here.[1]

(1)		Singular noun		Diminutive singular	
	a.	bù - t͡ʃí	'head'	kɛ̌ - t͡ʃî	'little head'
	b.	lè - bɛ́l	'breast'	kɛ̌ - bɛ̂l	'little breast'
	c.	bɛ̀ - líe	'food'	kɛ̌ - lîe	'little food'
	d.	è - fúfú	'sweat'	kɛ̀ - fúfú	'little sweat'
	e.	lè - bàrò	'liver'	kà - bàrò	'little liver'

The above data show the form of diminutives when the noun stem contains no nasals. If the noun contains a nasal, the diminutive is formed as above with [kɛ] but closed with a nasal homorganic to the following onset:

(2)		Singular noun		Diminutive singular	
	a.	è - bàm	'bag'	kàm - bàm	'little bag'
	b.	–		kàɱ - fàŋ	'little path'
	c.	bù - tɛ̀m	'heart'	kɛ̌n - tɛ́m	'little heart'
	d.	lè - lɛ́m	'tongue'	kɛ̌n - lɛ̂m	'little tongue'
	e.	kɛ̀ - nɛ́n	'bird'	kɛ̌n - nɛ̂n	'little bird'
	f.	lé - ʃíaní	'work'	kán - ʃíaní	'little work'[2]
	g.	ó - kùɔm	'snake skin'	kɛ́ŋ - kùɔm	'little snake skin'
	h.	é - g͡bénó	'upper arm'	kɛ́ŋ͡m - g͡bénó	'little upper arm'

It is reasonable to question what kind of phonological mechanism produces this kind of nasal agreement effect. Is it spreading? Segment

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[1] The diminutive tonal patterns are as follows (after Bamgbose 1966: 49-50; using abbreviations L-low [`], H-high [´], R-rising [ˇ], F-falling [ˆ]). With monosyllabic nouns, the diminutive prefix is R; H-stem becomes F and L-stem becomes H. With disyllabic nouns, HH is unchanged, HL becomes FL or HL, LH becomes RF, LL is unchanged or becomes RH. With nouns over two syllables, stem tones remain unchanged and the prefix usually takes the initial tone of the noun, although some L-initial nouns take a R-diminutive prefix.
[2] Nasals are realized as [n] before [ʃ, t͡ʃ, d͡ʒ] and [ɲ] before [j] (Bamgbose (1971: 10).

copying (i.e. reduplication)? The nasal agreement has properties which argue against this being a case of [+nasal] spreading. First, there is no alternating target segment, rather there is an alternation between the occurrence of a nasal segment and zero. Feature spreading does not induce the appearance of a new segment but affects the featural properties of a segment already present. We might speculate that the nasal agreement actually represents a featural alternation in the onset consonant in the form of prenasalization; however, the coda status of the nasal is supported by its triggering a vowel reduction known to take place in closed syllables (Bamgbose 1971: 104). Also, prenasalized consonants do not occur generally in the language. Another reason to reject a spreading analysis is that the nasal agreement is non-local, that is, the dependent nasal and the stem nasal may be at any distance in the word. A recent cross-linguistic study of nasal harmony gives persuasive evidence that [+nasal] spreading occurs only between adjacent segments (Walker in prep.; and on segmental adjacency of feature spreading in general see Ní Chiosáin & Padgett 1997; cf. also Gafos 1996).

Given these arguments we are left with the possibility that Mbe nasal agreement is produced by segment copying. But this does not look like a typical case of reduplication. Reduplicative affixation usually copies at least a syllable (or an onset plus default vowel); yet in this case, material is copied as a coda or fails to be copied at all. There also is a fixed segmental component to the formation of diminutives ([kɛ-]), which may seem to suggest that the prefixation is not reduplicative. On the other hand, the nasal agreement has properties consistent with it being reduplication. The limitation of nasal agreement to the formation of specific morphemes is expected if this is a reduplicative phenomenon. Also expected is the dependency of affix segmentism on root material, i.e. the occurrence of the affix nasal is conditioned by the occurrence of a nasal in the root.

Based on the arguments against spreading and properties consistent with segment copying, I come to the interim conclusion that the nasal agreement is a case of *reduplication,* not nasal feature *spreading*. In what follows I will show that analyzing nasal agreement in Mbe as nasal copy is both plausible and motivated and illuminates the theory of reduplication.

3. Nasal Copy in Imperative Verbs

3.1 Data

Independent evidence for the nasal agreement phenomenon as a case of nasal copy comes from a pattern of reduplication occurring in imperative verbs in Mbe. Verbs in Mbe are categorized as Class 1 or Class 2, corresponding to the particular form of affixation or reduplication that takes place in verbal inflection. The pattern of reduplication for Class 2 imperative singular verbs is illustrated below. First, in the data in (3), the reduplicative prefix is an open syllable, copying material in the verb stem from left to right. The prefix vowel is an identical copy for a high stem vowel and [ə] for any non-high vowel. Only the first vowel of a diphthong (high vowel followed by low) is copied. Tonal changes also occur in the reduplicative form.[3]

[3] The tone pattern for a reduplicative form of a simple monosyllabic Class 2 verb is FF. If the simple verb is disyllabic, the reduplicative form has the tone pattern FHL for verbs ending in [o] and FFL for verbs ending in [i] (Bamgbose 1967a: 185).

(3) Class 2, Imperative non-continuous singular

	Simple	Reduplicative	Gloss
a.	rû	rû - rû	‘pull’
b.	t͡ʃî	t͡ʃî - t͡ʃî	‘help put on head’
c.	gê	gə̂ - gê	‘belch’
d.	fûel	fû - fûel	‘blow’
e.	ʃîe	ʃî - ʃîe	‘sell’
f.	júbô	jû - júbò	‘go out’
g.	g͡bárî	g͡bə̂ - g͡bârì	‘embrace’
h.	bɔ́rô	bə̂ - bɔ́rò	‘help’
i.	púabrî	pû - pûabrì	‘stray’

The data in (4) show that if the verb stem contains a nasal, the reduplicative prefix is formed as above but closed with a homorganic nasal.

(4) Class 2, Imperative non-continuous singular

	Simple	Reduplicative	Gloss
a.	bîem	bîm - bîem	‘believe’
b.	d͡zûɔŋ	d͡zûn - d͡zûɔŋ	‘be higher’
c.	g͡bénô	g͡bə̂ŋ͡m - g͡bénò	‘collide’
d.	bámô	bə̂m - bámò	‘hide’
e.	púɔnî	pûm - pûɔnì	‘mix’
f.	jíɔnî	jîɲ - jîɔnì	‘forget’
g.	lúonî	lûn - lûonì	‘repair’

In imperative reduplication, the nasal agreement is unambiguously segmental copy. Aspects of the analysis of this reduplication phenomenon will prove to provide explanation for the similar nasal agreement phenomenon in the diminutive nominals. Accordingly, I will present an analysis of the imperative cases and then return to the diminutives.

3.2 Analysis of Imperative Reduplication

Faithfulness relations play a key role in any analysis of reduplication. Working in the framework of Optimality Theory (Prince & Smolensky 1993), I assume the correspondence model of segmental faithfulness (McCarthy & Prince 1995). McCarthy & Prince's 'Basic Model' of the correspondence relations holding in reduplication is given in (5) (1995: 273).

(5) The Basic Model of reduplicative identity:

Input: /Af$_{RED}$ + Stem/

↑↓ *Stem I-O Faithfulness*

Output: R(ED) ↔ B(ase)

B-R Identity

Following McCarthy & Prince (1995), I adopt the MAX and DEP families of segmental faithfulness constraints:

(6) a. MAX
Every segment of S_1 (e.g. input, base) has a correspondent in S_2 (e.g. output, RED); i.e. 'no deletion'.

b. DEP
Every segment of S_2 (e.g. output, RED) has a correspondent in S_1 (e.g. input, base); i.e. 'no epenthesis'.

Examples of input-output segmental correspondence constraints are MAX-IO and DEP-IO, and for base-reduplicant correspondence, MAX-BR and DEP-BR. After McCarthy & Prince (1995), I assume featural faithfulness is evaluated by IDENT[F] constraints, which require that correspondent segments are identical in specification for feature [F].

In the analysis of Mbe reduplication, an important function will be performed by The Emergence of the Unmarked (McCarthy & Prince 1994b, 1995). The ranking schema for TETU effects in reduplication is given in (7).

(7) Faith-IO >> Phono-Constraint >> Faith-BR

Because Faith-IO dominates the Phono-Constraint (e.g. markedness or alignment), the effect of the Phono-Constraint is not apparent in general, i.e. it will not affect correspondence between an input and output. However, with the Phono-Constraint dominating Faith-BR, it will be respected in Base-to-RED copying and can induce BR correspondence violations. This produces an 'Emergence of the Unmarked' in reduplication.

The syllable-size reduplication in imperative verbs can be obtained through a TETU ranking. Spaelti (1997) observes that this can be achieved atemplatically using an alignment constraint: ALLσL (Mester & Padgett 1994; a similar approach using all-foot-alignment to obtain foot-size reduplicants is employed by McCarthy & Prince 1994a; Prince 1996).

(8) ALLσL: ALIGN(σ, L, Pwd, L)

Following the generalized interpretation of alignment constraints, ALLσL expresses the demand that the left edge of *every* syllable be aligned with the left edge of *some* prosodic word (McCarthy & Prince 1993b). Violations are reckoned such that every misaligned syllable incurs a mark for each syllable separating it from the left edge of the Pwd. Each word containing more than one syllable will thus violate ALLσL, and violations increase with every additional syllable. As a result, ALLσL acts as a size-restrictor by favoring words containing only one syllable (assuming the optimal output is fully syllabified). Spaelti's TETU ranking places ALLσL between IO and BR Faith:

(9) MAX-IO >> ALLσL >> MAX-BR

The ranking is illustrated in (10) (tones omitted). Since MAX-IO dominates ALLσL, the alignment constraint does not place a limit on root material (see (c)). However, ALLσL outranks MAX-BR, preventing the addition of more than one syllable in reduplication (compare (a) and (b)). I assume that high-ranking constraints on morpheme realization and syllable structure rule out alternatives copying less than a syllable ([jubo], [j-jubo]).

(10) Syllable-size reduplicants

	RED-jubo	MAX-IO	ALLσL	MAX-BR
☞	a. ju-jubo		***	bo
	b. jubo-jubo		****!**	
	c. ju-ju	b!o	*	

The restriction of reduplicants to one syllable is a TETU effect, i.e, it is an occurrence of unmarked structure in reduplication that does not otherwise limit forms in the language. On the other hand, the restriction of reduplicant codas to a nasal with place features linked to the following onset is a distribution holding of Mbe syllable structure in general. Bamgbose (1967c: 11) notes that across the Mbe language coda nasals must be place-linked except root-finally (i.e. word-final or before a C-initial suffix). From Bamgbose's data it also appears that within the domain of [prefix + root], a nasal is the only possible medial coda. Other consonants can occur in root-final position.[4] The condition on codas in Mbe thus consists of three parts (i) place features of a coda consonant must be linked to a following onset, (ii) coda consonants are limited to nasals, and (iii) the restrictions of (i) and (ii) are exempted in root-final position. Various aspects of similar coda conditions have been analyzed elsewhere (see, e.g., Padgett 1995; Itô & Mester in press, Alderete et al. 1996). For expository convenience, I will employ a constraint, CODACOND, which simply describes the coda condition in Mbe. This descriptive constraint is given in (11) (for discussion of the rankings that constitute the content to CODACOND see Walker in prep.).

(11) CODACOND:
Codas (except root-final) must be nasals with place features linked to the following onset.

Because CODACOND is respected throughout the Mbe language, it must outrank MAX-BR and Faith-IO (I assume MAX-IO). This is shown for BR faith in (12) for the imperative form of [fuel]. Here candidate (b) copies the [l] coda, but even though this fares better on MAX-BR, it loses to candidate (a) because it violates CODACOND. The alternative in (c), which loses [l] in the base in order to better satisfy MAX-BR, is ruled out on the basis of MAX-IO. I assume that undominated IDENT-IO/BR[nasal] rules out alternatives changing oral consonants to nasals ([fun-fuel], [fun-fuen]).

(12) Non-nasal codas are prohibited

	RED - fuel	CODACOND	MAX-IO	MAX-BR
☞	a. fu - fuel			el
	b. ful - fuel	l!		e
	c. fu - fue		*!	e

[4] Examples of word-final Cs : [káb] 'dig', [wél] 'drive away', and of root-final Cs before a C-initial suffix: [jùab - kî] 'be washing', [fùel - kî] 'be blowing', [jǐɛm - kì] 'be singing'.

Since a stem nasal can be copied but may end up changing its place specification in the reduplicant, MAX-BR must outrank the base-reduplicant place identity constraint to prevent segments from deleting rather than undergoing place assimilation. This is shown in (13) for the imperative of [jiɔni] (restricting attention to candidates with syllable-size reduplication as in (10)). Candidate (b) loses on CODACOND because the reduplicant nasal is not place-assimilated. The alternatives are to not copy the nasal, as in (c), or copy and place-assimilate the nasal, as in (a). Even though it violates IDENT-BR[Place], candidate (a) wins, since it better satisfies MAX-BR.

(13) Nasal codas are place-linked

	RED - jiɔni	CODACOND	MAX-BR	IDENT-BR[Place]
☞	a. jiɲ͡-jiɔni		ɔi	*
	b. jin - jiɔni	n!	ɔi	
	c. ji - jiɔni		ɔni!	

Vowel reduction and loss of diphthongs in imperative reduplicants will not be examined here (see Walker in prep. for a TETU analysis). The rankings established for Mbe thus far are summarized in (14).

(14) a. Reduplicant is a syllable: MAX-IO >> ALLσL >> MAX-BR

b. Coda condition and nasal copy:
CODACOND >> MAX-IO >> MAX-BR >> IDENT-BR[Place]

In the next section I explore how aspects of the analysis of the imperative reduplication can lend insight to the nasal agreement phenomenon seen in the formation of diminutive nominals.

4. Back to Diminutives: Another Pattern Predicted by ALLσL

The previous section presented a clear case of reduplication in imperative verbs. Interestingly, the imperative and diminutive structures have in common that a coda is only added to the prefix when a nasal can be copied from the stem, and the copied nasal must be homorganic to the following onset. We have established that restriction of codas to place-linked nasals is explained by a general coda condition in Mbe. In this section I will show that in analyzing diminutive nasal agreement as reduplication, the restriction to coda size or zero falls out from the interaction of a differentiated morpheme realization constraint and the same size-restricting constraint as that required for the imperative reduplication, ALLσL. In fact, the diminutive will provide an important example of minimized copy predicted by the atemplatic approach to size limiters in reduplication. I first present arguments that diminutive formation is complex with separate RED and fixed segment ([kɛ-]) morphemes, and then I show how constraints and rankings already required for Mbe contribute to obtaining the size restriction on RED.

4.1 The Complex Nature of Diminutive Formation

Let us review the key points of formation of diminutive nominals. Singular diminutives are formed with a prefix [kɛ-]. If there is a nasal in the noun stem, then the prefix is closed with a nasal coda homorganic to the following onset. Tonal changes also take place in diminutive formation. Some examples from (1-2) are repeated below.

(15) a. kɛ̌ - bɛ̂l 'little breast'
b. kɛ̀ - fúfú 'little sweat'
c. kɛ̌n - tɛ́m 'little heart'
d. kɛ́ŋ͡m - g͡bénó 'little upper arm'

Bamgbose (1966: 48) notes that plural diminutive nouns are formed in the same way, but with [ke-] as the fixed portion of the prefixation.

Given that diminutive noun formation combines fixed segmentism, reduplication, and tone patterns, it is worth considering what the internal structure of diminutive nouns is. I propose that the prefixation is complex, consisting of a prefix [kɛ-], with segmental material in the input, and a second purely reduplicative affix, RED, with no underlying segmental content. I will argue that it is RED that forms the diminutive morpheme and [kɛ-] performs a separate function. In addition to RED, a morphologically-conditioned tonal pattern is required for diminutives. The complex structure is shown in (16).

(16) Diminutive nominals:
kɛ + RED + *noun stem* (plus tonal information)

Importantly, I claim that diminutive prefixation does not consist of a single affix combining prespecified material ([kɛ]) and reduplication, as in (17).

(17) * RED + *noun stem* (plus tonal information)
kɛ

A prespecification analysis like that in (17) may be rejected on the basis of cross-linguistic evidence and an argument from Mbe morphology. The cross-linguistic argument concerns overgeneration. If prespecification were permitted in reduplicants, we would expect fixed material of all kinds; however, this is not the case: fixed segments in reduplication are usually default in character and can be derived through TETU rankings (McCarthy & Prince 1986, 1990; Urbanczyk 1996a, b; Alderete et al. 1996; Spaelti 1997).[5] If prespecification in reduplicative affixes were excluded, the limitation of fixed material to default segments would be explained.

The next point concerns nominal classes in Mbe. Recall that Mbe has seven primary nominal classes, which determine the form of number category prefixes and syntactic agreement markers. Bamgbose (1966: 48) notes that diminutive nominals are all members of Class 4 (regardless of the class for the noun root in non-diminutive form). Subject agreement prefixes and other concord markers for diminutives thus match those for Class 4. Interestingly, the Class 4 nominal prefixes, [kɛ-] (sg.) and [ke-] (pl.), precisely match the fixed segmentism in the singular and plural diminutive

5 McCarthy & Prince (1986, 1990) and Alderete et al. (1996) note that a distinct set of cases of fixed segmentism in reduplication phenomena have a morphological basis (these are characterized as 'melodic overwriting' by McCarthy & Prince 1986).

formation; however, non-diminutive Class 4 nouns do not exhibit nasal copy (18a). As a consequence, Class 4 non-diminutive nouns are identical in segmentism to their diminutive counterparts when they do not contain a nasal, although they are usually distinguished by tonal properties (18b).

(18)		Class 4 (non-diminutive)			Diminutive form	
	a.	kɛ̀-tɛ̀m	*kɛ̌n-tɛ̀m	'axe'	kɛ̌n-tɛ́m	'little axe'
	b.	kɛ̀-cì		'stick'	kɛ̌-cí	'little stick'

Given that diminutives are Class 4 and have prefixal material identical to the usual Class 4 prefixes, I conclude that the [kɛ-]/[ke-] portion of diminutive formation is a Class 4 prefix, not part of the diminutive morpheme itself. I suggest that the phonological constituency of the diminutive morpheme actually consists of just a tonal component and a purely reduplicative segmental component (i.e. the coda nasal). This gives a modular view of diminutive formation, shown in (19).

(19)

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        Diminutive
         /      \
      RED      Tonal pattern
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The diminutive nominal is Class 4 and thus takes a [kɛ-]/[ke-] prefix. This structural analysis explains the uniformity of Class 4 and diminutive affixes and agreement markers. If the [kɛ/ke] material were a prespecified part of a reduplicative diminutive affix, this homophony would be accidental.

4.2 Deriving the Size of the Diminutive Reduplicant

I turn now to deriving the size of the reduplicative element of the diminutive morpheme. The diminutive reduplicant is restricted to filling a syllable coda or failing to be realized at all. I suggest that the relevant generalization which underlies this pattern is that material is copied in diminutive formation only if it does not add a syllable to the word. This will be shown to be connected to the size restriction of the imperative reduplicant. In order to understand how these two size restrictions are related, we will need to call on constraints on morpheme realization. The kind of constraint I propose to employ is given in (20) (with foundation in morpheme realization constraints from Samek-Lodovici 1992; Gnanadesikan 1996; Rose 1997).

(20) REALIZEMORPH:

i. A morpheme must have some phonological exponent in the output. For morphemes composed of modular components, each component must have phonological exponence in the output.

ii. A violation is incurred for each morpheme failing to have some phonological exponent in the output; for morphemes with a modular structure, a violation is accrued for each component failing to have some phonological exponence in the output.

Both the diminutive and imperative morphemes have two modular elements demanding phonological expression, a reduplicative segmental component and a tonal pattern component.[6] Part (i) of REALIZEMORPH demands that

[6] It is conceivable that the tone and RED elements correspond to distinct morphemes in

both of these elements have some phonological exponence in the output. Part (ii) makes explicit how violations of the constraint are reckoned (after Zoll 1996): one violation will be incurred for each component for which there is no phonological exponent in the output.

In imperative reduplication, both the reduplicative and tonal components of the morpheme always have some phonological exponence in the output. In the case of the reduplicative component, this takes place at the cost of ALLσL, since the reduplicative material adds a syllable to the word. This motivates the ranking in (21) (I assume that morpheme realization constraints may be specific to particular morphemes).

(21) REALIZEMORPH$_{imp}$ >> ALLσL

In contrast to the imperative, realization demands for the diminutive morpheme cannot compel the addition of a syllable. Reduplication occurs in diminutive formation only when material can be copied without adding a syllable (i.e. material is copied as a coda or not at all). ALLσL must thus outrank the diminutive realization constraint:

(22) ALLσL >> REALIZEMORPH$_{dim}$

Copy of a nasal along with tonal changes in the diminutive is illustrated in (23), combining the ranking in (22) with the TETU size-restriction ranking established earlier (MAX-IO >> ALLσL >> MAX-BR). The complex constituency of the diminutive nominal is shown in the input, consisting of the Class 4 prefix [kɛ-], the diminutive morpheme composed of RED and tonal information, and the noun stem [tɛm].

(23) Nasal copy and tonal changes in a diminutive nominal

	Tone kɛ - RED - tɛm	MAX-IO	ALLσL	MAX-BR	REALIZE MORPH$_{dim}$
☞	a. kɛ̌n͡tɛ́m		*	tɛ	
	b. kɛ̌tɛ́m		*	tɛm(!)	*(!RED)
	c. kɛ̌tɛ́n͡tɛ́m		**!*		
	d. tɛ̌m	k!ɛ		tɛm	*(RED)
	e. kɛn͡tɛm		*	tɛ	*!(tone)

Candidate (d) shows that MAX-IO >> ALLσL compels retention of input segments, even though this produces an output containing more than one syllable. However, as apparent from candidate (c), ALLσL >> MAX-BR in this case prevents copied material from producing more than the two syllables required to accommodate input segments. This is one of two possible TETU size restrictions that can emerge from ALLσL: here reduplication is restricted in size to not adding a syllable to the word. The winning candidate in (a) partially satisfies MAX-BR by copying a nasal, and it satisfies REALIZEMORPH both through this segmental copy and realizing

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Mbe, in which case a modular view of the diminutive and imperative morphemes would not be required and REALIZEMORPH could be simplified. This is a matter for further study.

the necessary tonal pattern. Candidate (e) loses because it fails to realize the tone pattern and (b) loses either on the basis of failing to copy any material (REALIZEMORPH) or an extra MAX-BR violation. It should be noted that since reduplication can copy a nasal anywhere in the stem, MAX-BR must outrank LEFT-ANCHOR-BR (McCarthy & Prince 1995: 371).[7]

The tableau in (24) illustrates a case where reduplication fails in the diminutive. For this input, there is no nasal to copy as a coda. Since the coda condition prohibits other coda segments, this narrows the range to candidates exhibiting copy of a syllable (b) or no copy at all ((a) and (c)). The candidate copying a full syllable loses on violations of ALLσL. The remaining alternatives each violate REALIZEMORPH with respect to the RED component of the diminutive morpheme. Candidate (c) loses to (a), because (c) also fails to realize the tonal component of the morpheme.

(24) Copy fails in diminutive; tonal changes occur

Tone kɛ - RED - bɛl	MAX-IO	ALLσL	MAX-BR	REALIZE MORPH$_{dim}$
☞ a. kɛ̌bɛ̂l		*	bel	*(RED)
b. kɛ̌bɛ̂bɛ̂l		**!*	l	
c. kɛbɛl		*	bel	**!(RED, tone)

In (25), we see how the different ranking of REALIZEMORPH$_{imp}$ produces syllable-size copy in the imperative. This morpheme realization constraint is undominated, forcing some segmental copy to take place along with tonal changes. Candidate (c), which fails to copy any material, is ruled out by REALIZEMORPH. Candidate (b) loses on the basis of ALLσL, because it adds more than one syllable. The winner (a) copies one syllable to minimally violate alignment while satisfying realization. This gives a second TETU size restriction from ALLσL: copy is limited to one syllable.

(25) Syllable-size copy and tonal changes in imperative

Tone RED - jubo	MAX-IO	REALIZE MORPH$_{imp}$	ALLσL	MAX-BR
☞ a. jû-júbò			***	bo
b. jûbô-júbò			****!**	
c. jûbô		*!(RED)	*	jubo

To review, we have now seen that the same atemplatic size-restricting constraint in combination with differently-ranked morpheme realization constraints accounts for the coda/null size limitation in the diminutive and the syllable-size limitation in the imperative. The constraint hierarchy obtaining this result is given in (26).

(26) Size-restriction ranking summary
MAX-IO, REALIZEM$_{imp}$ >> ALLσL >> MAX-BR, REALIZEM$_{dim}$

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7 For similar but different cases of single consonant copying, see Spaelti (1997) on 'syllable recycling' in the Aru languages , Gafos (1996) on Temiar, and Takeda (1997) on Kammu.

The motivation from the analysis of the imperative for the reduplication account of the diminutive is two-fold. First, the limitation to nasal copy falls out from the independent demand of CODACOND. Second, the TETU approach to the size-restriction on imperative reduplication can also explain the size-restriction seen in the diminutive. Differences in size-restriction outcomes come from different rankings of morpheme realization constraints. The diminutive account thus strengthens the atemplatic TETU approach to size restriction by providing evidence of a phenomenon predicted by factorial constraint ranking (Prince & Smolensky 1993: 84).

5. Atemplatic versus Templatic Approaches to Size Restriction

In the above analysis of prefixation in Mbe, ALLσL obtains imperative syllable-size copy and diminutive coda/null copy. Previous approaches to size-restrictions in reduplication call on templates to limit copied material. In this section, I compare this alternative to the atemplatic TETU account.

One of the template-based approaches makes use of reduplication-specific templatic constraints. Under the Prosodic Morphology Hypothesis, these templates are prosodically-defined (e.g. RED=σ; McCarthy & Prince 1986, 1990, 1993a). This approach marked a breakthrough in the understanding of reduplication, and it accounts for the majority of reduplication phenomena, for example, RED=σ, can handle the imperative syllable-size copy. However, the more unusual size restriction exhibited by the diminutive poses a problem for prosodically-defined templates. One problem is that the coda/null size of the reduplicant does not correspond to a unit of prosody; another drawback is that a fixed templatic form does not predict the variability of the reduplicant realization as a coda or zero.

A second alternative building on Prosodic Morphology is known as 'Generalized Template Theory' (McCarthy & Prince 1994a, b; Urbanczyk 1996a, b). This approach achieves size restrictions through TETU rankings with templatic constraints on the phonological structure of a general morphological category, e.g. 'Affix'. An example of a generalized templatic constraint is Afx≤σ: 'the phonological exponent of an affix is no larger than a syllable'. Like RED=σ, Afx≤σ handles the case of imperative syllable-size copy. However, although generalized templates account for the majority of reduplication phenomena, they are insufficient for the diminutive copy. The problem is that the templatic size restrictor is specific to the size of the affix and does not make reference to the overall syllabic structure of the word. Ranked between IO and BR faith, Afx≤σ predicts that a full syllable will be copied, driven by the maximizing function of MAX-BR, as shown in (27). The incorrect outcome is signalled by the left-pointing hand by candidate (b). The actual outcome (a) is not selected by this tableau.

(27) Afx≤σ gives wrong outcome for diminutive

	kɛ-RED-tɛm	CODACOND	MAX-IO	Afx≤σ	MAX-BR
☞	a. kɛn͡-tɛm				t!ɛ
☜	b. kɛtɛn͡-tɛm				

The fact that reduplication for the diminutive morpheme takes place only when it will not add a syllable to the word requires independent explanation. ALLσL is what achieves this explanation; yet it is also capable of capturing the size-restriction on its own. It thus obviates the need for a generalized templatic constraint. The atemplatic approach to syllable-size restriction (Spaelti 1997) can be understood as a progression of the Prosodic Morphology Hypothesis and Generalized Template Theory. It retains the insights that size restrictions in reduplication are correlated to prosodic structure and may be derived with TETU rankings. Where it advances is in eliminating the need for templates. The morphology of Mbe provides empirical evidence that this is a necessary step to take.[8]

6. Ruling out Prespecification in Reduplication

I conclude this discussion by returning to the issue of prespecification in reduplication. The formation of diminutives, in which a reduplicated nasal forms the coda to [kɛ-], may at first seem to suggest a need for prespecified segments in reduplicative affixes. However, in section 4 I presented evidence from Mbe morphology showing that the fixed segmentism was best analyzed as material belonging to a separate morpheme from RED. It was also noted that previous analysts have argued that prespecified material in reduplicants should be generally disallowed, since the theory would otherwise predict a wider range of fixed segmentism than is actually attested (McCarthy & Prince 1986; Urbanczyk 1996a, b; Alderete et al. 1996). I propose to obtain this result through constraint rankings holding over the set of output candidates, without stipulating any restrictions on the input (assuming 'richness of the base'; Prince & Smolensky 1993: 191).

I begin by reviewing correspondence in reduplication. The 'Basic Model' of McCarthy & Prince (1995) (see (5)) posits correspondence between input and output forms of the stem, and between the output form of the stem (base) and the output form of the reduplicative affix. In this model, the reduplicative affix is in correspondence only with the base. If it were assumed that the reduplicative affix came with no prespecified material, the input form of the affix would have nothing to which the output could correspond. However, let us suppose that the reduplicative affix can have prespecified segmentism. This necessitates an elaborated model with correspondence between input and output forms of the affix, as in (28).

(28) Elaborated Basic Model of reduplicative identity:

Input:		/Af_{RED} + Stem/		
	Affix-IO Faith	↑↓	↑↓	*Stem I-OFaith*
Output:		Af_{RED} ↔ Base		
		B-R Identity		

For reduplicative affixes, Affix-IO faith has the potential to conflict with BR Identity. The possible rankings are given in (29). Subscripting indicates that these refer to any combination of faith (i.e. MAX, DEP, etc.).

(29) a. $Faith_i$-BR >> Affix-$Faith_j$-IO
b. Affix-$Faith_i$-IO >> $Faith_j$-BR

[8] Prince (1996) and Spaelti (1997) discuss another argument against templates, known as the Philip Hamilton/René Kager Conundrum, i.e. 'no back-copying of templates'.

The ranking in (29a), which places BR-Faith over Affix-Faith, yields a pattern in which maximal reduplication takes place (within the limits of any size-restriction) and wins over prespecified material. This corresponds to an outcome with no apparent prespecification, a well-attested result. The second ranking, in (29b), places Affix-Faith at the top. Taking this hierarchy for MAX as an example, any prespecified material is expected to appear in the output at the cost of maximizing copied material from the base, as shown in (30) for a hypothetical language with RED containing prespecified segments [so]. Here prespecified material is preserved and reduplication occurs to fill up the remainder of the size restriction. This is an outcome we have seen reason to believe is unattested. Another problematic fixed segment pattern given by AFFIX-MAX-IO >> DEP-BR is discussed by Walker (in prep.).

(30) A ranking yielding combined prespecified material and reduplication

	RED - bam so	AFFIX-MAX-IO	ALLσL	MAX-BR
☞	a. sob - bam		*	am
	b. bam - bam	*!	*	

Note that Faith-BR and Affix-Faith-IO only have the potential to conflict when correspondence holds for a given affix to both input material and base material, i.e. when a reduplicative affix comes with prespecified content. If the ranking in (29b) could be eliminated, we would prevent prespecified material from ever appearing in the output of a reduplicative affix at the cost of reduplicative faith. I suggest that this can be achieved by extending McCarthy & Prince's Root-Faith >> Affix Faith metaconstraint (1994a, 1995), a ranking-restrictor with independent motivation in the theory (see, e.g. Alderete 1997, Urbanczyk 1996b, Beckman 1998). Let us consider the correspondence relations in (29) in terms of root and affix faith. Affix-Faith-IO is an affix-to-affix correspondence relation, and Faith-BR is a correspondence relation between a root or root-containing stem and an affix. The undesirable ranking in (29b) thus ranks a faith relation between affixes over a faith relation between a root-based form and an affix. I propose to revise the Root-Affix Faith metaconstraint such that any correspondence relation in which the first argument is a *root* or root-containing stem universally outranks a correspondence relation where the first argument is an *affix*. The revised metaconstraint is given in (31):

(31) Revised Root-Affix Faith metaconstraint:
Faith$_i$-Root-X >> Faith$_j$-Affix-Y

(31) admits the rankings Root-Faith$_i$-IO >> Affix-Faith$_j$-IO and Faith$_i$-BR >> Affix-Faith$_j$-IO and rules out their reverse counterparts *Affix-Faith$_i$-IO >> Root-Faith$_j$-IO and *Affix-Faith$_i$-IO >> Faith$_j$-BR. We thus eliminate the ranking in (29b), and consequently prespecified material in reduplicative affixes, on the basis of the general principle of Root over Affix Faith.

References

Alderete, J. 1997. Root-controlled accent in Cupeño. Ms., UMass, Amherst.

Alderete, J., J. Beckman, L. Benua, A. Gnanadesikan, J. McCarthy, & Suzanne Urbanczyk. 1996. Reduplication and segmental unmarkedness. Ms., University of Massachusetts, Amherst.

Bamgbose, A. 1966. Nominal classes in Mbe. *Afrika und Übersee* 49, 32-53.

Bamgbose, A. 1967a. Verbal classes in Mbe. *Afrika und Übersee* 50, 173-93.

Bamgbose, A. 1967b. Tense/aspect forms in Mbe. *Research Notes,* Department of Linguistics and Nigerian Language, University of Ibadan, 1, 12-20.

Bamgbose, A. 1967c. Notes on the Phonology of Mbe. *Journal of West African Languages* 4, 5-11.

Bamgbose, A. 1971. Nasal harmony in Mbe. *Annales de l'Université d'Abidjan 1971,* Série H, Fascicule hors série, Vol. 1, pp. 101-7.

Beckman, J. 1998. *Positional Faithfulness*. PhD dissertation, UMass, Amherst.

Gafos, A. 1996. *The Articulatory Basis of Locality in Phonology*. PhD dissertation, Johns Hopkins University.

Gnanadesikan, A. 1996. *Phonology with Ternary Scales*. PhD dissertation, University of Massachusetts, Amherst.

Itô, J., & A. Mester. in press. Realignment. In R. Kager, H. van der Hulst, & W. Zonneveld , eds., *Proceedings of the Utrecht Workshop on Prosodic Morphology*. Mouton.

McCarthy, J., & A. Prince. 1986. Prosodic morphology. Ms. University of Massachusetts, Amherst and Brandeis University.

McCarthy, J. & A. Prince. 1990. Foot and word in prosodic morphology: the Arabic broken plural. *NLLT* 6, 209-82.

McCarthy, J., & A. Prince. 1993a. Prosodic morphology I. Ms., University of Massachusetts, Amherst and Rutgers University.

McCarthy, J., & A. Prince. 1993b. Generalized alignment. In G. Booij & J. van Marle, eds., *Yearbook of Morphology 1993,* pp. 79-153.

McCarthy, J., & A. Prince. 1994a. An overview of Prosodic Morphology: I & II. [Talks presented at OTS/HIL Workshop on Prosodic Morphology, Utrecht.]

McCarthy, J., & A. Prince. 1994b. Emergence of the unmarked: optimality in Prosodic Morphology. In M. Gonzàles, ed., *NELS* 24, pp. 333-79. GLSA.

McCarthy, J., & A. Prince. 1995. Faithfulness and reduplicative identity. In J. Beckman, L. Walsh Dickey, & S. Urbanczyk, eds., *UMOP 18,* 249-384.

Mester, A., & J. Padgett. 1994. Directional syllabification in generalized alignment. In J. Merchant, J. Padgett, & R. Walker, eds., *PASC* 3, 79-85.

Ní Chiosáin, M. & J. Padgett. 1997. Markedness, segment realization, and locality in spreading. Report no. LRC-97-01, University of California, Santa Cruz.

Padgett, J. 1995. Partial class behavior and nasal place assimilation. In K. Suzuki & D. Elzinga, eds., *Arizona Phonology Conference: Proceedings of SWOT, Vol. 5, Coyote Papers,* pp. 145-83. University of Arizona, Tucson.

Prince, A. 1996. Aspects of mapping under OT. Talk presented at UC Santa Cruz.

Prince, A., & P. Smolensky. 1993. Optimality Theory: constraint interaction in generative grammar. Ms. Rutgers University & Univ. of Colorado, Boulder.

Rose, S. 1997. *Theoretical Issues in Comparative Ethio-Semitic Phonology and Morphology*. PhD dissertation, McGill University.

Samek-Lodovici, V. 1992. A unified analysis of crosslinguistic morphological gemination. *Proceedings of CONSOLE 1*. Utrecht.

Spaelti, P. 1997. *Dimensions of Variation in Multi-Pattern Reduplication*. PhD dissertation, University of California, Santa Cruz.

Takeda, K. 1997. Causative formation and single consonant reduplication in Kammu, Ms., University of California, Irvine.

Urbanczyk, S. 1996a. Morphological templates in reduplication. In K. Kusumoto, ed., *NELS* 26, pp. 425-40, GLSA.

Urbanczyk, S. 1996b. *Patterns of Reduplication in Lushootseed*. PhD dissertation, University of Massachusetts, Amherst.

Walker, R. in preparation. *Nasalization, Neutral Segments, and Opacity Effects*. PhD dissertation, University of California, Santa Cruz.

Zoll, C. 1996. *Parsing below the Segment in a Constraint-Based Framework*. PhD dissertation, University of California, Berkeley.