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Re Reduplication

In the recent literature, reduplication has been claimed to cause two serious problems for theories of morphology and phonology. First, as McCarthy (1979) points out, no one has developed an observationally adequate formalization of reduplication rules without adopting a notation which allows morphological rules to be written that never occur cross-linguistically. Most investigators have either implicitly (e.g. Wilbur (1973), Munro and Benson (1973)) or explicitly (e.g. Carrier (1979)) employed a transformational notation for reduplicative processes. Munro and Benson (1973, 18) characterize a reduplicative adjective formation rule of Luiseño as shown in (1), while Carrier (1979, 353) formulates a reduplication rule of Tagalog as shown in (2) (where *M* is a morpheme).

(1) $C_1V_1C_2V_2 + C_1V_1C_2V_2 + i + \check{c}$

(2) [(M) C V X
1 2 3 4 → 1, 2, 3, 2, 3, 4
[−long]

Given the formal apparatus of (1) or (2), one can write many types of morphological rules which are not instantiated in natural languages. For example, although expressible in the transformational notations of (1) and (2), mirror-image reduplication rules such as (3a,b) are not found in any language.

(3) a. $C_1V_1C_2V_2 + V_2C_2V_1C_1$
b. C V C V
1 2 3 4 → 4, 3, 2, 1, 1, 2, 3, 4

An adequate theory of reduplication would formalize the process while allowing one to express only the sorts of reduplication which occur cross-linguistically and not the sorts of rules exemplified in (3).

Wilbur (1973) presents the most extensive discussion of the second apparent problem for an analysis of reduplication—its unusual interaction with certain phonological pro-

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The research summarized here was conducted during the 1979–1980 academic year. The article itself was written in August, 1980, and has since been revised. In the time since the ideas presented here were developed, they have been productively set to work by a number of other linguists, e.g. in Halle and Vergnaud (1980a,b), Pranka (1981), and Yip (1981).

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cesses. As we shall see in section 2, some phonological rules appear to "overapply" to reduplicated forms, that is, to apply to segments in both the base and the copied material in a reduplicated form although only one set of these segments occurs in the proper environment for the application of the rule. This behavior of reduplicated forms has led some linguists (e.g. Carrier (1979)) to order the overapplying phonological processes before reduplication in the grammar. The output of these processes may thus be copied by reduplication, yielding the appearance of overapplication. Although this approach accounts for the occurrence of the output of the phonological processes in both the base and the copied material, it has the result of mixing morphological and phonological processes. The conceptually simpler theory would place these processes in separate components of the grammar. Moreover, as Wilbur (1973) points out, the ordering approach would not be able to account for the other puzzling interaction of phonological rules with reduplication: some phonological rules appear to *under*apply to reduplicated forms; that is, they do not apply to segments in either the base or the copied material in a reduplicated form although one set of these segments occurs in the environment of the rule. An adequate theory of reduplication would explain these apparently aberrant interactions of reduplication and phonological processes and predict just which phonological processes will "over- and underapply" to reduplicated forms.

The solution to these problems associated with reduplication is simply to make the minimal special assumptions or statements about reduplication. Except for the fact that the material attached to the stem in reduplication resembles the stem phonologically, reduplication rules look like normal affixation processes. To provide the best account of reduplication rules, we say they *are* normal affixation processes. The one unique feature of reduplication, the feature which leads us to group together diverse morphological processes under the title *reduplication*, is the resemblance of the added material to the stem being reduplicated. As demonstrated in section 1, we can devise a simple procedure for lending to the reduplicating affix phonemic material from the stem to which it attaches without adding unneeded power to the grammar.

The solution to problems posed by reduplication, then, is to say that there is nothing special about reduplication other than the resemblance between the affix and the stem to which it is attached. An extension of John McCarthy's recent account of Arabic verbal paradigms (McCarthy (1979; 1981)) provides a simple formalism for reduplicating processes which does not involve the full power of transformations (section 1). As for the interaction of reduplication with phonological and other morphological rules (section 2), once we establish that reduplication is simply affixation, recent improvements in phonological and morphological theory explain this interaction by predicting which rules will appear to over- and underapply to reduplicated forms. No special ordering of reduplication rules or special conditions on phonological rules prove necessary to account for the data.

1. The Formal Nature of Reduplication

In this section I exploit a proposal made by John McCarthy (1979; 1981) in an analysis of the Arabic verbal system to provide a formal account of reduplicative processes.

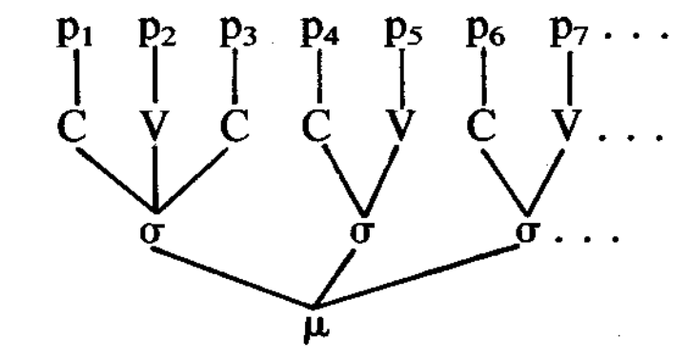
McCarthy claims that words should be represented (in part) as consonant–vowel *skeleta* (his *prosodic templates*) connected to phonemic *melodies* on separate tiers in accordance with the principles of autosegmental phonology (see Goldsmith (1976) on autosegmental phonology and Halle and Vergnaud (1980a) on "tiered phonology").

(4) phonemic melody

consonant–vowel skeleton

syllabic skeleton

morpheme symbol



p_i = phoneme
C = consonant
V = vowel
σ = syllable

I will review McCarthy's discussion of Arabic verbs in section 1.2. I will support the claim that most reduplication processes are best analyzed as the affixation of a consonant–vowel (C–V) skeleton, itself a morpheme, to a stem. The entire phonemic melody of the stem is copied over the affixed C–V skeleton and linked to C and V "slots" in the skeleton according to principles to be made explicit below. Section 1.4 attempts to unify the analysis of C–V skeletal reduplication with the remaining examples of reduplication found in the literature.

1.1. What Reduplication Is Not and Preliminary Indications of What It Is

Ignoring difficulties, I will tentatively identify reduplication as a morphological process relating a base form of a morpheme or stem to a derived form that may be analyzed as being constructed from the base form via the affixation (or infixation) of phonemic material which is necessarily identical in whole or in part to the phonemic content of the base form. This working definition of *reduplication* matches, for the most part, the term's use in the literature. In providing a formal analysis of reduplication processes, this article will give, in essence, a formal definition of reduplication to replace the rough characterization above. To the extent that this formal definition excludes processes which share crucial properties with the processes it includes, to that extent my analysis of reduplication is in error.[1]

1.1.1. Reduplication Is Not Constituent Copying. Many languages include morphological processes which copy entire morphemes or words (Moravcsik (1978) cites many examples). For instance, Warlpiri forms the plural of some nouns, primarily those referring to humans, by *total reduplication* (Nash (1980, 130)).

[1] This [illegible] does exclude some of the Semitic "doubling" and "gemination" processes discussed in McCa[illegible]thy explains how these processes differ crucially from what I will call "reduplication" [illegible]

(5) a. kurdu 'child' kurdukurdu 'children'[2]
b. kamina 'girl, maiden' kaminakamina 'girls, maidens'
c. mardukuja 'woman, female' mardukujamardukuja 'women, females'

Any theory of morphology will need some mechanism to effect the copying of an entire morpheme as in (5).

Banking on this fact, one might propose a straightforward analysis of reduplication claiming that it always involves the copying of a constituent of a morpheme at some level of analysis or at some tier in an autosegmental representation of the morpheme. On this hypothesis (found, for example, in McCarthy (1979, chapter 4)), reduplication could copy a phoneme, a syllable, a metrical foot, an entire morpheme, or some other constituent of a morpheme but could not copy pieces of constituents which do not themselves make up a constituent.

However, well-attested reduplication rules do copy sequences of consonants and vowels from a morpheme which form no constituent of the morpheme. For example, we find reduplication rules which prefix a copy of the first CV of a stem to the stem regardless of whether the C and V constitute the entire first syllable of the word or only its onset and syllabic nucleus.[3] Quileute forms plurals with such a rule according to Andrade (1933, 189) as reported in Moravcsik (1978):[4]

(6) a. ci·phókwat' 'Negro' cici·phókwat' 'Negroes'
b. qa·x̣ 'bone' qaqa·x̣ 'bones'

Tagalog employs three distinct processes of reduplication, one which prefixes a copy of the first CV of a stem to the stem making the copied V short, one which prefixes a copy of the first CV of a stem to the stem making the copied V long, and one which prefixes a copy of the first CV(C)CV(C) of a stem to the stem making the copy of the second V long (Carrier (1979)). These reduplication processes, sometimes in connection with additional affixation, are used for a variety of derivational and inflectional purposes. Although the inclusion of the last C in the third reduplication process depends on the stem being reduplicated in a manner discussed in footnote 5, none of the Tagalog reduplication rules respect the syllabification or constituent structure of the forms to which

[2] For the most part I will employ the orthography of my sources in cited examples, providing phonetic interpretation only when relevant to the discussion. I have occasionally modified transcriptions to substitute more widely used symbols for more obscure ones, to ease typographic reproduction, or to standardize different sources on the same language. I have also left out stress and tone markings in some examples where these have no bearing on the issues at hand.

[3] In the pages to follow I will write as if there were no problem in deciding whether a given reduplication process involves prefixing, suffixing, or infixing. In fact, there are usually strong arguments for classifying a reduplicating rule in one of these categories, some of which may be found in the sources I cite. However, for most of the discussion below, it will not be important whether we consider any particular reduplication rule as prefixing, suffixing, or infixing the "copied" material.

[4] Andrade (1933, 189):

> Reduplication concerns regularly only the initial consonant or the first vowel of the word or both. . . . This principle is strictly adhered to even in cases in which a monosyllabic stem has a terminal consonant, or when we may infer from the general phonetic tendencies that the consonant following the first vowel belongs to the initial syllable.

they apply. That is, they copy a CV or CV(C)CV(C) whether or not these form a constituent (syllable or metrical foot).

(7) a. lākad 'walk' pag-lalākad 'walking'
b. kandīlah 'candle' pag-kakandīlah 'candle vendor'
c. linis 'clean' mag-līlinis 'will clean'
d. um-takboh 'run' (*tumakboh* after infixation) um-tātakboh 'will run' (>*tumātakboh*)
e. ma-talīnoh 'intelligent' ma-talītalīnoh 'rather intelligent'
f. baliktad balībaliktad 'all topsy-turvy'

Examples (7b,d,f) clearly display reduplication processes which do not copy a constituent.

The CV reduplication processes in Quileute and Tagalog copy a C and a V regardless of whether they make up a syllable or only part of a syllable. There are also reduplicating processes which prefix a copy of the first CVC of a stem to the stem regardless of whether the CVC constitutes the first syllable of the stem or the first syllable plus the onset of the following syllable. For example, Agta forms various sorts of plurals by CVC prefixing reduplication (examples from Healey (1960, 7)).

(8) a. bari 'body' barbari-k kid-in 'my whole body'
b. mag-saddu 'leak (verb)' mag-sadsaddu 'leak in many places'
c. na-wakay 'lost' na-wakwakay 'many things lost'
d. takki 'leg' taktakki 'legs'

In examples (8a,c), reduplication copies material which does not make up a constituent of the word being reduplicated.

As reported in Krause (1980), Chukchee also exhibits a CVC reduplication rule which does not respect syllabic structure and which, therefore, does not copy a phonological constituent. Copying the initial CVC of a noun to the right of the noun produces the absolutive singular in Chukchee.

(9) a. jilʔe- 'gopher' jilʔe-jil 'abs. singular'
b. nute- 'earth, ground' nute-nut 'abs. singular'

Examples like (9b) demonstrate the copying of a CVC sequence which does not constitute a syllable in Chukchee.

1.1.2. Reduplication as Affixation of Skeletal Morphemes. We have seen that the constituent copying theory of reduplication fails because reduplication may copy sequences of Cs and Vs which do not form a constituent. However, every reduplication process may be characterized by a "skeleton" of some sort, either a C–V skeleton, a syllabic skeleton, or a skeleton of morpheme symbols (see (4)). That is, the shape of the copied material in reduplication is fixed for the reduplication process; the shape is independent

hierarchical structure of the morpheme being copied.[5] After reviewing a large sample of reduplication rules from the world's languages in connection with the Stanford Project on Language Universals, Moravcsik (1978, 307) concluded that[6]

> whereas the relevant string [i.e. the portion of a stem to be copied by reduplication] could in principle be defined by any phonetic property (segmental or suprasegmental) or in terms of absolute linear position, or in terms of simply the number of adjacent segments involved; and it could also be left undefined (i.e. "reduplicate any one or more segments in the total string"), reduplicated phonetic strings I found invariably defined in reference to consonant–vowel sequences and absolute linear position.

My own research has identified only one exception to Moravcsik's claim (brought to my attention by David Nash), the Yidin^y reduplication rule to be discussed in section 1.4.

Moravcsik's generalization suggests that reduplication rules involve the affixation of a C–V skeleton to a stem, the C–V skeleton borrowing phonemes from the phonemic melody of the stem to which it attaches. After an introduction to C–V skeleta in the form of a review of McCarthy's (1979; 1981) work on Arabic verbs, I will present a theory of reduplicative processes which claims that most reduplication is just that—the affixation of a C–V skeletal morpheme to a stem and the association of a copy of the stem's phonemic melody with the affixed skeleton. As will be shown in section 1.4, this theory readily extends to the syllabic reduplication of Yidin^y and the full morpheme reduplication found in many languages.

1.2. An Introduction to C–V Skeleta: McCarthy's Analysis of the Arabic Verbal System

With the preliminary observations of the workings of reduplicative processes made in section 1.1, we are almost prepared to develop a complete formal account of reduplication. First, however, we must examine McCarthy's (1979; 1981) use of C–V skeleta

[5] Aside from the Yidin^y syllabic reduplication and the whole morpheme reduplications discussed in section 1.4, I know of two cases in which the C–V skeleton of the reduplicating morpheme does depend on the stem to which it attaches: CVCCV(C) reduplication in Dyirbal (Dixon (1972)) and Tagalog (Carrier (1979); see examples (7e,f)). In both languages, a morpheme-final C following the first CVC(C)V of a stem is either optionally (Dyirbal) or obligatorily (Tagalog) reduplicated along with the CVC(C)V. Note that the dependence of the C–V skeleton of the reduplicating morpheme on the stem in these cases has nothing to do with the syllabification or hierarchical structure of the stem. The rules in question do not copy an additional syllable-final C unless it is also morpheme-final. Moreover, when the constitution of the reduplicating C–V skeleton does seem to depend on the stem, i.e. when the extra C is copied, what the reduplication rule reduplicates is an entire stem. We have already noted that total morpheme or stem reduplication is quite common cross-linguistically. Thus, what we should say about the reduplication in Tagalog and Dyirbal which copies the extra morpheme-final C is not that the C–V skeleton of the reduplicating morpheme is dependent on the stem in these cases but rather that there is no C–V reduplicating skeleton involved at all—the rule is copying a stem. That is, the reduplicating affix has two allomorphs in Tagalog and Dyirbal. One, a morpheme skeletal affix (see section 1.4), attaches either obligatorily (Tagalog) or optionally (Dyirbal) to stems of the form (C)V(C)CVC#, copying the whole stem. The other allomorph, the C–V skeletal affix CVCCV, attaches to all other stems. See section 2.2.2.2 for further discussion of the Tagalog case.

[6] McCarthy (1979, 367–368) provides an insightful discussion of the significance of Moravcsik's findings for the "tiered phonology" model assumed in this article.

in his analysis of Arabic verbs. This review serves two purposes: to explain the mechanisms of C–V skeleta, phonemic melodies, and their association and to give independent justification for the formal machinery required for an analysis of reduplication.

Consider table 1, an expanded piece of McCarthy's table 1 (1981, 385). Each row displays part of the inflectional paradigm for the Arabic root *ktb* 'write' in one *binyan* (plural, *binyanim*) or conjugation.

> The first binyan [not included in my table 1/AM] is a possible category for nearly all roots that can appear as verbs. It is relatively unmarked phonologically, at least in the finite forms and it has no special semantic properties . . . But the others, the so-called derived binyanim, generally involve some special modification of the meaning of the root. So, for instance, the third triliteral binyan is usually reciprocal, while the sixth is usually the reflexive or effective of the reciprocal. It is, in general, an idiosyncratic property of any root whether it can appear in a particular binyan. Nevertheless, neologisms abound, loanwords are easily incorporated into the system, and speakers of Modern Standard Arabic report a reasonable facility in extending a root to other binyanim and interpreting the result. (McCarthy (1979, 239))

McCarthy notes that, for the most part, each binyan has a characteristic C–V shape, shown in the last column of table 1. The same triliteral root, *ktb*, appears in all the forms in table 1 and, with one exception (the imperfective active), the same vocalic melodies appear consistently within each column (see the second to last row in table 1). The key to a revealing analysis of the Arabic verbal system, McCarthy claims, is to separate the root consonants and vocalic melodies from each form as morphemes in themselves. These morphemes attach to the various C–V skeletal binyanim of the second to last column in table 1 according to the principles of autosegmental phonology with a more or less predictable semantic effect.

The binyanim, considered as C–V skeletal morphemes, operate in a manner similar to derivational affixes in other languages. Although, as McCarthy notes, they do not always impart the same meaning to the roots with which they associate, they possess a usual semantics which allows their extension, for example, to borrowed roots. For what follows, we shall assume that the binyanim, the consonantal roots, and the inflectional vocalic melodies are all morphemes—they all have lexical entries containing information about their possible combination with other morphemes and about the categorial and semantic results of such combinations.

Constituents of the autosegmental morphemes root, binyan, and inflectional vowel melody link together as dictated by the constraints of autosegmental phonology (cf. Goldsmith (1976)). The overriding principle of autosegmental phonology states that

(10) Linking lines never cross.

In the Arabic verbal system, another principle requires that

(11) Each slot in the skeleton is linked to at least one segment in the phonemic melody.

On McCarthy's analysis, each morpheme is arranged on a separate "tier" or level.