The Asymmetrical Application of Phonological and Morphological Principles in Reduplication

A Preliminary Investigation

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0. Introduction

The goal of any formal theory of prosodic morphology is to characterize the processes in a manner as consistent as possible with other morphological processes. Only those idiosyncratic aspects about which generalizations cannot be made which are consistent with the broader domain of morphology as a whole should be considered peculiar to prosodic morphology.

Since McCarthy and Prince (1986), and Steriade (1988), it has been shown that the output of prosodic morphological processes makes reference to prosodic constituency, for example, the syllable (light, heavy, or core), or the foot. The other property peculiar to these processes is that the prosodically-defined morphological constituent is melodically dependent upon the base. It is these two properties -- prosodically constrained output, and melodic dependence upon the base -- that are peculiar to prosodic morphology. Beyond these two peculiarities, the derivation of prosodically-conditioned morphemes should proceed as unexceptionally as possible.

In this paper, I argue that the extension of general phonological and morphological principles to the domain of prosodic morphology results in the simplification of prosodic morphological rules and representations. Specifically, I will invoke the principle that phonological operations require strict adjacency of trigger and target, stem- and word-level affixation, rules of cyclic and post-cyclic lexical syllabification, the lexical/non-lexical categorial distinction, and elements of compositional semantics as reflected in the Mirror Principle (Baker 1985) to motivate prosodic morphological derivations which appear to violate universal morphological ordering principles. Within the domain of prosodic morphology, these principles will be shown in certain cases to interact in an asymmetrical fashion, surface forms indicating a hierarchical ordering of said principles: when principles make conflicting demands on a derivation, particular principles will win out over others. The present approach to prosodic morphology will reduce the abstractness of rules and representations, while concomitantly eschewing the arabesque architectonics that have acquired all-too-acceptable status in the

The one innovation to be presented herein is a new account of "Transfer of Length" effects, first discussed in Clements' (1985) parafixational account of reduplication, whereby vowel length in the base is retained in the copy. McCarthy and Prince (1987) account for Transfer of Length effects by proposing a theory in which reduplication proceeds from a re-summoning of a lexical entry of the base, crucially including a lexical mora for long segments. Alternatively, Steriade (1988) argues that copying proceeds from the fully articulated surface form of the base: as all surface prosodic structure copies, transfer of length is a natural consequence.

Herein, I will fully embrace neither of these approaches, instead arguing for something of a middle ground between the two. I will invoke the concept of Nuclear Integrity to account for Transfer of Length effects. Nuclear Integrity may be defined as follows:

Nuclear Integrity: The components of a structure that are crucial to the representation of the syllabicity of a given feature matrix are retained with their original association lines as prosodic morphological operations proceed

In other words, all prosodic structure which bears a matrilineal relationship to nuclei, up to the syllable-level, survives intact throughout a prosodic morphological derivation.

Nuclear Integrity is exemplified in the figures in (1).

(1) a. b.

i. F

| s s |

| m m |

| V V |

ii. F

| s s |

//\ mm mm

|\ \ |

\ \ CCV C CCV C

iii. F

// s s s s

//\ | |
In (1), the (a) structures are the input to the prosodic morphological operation: surface representations with complete prosodic structure. The (b) structures result from prosodic erasure with Nuclear Integrity: only that structure which bears a matrilineal relationship to nuclei, and is crucial to the representation of syllabic identity, is salvaged from erasure. As syllable nuclei are determined during the course of a derivation, and not specified underlyingly, I assume that prosodic morphological operations proceed from surface representations, not underlying representations. I will therefore be arguing against McCarthy and Prince's (1987) "lexical look-up" approach to reduplication, whereby all reduplicative processes proceed from a re-summoning of the lexical entry(s) of the morpheme(s) targeted. Transfer of Length will be shown to be a free by-product of Nuclear Integrity.

Since prosodic morphological processes proceed from fully articulated surface structures, they are provided with a "head start" as re-prosodization proceeds. Specifically, only that prosodic structure which dominates base nuclei is retained. All other prosodic structure is erased. As many theories of syllabification argue that the process proceeds from nuclei outward (Levin 1985, *inter alia*), the "head start" is literally just that: the head of a syllable (in the X-bar theoretic sense of Levin 1985) survives the derivation, re-projecting structure as prosodic templates constrain output.

In Section 1 I present a critical analysis of Aronoff (1988). Therein the author argues that targeting the head of a complex morphological form (as opposed to the whole of a form) can be extended to account for certain instances of reduplication. The author further shows that reduplication is subject to stratal distinctions: certain instances of reduplication apply at the stem level, while others apply at the word level. With these two choices to be made, argues Aronoff, reduplication patterns with regular morphological operations. I provide evidence from Indonesian and Fijian in support of Aronoff's general conclusions regarding head/whole, stem level/word-level morphological choices.

In Section 2 I observe that certain non-formalized aspects of Aronoff's analysis may be incorporated into a theoretic framework in which the phonological requirement of strict adjacency between target and trigger, together with rules of cyclic versus post-cyclic lexical
syllabification, as well as the lexical/non-lexical categorial distinction, interact in an asymmetrical fashion to account for cross-linguistic patterns of reduplication.

In the Section 3 I discuss Bat El's (1990) analysis of stem modification in Modern Hebrew, supporting her argumentation against McCarthy's (1979) non-concatenative approach to Semitic morphology. However, I further argue that Bat-El's assumption that stem modification entails complete erasure of the prosodic structure of the base makes incorrect predictions regarding observed "cluster transfer" effects. Instead, I argue that an approach to stem modification which assumes Nuclear Integrity correctly accounts for the observed phenomenon of "cluster transfer".

In Section 4, I will further claim that Semitic root-and-pattern morphology, as well as all prosodic morphological processes in which the syllabification of the base is disrupted, such as cases displaying infixation effects (reanalyzed as edge-affixation to a prosodically circumscribed base (McCarthy and Prince 1989)), must be early processes in which syllabification still operates on the cycle.

1. Morphological Targeting

1.1 Head/Whole, Stem-level/Word-level Operations

Aronoff (1988) argues that the concatenation of morphemes normally requires two choices to be made regarding affixation:

1) Will the morpheme affix to the whole of the form or the head of the form?

2) Will the morpheme affix at the stem-level or at the word-level?

To exemplify the possibilities admitted by the first question, Aronoff provides data from English inflectional morphology.

(1)

<table>
<thead>
<tr>
<th></th>
<th>a. [man]+[pl.] = [men]</th>
<th>b. [postman]+[pl.] = [postmen]</th>
</tr>
</thead>
</table>

(2)

|   | a. [stand]+[tense] = [stood] | b. [understand]+[tense] = [understood] |

The (a) examples show that an inflectional marker affixed to a monomorphemic stem displays a lexically idiosyncratic ablaut pattern. The (b) examples show that the same inflectional marker, when attached to a polymorphemic stem with an identical head, displays the same irregular pattern. Aronoff concludes that English past tense is targeting the head of the morphologically complex stem. Derivations of the (b) forms are in (3).
Observe that if affixation targeted the full stem, we would expect the unmarked morphology to surface:

(4) input:
[post+man]+[pl.]    [understand]+[tense]]

affixation (stem targeting):
[[post+[man]]+[pl.]]    [[understand]+[tense]]

output:
*postmans    *understood

Minimal pairs provide compelling evidence for head- versus whole- operations:

(5) (a) [Maple Leaf]+[pl.] = [Maple Leafs]
(b) [maple+[[leaf]+[pl.]]] = [maple leaves]

In (5a), the plural marker has no access to the internal structure of the stem, and thus the idiosyncratic morpho-phonological behavior of the head plays no role in the subsequent morphology, and the regular plural form results. In (5b), the plural marker attaches to the head of a complex form, and hence irregular morpho-phonological processes lexically conditioned by the head are applied.

Hoeksema (1984) provides the following definition of a head operation:

F is a head operation if F(Y)=Z, and W=XY (where Y is the head of W) together imply that F(W)=X+F(Y)=X+Z

The second choice that any affixational process must make is repeated in (x)

(x) Will the morpheme affix at the stem level or at the word level?

Aronoff exploits the fact that there are two types of affixes, which are, in certain theories (though not Aronoff’s), ordered in an exceptionless relation to one another. Stem level affixes are ordered first. They may trigger cyclic lexical rules such as resyllabification and stress
reassignment. Word-level affixes are always ordered after stem level affixes. This second type of affix does not affect lexical syllabification or stress of the stem. Aronoff assumes that word-level affixes induce "prosodic closure" on the stem, resulting in the stem being treated as a phonological word. Prosodic closure may be defined as a condition on rule application whereby operations applied to a prosodized string may not disrupt existing prosodic structure.

English stem-level affixes are exemplified in (7).

(7) solemn+ity -> solemnity  posit+ion -> position

The stem-level suffixes -ity and -tion affect stress assignment and syllabification.

On the other hand, word-level affixes do not display these properties:

(8) listless#ness -> listlessness  posit#able -> positable

The notion of "prosodic closure", which is not formally characterized in Aronoff's discussion, may in fact be reducible to cyclic versus post-cyclic rule application: before prosodic closure is induced, a form may undergo cyclic syllabification, in that the concatenation of additional material may trigger the re-assignment of prosodic structure. However, when the post-cyclic component is reached, "prosodic closure" is apparently induced, as additional melodic material, and any subsequent lexical morpho-phonological processes, may not trigger the re-assignment of prosodic structure. It is only in the post-lexical phonology, then, that strings in the post-cyclic component may be re-assigned prosodic structure.

Recall that the goal of any theory of reduplication is to characterize the process in a manner as consistent as possible with other morphological processes. We therefore expect four types of reduplication:

(9) (I) stem-level rule; whole operation
(II) stem-level rule; head operation
(III) word-level rule; whole operation
(IV) word-level rule; head operation

Aronoff characterizes Type (I) reduplication as "unexceptional", widely discussed in the literature. These are instances of reduplication in which the copy (either truncated or full) is in the same stress domain as the base. Type (II) is "difficult to detect", requiring a careful analysis of semantic and syntactic scope. Type (III) is "commonly discussed" in the literature on overapplication. In the remainder of this section, I will discuss several examples of Type (IV) reduplication. The first two examples, Kihehe and Makassarese, are discussed in Aronoff. I will provide an alternative account of the Makassarese data. The second two examples, Indonesian and Fijian, have not previously been analyzed in this framework.
1.2 Kihehe

Reduplication in Kihehe prefixes the whole of the stem, internally to non-stem material. Non-stem material is copied as well just in case this material is syllabified with the stem. Examples follow (Odden and Odden 1985).

(10) ku-haata   -> ku-haata-haata
    (to ferment)    (to start fermenting)

    ku-ita [kwiita]   -> kwiita-kwiita
    (to pour)    (to pour a little)

    ku-lu-ita [kulwiita]  -> ku-lwiita-lwiita
    (no gloss)    (to pour it (11) a bit)

    ku-gohomola   -> ku-gohomola-gohomola
    (to cough)    (to cough a bit)

    mi-oolofu [myoolofu]  -> myoolofu-myoolofu
    (no gloss)    (fairly plentiful (4))

Aronoff explains these patterns by categorizing Kihehe reduplication as Type (IV). The process is a head rule, in that only the stem is targeted for copying. But also, it is a word-level rule, as syllabification of the copy respects syllabification of the base, i.e. the syllables which compose the stem are not dichotomous with those resulting from reduplication; syllables instead copy in full, including non-stem material that had been syllabified with the stem. In other words, word-level affixation has induced "prosodic closure" on the base, and so any material which is copied may only target full prosodic constituents, i.e. syllables. Restated more formally, at the point in the derivation where reduplication applies, cyclic syllabification has ceased, and thus any further morpho-phonological process may not trigger the re-assignment of prosodic structure. Therefore, only existing prosodic constituents may be targeted for copy: reduplication of kw-iita results in kwiita-kwiita, as the prefix is syllabified with the head of the form at the point in the derivation when word-level reduplication applies, i.e. in the post-cyclic syllabification component. Were prosodic closure not induced on the base at the point where reduplication applies, head reduplication might result in *kwiita-ita.

Note that neither McCarthy and Prince nor Steriade can formally account for morphological targeting in Kihehe reduplication, as these authors do not formally consider cases of reduplication which display this behavior. Moreover, the Kihehe data pose a serious problem for McCarthy and Prince's "lexical look-up" hypothesis. McCarthy and Prince would require a stipulation that whenever non-stem material syllabifies with the base, the lexical entry for this morpheme must be summoned along with the lexical entry(s) of the stem:
kuahaata    ->    ku # /haata/ # haata
kulwiita   ->    ku # /lu/ # /ita/ # lwiiita

This derivation comes at a very high price to the grammar, as lexical entries are summoned contingent solely upon superficial properties of syllabification. As copying is dependent on superficial prosodic structure anyway, such forms can surely be accounted for in a more economical and more constrained manner if the derivation proceeds from structures that are present on the surface, and not from the re-summoning of lexical entries.

Note further that the copy displays the same process of glide formation and compensatory lengthening of the vowel as does the base. As this process is limited to stem-level concatenation in Kihehe (David Odden, p.c.), the boundary between the root and the rightmost prefix must be a weak one. However, assuming with Aronoff that reduplication in Kihehe is a word-level process, an analysis along the lines of McCarthy and Prince results in an ordering paradox: reduplication is word-level, but the boundary between the re-summoned morphemes is stem-level. Again, if the derivation proceeds from structures present on the surface, and not from the re-summoning of lexical entries, no ordering paradox is encountered, as no morphological boundary exists within the copied material.

1.3 Makassarese

Aronoff’s second example comes from the Indonesian language Makassarese. Makassarese reduplication is sensitive to syllable structure in the following way: "If the base contains two syllables, the rule prefixes those syllables; if, however, the base contains any more material, the final syllable ends in \( k \). Thus \( golla \) is reduplicated \( gollagolla \), but \( manara \) is reduplicated as \( manakmanara \"" (p.9). Furthermore, stem level suffixes affect stress and syllable structure, whereas word-level suffixes do not, as the following examples show.

<table>
<thead>
<tr>
<th>Base</th>
<th>(big)</th>
<th>Reduplication</th>
<th>(somewhat big)</th>
</tr>
</thead>
<tbody>
<tr>
<td>lompo</td>
<td>big</td>
<td>lompolompo</td>
<td>somewhat big</td>
</tr>
<tr>
<td>lompo+i</td>
<td>make it big</td>
<td>lompolompoi</td>
<td>make it somewhat big</td>
</tr>
<tr>
<td>lompo#i</td>
<td>it is big</td>
<td>lompolompoi</td>
<td>it is somewhat big</td>
</tr>
<tr>
<td>gassing</td>
<td>strong</td>
<td>gassinggassing</td>
<td>somewhat strong</td>
</tr>
<tr>
<td>gassing+i</td>
<td>make it strong</td>
<td>gassikgassingi</td>
<td>make it somewhat strong</td>
</tr>
<tr>
<td>gassing#i</td>
<td>it is strong</td>
<td>gassikgassingi</td>
<td>it is somewhat strong</td>
</tr>
</tbody>
</table>

Stress in Makassarese is penultimate. -i-suffixation may apply at the stem-level, in which case stress is re-assigned to the derived penult. But -i-suffixation may also apply at the word-level, in which case the stress of the stem is preserved: \( lompo#i \). Semantic distinctions between +i-suffixation and #i-suffixation confirm that these are indeed homophonous morphologically distinct forms. Aronoff claims that the appearance of -k in \( gassikgassingi \) is evidence for the word-level status of reduplication. His reasoning is as follows: The
penultimate stress in this form indicates the stem-level status of -i-suffixation. At this point, resyllabification is triggered, and /ng/, which is morphologically associated with the stem, becomes prosodically associated with the suffix. The base therefore exceeds bisyllabicity as reduplication applies, thus -k surfaces in the copy. Aronoff concludes that reduplication in Makassarese must be a word-level process, crucially following +i-suffixation.

I will now provide an alternative analysis of the Makassarese data. Note first two facts that are incontrovertible. 1) Stress patterns (and semantic interpretations) indicate that there are indeed homophones stem-level and word-level suffixes. 2) Reduplication must follow stem-level suffixation, and so we get gassik-gassing+i, not *gassing-gassing+i, since consonantal elements following the second nucleus copy only when the base does not exceed bisyllabicity.

Beyond these two facts, however, the data are still open to interpretation. I will consider the six logical possible derivations of /gassing/-/i/., employing an Aronovian analysis.

/gassing/+i/  /gassing/#+i/

1) stem-level suffixation:  gas.si.ng+i
word-level suffixation:  gas.sing.#i
word-level redup. (whole): gas.sik.gas.si.ngi gas.sing.gas.sing.i

2) stem-level suffixation:  gas.si.ng+i
word-level suffixation:  gas.sing.#i
word-level redup. (head): gas.sik.gas.si.ngi gas.sing.gas.sing.i

3) stem-level suffixation:  gas.si.ng+i
word-level redup. (whole): gas.sik.gas.si.ngi gas.sing.gas.sing
word-level suffixation:  gas.sing.gas.sing.i

4) stem-level suffixation:  gas.si.ng+i
word-level redup (head): gas.sik.gas.si.ngi gas.sing.gas.sing
word-level suffixation:  gas.sing.gas.sing.i

5) stem-level suffixation:  gas.si.ng+i
stem-level redup. (whole): gas.sik.gas.si.ngi gas.sing.gas.sing
word-level suffixation:  gas.sing.gas.sing.i

6) stem-level suffixation:  gas.si.ng+i
stem-level redup (head): gas.sik.gas.si.ngi gas.sing.gas.sing
word-level suffixation:  gas.sing.gas.sing.i

Note that Aronoff is unclear as to whether -k (which I will refer to as the -k-marker) surfaces when the base exceeds bisyllabicity, or whether it surfaces in a polysyllabic base in which a
consonant following the second nucleus syllabifies to the left.

Based on the presented data, it is not possible to conclude which structure will trigger -k-marking. The controversial derivation is (1), in which reduplication is a whole operation: gassing#i. In this structure, /ng/ must syllabify to the left (as #i suffixation is word-level) thus triggering prosodic closure on the stem. Now, the question is whether -k-marking will apply in this structure. There are two possibilities. 1) -k-marking will apply, since reduplication is a whole operation, and hence the stem is more than two syllables. 2) -k-marking will not apply, as the root is prosodically closed, and thus ng syllabifies to the left. It is not possible to determine which outcome to expect.

Nonetheless, employing Aronoff’s own assumptions regarding Makassarese reduplication, I will tentatively assume that -k-marking does not apply in this structure. Aronoff claims that k-marking applies when the stem covers "two syllables plus part of a third" (p.9). As this description does not apply to gassing#i, I for now assume that -k-marking does not apply. Therefore, the expected outcome of reduplication on this form is gassing-gassingi.

With this in mind, observe that all six logical possibilities produce the correct output (I assume that post-lexical syllabification will ultimately apply to ng’s in the right-hand column). Reduplication in Makassarese may therefore apply at the stem-level or at the word-level. Furthermore, the operation may apply to the head of the form, or to the whole of the form. In other words, Makassarese reduplication contributes nothing to Aronoff’s theory.

There is evidence from stress patterning that Makassarese reduplication is in fact a stem-level operation. Uhrbach (1987) remarks that Indonesian languages like Makassarese differ as to whether reduplication is a Level One or Level Two operation. In languages in which reduplication applies at Level One, stress will be assigned once to the full form. In languages in which reduplication applies at Level Two, stress is assigned to the two halves independently. Note that the reduplicated forms in Makassarese only receive form-penultimate stress. Thus forms such as *gassikgassingi, *gassinggassingi do not arise. Here, each part of the reduplicated form is stressed independently, indicating that the two halves are independent phonological words.

Further evidence for the word-level status of Makassarese reduplication is available from the analysis of lexical versus post-lexical phonological rules. In Makassarese, glottal stops acquire place features from a following voiceless consonant, resulting in gemination. Uhrbach states (though does not provide evidence) that this process is "clearly limited to within [phonological] words" (p.283). The process applies in Makassarese reduplication: pala? (ask) -> palappala? (no gloss), tepo? (broken) -> tepottepo? (no gloss). Uhrbach concludes that reduplication in Makassarese is a stem-level process. The Makassarese data thus fit a stem-level pattern of reduplication.

As we cannot determine whether Makassarese reduplication is a head- or a whole-operation, we may conclude that Makassarese reduplication contributes nothing to the theory of head operations. Furthermore, it appears to be a stem-level, not a word-level process.

1.4 Indonesian

We now turn to languages which are not discussed in Aronoff, yet which seem to provide
evidence supporting his general conclusions regarding head/whole distinctions in reduplicative operations. Indonesian reduplication displays some previously recalcitrant properties that are straightforwardly handled in a theory of reduplication that admits head-whole, and stem-word choices.

Reduplicated forms with the verbal prefix *meN* display apparent rule overapplication, together with syllable preservation of the root (Uhrbach 1987):

- meN-pilih (think) -> memilih-milih (think over)
- meN-kira (approximately) -> mengira-ngira (to guess)
- meN-tari (dance) -> menari-nari (dance for joy)
- meN-isi (contents) -> mengisi-isi (fill with various things)

Root syllabification is preserved in these forms, in that copied vowel-initial roots are not provided with onsets (cf. *mengisi-ngisi*). As syllabification of the base is preserved under reduplication, we are dealing with a word-level process of verbal prefixation. Prefixation obviously precedes reduplication, as the copied material is sensitive to rules triggered by *meN*-affixation. We may therefore logically conclude that reduplication is word-level as well. Evidence supporting this conclusion comes from the behavior of stress in Indonesian reduplicated forms. Each instance of the root is always treated independently for the purpose of stress assignment, which is normally penultimate in the language. Therefore, we derive *memilih-milih*, and not *memilih-milih*. Furthermore, as reduplication copies only root material, we are apparently dealing with a head operation.

I conclude that this paradigm displays word-level head-rule properties. Hypothesized derivations follow. Verbal prefixation applies on Level Two, thus respecting the syllabification of the stem. After phonological processes apply, reduplication proceeds, also respecting the prosodic structure of the stem:

<table>
<thead>
<tr>
<th>UR:</th>
<th>/isi/</th>
<th>/buku/</th>
<th>/pilih/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level One</td>
<td>---</td>
<td>buku+nya</td>
<td>-------</td>
</tr>
<tr>
<td>affixation:</td>
<td>---</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>phonology:</td>
<td>---</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>Level Two</td>
<td>1. affixation:</td>
<td>meN#isi</td>
<td>-------</td>
</tr>
<tr>
<td>phonology:</td>
<td></td>
<td>meng#isi</td>
<td>-------</td>
</tr>
<tr>
<td>2. redup.:</td>
<td>mengisi#isi</td>
<td>buku#bukunya</td>
<td>memilih#milih</td>
</tr>
<tr>
<td>surface:</td>
<td>mengisi-isi</td>
<td>buku-bukunya</td>
<td>memilih-milih</td>
</tr>
</tbody>
</table>

*the nasal coda of the prefix triggers nasalization of stem-initial voiceless plosives, and subsequently deletes
The second example (buku-bukunya) shows that it is indeed the root that is targeted for copying, and not simply the last two syllables of the stem. Thus reduplication in Indonesian may be classified as Aronoff's Type (IV) -- a word-level, head operation.

1.5 Fijian

Another language that displays word-level, head reduplication which is not addressed by Aronoff is Fijian (Milner 1956, Schutz 1985, Dixon 1988). In Fijian, reduplication normally (but not exclusively) consists of the prefixation of a bimoraic template. The language displays several patterns of template filling, which will be discussed in more detail in Sections 2 and 3.

In the first pattern, the first two moras of the base are copied with their tautosyllabic material. If the base is bisyllabic, consisting of two light syllables (a), or is a monosyllabic heavy syllable (b), we observe full copy. If the base is polysyllabic and the initial syllable is bimoraic (c), only the initial syllable is copied. If the base is polysyllabic and the first two syllables are light, these syllables are copied (d):

a. caka (doing) -> cakacaka (working)
   tuku (releasing) -> tukutuku (reporting)
   qase (old) -> qaseqase (clever)
b. va: (four) -> va:va: (all four)
   dre: (pulling) -> dre:dre: (difficult)
c. qoolou (shout) -> qooqoolou (shout for an extended period)
d. yaqona (kava) -> yaqoyaqona (a plant related to kava)
   vinaka (good) -> (vaka)-vinavinaka (thanking)

Alternatively, sometimes the initial light syllable of a base is copied and lengthened. In bisyllabic forms, this second pattern is limited to forms that display an identity of syllables within the root:

cici (running) -> ci:cici (running)
lili (hanging) -> li:lili (hanging)
dredre (laughing) -> dre:dredre (laughing)
rere (be frightened) -> re:rere (be frightened for a time)
vinaka (good) -> vi:vinaka (good, common)
A third pattern, which may be limited to bases of more than two syllables, copies twice
the initial light syllable.

balava (long) -> bababalava (very long)

As Dixon reports that the minimal word is bimoraic, we might therefore hypothesize that
reduplication is a word-level operation, as it requires a bimoraic template to be filled. Evidence
confirming this hypothesis becomes available when the Fijian stress system is considered. The
Fijian stress rule is as follows:

primary stress: syllable containing the penultimate mora

secondary stress: syllable containing the pre-antepenultimate mora, and the
syllable containing the sixth mora from the end of the word

We can conclude that binary, left-headed feet are constructed right-to-left over moras,
and that the minimal word consists of a single foot.

Analyzing the stress pattern of reduplicated forms confirms the word-level status of
reduplication:

buta-butao (steal on a number of occasions)
tui-tuia (hammer it a lot)

In these forms, the copied base is treated independently for the purposes of stress
assignment, indicating that reduplication is a word-level morphological process. If it were a
stem-level process, secondary stress should be marked on the syllable containing the
pre-antepenultimate mora:

*buta-butao *tui-tuia

Further evidence for the word-level status of reduplication comes from patterns of glide
formation, analyzed as trochaic shortening in Hayes (1991). Dixon reports that a non-high
vowel - high vowel sequence will trigger glide formation within the phonological word: ta+isi
-> taysi. However, glide formation is blocked across a phonological word boundary, thus ilo
reduplicates as ilo-ilo (cf. *iloylo).

In trisyllabic stems, all three syllables may be reduplicated, the first separately from the
second and third (Schutz 1985):

tabasu (broken (by itself)) -> tatabasubasu (freq)
calidi (crackling noise) -> cacalidilidi (freq)
cakuvu (explode) -> cacakuvukuvu (freq)
Dixon reports that these are special cases of a bisyllabic base reduplicating simultaneously with a stem-level prefix of the "spontaneous" (mimetic) class:

\[
\begin{align*}
ca+lidi & \rightarrow \text{stem level redup.} \rightarrow ca+ca+lidi & ta+ta+basu \\
\rightarrow \text{word level redup.} & \rightarrow ca+ca+lidi#lidi & ta+ta+basu#basu
\end{align*}
\]

Evidence for the stem level status of the "spontaneous" class of verbal prefixes (including \(ta-, a-, ca-,\) and \(ra-\)) is available from analyzing patterns of glide formation. Recall that glide formation may apply across a stem-level boundary, but is blocked from applying across a word-level boundary. In fact, the affixation of "spontaneous" class prefixes to high vowel-initial roots does trigger glide formation: \(ta-uru \rightarrow tawru\) (become slack). This class of prefix is thus stem-level, and therefore must precede word-level root reduplication.

What is crucial to note in these forms is that here, the reduplicative prefix does not simply target the first two moras of a stem (cf. \(*cacacacalidilidi\), or \(ca:cacalidilidi\)). Instead, the verbal root is targeted. In other words, the head of the complex morphological constituent is reduplicated. As Aronoff notes, "...in all cases where reduplication must take place internally to an affix ... the base of reduplication is the morphological ... head of the whole"(p.3). Thus, in the case of cacalidilidi, "(R)eduplication, which is internal to prefixation, nonetheless follows it in an ordered derivation"(p.3).

We may now conclude that Fijian posseses a process of reduplication which is a word-level, head operation. It is a word-level rule based on evidence from stress placement and glide formation. It is a head operation in that only the head is targeted for copy. These findings support a theory of reduplication like Aronoff's in which both head/whole, and stem-level/word-level choices are available for the morphological process of reduplication.

2. Head Affixation as Lexical Targeting

Aronoff's whole-head distinction shows that prosodic circumscription (McCarthy and Lombardi (1987), McCarthy and Prince 1989, 1990), in which the input for reduplicative operations must conform to a particular prosodic shape, is insufficient to characterize the cases discussed in the previous section. For example, in Kihehe reduplication, potentially any number of syllables may precede the copied stem, and therefore no left-edge prosodic conditioning is employed. Similarly, the copied stem may potentially possess any number of syllables, and thus no right-edge prosodic conditioning is employed. It is obviously morphological conditioning, not prosodic conditioning, which acts to isolate the melodic material relevant for copy.

Note that neither McCarthy and Prince nor Steriade make reference to morphological targeting in their accounts of reduplication, and thus cannot account for reduplication in Kihehe, Indonesian, or Fijian, where the morphological head is targeted for copy.

In this section, I will adopt Aronoff’s general conclusions, along with the crucial assumption that phonological targets and triggers require strict adjacency, providing an account
of the process that is sufficiently generalizable to explain all the data in question in a manner fully consistent with other phonological and morphological processes, while simultaneously sufficiently constrained to prevent overgeneration. This account will recast reduplication in a way that departs minimally from regular morphological and phonological processes, but requiring the asymmetrical instantiation of competing principles.

2.1 The Crucial Role of Strict Adjacency

Before proceeding, there is still one issue that requires consideration. Aronoff's stem-level versus word-level morphological distinction is a completely natural one, in that its occurrence is well-attested cross-linguistically. While Aronoff assumes that head operations are made readily available by universal grammar, they in fact seem to be almost exclusively limited to strong morphology and reduplication (references! --Greenberg?). Thus head affixation in reduplication would seem to be the only case in which an affixational process gains access to the head of a morphologically complex form. The question to be asked then, is why does reduplication so readily exploit head affixation, a process that, beyond this domain, is rarely (if ever) attested?

On the face of things, there are seemingly two possible motivations for this. 1) The head- versus whole- choice available to reduplicative operations is a third property that is peculiar to this morphological domain (along with prosodic constituency and melodic dependence upon the base). 2) The head- versus whole- choice is the natural consequence of one of the other two properties peculiar to the domain of prosodic morphology. I will be arguing for this second possibility.

Since the advent of autosegmental phonology (Goldsmith 1976), the notion of locality -- and in particular, strict adjacency -- has come to play an increasingly prominent role in phonological theory: ideally, all phonological structures are hypothesized to be conditionable only by strictly adjacent phonological material. Indeed, locality conditions have acquired theoretical relevance in other grammatical domains as well. Many syntactic relations are presumed governed by locality (Chomsky 1973, Stowell 1981, inter alia). All morphological processes are hypothetically constrained by the Mirror Principle (Baker 1985), under which the linear order of affixation is conditioned by syntactic locality, as well as by the order of operations in a syntactic derivation.

Briefly, the Mirror Principle states that morphological derivations must directly reflect syntactic derivations, in that the linear order of morpheme concatenation to a root mirrors the steps in an ordered syntactic derivation. For example, in a language which displays subject-verb agreement in active sentences, but object-verb agreement in passives, while concomitantly possessing overt passive morphology, the syntactic derivation presumably orders agreement marking prior to passivization. The Mirror Principle therefore predicts that agreement on the verb will be linearly ordered internal to the passive marker:

\[
\text{syntax} \quad \text{morphology}
\]

\[
\text{D-structure} \quad : \quad \text{NP}_1 \ V \ \text{NP}_2 \quad \text{NP}_1 \ V \ \text{NP}_2
\]
agreement : $\text{NP}_1^1 \text{V}^1 \text{NP}_2 \quad \text{NP}_1^1 \text{V}^1 \text{NP}_2$

passivization : $\text{NP}_2 \text{V}^1 \text{NP}_1^1 \quad \text{NP}_2 \text{V}_p^1 \text{NP}_1^1$

However, if agreement is always between the surface subject and the verb, whether passivization has applied or not, then passivization presumably precedes agreement marking. The Mirror Principle thus predicts passive morphology linearly ordered internal to agreement marking:

<table>
<thead>
<tr>
<th>syntax</th>
<th>morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-structure : $\text{NP}_1 \text{V} \text{NP}_2$</td>
<td>$\text{NP}_1 \text{V} \text{NP}_2$</td>
</tr>
<tr>
<td>passivization : $\text{NP}_2 \text{V} \text{NP}_1$</td>
<td>$\text{NP}_2 \text{V}_p \text{NP}_1$</td>
</tr>
<tr>
<td>agreement : $\text{NP}_2^1 \text{V}^1 \text{NP}_1$</td>
<td>$\text{NP}_2^1 \text{V}_p^1 \text{NP}_1$</td>
</tr>
</tbody>
</table>

While Baker introduced the Mirror Principle to motivate lexical derivations of morphologically complex forms, the Principle may in fact be invoked for syntactically based morphological derivations as well. Assuming a post-Pollockian (1989) account of inflectional morphological derivations, in which each morphological head projects to the phrasal level, concomitantly taking a phrasal complement, the Mirror Principle may simply characterize constraints on head movement: head to head movement is constrained by locality, as expressed formally by the Head Movement Constraint (Travis 1984) (the Empty Category Principle (Sportiche 1990, Rizzi 1990)). That is, in order for a head to move long distance, it must abide by strict cyclicity, in that each intervening head position must be passed through, adjoining to any and all intervening heads, such that each cyclically moved element governs its preceding trace:

```
... /
  \ XP
   / \ X'
  / \ X
   / \ X^0 YP
      / \ Y'
         = [X^0 Y^0 Z^0] (or [Z^0 Y^0 X^0])
   / \ Y^0 ZP
```
Note that a syntactic morphological derivation captures syntactic scope relations in the morphology as mirroring c-command relations in the syntax. Thus $Y^0$ c-commands $Z^0$, $X^0$ c-commands both $Y^0$ and $Z^0$. These relations capture both syntactic scope relations, and mirror an ordered derivation as expressed in the linear order of morphemes at S-structure.

As Baker argues, the Mirror Principle is not a stipulation on the well-formedness of both syntactic and morphological derivations, but instead is simply the characterization of a natural consequence of grammatical structure.

Baker presents cross-linguistic evidence in support of the Mirror Principle, overtly exempting non-concatenative morphological processes from his domain of investigation. However, the domain of nonconcatenative morphology, and reduplicative head operations in particular, would seem a rigid testing ground for the universal applicability or inapplicability of the Mirror Principle. If the characterization of the cases of reduplication presented in Aronoff (1988) (and supported herein) are indeed on the right track, the Mirror Principle, at least in its strongest form, cannot be entirely correct.

What requires investigation, therefore, is why partial reduplication so readily violates the Mirror Principle? Why in Kihehe, Fijian, and elsewhere do reduplicative morphemes disobey strict ordering principles, in that they surface internally material attached earlier? On the one hand, normal concatenative processes, in which a morpheme’s melodic content is lexically specified, consists of the free attachment of the morpheme to the edge of a stem in a linearly ordered fashion, governed by the Mirror Principle. These morphemes thus have syntactic scope over the entire stem to which they attach.

Partial reduplication, on the other hand, requires the isolation of a subpart of the stem, the melodic content of which survives the derivation by associating to the reduplicative template. It thus becomes an empirical question whether the surviving melodic material possesses a special status within the stem, or rather is simply any available melody eligible for copy. The fact that partial reduplicative operations so often target the head of a morphologically complex stem for melodic acquisition -- crucially by-passing intervening melodic material -- indeed suggests that the melodic content of reduplicants is conditioned by some grammatical component other than the phonology. The question is, then, what component of the grammar is triggering this process?

A possibility worth investigating is supplied by the analysis of reduplication in Ancient Greek. Ancient Greek has a reduplicative process which prefixes a light syllable with a prespecified vowel, in which consonantal laryngeal features have been deleted. If the input to reduplication is a N-N or N-V compound, the reduplicative morpheme targets the whole of the form:

<table>
<thead>
<tr>
<th>Present</th>
<th>Perfect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. mut$^b$o-loge-oo</td>
<td>me-mut$^b$o-logee-k-a</td>
</tr>
</tbody>
</table>
In another paradigm, the nominal head of a derived verb is targeted for partial copy:

<table>
<thead>
<tr>
<th>Present</th>
<th>Perfect</th>
</tr>
</thead>
<tbody>
<tr>
<td>en-tʰume-omai</td>
<td>-&gt; en-te-tʰumee-stʰai</td>
</tr>
<tr>
<td>in-soul -1st.,s.</td>
<td>-redup.</td>
</tr>
</tbody>
</table>

In this paradigm, the reduplicative morpheme crucially bypasses non-head material, which here consists of a prepositional element.

Golston (1991) provides extensive evidence indicating that the prepositions in question possess non-lexical status in Ancient Greek. The facts from reduplication in Kihehe, Fijian, Indonesian, as well as in many other languages discussed in the literature may be accounted for if we assume that partial reduplication, at least in the unmarked case, targets lexical categories for copying, by-passing any intervening non-lexical material. While non-lexical material does indeed copy in certain instances (e.g. Fijian), such cases may in fact be marked, in that they only arise if the language in question also copies lexical material. Thus the following implicational statement is predicted to obtain:

If a language possesses a process of non-lexical copy, then it necessarily possesses a process of lexical copy.

To sum up the argument so far, we have presented two independently motivated principles that, operating together, appear to account for the peculiar nature of partial reduplicative operations. 1) Phonological operations require strict adjacency between trigger and target. 2) Normal morphological operations are governed by the Mirror Principle, which accounts for linear ordering within a morphologically complex form. While the Mirror Principle may strictly apply to normal morphological derivations, the phonological component inherent to reduplicative processes triggers an override of the principle, so that strict adjacency between trigger and target is achieved. We have made the further assumption that, due to the fact that partial reduplication, unlike normal concatenative processes, isolates a subpart of the stem, and due to the empirical observation that this subpart consists of root material, the melodic content of reduplicative templates is not simply an arbitrary segmental subpart of the stem, but instead is conditioned by other grammatical considerations. Specifically, reduplicative morphemes, at
least in the unmarked case, seem to affix to lexical categories, by-passing non-lexical categories. My argumentation might be more readily comprehensible by giving a few examples. Normal ordered morphological derivations abide by strict locality and the Mirror Principle, in that each morpheme attaches directly to the edge of the stem, on the cycle:

1. [institute]
2. [[[institute]+ion]+al]
3. [[[institute]+ion]+al]+ize]

surface: institutionalization

Head affixation, on the other hand, is not observed in normal morphological derivations, as the Mirror Principle would be violated: the head-affixing morpheme has syntactic scope over the entire stem, yet attaches internally to pre-attached forms:

1. [institute]
2. [[[institute]+ion]+al]
3. [[[institute]+ion]+al]+ize]

surface: *instituteationionalize
(meaning institutionalization)

Were partial reduplication as stringently governed by the Mirror Principle, the following type of derivation might be expected (from Fijian):

1. [lidi]
2. [ca+[lidi]]
3. [ca+[ca+[lidi]]]
4. [lidi#[ca+[ca+[lidi]]]]

surface: *lidicacalidi

In this derivation, the Mirror Principle has been strictly enforced at the expense of strict phonological adjacency. As the word-level reduplicant lidi does not have access to that material on which it is melodically dependent, such a derivation is ungrammatical: strict adjacency has been violated. In fact, such forms are, to the best of my knowledge, cross-linguistically unattested.

Instead, allowing reduplicative morphemes access to the lexical head of a morphologically complex form obeys strict adjacency:
Given this strict adjacency requirement, which gives rise to violations of the Mirror Principle, it should not be surprising that, throughout the literature on reduplication, rarely if ever is encountered a reduplicant that is not either strictly adjacent to its base, or separated at most by late epenthetic material independently required (due to, for example, language-specific phonotactic constraints). Apparent exceptions, such as final syllable prefixation in Madurese (Mester 1986), have been shown to proceed from a strictly adjacent copy of the full stem (Steriade 1988).

The only other possible way in which strict phonological adjacency and the Mirror Principle could be maintained were if partial reduplicants were permitted access only to stem-edge melodic material. This constraint would readily result in the neutralization of melodic contrast within the copy. The following hypothetical forms from Indonesian exemplify this problem, in which the reduplicative template is disyllabic.

1.  [milih] [isi] [kira]
2.  [pe+[milih]] [peng+[isi]] [pe+[ngira]]
3.  [pemi#[pe+[milih]]] [pengi#[peng+[isi]]] [pengi#[pe+[ngira]]]

This hypothesized derivation, in which the reduplicative template does not have access to the lexical head of the morphologically complex form, generates surface forms that are both melodically indistinct, and presumably morpho-syntactically anomalous, in that it is primarily the non-lexical derivational affix which copies, not the lexical head.

Finally, it should be noted that non-linear accounts of reduplication (e.g. Clements 1985, inter alia) would not predict strict linear adjacency of reduplicant and base. As the reduplicant is generated in a structurally adjacent position (albeit in a weird sense), there is no motivation for linearization to result in strict adjacency between base and copy: reduplicants would be predicted to just as readily linearize at-a-distance.

To summarize this section, I have argued that head-affixation, though peculiar to the domain of prosodic morphology, nonetheless is the expected consequence of a morphological process that crucially relies on phonological access to the lexical head of a morphologically complex form. Further, only a linear account of reduplication predicts the attested string-adjacency of base and reduplicant; parafixational theories do not predict that linearization be constrained in this fashion.

2.2 A Formal Approach to Morphological Circumscription

As head targeting can now be seen as a natural consequence of melodic dependence upon
the base, combined with locality constraints, we are now nearly equipped to provide a fully formalized account of the cases of reduplication presented in Section 1. We need only invoke the notion of Nuclear Integrity, discussed in Section 0, to explain Transfer of Length effects.

Here then, is a formalized approach to the relevant cases of reduplication:

1) <morphologically circumscribe the lexical head>

2) * insert the reduplicative morpheme linearly adjacent to the domain circumscribed in (1)

3) Copy in full the melodic structure of the morphological target, copy only that prosodic structure which bears a matrilineal relationship to base nuclei, up to the syllable level.

4) Project syllables from morphologically circumscribed nuclei to encompass all material up to well-formedness

In (1), the phonological principle of locality between trigger and target demands that the reduplicative morpheme be strictly adjacent to the morphological constituent being modified. In cases of full reduplication (plus optional trimming), affixation to the full stem still abides by strict adjacency. However, under certain conditions, for example, cases in which the partial reduplicant is to be prefixed to a stem already possessing non-lexical prefixal material, morphological circumscription of the head may be observed. In (2), if reduplication is a stem-level process, or in other words, applies during the course of the cyclic syllabification component, syllabification of the base may be disrupted, and thus the inserted morpheme may affix directly to the (left or right) edge of the base. However, if reduplication is a word-level process, applying in the post-cyclic syllabification component, syllabification of the base may not be disrupted. Therefore, while morphological circumscription has isolated a specific morphological domain, constraints on word-level operations may potentially prohibit affixation from gaining immediate access to this domain, and thus the reduplicative morpheme affixes to the edge of the first available prosodic juncture. Consequently, phonological material not morphologically circumscribed may intervene between the reduplicative morpheme and the morphologically circumscribed head. At this point, in (3), intervening material is subject to copying. Were it not to copy, strict adjacency between trigger and target would be violated. Finally, (4), full prosodization of the copy proceeds.

We have thus isolated the following phonological and morphological principles which apply asymmetrically in reduplication:
1) Lexical Targeting
2) Strict Adjacency Condition
3) Prosodic Closure (cyclic versus post-cyclic syllabification)
4) The Mirror Principle

Reduplication normally targets lexical categories. As reduplication is a morphological operation with an inherent phonological component, it is subject to the Strict Adjacency Condition. However, if reduplication applies at the word level, in the post-cyclic rule component of the phonology, syllabification of the base may not be disrupted, and thus Strict Adjacency overrides Lexical Targeting: the reduplicative morpheme may only be inserted at the nearest prosodic juncture to the lexical target. At this point, if non-lexical material is syllabified with the lexical target, it is subject to copying as well. Finally, the Mirror Principle, which characterizes normal morphological derivations, is overridden due to the more strict demands placed on reduplicative operations.

2.3 Kihehe Again

Odden and Odden (1985) state that in Kihehe, "what is reduplicated ... is the stem -- that is, the root, any following extensions, and the so-called final vowel morpheme" (p.500).

We may now assume the following derivation for Kihehe reduplicated forms (throughout, prosodic structure of the base is suppressed):

input:
ku.haa.ta  ku.lwii.ta  ku.mwii.mbi.la

morphological circumscription:
ku.<haa.ta>  ku.lwi<i.ta>  ku.mwi<i.mbi.la>

affixational targeting:
ku.*<haa.ta>  ku.*lwi<i.ta>  ku.*mwi<i.mbi.la>

melodic copy with nuclear integrity:
kũ.\textit{haata}<\textit{haa.ta}>  ku.lwi<i.ta>  \textit{ku.mwiimbilamwi}<\textit{i.mbi.la}>  \sqcup  |  \sqcup  |
\begin{tabular}{cccc}
s & s & s & s \\
\end{tabular}

reprosodization:
kũ.\textit{haata}<\textit{haa.ta}>  ku.lwi<i.ta>  \textit{ku.mwiimbilamwi}<\textit{i.mbi.la>}
\begin{tabular}{cccc}
\sqcup |  \sqcup |  \sqcup |  \sqcup |
s & s & s & s \\
\end{tabular}

surface:
kuhaata-haata     kulwiita-lwitakumwiimbila-mwiimbila

Since reduplicative morphemes are melodically dependent upon the base, strict phonological adjacency is required. Therefore, the morphological lexical head (in this case along with suffixal material) is circumscribed. However, as reduplication in Kihehe is a word-level process, syllabification of the base may not be disrupted. Therefore, the prefix seeks the first available prosodic juncture. At this point copying proceeds. As non-stem material intervenes between the stem and the affix, it must copy as well, if strict phonological adjacency between trigger and target is to be maintained. All melodic material, as well as only that prosodic structure which is necessary for the representation of syllabicity, is prefixed. Note that Transfer of Length effects, as well as the non-alternation of glides/vowels (both discussed in Clements 1985) are a natural consequence of this operation. Reprosodization then proceeds, thus completing the derivation.

As noted in the introduction, since reduplication is just a special case of morpheme affixation, its derivation should be as consistent as possible with all other morphological processes. Reduplicants acquire melodic content from the base, thus requiring strict phonological adjacency. Once summoned, the morphological constituent should be assigned prosodic structure in a manner fully consistent with the language-specific phonology: syllables are be constructed maximally up to well-formedness, from nuclei outward.

Note that this approach circumvents the need to assume isomorphism between morphemic and syllabic structure, as hypothesized by Odden and Odden (1985). In these authors' account, morpheme is prefixed to the stem, copying in full prosodic structure dominated by this morpheme:

underlying

```
   m   m   m
   |   / \  
  s   s   s
  / \ | / \ 
 C V C V C V
| | | | |
 ku i t a
```

fusion

```
 m m
/ \ 
 s s
/\//\ 
 CCVVCV
|\| |
 kw ita
```
But observe the circularity of this approach: a morpheme is prefixed which observes the syllabification of the structure it dominates, and the syllable structure of the base determines the shape of the morpheme to be copied.

Under the present approach, syllabification of the reduplicant is assigned independently of morphological considerations, and thus requires no special stipulations regarding syllable-morpheme isomorphism. Instead, it is the combination of constraints on post-cyclic syllabification, and strict adjacency which accounts for the melodic content of the copy.

2.4 Makassarese Again

Recall that unlike Kihehe, reduplication in Makassarese possesses a weight limit on the reduplicant. The copy may be maximally two syllables. When the base exceeds bisyllabicis, the marker -k closes the second syllable of the copy. I therefore assume that a binary foot template is constructed for the copy. When reduplication is constrained by a prosodic template, as in the case of Makassarese, the template targets the appropriate morphologically circumscribed nuclei, and reprodosodization proceeds. Nuclei which are not targeted by the template lack proper licensing conditions, and are consequently erased through Stray Erasure (Ito 1986). Finally, recall that reduplication in Makassarese has been shown to be a stem-level process.

(a)      (b)
Level One
input:     gas.si.ng+i   gas.sing
morphological circumscription:  <gas.si.ng+i>   <gas.sing>
affixational targeting:  *<gas.si.ng+i>   *<gas.sing>
melodic copy with nuclear integrity and template provision: \[ gassingi + <gas.si.ng+i> \quad gassing + <gas.sing> \]

| | |
| s s | s s |
\[ \backslash / \quad \backslash / \]
F F

reprosodization: \[ gassingi + <gas.si.ngi> \quad gassing + <gas.sing> \]

\[ \backslash / \quad \backslash / \]
| s s | s s |
\[ \backslash / \quad \backslash / \]
F F

stray erasure/post-specification
-k marking: gassik + gassing + i

Level Two
input: gassik + gassing + i gassing + gassing
affixation: ------------ gassing + gassing # i

surface: gassik-gassingi gassing-gassingi

The fact that /ng/ does not surface in the copy in (a) indicates that -k-marking applies whenever a base exceeds bisyllabicity, regardless of the syllabic affiliation of the segmental material. Thus -k-marking applies due to the fact that there exists a mismatch between morphologically circumscribed material and prosodically circumscribed material.

I now assume that reduplication in Makassarese targets the whole of the form, and not solely the head. Were the process a head operation, after template fitting, the entire morphologically targeted constituent would fit the template, and -k-marking would not be expected to apply:

\[ gassing + <gassing+i> \rightarrow \ast gassing-gassingi \]

\[ \backslash / \]
| s s |
We would therefore expect /ng/ to surface in the copy, as the morphologically targeted constituent is bisyllabic, thus capable of being fully accommodated by the template. As /ng/ does not surface in the copy, we may now conclude that reduplication is a stem-level, whole operation (derivation #5 from Section 1.3), and is, to employ Aronoff’s own characterization of this type of reduplication, “unexceptional”.

Note finally that the theory outlined herein permits a far more constrained interpretation of the data. Recall that Aronoff’s theory admitted six possible derivations, whereas the present theory admits only two (one, when considering stress patterning and lexical place spreading).

2.5 Indonesian Again

This approach to reduplication can rather straightforwardly handle the facts from Indonesian. Recall that the meN- prefix attaches at the word-level, as reduplicated stems are sensitive to rules triggered by word-level verbal prefixation (cf. meng-isi-isi, me-ngira-ngira).

We may therefore assume the following derivation.

input: meN.pi.lih  meN.i.si
phonology: me.mi.lih  meng.i.si*
morphological circumscription: me.<mi.lih> meng.<i.si>
affixational targeting: me.*<mi.lih> meng.*<isi>
melodic copy with nuclear integrity: me.milih<mi.lih> meng isi<i.si>
    s s s s
reprosodization: me.milih<mi.lih> meng isi<i.si>
    s s s s
surface: memilih-milih mengisi-isi

* Uhrbach assumes velar default place
Word-level reduplication must respect syllabification of the base, while simultaneously requiring strict phonological adjacency to the root. The affixational target thus seeks the first prosodic juncture left of the root, and full melodic copy with nuclear integrity proceeds. Finally, the copy is fully syllabified, and the attested forms surface.

It should be added at this point that the process of full reduplication is merely the unmarked derivation. We still assume morphological circumscription and reprosodization to apply. Syllable structure of the copy is identical to that of the base not because prosodic structure is retained throughout the derivation, but because identical processes of syllabification operate on identical strings, thus giving the illusion of copying.

Indonesian displays a pattern of full reduplication which is handled in a straightforward manner within the present framework. Forms with the nominalizing prefix *pen* may reduplicate to form the plural, thus *dudak* (sit) -> *pendudak* (no gloss)-> *pendudak-pendudak* (inhabitants). The derivation proceeds as follows:

<table>
<thead>
<tr>
<th>Input</th>
<th>pen.du.dak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphological circumscription</td>
<td>&lt;pen.du.dak&gt;</td>
</tr>
<tr>
<td>Affixational targeting</td>
<td>*&lt;pen.du.dak&gt;</td>
</tr>
<tr>
<td>Melodic copy with nuclear integrity</td>
<td>pendudak&lt;pen.du.dak&gt;</td>
</tr>
<tr>
<td>Reprosodization</td>
<td>pendudak&lt;pen.du.dak&gt;</td>
</tr>
<tr>
<td>Surface</td>
<td>pendudak-pendudak</td>
</tr>
</tbody>
</table>

2.6 Fijian Again

In Fijian, as foot construction is sensitive to moraic structure, not syllabic structure, I assume quite naturally that reduplicative operations too make reference to the mora in their prosodic targeting operations. Where Fijian departs from the other languages discussed is that this language possesses several methods of filling its reduplicative template, which consists of a single foot. In Section 3 we will discuss the theoretic significance of this fact. I assume that full syllable copy is the unmarked derivation. Just as in Makassarese, I assume that the reduplicative template is constructed as copying proceeds. As the Fijian syllable does not permit consonantal codas, consonants are never moraic. Therefore, to satisfy the bimoraic template, two (moraic) vowels within the lexical head must be targeted for retention (cf. *cak-caka*).
Reprosodization of the morphologically circumscribed constituent departs minimally from prosodization elsewhere: a morpheme is summoned, and prosodic rules proceed to assign structure maximally up to well-formedness, constrained by the reduplicative template.

Alternatively, the bimoraic template may be filled by lengthening the vowel of the root-initial light syllable. Recall that this is the only attested form in roots with light syllable identity. As truncation and V-lengthening are obligatory in roots with light syllable identity, I assume the process is available for other forms, hence \textit{vi:vinaka} (good, common pl.) (cf. \textit{(vaka)vina-vinaka} (Thanking)).

Since light syllable copying is obligatory elsewhere in the grammar (cf. \textit{ci -> cici}), the process is also available in later cases of reduplication. Thus, from \textit{balava}, light-syllable copying produces ba-balava. The minimal word requirement is met by copying again the first syllable of the base: \textit{ba-ba-balava}.

Note that the various patterns of reduplication in Fijian are all attested independently in the grammar. Therefore, template filling is in no sense idiosyncratic. Rather, it merely exploits
processes that are attested elsewhere in the grammar, producing novel forms whenever semantic distinctions are necessary (cf vi:-vinaka (good, common pl.) vs. vaka vina-vinaka (thanking)).

Finally, we may easily account for the peculiar form cacalididi: The prefix copies in full, as does the root.

3. Evidence for Nuclear Integrity in Prosodic Morphology: Hebrew

Until this point I have provided only theory-driven evidence supporting the hypothesis that reduplication entails a process of Nuclear Integrity and reprosodization. As all examples we have analyzed thus far retain syllabification of the base in the copy, the only "evidence" provided for the hypothesized strategy comes from assumed strategies of lexical prosodization: for a given morpheme, regardless of its origin, prosodic structure is supplied from nuclei outward (Levin 1985).

We will now turn to data in which syllabification of the base is not preserved after prosodic morphological operations apply. We will look at a process of stem modification in Modern Hebrew as presented in Bat El (1990). I will argue that a theory of prosodic morphology in which Nuclear Integrity and maximal reprosodization up to language-specific well-formedness handles the data in a straightforward manner, and departs minimally from less marked instances of prosodization in derived domains.

Hebrew displays the following morphological pattern of denominalization:

<table>
<thead>
<tr>
<th>Base</th>
<th>Derived Verb</th>
</tr>
</thead>
<tbody>
<tr>
<td>xantaris (nonsense)</td>
<td>xintres (to talk nonsense)</td>
</tr>
<tr>
<td>telegraf (telegraph)</td>
<td>tilgref (to telegraph)</td>
</tr>
<tr>
<td>sandlar (shoemaker)</td>
<td>sindler (to make shoes)</td>
</tr>
<tr>
<td>sinxroni (synchronic)</td>
<td>sinxren (to synchronize)</td>
</tr>
<tr>
<td>praklit (lawyer)</td>
<td>priklet (to practice law)</td>
</tr>
</tbody>
</table>

Bat El observes that consonant clusters which exist in the base are preserved in the denominalized forms. And so in the CCVCCVC praklit the initial CC cluster is preserved in the derived form, as is the medial CC cluster derived from the CVCVCCVC form telegraf. Bat El further observes that cluster preservation cannot be accounted for in the root-and-pattern theory of Semitic morphology, as initially presented in McCarthy (1979). Assuming that all morphological operations in Semitic project from lexical root morphemes, inflectional morphemes, and skeletal morphemes, there would be no principled way to account for patterns of cluster transfer in Hebrew denominals. Specifically, there is no principled way to account for the fact that the CV skeletal morphemes for tilgref (CVCCVC) and priklet (CCVCCVC) are distinct in exactly a manner by which consonant clusters present in the base are retained in the derived form.

Bat El concludes that denominalized forms (and, by extension, all Semitic morphological
alternations) are not derived from the lexical summoning of distinct morphemes which combine to build a form, but instead are derived through modification(s) of the (unmarked) stem.

I will now briefly run through the crucial aspects of Bat El's analysis, along the way pointing out a crucial theoretical problem in her solution. I will then present a modified analysis of the data in which this theoretical problem does not arise.

Bat El assumes that all prosodic structure of the base is erased as stem modification proceeds, as consonants often shift their syllabic association (e.g. `telegraf' -> `tilgref'). A process of edge-in association of pre-specified vocalic elements accounts for the observed ablaut pattern. At this point in the derivation, syllable nodes are constructed over pre-specified vowels, and full syllabification up to well-formedness subsequently proceeds. Therefore cluster transfer follows as a natural consequence of the derivation. All unlicensed material is subsequently deleted from the representation through Stray Erasure.

```
base: kaftor sandlar

\[\begin{array}{c}
|\|
|\|
s s \\
\end{array}\]

prosodic erasure/ kiafteor siandlear

\[\begin{array}{c}
|/|
|/|
s s s \\
\end{array}\]

edge-in pre-
specification

\[\begin{array}{c}
**
**
**
**
\end{array}\]

syllabification: kiaftoer siandlaer

\[\begin{array}{c}
|/\
|/|
s s s \\
\end{array}\]

stray erasure: kifter sindler

\[\begin{array}{c}
|/|
|/|
s s s \\
\end{array}\]

surface: kifter sindler

(Bat-El states that * indicates root nodes or the CV tier)

Note that Bat El makes a crucial assumption concerning the nature of prespecification. As she assumes all prosodic structure to be absent at the stage in the derivation when prespecified segments associate, she provides no principled way to account for which segments are targeted for replacement. As syllabicity is assumed always predictable, no such information is present in the underlying feature bundle out of which each segment is composed (therefore, "*" should indeed represent root nodes, and not a CV tier). It is therefore not possible to provide a theoretically motivated account of vowel replacement (and concomitant cluster transfer) under this analysis. To illustrate, I present the following schematized derivation for the two forms telegraf and praklit, in which syllabicity is not specified in root nodes.

(Bat-El states that * indicates root nodes or the CV tier)
As soon as prosodic structure is erased, all information regarding segmental syllabicity is lost. At this point, prespecified vocalic segments will have no information regarding which segments in the representation they are supposed to be replacing. We would therefore expect association of prespecified vocalic segments to be governed by language specific principles of syllabification, applied unexceptionally. If this scenario were to obtain, we would not expect clusters to transfer from the base, but instead we would expect CV patterning to be completely regular in the derived forms, as the same principles of syllabification apply in each instance: \textit{tilgref}, *\textit{pirklet} (assuming vowels replace the second root node encountered).

As we do not observe these phenomena, I assume that a certain amount of prosodic structure is salvaged from erasure as prespecification and subsequent reprosodization proceed.

I now propose a modification of Bat El's analysis which results in a derivation exactly parallel to that proposed in Section 2 for reduplication.

As denominalization proceeds, a binary foot template associates edge-in with the form, targeting nuclear elements, and ablaut applies. All prosodic structure not immediately dominated by the template is erased. Subsequently, full prosodization proceeds, maximizing syllable structure up to well-formedness. Non-licensed material is deleted via Stray Erasure. This approach to stem modification in Hebrew is exemplified below.
This approach is also applicable in other paradigms. Certain inputs to denominalization do not possess sufficient melodic material to fill the denominal template. (\textit{kis} (pocket) $\Rightarrow$ \textit{kiyes} (to pickpocket), \textit{bul} (stamp) $\Rightarrow$ \textit{biyel} (to stamp)). A templatic approach which assumes nuclear integrity can account for these forms as well.

All syllables in Hebrew require onsets. In denominalized forms, there is apparently a choice to be made regarding how onsets are provided for syllables lacking onsets after template-fitting. We witness either glide insertion (\textit{biyel}, \textit{kiyes}) (which can be perhaps be better characterized as spreading the surface vowel to the following onset position), or leftward spreading of the final C (\textit{ximem}). As vocalic material is supplied along with the template, the final stem C may spread leftward without violating the ban on crossing association lines: the root nodes of the involved segments are non-coplanar, and therefore are non-adjacent at the point in the derivation where spreading applies.

Bat-El actually assumes that the intermediate form of \textit{ximem} is \textit{xime}, and that reduplication then copies the base in full, at which point the copied /m/ is incorporated, all residual material deleting. However, this analysis is inconsistent with her observation that elsewhere, edge-in ablaut always bypasses coda-less final syllables (hence Bat-El considers...
coda-less final syllables extrametrical, despite her assumption that all prosodic structure is erased, thus rendering the concept of extrametricality moot). Therefore, from xam, we expect the intermediate form xiem, as edge-in ablaut must first encounter a C, namely /m/.

Analyzing a form in which glide-vowel alternations are theoretically possible supports the approach to denominalization presented here. The noun fantazya ("fantasy") denominalizes to fintez ("to fantasize"). Assuming that denominalization proceeds as theorized herein, we assume the following derivation:

input: fantazya
    \|
    s s s

nuclear fintezya
retention,  
template s s
provision, \ / 
ablaut: F

reprosodization: fintezya
    \|
    s s
    \ /
    F

Stray Erasure: fintez
    \|
    s s
    \ /
    F

surface: fintez

As open final syllables are extrametrical, the template associates with the penultimate surviving syllable node and ablaut applies, resulting in the attested form.

Assuming Bat-El's approach, we must assume that pre-specified segments have no access to the syllabicity specification of base segments, as all prosodic structure has been erased. Therefore, the right edge of the template will associate with the first available feature matrix left of the final extrametrical vowel. For the form fantazya, the surface glide y would be targeted for replacement, thus deriving the unattested *fintzez:

base: fantazya
    \|

As already noted, Bat-El's evidence for stem modification in Hebrew calls into serious doubt McCarthy's (1979) root-and-pattern account of Semitic morphology. McCarthy and Prince (1986) in fact re-analyze Semitic in a manner consistent with the theory of prosodic morphology presented therein: Binyanim are not constructed by the filling of CV templates, but rather are constructed by the filling of syllabic templates. Nonetheless McCarthy and Prince hold fast to the non-concatenative approach of McCarthy (1979) in that Binyanim are still assumed constructed from combining the lexical entries of root, inflectional, and prosodic morphemes.

One problem that McCarthy and Prince do not adequately address in their re-analysis of the Semitic data is the fact that association dichotomies exist between melody and template; between identical melodic material and identical prosodic material. Of the fifteen CV-skeleta McCarthy and Prince list, there exists a one-to-one correspondence between CV-skeleta and syllabic skeleta for only eleven paradigms. In other words, four of the eleven syllabic skeleta accommodate two CV-skeleta each. The four paradigms are listed:

<table>
<thead>
<tr>
<th>syllabic skeleton</th>
<th>Corresponding CV-skeleta</th>
</tr>
</thead>
<tbody>
<tr>
<td>smm s</td>
<td>CVVCVC, CVCCVC</td>
</tr>
<tr>
<td>smm s (s)</td>
<td>CVVCVVC, CVCCVVC</td>
</tr>
<tr>
<td>(s) smm s</td>
<td>CCVCCVC, CCVVCVC</td>
</tr>
<tr>
<td>(s) smm s (s)</td>
<td>CCVCCVVC, CCVVCVVC</td>
</tr>
</tbody>
</table>

If syllabic skeleta form the basis of the prosodic template in Semitic, reference to the syllabicity of skeletal slots should not be a consideration. Conversely, if the prosodic morpheme indeed makes reference to the syllabicity of skeletal slots, then the syllabic component of the morphemic representation is redundant, as this information is predictable. McCarthy and Prince
themselves argue the former; that the segmental skeleton is entirely superfluous. This being the case, the authors are at a loss to explain how identical melodic material may associate in more than one way to identical syllabic patterns.

The authors have little to say about how these templates are filled. But observe that under their analysis, the surface distinction between a given pair of underlingly identical forms must be the result of phonological operations, not a result of lexically contrastive information. To exemplify, consider the hypothetical case of a root, say /ktb/, associating with an inflectional morpheme, say /ia/, and a syllabic skeleton, say /s_{nn} s/. Two Binyanim are derivable:

\[
\begin{array}{ccc}
\text{skeleton:} & \text{CVVCVC} & \text{CVCCVC} \\
\text{root:} & s_{nn} s & s_{nn} s \\
\text{inflection:} & k t b & k t b \\
\text{surface:} & kiitab & kuttab
\end{array}
\]

In these structures, the underlying morphemes are identical. It is only during the course of the derivation that distinctions arise between them. This is surely an undesirable situation, as morphologically contrastive forms, unless homophonous, should possess underlying structural distinctions.

This problem is not encountered in a theory of prosodic morphology based on stem modification and Nuclear Integrity. Recall that Fijian permits several lexically contrastive strategies of filling its bimoraic reduplicative template (vi:-vinaka vs. vinavinaka). Assuming that Semitic morphology allows for the same type of lexically contrastive stem modification as Fijian allows in its reduplicative morphology, the problem of lexically identical forms giving rise to superficially distinct forms does not arise.

Stem modification does not involve the resummoning of lexical entries, but instead applies to existing surface forms. Templates of identical prosodic weight may be filled in a variety of fashions. The morpheme is thus not solely the template itself, but includes the pattern of re-association of the relevant elements within the base.

We can now appreciate the theoretic significance of Fijian's distinct strategies of template-fitting as presented in Section 1.5. The fact that Fijian allows for several methods of template filling shows that prosodic morphology cannot solely rely on language-specific rules of syllabification as template-fitting proceeds. Instead, certain aspects of the derivation -- specifically, segment association to the template -- can play an active role in the prosodic morphology. (Alternatively, of course, syllabification itself may be supplied lexically (McCarthy and Prince 1991).) I still assume, however, that normal syllabification is the unmarked strategy. If prosodic morphological operations proceed from derived (i.e. surface) forms (as in Bat-El's stem modification approach and the present approach to reduplication), derivational dichotomies are an expected consequence, as the morpheme itself is not derived from lexical representations, but instead possesses the special status of being derived from a
derived form. But if prosodic morphological processes proceed from a re-summoning of lexical entries (as in the McCarthy and Prince approach), derivational dichotomies would not be expected, as the re-summoned elements would not have access to their status as prosodically-conditioned elements, and therefore would be expected to undergo phonological processes solely in the unmarked fashion.

Furthermore, if we assume with McCarthy and Prince (1987) that certain reduplicative templates are equipped with pre-associated moraic material, we would still be unable to account for the various attested surface forms in Fijian (cf. vi:-naka vs. baba-balava) where the association of non-moraic melodic material is morphologically conditioned.

The analysis of prosodic morphological processes presented in the preceding paragraph, and exemplified by Fijian, should not be misconstrued as one which admits skeletal templates. Were Fijian to admit skeletal templates of the form CVV, CVCV, C1V1C1V1, the generalization that all these templates are bimoraic would be missed.

To summarize this section, we have argued in favor of Bat-El's stem modification approach to Semitic morphology, as this approach can account for cluster transfer in a principled manner. However, I have shown that Bat-El's theory of full prosodic erasure requires modification in order to properly account for cluster transfer. I assume that Nuclear Integrity holds as stem modification proceeds. Nuclear Integrity thus accounts for cluster transfer, and additionally, brings Semitic prosodic morphology in line with the reduplication processes discussed in the previous sections: prosodic structure dominating nuclei is retained as prosodic morphological processes proceed.

Furthermore, we have reconsidered the Fijian data, which has supplied further support for a theory of prosodic morphology in which derivations proceed from surface representations, and not from lexical representations.

4. Mangarayi: Cyclic Syllabification, and the Extraprosodicity - Onset Provision Correlation

At this point, we may extend Aronoff's notion of "prosodic closure", re-analyzed here as post-cyclic syllabification, to make categorical inroads into the derivational status of root-and-pattern morphological systems, and in fact all instances of prosodic morphological operations in which the syllabification of the base is disrupted. Recall that I have argued that prosodic erasure with Nuclear Integrity holds in Hebrew denominalization, and, by extension, in all Semitic root-and-pattern morphological alternations. In order to maintain theory-internal consistency, I must claim that such systems, as prosodic structure of the base is disrupted, must undergo cyclic syllabification. Further I must claim that all instances of prosodic disruption of the base, including the re-parsing (as opposed to "picking") of a prosodically circumscribed domain (McCarthy and Prince 1991), as well as all cases of apparent infixation, must be early processes in which syllabification operates on the cycle. Indeed, there exists a one-to-one correspondence between languages that superficially infix a reduplicative morpheme, and allow syllable structure of the base to be disrupted (John McCarthy, p.c.). This phenomenon will be exemplified by Mangarayi.

In Mangarayi plural formation, an onsetless heavy syllable copies internal to the form-
initial onset (McCarthy and Prince 1991, from Merlan, 1982):

a.  

<p>| | |</p>
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<tbody>
<tr>
<td>g</td>
<td>a</td>
</tr>
<tr>
<td>w</td>
<td>a</td>
</tr>
<tr>
<td>y</td>
<td>i</td>
</tr>
<tr>
<td>w</td>
<td>a</td>
</tr>
<tr>
<td>y</td>
<td>i</td>
</tr>
</tbody>
</table>

(gamag  gamamagji  (having digging sticks (=women))
walima  walalima  (young people)
yirag  yirirag  (fathers and children)

b.  

<p>| | |</p>
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<tbody>
<tr>
<td>j</td>
<td>i</td>
</tr>
<tr>
<td>m</td>
<td>u</td>
</tr>
<tr>
<td>g</td>
<td>u</td>
</tr>
</tbody>
</table>

(jimgan  jimgimgan  (knowledgeable people)
muygji  muygjuygji  (having a dog) (sic)
guryag  guryuryagji  (having a lot of liles)

Kiparsky (1985) states that "An element automatically loses its extraprosodic status at the end of the lexicon"(his (98d),p.118). Assuming that form-initial onsets have not been syllabified at the point in the derivation where reduplication applies (suggesting that reduplication is relatively early), the reduplicative morpheme is inserted at the left edge of the prosodized base. Note, however, that the syllabification of the base is altered, as material in the copy is provided as an onset for the leftmost stem syllable. The crucial examples are in (b), where lexical syllabification proceeds across the morpheme boundary. Hypothesized derivations follow.

input:
(g)a.mag   (j)im.gan   (g)ur.yag

circumscription:
(g)[a.mag]  (j)[im.gan]  (g)[ur.yag]

affixational targeting:
(g)*[a.mag]  (j)*[im.gan]  (g)*[ur.yag]

melodic copy with nuclear integrity:
(g)amag[a.mag]  (j)imgan[im.gan]  (g)uryag[ur.yag]
<p>| | | |</p>
<table>
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<tbody>
<tr>
<td>s</td>
<td>s</td>
<td>s</td>
</tr>
</tbody>
</table>

reprosodization:
(g)amag[amag]  (j)imgan[imgan]  (g)uryag[uryag]
<p>| | | |</p>
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</thead>
<tbody>
<tr>
<td>s</td>
<td>s</td>
<td>s</td>
</tr>
</tbody>
</table>

...  
surface:

gamamagji  jimgimgan  guryuryagji

The input to reduplication consists of a prosodized base with an extrametrical form-initial
onset. The prosodized base is circumscribed, and a heavy syllable template is prefixed. After full melodic copy, reprosodization proceeds. As reduplication is an early process (which is indicated by the extraprosodicity of the onset) the boundary between the two morphemes is a weak one, and thus syllabification still operates on the cycle. At this point, copied melodic material which cannot be accommodated by the template is still free to syllabify to its right. This suggests that the observed correlation between extraprosodicity and onset provision is due to the fact that cyclic syllabification operates at earlier lexical levels than non-cyclic syllabification.

5. Conclusion

In this paper I have preliminarily considered certain aspects of prosodic morphological processes whose formal characterization have not been extensively investigated in the literature. I have attempted to show that certain apparently aberrant morphological behavior is best viewed as a natural consequence of various principles, the phonological reality of which have been convincingly attested independently. Specifically, I have invoked the Strict Adjacency condition, the lexical/non-lexical categorial distinction, cyclic and post-cyclic rule application, and the Mirror Principle, arguing that these various principles apply asymmetrically, to formally account for various attested patterns of reduplication. Additionally, I have offered a new account of Transfer of Length effects through a preliminary investigation of Nuclear Integrity.

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