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Quantitative transfer in reduplicative and templatic morphology

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1. Introduction

1.1 The Problem

Segmental quantity—the distinction between long and short vowels or geminate and simplex consonants—is preserved under specifiable conditions in reduplication.[1] Current nonlinear phonology holds, for a number of compelling reasons, that segmental quantity is represented configurationally, in the mapping of phonemic melodies to prosodic templates. The theory also holds that reduplication is accomplished by specifying a template affix which is filled by the phonemic melody elements of the base. How can configurational information like segmental quantity be preserved in reduplication when the reduplicative affix itself specifies the configuration in the form of a template? This problem of preserving configurational information under reduplication is dubbed "transfer" by Clements (1985), and so we will refer to it here.

1.2 The Proposal

We will argue that the problem of how to transfer quantity morphologically reduces entirely to the problem of how to specify quantity lexically and how to satisfy a morphological template. Since any theory with a skeleton/melody split and morphological templates must address these two subordinate problems, we conclude that the problem of transfer is ultimately illusory—its solution follows from the solution to far more fundamental problems in prosodic morphology.

To this end, we will present a theory of nonredundant lexical specification of quantity which, when combined with our theory of template satisfac-

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tion, provides a straightforward solution to the transfer problem for quantity. We begin in section 2 by presenting the major relevant examples of quantitative transfer and the theories that have been proposed to account for them, most notably the association-line copying approach of Marantz (1982) and the parafixation model of Clements (1985). We reserve direct comment on the adequacy of these theories and the appropriateness of the examples until section 3. In the following section, we assemble a number of observations and generalizations that lead us to the reduction outlined above. And in section 5, we present a theory of nonredundant lexical specification of quantity and integrate it with the theory of template satisfaction, showing how it accounts for the examples of section 2. In section 6, we critically examine the role of quantitative transfer in a templatic morphological system, the broken plural of Classical Arabic.

We conclude with a brief look at other transfer effects that have been noted, extending our account beyond pure segmental quantity.[2]

2. Examples and Theories of Quantitative Transfer

2.1 Onset Transfer in Yidin^y: Copying Association Lines

Although it is not a case of quantitative transfer, the phenomenon of onset transfer in Yidin^y involves a mechanism—association-line copying—that has been extended in later work (Marantz and McIntyre 1986) to segmental quantity proper. It is also the first case in which a transfer-like phenomenon has been noted (by Marantz 1982) and deserves our attention for that reason alone.

The relevant data of Yidin^y are as follows:

(1)

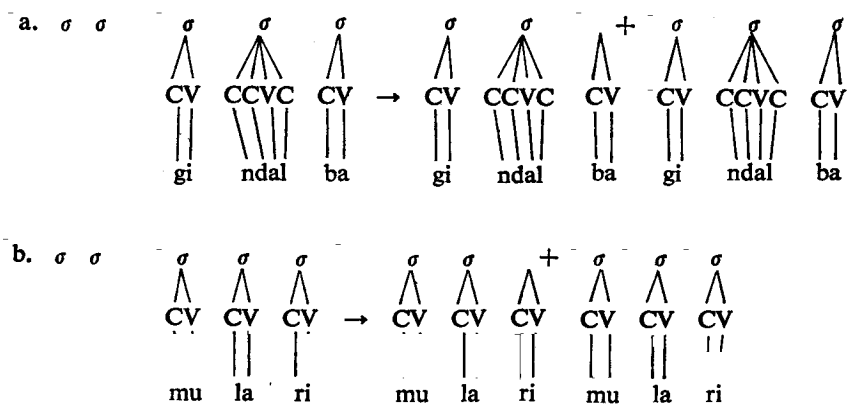
mulari	mula-mulari	'initiated man/(pl.)'
gindalba	gindal-gindalba	'lizard/(pl.)'
kalamparra	kala-kalamparra	'March fly/(pl.)'

It is apparent that the reduplicated string is two syllables long in all cases, but there is a crucial difference in how those two syllables are filled. While the reduplication ends in a consonant in *gindal,* it is vowel-final in the other two cases. This distinction is not arbitrary: the final *l* of *gindal* is licensed because it is the coda of the second syllable in *gindalba*; the *r* or *mulari* cannot be copied because it is the onset of the third syllable. The apparent problem of *kalamparra* is merely illusory; as Nash (1982) argues, Yidin^y homorganic nasal-stop sequences (like *mp*) are complex onsets or perhaps even monosegmental, so they come under the same rubric as single intervocalic consonants.

What we see in Yidin^y, then, is that the "onsethood" of *r* in *mulari* and like examples is preserved or transferred under reduplication. An *r* which is an onset cannot fill a coda position in the reduplication, and therefore it cannot be associated.

The mechanism that Marantz (1982) adopts to account for this case is copying bare association lines, with their subordinate elements but without their superordinate ones. The reduplicative affix is $\sigma\sigma$; this links up with the copied association lines until it is exhausted. The relevant derivations therefore proceed as in (2):

(2)



The last syllable copied—denoted by *ba* or *ri* with skeletal structure but without σ-level structure—has not filled a template slot and will therefore be erased by a general convention holding for excessive reduplicated elements. The *r* cannot be linked to the reduplicative prefix; it is indissolubly linked by bare association lines to the ephemeral copied syllable *ri*.

2.2 Quantitative Transfer and Parafixation

The most extensive and provocative proposal for accomplishing quantitative transfer—and many other kinds of transfer as well—is presented by Clements (1985). Clements's fundamental idea, which we will elaborate on below, is that reduplication is not the linear attachment of CV or other templatic structure adjacent to the template of the base, but rather a kind of parafixation, in which the two morphemes, base and templatic affix, are simultaneous. Instead of the melody-copying of Marantz (1982), Clements invokes a mechanism of projection (called by him transfer, a term that we will reserve for the phenomenon rather than any particular analysis of it) in which the base and parafix templates first are linked one-to-one and then the melodic and configurational (association-line) information

of the base is passed to linked positions of the affixal template. This truly nonlinear representation is later linearized, yielding the familiar prefix/suffix/infix structure of nonparafixal morphemes. We now examine in detail how this mechanism works.

Total reduplication involves copying an entire word at some specified point in the derivation (that is, the entire word as it is constituted at that stage is copied). It is indifferent to the phonological make-up of the word—no limits are placed on the prosody, as they are in partial reduplication. Quantitative transfer invariably occurs in total reduplication.

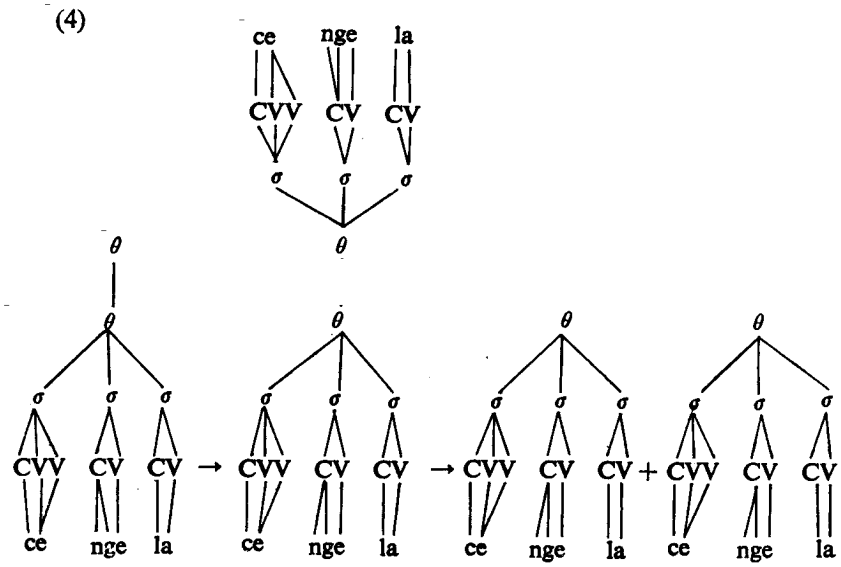
One example of this phenomenon will suffice, the transfer of vowel length in Kihehe, reported by Odden and Odden (1985) and discussed by Clements. In Kihehe, the entire morphologically characterized unit called the stem is copied, as in the following examples:

(3)

ku-ceeng-a	ku-ceenga-ceenga	'to build/a bit'
ku-ceeng-el-a	ku-ceengela-ceengela	'to build for/a bit'

The stem—the material minus the prefix *ku*—is replicated exactly, down to the length of the vowel in the first syllable.[3] In Clements's analysis, the stem is characterized by a template θ. The stem template θ is parafixed (linked) to the base θ, and all properties of the base θ are projected onto it. The representation is later linearized:

(4)



Other examples of total reduplication—with templates R (root), θ (stem), or W (phonological word)—will behave similarly. The projection operation accomplishes the entire work of melody copying and adds to it the transfer of vowel length.

Partial reduplication, in which the parafix is characterized by a string of templatic units, works in essentially the same way, although the derivation is naturally somewhat more complicated. We will look at three examples that exhibit transfer effects, although others that are precisely parallel could be brought to bear as well:

(5)

a. Makassarese (Aronoff 1985, Aronoff et al. 1987)

ballak	ballak-ballak	'house'
golla	golla-golla	'sugar'
tau	tau-tau	'person'
manara	manak-manara	'tower'
balao	balak-balao	'rat'

b. Tagalog (Carrier[-Duncan] 1979, 1984; Clements 1985)

li:nis	li:nis-li:nis	'clean'
walis	walis-walis	'sweep'
baluktot	balu:-baluktot	'crooked'

c. Mokilese (Levin 1985)

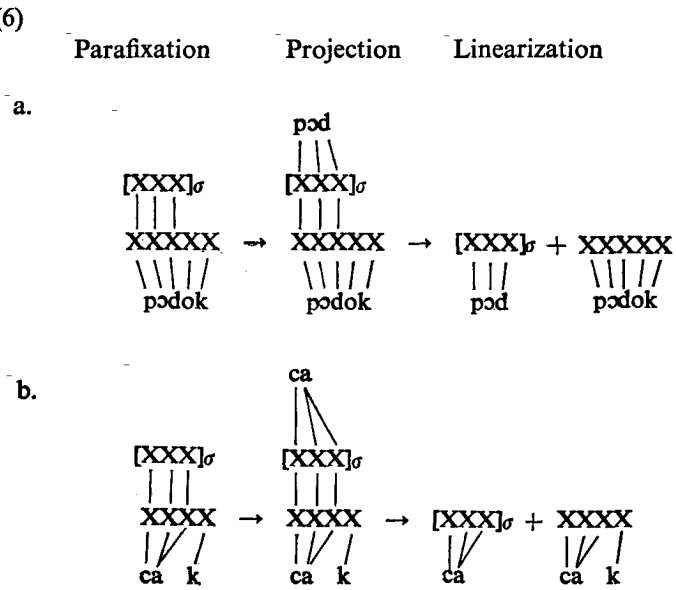
pɔdok	pɔd-pɔdok	'plant/(prog.)'
caak	caa-caak	'bend/(prog.)'
onop	onn-onop	'prepare/(prog.)'
andip	and-andip	'spit/(prog.)'
pa	paa-pa	'weave/(prog.)'
wia	wii-wia	'do/(prog.)'

The transfer effects in these three languages are: (1) Makassarese medial consonant gemination is preserved under disyllabic reduplication; (2) Tagalog initial-syllable vowel length is preserved under disyllabic reduplication; (3) Mokilese vowel length is preserved under monosyllabic (heavy syllable) reduplication (contrast *pɔd-pɔdok* with *caa-caak*, **cakcaak* —superheavy *caak* exceeds the requirements of the reduplicative template).

In general outline, this is the transfer effect in partial reduplication. The precise details of the analysis of these languages are rather complex, however, and exploring these would take us rather far afield. They are dealt with in detail in McCarthy and Prince (1986). Let us concentrate on a single case, Mokilese. Levin (1985) proposes that the reduplicative affix in Mokilese is [XXX]σ—that is, a syllable containing three segmental slots unspecified for further structure. Adopting Clements's parafixation idea,

she derives the *pɔd-pɔdok/caa-caak* contrast as follows:

(6)



The projection operation copies the phonemic melody and association lines of the base exactly, transferring vowel length from base to parafix. Similar results hold for Tagalog and Makassarese.

3. Discussion

We now examine the theories (and the data) discussed above in greater detail.

3.1 On Association-line Copying

The transfer effect in Yidinʸ obviously stands out; it is the only case discussed where something other than segmental quantity is preserved. This does not make it unique, however, since there is some evidence (in Clements (1985) and in the concluding section of this paper) for transfer effects involving properties other than quantity. Rather, the uniqueness of Yidinʸ lies in the predictability of the property transferred: while segmental length is clearly unpredictable in any of the languages considered, the syllabification of VCV sequences is obviously predictable in Yidinʸ and, very likely, all other languages as well.

We shall expand on the importance of unpredictability in transfer effects later. It is sufficient to note that onsethood is not ordinarily transferred.

In effect, this point is made by Marantz (1982) in his discussion of Agta—in the reduplication *bar-bari* the *r* is an onset in the base and a coda in the reduplication. Any general requirement of transfer of onsethood (and similar properties of syllable position) would make Agta impossible and would require that all reduplication be analyzable as syllable copying.[4]

There are more specific empirical problems with the analysis of Yidin^y via transfer. There is a minimal contrast in the apparent transfer effect between Yidin^y and another Australian language, Lardil (Wilkinson 1986, McCarthy and Prince 1986). Compare Yidin^y *mula-mulari* with Lardil *parel-pareli.* In all relevant respects the reduplicative affixes of the two languages are the same (the minimal word or the foot). Yet in Lardil the onset consonant *l* can convert to a coda; in Yidin^y it cannot. If we adopt the goal of finding necessary and sufficient conditions for transfer, then Yidin^y simply cannot be a case of transfer, since the difference between Yidin^y and Lardil is inexplicable within transfer theory.

In fact, the difference between Yidin^y and Lardil lies in a different domain, first noted by Nash (1982). Nash proposes that the melodic elements in Yidin^y that are available for association with the reduplicative affix are just exactly those of the initial foot—equivalent to the first two syllables. In other words, reduplication takes as its domain or has scope over only the first two syllables of the base—thus, only that much of the base melody is copied and available for association.

Broselow and McCarthy (1983) show that precisely this mechanism is required to account for one type of infixing reduplication. In Samoan, the plural of verbs is formed by reduplicating the stressed (penultimate) syllable: *alófa, alolofa* 'love'. By prefixing CV (or more properly σ) to the foot, we derive both the position and copying scope of this reduplicative affix.

Yidin^y, then, is prefixation to the minimal word (the foot). As it happens, the foot is initial, so we get no infixation effects. We do get more extensive effects of prefixation to a minimal word in Tagalog and Makassarese, however, as is shown in McCarthy and Prince (1986). Lardil lacks the specification of a prosodic constituent to which reduplication applies; it therefore reduplicates in a way that is minimally different from Yidin^y.

These considerations impeach the idea of copying association lines. This theory requires that all languages with the same reduplicative affix behave in the same way as Yidin^y; Lardil does not. Furthermore, Yidin^y can be analyzed in a way that requires no mechanism that is not independently motivated. Finally, copying association lines predicts effects of a more general character that are not observed; Agta with its σ affix freely ignores syllable breaks in the base, as in fact do all other languages.

3.2 On Parafixation

The parafixation theory does not exhibit comparable problems in dealing with the general freedom of reduplication to reparse the syllables of the base. And it is clearly an attractive account of quantitative transfer. It does, however, run into other problems when it is regarded as an overall theory of reduplication.

First, as we observe in McCarthy and Prince (1986), the parafixation theory has serious difficulties in accounting for the locality of reduplication (Kim 1984). Without exception (v. McCarthy and Prince (1986) for justification), the copy and its original are absolutely adjacent (up to extrametricality). This regularity is essentially inexpressible in the parafixation theory. On the one hand, the parafixation theory must stipulate some direction of association of each parafix with the base. On the other hand, though, it must somehow retrieve this information when it comes time to linearize the representations. If direction of association and direction of linearization are entirely divorced from one another, then the requirement of locality or contiguity between the original and the copied strings becomes unattainable. This problem is by no means a trivial one; if association and linearization are separated by the application of other rules, as Clements carefully argues to account for over-and under-application, then some global mechanism (like features [Prefix] and [Suffix]) will be needed to transmit information through the course of the derivation. Furthermore, this linearization operation, whatever its character, will be a mechanism peculiar to reduplication, since any efforts to collapse it with the independently motivated mechanism of Tier Conflation (McCarthy 1986) run afoul of precisely this linear order problem.

There are also specific empirical problems with the parafix approach in relation to the Onset Rule. In McCarthy and Prince (1986), we show that applications of the Onset Rule across the affix-base juncture are critical to accounting for patterns of reduplication. This is especially true of a language like Mokilese. Recall that the analysis in Levin (1985) of Mokilese is a [xxx]σ parafix—a syllable containing three X units without further structure. Examples like *onn-onop* or *and-andip* are simply incompatible with this. Mokilese has no tautosyllabic geminate clusters anywhere, and tautosyllabic nongeminate clusters are limited to final position in 9 words (out of 3621 in the dictionary) of obviously foreign origin.[5] Rather, the Mokilese prefix is a heavy syllable, call it H for now. Application of the Onset Rule across the prefix-stem boundary gives the effect of additional copying:

(7)

Such applications of the Onset Rule, especially in a form like *and-andip* or even more compellingly in the infixing reduplication cases analyzed in McCarthy and Prince (1986), cannot be accomplished with parafixation: the *d* can never be copied since it is unlinked in the parafix, achieving segmenthood only by cross-juncture association.[6]

4. Assembling the Observations and Generalizations

It is now appropriate to assemble some basic observations about quantitative transfer which any theory must explain.

First, we observe that quantitative transfer is found only in languages with lexically distinctive quantity. This is, in a sense, completely obvious; nevertheless, it is important since it accords with our dichotomy between quantitative transfer and the illusion of transfer of a nondistinctive property in Yidin[7].

Second, quantitative transfer is always secondary to the requirements of template size. Quantitative transfer invariably occurs in total reduplication (Kihehe), since total reduplication places no limits on template size. Quantitative transfer occurs in partial reduplication if the reduplicative affix has enough room (Tagalog, Makassarese, Mokilese). Quantitative transfer never occurs if the affix is too small. For example, Tagalog also has a light syllable (=CV) reduplicative prefix which abjures transfer: *ka-kandilah* 'candle', *ʔa-ʔa:ral* 'read'.

In this respect, quantitative transfer precisely parallels phonemic melody "transfer". The transfer of the melody in reduplicative or templatic morphology—that is, the association of the melody—is always secondary to the requirements of template size and prespecification.

This last point is at once the most obvious, counter-intuitive, and important of the lot. The phonemic melody is always transferred from base to reduplicative affix. The transfer of the melody is imperfect in a familiar way—it can be overridden by a too-small template or by prespecification. In these respects, it appears identical to the transfer of quantity.

What, then, is the difference between the melody and quantity? Quantitative transfer appears special because all languages have distinctive melodies (all languages make featural distinctions), but only some languages have distinctive quantity. Quantitative transfer is not special simply because templates themselves encode quantity requirements; templates also encode melodic requirements in the form of prespecification. Quantitative transfer also appears special because quantity is encoded configurationally, in the melody-to-skeleton mapping, and reduplicative and templatic morphology have procedures for predicting the melody-to-skeleton mapping. But lexically distinctive quantity is just the case where the melody-to-skeleton mapping

is unpredictable not only in reduplication, but in ordinary underived words as well. In other words, if a language has distinctive quantity, we need more information than the melody alone contains not only to satisfy a reduplicative template but also to build skeletal structure where there is no template at all. Distinctive quantity means that the skeleton cannot be projected from the melody unaided (likewise for syllabicity, although we do not discuss that here). It is no surprise that the same thing holds in reduplication. We will elaborate on this below.

Remark

We briefly digress for a clarificatory remark. We assume, with work in the Lexical Phonology framework (Kiparsky 1982, Archangeli 1984, Pulleyblank 1986), that lexical entries cannot contain predictable information—that is, lexical representations are minimally redundant. We assume too that syllable structure is in general predictable from the melody. Since quantity is represented by one kind of syllable structure information, lexically distinctive quantity subverts the general predictability of syllable structure.

We have not been successful in finding explicit statements in the literature about what it means to minimize the redundancy of skeletal information in lexical entries,[7] although at least one demonstrably incorrect view seems frequently implicit. This view holds that, while syllable structure is not represented lexically, skeletal structure, denoted by C/V or X, is. There are two reasons that this is insupportable. First, many aspects of skeletal structure are themselves redundant, predictable from characteristics of the melody alone. We elaborate below. Second, this presupposes a strict distinction between syllabic and skeletal information, a distinction which, as we show in McCarthy and Prince (1986), is false.

Finally, it is worth noting that the problem of predicting syllabic structures from the melody arises not only when a lexical representation is first encountered, but also later in the derivation when resyllabification occurs (because of phonology, loss of extrasyllabicity, or subsequent morphology). In particular, if one adopts the position that some or all preexisting syllable structure is erased in these circumstances, the problem of distinctive quantity in resyllabification is then identical to the problem in initial syllabification.

What we have shown up to this point is that quantitative transfer does not have a peculiar place in morphology and phonology. If anything, it should be the expected outcome. Our claim is that all and only the lexically specified properties of the input are available for association (therefore "transferred") to the output in reduplicative and templatic morphology. If lexical representations are minimally redundant, only the distinctive properties are lexically specified. The melody is always distinctive, therefore always lexically specified; it is always transferred. Quantity is lexically specified in languages where

it is distinctive; in those languages it is transferred. Syllabification of VCV sequences is apparently never distinctive; it is never transferred.

Before continuing, we take a moment to expand on the notion "lexically specified". Lexical representations assert only distinctive properties of the words they underlie, ensuring that they are nonredundant. Thus, the lexically specified properties of a form can be determined by recursive application of the following procedure. (1) Anything in an underived lexical entry is lexically specified. (2) Distinctive differences between a representation at the end of one cycle and the end of the previous cycle are lexically specified.

Why are all and only the lexically specified properties of the input transferred to the output? In the case of templatic morphology, which shares with reduplication the morphological specification of a template, the answer is self-evident: the lexical representation of the input is mapped onto the template. The Arabic verb *kattab* is derived by mapping the lexical representation *ktb* onto a particular template. Association of the lexically specified properties of the input is exactly what we expect in templatic morphology.

In the case of reduplicative morphology, the assumption is made (in both parafixing and nonparafixing theories) that the base itself is copied and associated. This copying, however it is achieved, is incompatible with "reversion" to the lexically specified input, since the material available for copying contains a considerable amount of redundant information, especially syllable structure. We cannot say that syllable structure is "erased" from the copy, because we do not know which aspects of syllable structure are distinctive (marking quantity, for instance) and which are predictable. And we cannot say that predictable structure has not yet been assigned to the base, since cases like Ponapean (McCarthy and Prince 1986) demand prior knowledge of syllable or mora count to determine the form of the reduplicative affix. By our insistence on only transmitting lexical specification from base to reduplication, we are in fact rejecting melody copying, however it is accomplished, as a reduplicative mechanism. Insertion of the lexical specification of the base in lieu of copying is just as good a stipulation—it is better, since it has substantial independent plausability, as we now show.

By far the most widespread type of reduplication is total reduplication, and most commonly total reduplication exhibits exactly the same phonological properties as ordinary compounding at the same lexical level (root, stem, or word). Since McCarthy (1979, 1981) and Marantz (1982), total reduplication has been regarded as the result of affixing a template with no phonological conditions—a W for word copying, for example, or the stem θ of Kihehe. The sole job of this affixal template in the theory has been to induce total melody copying (and quantitative transfer), accomplished either by copying and association in Marantz (1982) or by other mechanisms in

McCarthy (1979) or in the parafix theory of Clements (1985). Yet the normal connection between total reduplication and compounding suggests a very different account: total reduplication involves no copying at all; it is the result of compounding a word with itself. Thus, there is no mapping onto a template in total reduplication—the template is essentially vacuous anyway. Total reduplication is tautologous compounding.

Of course, not all cases of total reduplication are paralleled by ordinary compounding at the same lexical level. This is unsurprising; "compounding" does not describe a single morphological process of all languages, but rather a diversity of phenomena in which two bases are conjoined in a single word. In the extreme case, total reduplication may be the only form of compounding a language has. This is not an intolerable idiosyncrasy; some languages have compounding only in far more restricted domains, like their numeral systems.

By itself, the demonstration that total reduplication is nontemplatic tautologous compounding is not a big deal; the template did no work anyway. But one property of compounding is important: a compound like *postman* is composed of the lexical entries for *post* and *man*. In Kihehe stem reduplication, the lexical entry for each stem (composed of distinctive melodic and quantitative information only) is compounded with itself to give the observed pattern of reduplication. In cases of partial reduplication like Mokilese, Tagalog, and Makassarese, we can also call on tautologous compounding to supply the specified melody and quantity of the base, but a templatic constraint in the form of a skeletal prefix (or suffix) operates as well, reshaping one member of the compound to fit its requirements. It is not unknown to have a templatic constraint imposed on one member of a compound even when reduplication is not involved: the cases of Madurese and Zuni are discussed in McCarthy and Prince (1986). Yet another reason to regard reduplication as compounding is that reduplication frequently displays important linear-order differences from ordinary affixation. In many languages (Turkish, various Australian languages), partial reduplication is the only form of prefixation in an exclusively suffixing language. In others (Chinese), reduplication is the only productive affixation process there is. These asymmetries are far more likely if reduplication is a kind of compounding.

A final remark. One may think of tautologous compounding as a convenient analogy for what happens in full and partial reduplication, an analogy without theoretical substance. That view is not inimical to ours. It requires only the recognition that insertion of the lexical entry of the base stands in place of the melody-copying machinery of other theories—a fair trade-off of one bit of stipulation for another.

We have established the basic source of quantitative transfer in reduplication; we must now show how a templatic constraint modifies it.

5. The Proposal

5.1 Formal Background

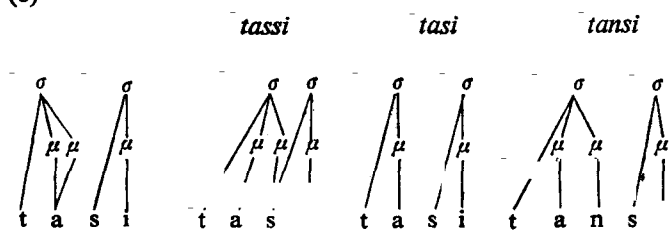
Let us begin with a trivial case, a language with no distinctive quantity. (Here and subsequently we disregard syllabicity distinctions as well; we will return to them in the conclusion.) Nonredundant lexical representations in such a language will contain no skeletal information at all, since all skeletal information can be straightforwardly projected from the melody by exceptionless rules. We will call these rules of prosodization and will develop a theory of them here.[8]

Introducing a quantity distinction into this hypothetical language should complicate its lexical representations minimally—it should not mean, if we take minimization of redundancy seriously, that suddenly the full array of templatic structure appears in every lexical entry. How is this done?

We assume a theory of templatic structure in which only a moraic level (μ) intervenes between melodies and syllables (Hyman 1984, McCarthy and Prince 1986), but our remarks hold in a general way for theories in which more elaborated structure (C/V, X, N, R, O, etc.) is permitted. Heavy syllables contain two moras; light syllables only one. Long segments ought to bear some stigma of their special status in the nonredundant lexical entry, while short segments ought to be unmarked. The converse would make very little sense, since it inverts the logic of markedness. There are infinitely many possibilities for the special stigma of long segments. They could be melodically geminate, only to be fused immediately on their entry into the phonology (since the variety of OCP effects on geminates requires this). They could be marked with the feature [+long], which would have a special effect on their mode of prosodization, only to disappear from phonological representation. We could introduce some new templatic symbol, confined only by the versatility of printers and word processors. But the usual coherence requirements on scientific theories demand that, in the absence of contrary evidence, out lexical entries contain no wider array of descriptive elements than our derived representations. Since all long segments are at least in part moraic (except for some so-called long-distance geminates), linking to the lexically long melodic unit is the natural way to go.

Consider a hypothetical language without onset or coda clusters, but with contrastive vowel length and consonant gemination and with CV(C) syllables. In such a language, we can find the following surface vocabulary:

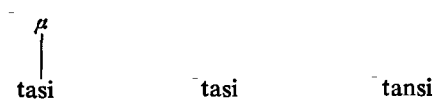
(8)



In these surface representations, we have made the assumption that a single melodic link exhausts a mora; thus, onsets are linked to the syllable. This asumption is not critical, as we observed in McCarthy and Prince (1986), but serves here only to maintain a degree of homogeneity in the trees we draw and the rules we propose.

Lexical representations for these four words that minimize redundancy will appear as in (9):

(9)



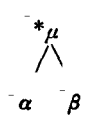
Only the underlying long segments, distinct from underlying short ones, have a moraic link.

There are many possible paths from the underlying representations in (9) to the surface ones in (8); we will outline just one of them. The essential element of all systems of prosodization is that lexical distinctness—in particular, the distinctness of prelinked μ and its absence—must be maintained up to templatic requirements. We will devlelop this distinctness idea below.[9]

We encode the fundamentals of the system of prosodization as a set of principles of well-formedness:

(10)

a. Moraic Exclusion



b. Mora Syllabification

$\sigma \rightarrow \mu\ (\mu)$

c. Morafication

$\sigma[\mu \ldots$ $\mu\mu]\sigma$

$\{v, c\}$ (v, c are designated vocalic and nonvocalic melodies)

d. Onset Rule

$\sigma[c \ldots$

We will digress briefly to comment on these conditions. Moraic Exclusion is merely an assumption; the alternative is to require that all melodic elements (or all in a specified domain or up to some limit) be linked to a mora. Mora Syllabification expresses the most common condition: a language with both heavy and light syllables. Some languages have only light syllables, and so they modify Mora Syllabification accordingly.

Morafication as it stands expresses the notion "what makes (is essential to) a mora" in our hypothetical language and in many familiar ones. Languages vary in the conditions placed on the first or second mora; English surface structure allows any sonorant (not just a vowel) in the first mora, for example. The conditions on the second mora are more relevant in reduplicative examples; Lardil is a clear case of a language in which only a vowel may make the second mora of a syllable. In Kwakiutl, we find a parallel to the English situation: only sonorants can make the second mora.

Finally, the Onset Rule expresses as a well-formedness condition the pervasive (but not exceptionless) cross-linguistic generalization that syllables must have onsets. It further encodes an exceptionless requirement on the syllabification of VCV sequences.

Our hypothetical language lacks nonmoraic coda consonants; in languages like Lardil that have them, a Coda Rule (acting in strict deference to other well-formedness requirements) will apply.

This grammar, together with the requirement that lexical distinctness is maintained, gives an unambiguous parsing of the underlying representations in (9) into the surface representations in (8). Distinctness requires that a vowel lexically specified as moraic is realized with two moras in prosodization, while a vowel without a mora in the lexicon receives a single mora. Likewise, the moraic consonant *s* is both coda and onset; the nonmoriac *s* is only an onset. The surface representations in (8) are the only solution to prosodizing (9) by the rules of prosodization while maintaining distinctness.

As they stand, the rules of prosodization encode regularities in the form of well-formedness conditions. They could as well be stated algorithmically, as a set of rules for generating surface structures one step at a time, but the two approaches are very nearly equivalent. We defer exploration of

such alternatives to another time. Morphology that manipulates templatic structure directly introduces just two complications into this model. First, we must say how the morphologically-specified template is satisfied by the preexisting melodic and prosodic structure of the lexical entry. Template satisfaction is obligatory and maximal (McCarthy and Prince 1986); all elements in the morphological template must be filled and the maximal amount of lexically-specified melodic and skeletal structure must be mapped onto the template. Second, we have to say something about directionality: the outermost edge of the template and the edge of the melody must coincide. ("Outermost edge" here is understood as a cyclic periphery.)[10] When the template is exhausted, prosodization stops. When prosodization stops, lexical distinctions may be lost. Lexical distinctions in prosody may disappear (as in the Agta example below or Tagalog *ʾa-ʾa:ral*), but lexical distinctions of melody are routinely lost as well, by the erasure of unprosodized melody elements. These, then, are the differences between template satisfaction and simple prosodization in nontemplatic morphology.

5.2 Exemplification

Total reduplication, as we have already observed, is not templatic at all; the "base" is compounded with itself, and the usual prosodization of free melody and skeleton applies without a templatic constraint. The entire distinctive content of the lexical entry is inserted, and the lexical distinctions are preserved exactly under reduplication because they are preserved exactly under simple prosodization (in fact, they must be). Rather, the real templatic action is in partial reduplication.

We begin with a simple example of partial reduplication which illustrates the basic mechanism and also a more subtle point: nontransfer of segmental quantity under a template size restriction. Agta is a language like our hypothetical one above, except that it displays consonant and not vowel length distinctions. With these syllabic well-formedness conditions, Agta works as follows:

(11)

a. Data

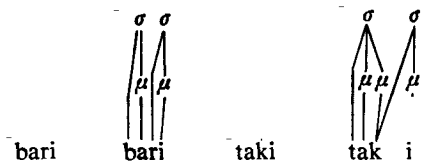
bari	bar-bari
takki	tak-takki

b. Lexical Representations

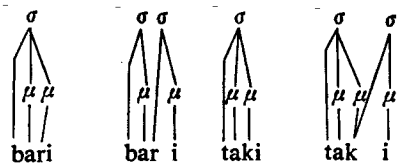
c. Reduplicative Affix

$\sigma +$

d. Reduplicative Structures (after insertion of lexical representation)



e. Surface Representations (before erasure of unprosodized melodic elements)



The really interesting part is the treatment of the intervocalic consonants *r* and *k* in these examples. In the base *bari, r* is an onset of the syllable *ri,* since syllables must have onsets. Its other option, coda of the preceding syllable, is just that—optional—and so it accedes to the immutable requirement of the Onset Rule. But in the reduplicative affix, template satisfaction has created no syllable *ri,* so maximization of the template σ pulls in the *r* as a coda. In the base *takki,* melodic *k* is lexically specified as moraic; it must therefore attach in syllable-final position (since a moraic consonant is necessarily postnuclear). The Onset Rule applies nevertheless, and so *k* is an onset of the syllable *ki.* In the reduplicative affix, there is no second syllable to demand dual allegiance of *k,* and so it is only a coda. The constraint imposed by the template of Agta neutralizes the lexical distinction between nonmoraic *r* and moraic *k,* but it also neutralizes the distinction between any melodic elements that fail to attach to the template. Falling off the end of the template is death to lexical distinctions of all kinds.

Now we consider cases of partial reduplication with quantitative transfer. We will first discuss two examples of minimal word reduplication, Makassarese (Tagalog would serve as well) and Lardil. Makassarese, it will be recalled, involves an additional complication in the copying of a final consonant; we will disregard this here, since it is irrelevant, and assume the ultimately correct analysis in which the minimal word is disyllabic. Here, W_{min} denotes the prosodic category "minimal word", and F denotes the prosodic category "foot".

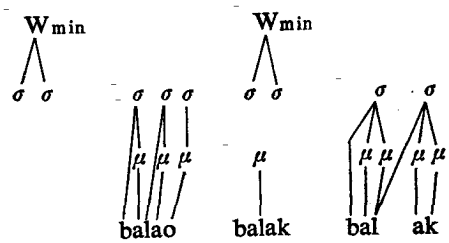
a. Data

balao	balak-balao	'rat'
ballak	ballak-ballak	'house'

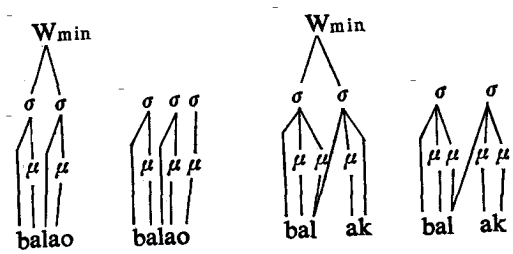
b. Lexical Representations

c. Reduplicative Affix
W_{min} (=F=σσ)

d. Reduplicative Structures (after insertion of lexical representation)



e. Surface Representations (before erasure of unprosodized melodic elements)



After the lexical entries have been inserted, prosodization under the minimal word templatic constraint takes place. The requirement that lexical distinctness is maintained means that the nonmoraic *l* of *balao* and the moraic *l* of *ballak* must be prosodized differently—the first as a simple onset, the second as a geminate coda plus onset. The transfer of quantity follows from this alone, a sequence of events that is essentially identical to prosodization of the lexical entries even when they are not reduplicated.

The minimal word in Lardil is bimoraic; in Lardil only vowels are moraic, and nonmoraic codas can be supplied by a coda rule.

(13)
Lardil

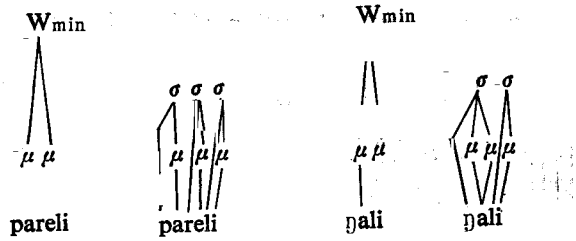
a. Data

pareli	parel-pareli
ŋaali	ŋaal-ŋaali

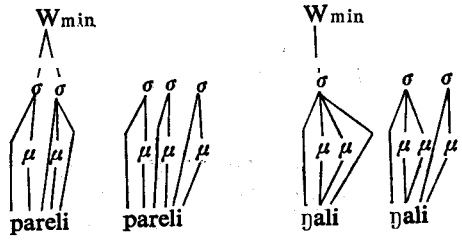
b. Lexical Representations

c. Reduplicative Affix
W_{min} (=F=$\mu\mu$ (one or two syllables is OK))

d. Reduplicative Structures (after insertion of lexical representation)



e. Surface Representations (before erasure of unprosodized melodic elements)



Preservation of lexical distinctness means that the *a* of *pareli* is prosodized as monomoraic, while the *a* of *ŋaali* is prosodized as bimoraic. In the former two syllables are required to satisfy the bimoraic template; in the latter, one syllable suffices. Maximization of the template requires adjoining a final consonant coda (since codas are nonmoraic in Lardil): the reduplicative affix therefore picks up the final *l*s.

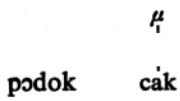
Finally, we examine Mokilese, which works in a very similar way. Mokilese has a heavy syllable ($[\mu\mu]_\sigma$) reduplicative affix, and both vowels and consonants can make the second mora of a heavy syllable.

(14)

a. Data

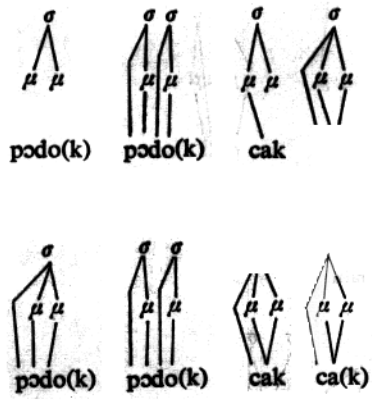
pɔdok	pɔd-pɔdok
caak	caa-caak

b. Lexical Representations



c. Reduplicative Affix

d. Reduplicative Structures (after insertion of lexical representation)



We have left the word-final consonant unassociated in these representations; distributional regularities suggest that it is extrametrical. The lexically-represented quantitative distinction is preserved in prosodization; thus, *ɔ* is short but *a* is long. Satisfaction of the template requires assigning *d* to the second mora of the reduplication, but *k* cannot be prosodized in the reduplication because superheavy syllables are impossible word-internally.

What we have seen up to this point, then, is that quantitative transfer in reduplication is not a special phenomenon requiring specialized machinery. Rather, it follows from a correct understanding of certain fundamental issues in phonological representation: the make-up of lexical entries, the rules of prosodization, and the nature of template satisfaction. Once these issues are disposed of, the problem of transfer, at least for quantity, is an illusion.

6. Quantitative Transfer in Pure Templatic Morphology

Although the original motivation for transfer effects is provided by reduplicative morphology, Hammond (1986) has argued that templatic morphology in Semitic also exhibits transfer. The domain where this arises is the system of broken plural formation that is the virtually exceptionless pattern for Arabic nouns with four consonants. The relevant data are as follows:

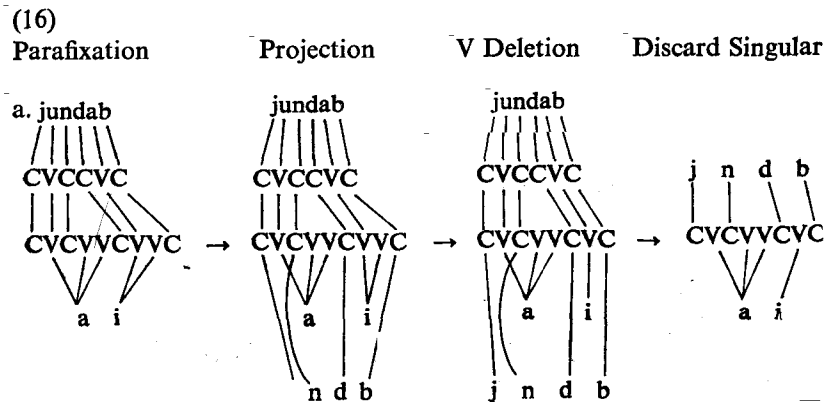
(15)

jundab	janaadib	'locust/(pl.)'
sulṭaan	salaaṭiin	'sultan/(pl.)'

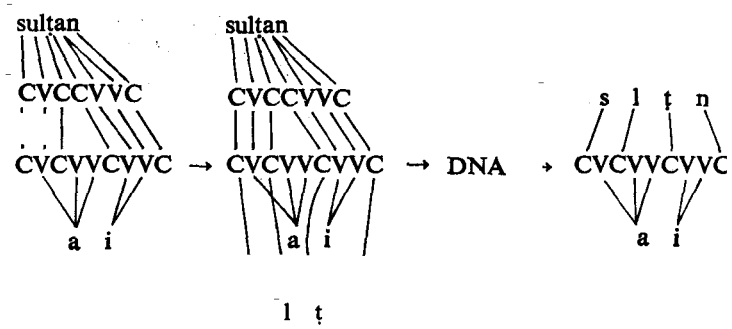
In McCarthy (1979) it was argued that this system is purely templatic in character; the consonants of the singular are mapped onto a template *Ca*C*aa*C*i*(*i*)C, closely paralleling the templatic morphology of the Arabic verb. But a templatic analysis runs into one serious problem: how can it capture the nearly exceptionless regularity that the vowel length of the final syllable in the singular is replicated in the final syllable of the plural? In McCarthy (1979) an additional redundancy rule stipulates this; in McCarthy (1982) the plurals are formed by an infixation rule, while the template itself is expressed with a nearly superfluous redundancy rule. Clearly neither of these alternatives is satisfactory.

Hammond (1986) argues that this phenomenon is a transfer effect comparable to those found in reduplicative systems. The idea is that a mechanism similar to Clements's projection applies between the skeleton of the singular and of the broken plural template CVCVVCVVC. If the final long vowel of the plural does not find a match in the final syllable of the singular, it is deleted by a language particular rule. The derivations proceed as follows:

(16)



b.



The base (at the top in these derivations) is linked to compatible elements of the parafixal skeleton. The associations of the base with parafixal skeletal elements that are not prespecified (therefore the consonants only) are then projected from base to parafix. The transfer effect itself is captured by applying the language-particular rule of V Deletion to the final unlinked V slot in the parafix of *jundab;* general stray erasure clearly cannot be invoked here, since the medial *VV* of the parafix is never linked with the base. At the final stage of the derivation, the singular template and melody must evidently be discarded.

It is important to note that this account differs in nontrivial ways from Clements's proposal for reduplication. First, we are dealing here not with a parafix and a base, but rather with a transderivational relation between singular and plural. Thus, at the end of the derivation it is obviously crucial that no linearization take place. Second, while quantitative transfer falls out from the universal machinery in Clements's account, here it must be stipulated by the rule of V Deletion—parafixation serves only to condition V Deletion, not to provide the transfer effect directly. Thus, the grammar of Arabic could as well lack this rule, displaying no transfer at all. Third, alignment of base and parafix skeleta at the initial stage of the derivation must proceed differently here than in reduplication. It is critical to Clements's account of transfer in reduplication that vowels link first, with consonants taking a subordinate role. For the Arabic plural, linking of vowels first, regardless of direction, yields exactly the wrong result. Instead, association must be driven by the base skeleton onto the parafixal skeleton.

The parafixation analysis of Arabic broken plurals not only has these various technical problems but also has a highly restricted empirical coverage. Below we review the full range of related broken plural (and similar diminutive) patterns, many of which are incompatible with this account. We will show that the correct analysis of broken plurals is of a very different character, exploiting machinery developed in McCarthy and Prince (1986).

6.1 Review of the Data

If we embed the broken plural phenomenon in the context of the full array of Arabic templatic morphology, it appears somewhat unusual. Arabic verb forms that are derivationally related—that is, different binyanim of the same root—share the root and nothing else. Quantity specifications and affixes that may appear in one binyan are absent in others. Furthermore, the presence of one binyan in the dictionary is no guarantee of the presence of any other. For these reasons, the different binyanim are derived directly from the root, rather than one binyan from another.

The situation with broken plurals is quite different. A broken plural invariably requires the presence of a related singular in the lexicon. A broken plural inherits a wide array of properties from its related singular in addition to the root. We exhibit the following cases, in which exceptionlessly derivational prefixes, idiosyncratic root-template linking, and root reduplication, in addition to vowel quantity, are "transferred" from the singular to its broken plural:

(17)

a. "Transfer" of Derivational Prefixes

marhal (at)	maraaħil	'stage/(pl.)' √rħl + "place"
miftaaħ	mafaatiiħ	'key/(pl.)' √ftħ + "instrument"
ʔumθul (at)	ʔamaaθil	'example/(pl.)' √mθl
taqdiir	taqaadiir	'calculation/(pl.)' √qdr
yanbuuʿ	yanaabiiʿ	'spring/(pl.)' √nbq

b. "Transfer" of Root Reduplication

zalzal (at)	zalaazil	'earthquake/(pl.)' √zl

c. "Transfer" of Idiosyncratic Root Consonant Association

nuwwaar	nawaawiir	'white flowers'
makkuuk	makaakiik	'drinking cup'

Arabic broken plurals inherit all properties from their singulars that are not specified by the broken plural template; the plurals are derived from the lexical entries of the corresponding singulars, not from the root. This is a fundamental difference between broken plural templatic morphology and verbal binyan templatic morphology.

This conclusion may appear to be self-evident, but it is important enough that it is worth emphasizing. The transfer of vowel quantity from singular to plural is one of a whole spectrum of properties transferred in broken plural formation.

This conclusion is reinforced by a brief examination of Arabic diminutive formation (McCarthy 1979, 1982). Diminutives are normally formed in almost exactly the same way as broken plurals, with the same transfer of vowel length

and other characteristics: *junaydib, sulayṭiin, murayħil, mufaytiiħ*. But the language also recognizes another mode of diminutive formation, called the "curtailed" diminutive, in which the root alone is preserved. Nothing is transferred—not vowel length, not exceptional root association, not affixes:

(18)

miˤṭaf	ˤuṭayf	
hammaam	humaym	'hot bath'
ˤuṣfuur	ˤuṣayfir	'sparrow'
qirṭaas	qurayṭis	
muqˤansis	quˤays	

The diminutive has available to it both modes of word formation: derivation from the already derived lexical entry of the noun, and derivation directly from the root. The root mode is not exhibited by the broken plural, which is unsurprising in view of its inflectional status.

In addition to singular/plural pairs of the *jundab/janaadib* and *sulṭaan/salaaṭiin* types, a number of superficially different patterns of broken plural formation are analyzed in the same way in McCarthy (1979, 1982). All masculine and feminine nouns of the shape CVVCVC, except for lexicalized active participles, form their plurals as in (19a). Nouns of the shape CVVCVVC form plurals as in (19b), showing quantitative transfer in the final syllable. All feminine nouns of the shape CVCVVC form their plurals as in (19c). All formally masculine CVCVC and CVCC nouns form their broken plurals according to one of the three patterns in (19d, e). These last two groups show variation in vocalism and the appearance of initial glottal stop, but all have the canonical pattern CVCVVC in the plural (McCarthy 1982).

(19)

a. CVVCVC Singulars		
baaˤiθ	bawaaˤiθ	'motive'
b. CVVCVVC Singulars		
jaamuus	jawaamiis	'buffalo'
c. CVCVVC Singulars		
jaziir (at)	jazaaʔir	'island'
d. CVCVC Singulars		
ʔasad	ʔusuud	'lion'
jabal	jibaal	'hill'
qadam	ʔaqdaam	'footstep' /qadaam/
e. CVCC Singulars		
nafs	nufuus	'soul'
baħr	biħaar	'sea'
farx	ʔafraax	'young of a bird' /faraax/

The diminutives conform to these patterns as well: *buwayˤiθ, juwaymiis, juzayyir, jubayl, nufays(at)*.[11] In McCarthy (1979, 1982) it is shown that the *w* of (19a, b) and the ʔ of (19c) come from the same source, a *w* inserted to fill in a position left empty in the mapping of root to template. That is, the *w* satisfies a null onset, resolving hiatus.

Essentially all the productive broken plural patterns, as well as all the fully productive diminutives, are reducible to just one canonical form, CVCVVC(V(V)C), with choice of the parenthesized options determined by the canonical form of the singular. Singulars CVCCVVC and CVVCVVC form plurals CVCVVCVVC; singulars CVCCVC, CVVCVC, and CVCVVC form plurals CVCVVCVC; and singulars CVCVC and CVCC form plurals CVCVVC. Any analysis must incorporate this pervasive regularity; clearly the parafixation analysis does not, at least without extensive additional stipulations.

A final factual point before we turn to the analysis. A significant argument for the templatic character of Arabic broken plurals is the phenomenon of truncation of nouns containing more than four consonants: *ˤankabuut*, pl. *ˤanaakib* 'spider'. What is sometimes not appreciated is that such singular nouns are noncanonical to start with: they do not reflect any normal, productive pattern of singular formation in the language, and all are loans. Not surprisingly, there is considerable diversity in the patterns they adopt in the singular. The following is an exhaustive list of noncanonical singular patterns of nouns which do form broken plurals (or diminutives):

(20)

ˤankabuut	'spider'
jaħmariš	'lazy old woman'
safarjal	'quince'
ʔistabraq	'thick gold brocade'
firˤawn	'Pharaoh'
namuuðaj	'model'
barnaamaj	'program'

There is another important observation about these noncanonical singular nouns: it is somewhat unusual for them to form broken plurals at all. Noncanonical recent loans never form broken plurals; rather, they take the feminine plural suffix *-aat: tilifuun*, pl. *tilifuunaat* 'telephone'. But canonical recent loans form broken plurals quite freely: *balyuun*, pl. *balaayiin* 'billion'. Noncanonical nouns that do form broken plurals all date from a much earlier period—for example, none are identifiable as borrowed from any European language.

Our final observation about these quinqueliteral nouns concerns their mode of broken plural (and diminutive) formation. There are several dif-

ferent ways in which quinqueliterals become quadriliteral in the plural (Dieterici (tr.) 1852:353). Most generally, the final consonant can be lost, as in *safarjal,* pl. *safaarij.* If the penult consonant is a servile consonant (a term to be explained below) or is homorganic with a servile consonant, it may be lost: *xadarnaq,* pl. *xadaariq; farazdaq,* pl. *faraaziq.* But it is said to be more common to lose the final consonant: *xadaarin, faraazid.* And if any consonant anywhere in the root is servile, it may be lost: *fadawkas,* pl. *fadaakis; barnaamaj,* pl. *baraamij.* The servile consonants are *t, n, w, y,* and perhaps a few more; these are the consonants that occur frequently in bound morphemes or are morphophonemically unstable. A final peculiarity of quinqueliterals: the diminutives and broken plurals may develop vowel length in the final syllable, purportedly in compensation for the loss of a consonant: pl. *safaariij,* dim. *sufayriij.*

It is clear from this traditional account of quinqueliteral plural and diminutive formation that the facts are quite vague and inconsistent. Moreover, significant regularities are decidely nonformal in character—a consonant that resembles a bound morpheme may be lost, even if it is not actually an instance of that bound morpheme. And the spontaneous development of vowel length in the final syllable is inconsistent with the far-reaching regularities about vowel length transfer in quadriliterals discussed above.

In view of these considerations, along with the observation that formation of broken plurals from new quinqueliterals has been impossible for some time, we conclude that this is not a grammatical phenomenon. Rather, what we see here is a nativization strategy, a paralinguistic mechanism for coercing noncanonical loans into a system that values canonicity above all else. Broken plurals from noncanonical nouns cannot be a simple mapping of lexical entry to plural template, but rather involve an assimilatory strategy of extracting consonantism from an unanalyzable (borrowed) base. The fundamental element of Semitic morphology, the root only, is teased out from the original and mapped onto the available template. The fact that certain consonants are disregarded because of their accidental resemblance to bound morphemes follows as well: getting to the root by this ad hoc strategy would certainly have that effect. Extraction of a pseudo-root in this way is independently required in the assimilation of loan words in the verb system in Semitic.[12] Thus, quinqueliteral broken plurals and diminutives are irrelevant to the analysis of the native vocabulary.

6.2 Analysis

Let us review what we know up to this point. First, broken plurals and diminutives (except for the curtailed diminutive) are formed from the corresponding singulars, not from the root. Second, they have a canonical pattern CVCVVC(V(V)C), with the presence of the optional elements de-

termined in a regular way by the canonical pattern of the base. Third, the behavior of noncanonical words has no direct bearing on the correctness of any analysis.

The proposal we will now make is quite different from the purely templatic accounts of McCarthy (1979) or Hammond (1986) or the infixation account of McCarthy (1982). The analysis has three parts. First, the lexical entry of the base (the singular noun) is reparsed into a sequence of a minimal word (two moras) and a remainder containing everything else. Second, the minimal word derived by this reparsing is mapped from left to right to a template consisting of a light syllable followed by a heavy one (=CVCVV). Third, the result of the mapping is concatenated with the remainder.

Before pursuing further formalization of this analysis, let us look at some examples. We will represent all vowels by V, since the vocalism of the derived forms is entirely determined by the morphology. A word like *jVndVb* is composed of the bimoraic minimal word *jVn* and the remainder *dVb*. Applying the minimal word to the template yields *jVnVV*, and concatenating this result with *dVb* gives *jVnVVdVb*. The example *sVlṭVVn* is parsed into *sVl* plus *ṭVVn*. Mapping *sVl* onto the template yields *sVlVV*, and concatenation produces *sVlVVṭVVn*. We thus dispose of the original examples of transfer.

The analysis has equal success with the other singular patterns. *bVVˀVθ* contains *bVV* and *ˀVθ*. Mapping *bVV* onto the template leaves an empty onset, marked informally here by C: *bVCVV*. And concatenation gives *bVCVVˀVθ*. Filling the empty onset with *w*, as in all other analyses, produces the desired surface result. Quantitative transfer is also exhibited with *qVVmVVs*, which parses to *qVV* and *mVVs*. We then derive *qVCVV* and finally *qVCVVmVVs* in the familiar way. The empty onset ends up in a different position in the plural of *jVzVVr*, which reparses into the bimoraic minimal word *jVzV* and the remainder *Vr*. Mapping to the template gives *jVzVV*, and concatenation of the results produces *jVzVVCVr*, with an empty onset in the position of hiatus. Examples like *jVbVl*, which were intractable in previous analyses, fall out straightforwardly. Parsing into a bimoraic minimal word gives *jVbV*, applying this to the template yields *jVbVV*, and adding the remainder produces *jVbVVl*. And finally, with a base like *nVfs*, the bimoraic minimal word is *nVf* and the remainder *s*. Mapping *nVf* to the template produces *nVfVV*, and adding the remainder produces *nVfVVs*. Resolution, the familiar moraic equivalence of a heavy syllable with two light syllables, accounts for the fact that *jabal* and *nafs* assume identical canonical patterns in the broken plural and diminutive.

In essence, what this analysis says is that the constant or shape-invariant in Arabic broken plurals or diminutives is a template imposed on the first two moras—the rest of the plural varies freely within the possibilities afforded by the corresponding singulars. That is exactly the right observation. The

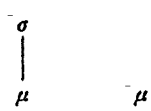
exception to this is the treatment of quinqueliterals but, as we have shown, quinqueliterals are exceptional in a wide variety of ways that have little place in a formal grammar. Our analysis cannot account straightforwardly for the quinqueliterals; in fact, no analysis can.

The analysis differs from earlier declarative accounts of Semitic morphology in having a more procedural character, to borrow two terms with some currency in AI research. But the operations invoked have extensive precedents elsewhere. Reparsing into a minimal word and mapping this onto a template is essential to our analysis of Yidin^{y} above, as well as a number of other cases in reduplication, language games, and truncation, discussed in McCarthy and Prince (1986). The notion of concatenating the unaffected portion onto the affected portion is essential to understanding patterns of infixing reduplication like Samoan *alolofa,* in which the minimal word *lofa* undergoes prefixing reduplication and then has the prestress syllables added back.

Now we turn to the details of formalization. First, we claim that the minimal word is bimoraic. The smallest words without inflectional desinences (which is how they appear in prepausal position) have the canonical pattern CVCC, CVVC, or CVCVC; CVC words are all clitic function words. This distribution follows from two requirements: the minimal word is bimoraic and all final consonants are extrametrical. Extrametricality of final consonants and a minimally bimoraic foot are in any case needed by the stress system, so these properties are independently motivated.

Second, we must establish the character of the broken plural and diminutive template. It is a sequence of a light syllable followed by a heavy one, therefore as in (21):

(21)
Broken Plural/Diminutive Template



The second mora of the heavy syllable is satisfied by morphologically-determined melodic elements: the *a* (or other vocalism) of the broken plural, the *y* of the diminutive.

Third, we must be specific about the input to formation of broken plurals and diminutives. As we have argued, the broken plural and diminutive are formed from the corresponding singular—more specifically, from the lexical entry of the singular. The lexical entry of the singular must, at a minimum, contain a considerable amount of skeletal information as well as the root.

since the skeletal patterns of singular nouns (and their vocalism) vary within quite a wide range. Broken plural formation exploits this information in two ways: it determines the parsing of the minimal word, and it is preserved in the material concatenated to the end of the broken plural template. The lexical entries of Arabic singular nouns, then, must in any case be supplied with fairly complete templatic information; we defer discussion of exactly how complete that information is until we have completed a project to extract all singular/plural pairs from an Arabic dictionary.

We have seen, then, that the one case in which transfer via parafixation was used outside reduplication is insupportable on both technical and empirical grounds. Using apparatus independently required in quite different domains, we have proposed a very different account of the Arabic plural and its transfer effect.

7. Other Transfer Effects

Our theory makes a straightforward claim: any property that is transferred is lexically distinctive and, conversely, lexically distinctive properties will be transferred. We have examined the melody and segmental quantity in some detail; we now turn briefly to other characteristics of phonological representation.

In Manam (McCarthy and Prince 1986), the reduplication rule suffixes a bimoraic foot, which is evidently equivalent to the minimal word in this language:

(22)

salaga	salagalaga	'long'
moita	moitaita	'knife'
ʔarai	ʔarairai	'ginger sp.'
laʔo	laʔolaʔo	'go'
malaboŋ	malabomboŋ	'flying fox'
ʔulaŋ	ʔulanlaŋ	'desire'

A small number of Manam words, however, are exceptional in three respects. First, they are monomoraic, violating the minimal word requirement: *ra* 'talk to', *pi* 'be forceful'. Second, in reduplication they appear not to fully satisfy the foot ($F=W_{min}=\mu\mu$) suffix: *ra-ra, pi-pi.* Third, although the language invariably stresses the penultimate mora, these do not, even when a prefix provides a resting place for penult stress: *i-rá, i-pí.*

The threefold exceptionality of roots like *ra* is reducible to a single stipulation: these roots specify a monomoraic foot already present in their lexical entry. That is, we represent *ra* lexically as:

(23)

From stipulating exceptional stress in this way in the lexicon (something that must be done in any case), it follows that *ra* already satisfies the foot-sized minimal word requirement, and reduplicating *ra* (by inserting its lexical entry) will satisfy the foot-sized reduplicative template as well.

This is a rather minor case of transfer compared to the major effects of segmental quantity and one other property, syllabicity. We have abjured discussion of syllabicity here for three reasons. First, it is not clear that syllabicity is ever distinctive or is ever transferred. Second, syllabicity, far more than segmental quantity, is subject to independent determination in original and copy, a problem that we noted at the outset of this paper. The illusion of transfer can be created by this—the mere fact that some melodic element is realized as a glide in original and copy is no proof of transfer if the rules for determining syllabicity would have this effect anyway. Third, there is clearly some doubt that syllabicity is always purely configurational (or prosodic). For example, Steriade's (1987) proposal of distinct velar (consonantal) and dorsal (vocalic) tongue-body articulators means that a melodic distinction between vowels and glides is possible without a special configuration or [syllabic].

Our prediction is simply stated in any case. Whenever syllabicity is distinctive, it will be transferred. Whenever it is not, it won't. Keeping in mind the warning about independent determination of syllabicity in base and affix, we leave it at that.

We conclude by reiterating our main point. Quantitative transfer is not a puzzling peculiarity of reduplication, but rather is the automatic consequence of the interaction of separate, independently required properties of the grammar. Transfer is a necessary concomitant of the theories of lexical specification, prosodization, and template satisfaction.

Notes

This paper, along with McCarthy and Prince (1986), is an excerpt from a longer work now in progress.

A cautionary note. Similarity between copy and original is not transfer, unless the similarity has no simpler explanation. Consider the hypothetical example of a language that lengthens all vowels in open syllables and also has CV reduplication. Observing reduplications of the form CV:-CV:CV . . . tells us nothing about transfer unless we can demonstrate that the lengthening rule must have applied before

reduplication. The status of the null hypothesis is always enjoyed by the analysis that simply happens to apply the same rule in original and copy.

3. Actually, it is not clear that this is an absolutely authentic case of quantitative transfer. Many Bantu languages have a quite general rule lengthening vowels before nasal-stop sequences. If Kihehe has this rule and if this rule is the only source of vowel length, then Kihehe does not provably exhibit transfer unless we can show that the lengthening rule precedes reduplication. We retain the example despite this defect because it has been discussed before and because it is easy to find many other cases of quantitative transfer in total reduplication.
4. It is worth pointing out one nonviable alternative. Marantz (1982) apparently regards the copying of association lines in Yidin^y as a concomitant of the $\sigma\sigma$ affix. The lower-level CVC affix of Agta in his system would then eschew line copying. As we show in McCarthy and Prince (1986), the importance of syllables and other high-level prosodic structure in specifying reduplicative templates is seriously underestimated, and in fact Agta is correctly analyzed as σ reduplication itself.
5. Levin (1985: 32fn.) makes a similar observation.
6. Obvious objections naturally come to mind; for instance, why not apply the Onset Rule to yield **onp-onop*? This violates a prohibition on skipping melodic elements. This and other possibilities are addressed in McCarthy and Prince (1986).
7. In fact, to our knowledge the issue seems to have been raised only once previously, in an unpublished lecture by J. Carrier-Duncan at the NELS meeting at Brown University in November, 1985.
8. Our hypothetical language, and many real ones, present an interesting problem if we add tonal distinctions as well, as Scott Myers has pointed out to us. In many tone languages, some or all tones must be prelinked in the lexicon. (Yoruba (Pulleyblank 1986) is a good case, with fairly trivial syllable structure as well.) Under the usual assumption that tonal linkages are to syllables rather than melodies, any language with tonal prelinking ought to have syllable structure in the lexicon. But if the syllable is fully predictable from the melody, there is a conflict between the minimization of redundancy in one domain and the need to make lexical distinctions in another. The obvious solution to this paradox—prespecification of syllable structure when needed for tone—makes the unlikely prediction that languages with prelinked tone will freely support a full array of distinctive treatments of the syllable-melody mapping as well. We could imagine having tones, syllables, and melodies in the lexical entry, with tone to syllable linkings and no syllable to melody linkings, but even then there is a redundancy if the mere number of syllables can be predicted from the melody. The best solution seems to be one of linking tone to melody directly, if both must be distinctive, but understanding these linkings not as an immediate dominance/association relation but rather as simple dominance.
9. The distinctness requirement is quite a natural one in lexical phonological terms. If rules of prosodization were to neutralize distinctions, then they would be subject to all of the requirements of the Strict Cycle (Kiparsky 1982), and so would be inapplicable in underived contexts.
10. This is a sufficient characterization of directionality effects in reduplicative and templatic morphology because it, together with the prohibition on skipping melodic elements, derives the observed consequences of directional association (except for core syllable reduplication). This is a simpler mechanism than the edge-in association of McCarthy and Prince (1986). Cf. Yip (1987) for a somewhat different view along the same lines.
11. *nats* is a feminine noun that exceptionally lacks the feminine suffix *at*. The diminu-

tive lacks this exceptionality.

12. Modern Hebrew (McCarthy 1984) works in virtually the same way: the verb *tirklen* 'clean a room' ignores the syllabification of its base noun *traklin*. Against this there is the case of the verb *praklet* 'treat someone as a lawyer would', which would be **pirklet* except for the influence of the noun *praklit*. Again, we are in the realm of loan-word strategies rather than formal grammar. Nativization strategies in more familiar cases are no less odd. For example, English speakers frequently assign final stress to recent loans regardless of the stress pattern of the source language. Final stress in English, particularly nouns, is rather unusual, but the strategy seems to have evolved from French models.

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