Circumscription Revisited

An Analysis of

Maori Reduplication

Comments appreciated!

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Paul de Lacy

ph. 64-9-6271101

E-Mail: [Home] <delacy@voyager.co.nz>

[University] <pvl@antnov1.auckland.ac.nz>

Abstract: It is argued that the process of circumscription must be reintroduced to current theories of prosodic morphology, specifically to Correspondence Theory. This notion has broader effects than the serial circumscriptive process, affecting concepts of categorisation within the grammar, as shown by discussion of the notion 'base of reduplication'. The reduplicative processes of the Maori language are analysed in this regard, and a hitherto unrecognised type of reduplication in this language is identified. Various other aspects of current phonological and morphological interest, such as lexical organisation, are also discussed.

0 Introduction[*]

Reduplication is one of the principal means of word-formation in Polynesian languages. Despite this, it has received little explanatory attention.[1] This paper aims to rectify this situation for the Maori language of New Zealand as well as addressing issues significant to current phonological theory. Prosodic Morphology, and more specifically Optimality and Correspondence Theory, provides the framework under which this analysis will be conducted.

Optimality Theory (Prince & Smolensky 1993, McCarthy & Prince 1993a) relies on the notion of constraint ranking to choose between a theoretically infinite number of possible output forms generated from an input. It is not necessary for an output form to satisfy every constraint; the only stipulation is that it must satisfy the constraints better than any other possible candidate — i.e. it must be **optimal**. Within this framework, Correspondence Theory (McCarthy & Prince 1994a,b; 1995a) is a recent development and has its most well known applications in reduplication. 'Correspondence' is a type of relation between two strings, such as hold between a base and its reduplicant. This relation can be restricted in various ways by the use of constraints such as MAX, BASE-DEPENDENCY, and IDENT(F). For example, an undominated MAX B-R requires that every element in the Base have a correspondent in the reduplicant, resulting in a full copy of the base. Despite the much broader applicability of Correspondence Theory to morphological and phonological processes, the immediate concern of this paper is reduplication, so these other applications will not be discussed in any depth.[2]

With these theoretical affiliations in mind, the aim of this paper is to provide a thorough account of Maori Reduplication while employing the minimum of theoretical devices necessary within a parallelist conception of language. During the course of this

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[*] This paper is avaliable on the Internet at http://www.ruccs.rutgers.edu/ling/roa/index.html, number #133 of Rutger's Optimality Archive. Thanks to Harry Leder, Wayne Lawrence and Sheila Collberg for their discussions. All of the data in this paper is taken from Williams (1971) or Harlow (1991). Data taken from Harlow (1991) has been cross-checked with Williams (1971).

[1] For descriptions of reduplication, the reader is referred to the appropriate Grammars for each language. A suitable bibliography can be downloaded from 'Austronesian On-Line" http://coombs.anu.edu.au/~marck/anhmpg.htm. A colleague and I are currently involved in an analytical survey of Polynesian reduplication, which will hopefully be completed in a short while. Samoan reduplication is the language most analysed within recent theoretical frameworks (Levelt 1990, McCarthy & Prince 1986, 1993a, 1995b, and others).

[2] The reader is referred to McCarthy & Prince (1995a) for a discussion of the possibilities, as well as the Rutgers Optimality Archive.

analysis, the structure of lexical entries will be considered, and an Optimality Theoretic device of circumscription will be proposed.

1 A Previous Analysis of Maori Reduplication

The main analytical study of Maori reduplication is presented by Ray Harlow (1991).[3] Harlow provides a summary of the reduplication patterns evident in Maori, subdividing them with regard to the moraic content of the stem:

(1) Bi-moraic stems:

(a) reduplication of the first syllable: $\sigma_1\sigma_1\sigma_2$, e.g. nunui 'large (pl.)'

(b) reduplication of both syllables: $\sigma_1\sigma_2\sigma_1\sigma_2$, e.g. huihui 'congregate'

(c) reduplication of the final syllable: $\sigma_1\sigma_2\sigma_2$, e.g. anganga 'aspect'

(2) Tri-moraic stems:

(a) reduplication of the first syllable: $\sigma_1\sigma_1\sigma_2\sigma_3$, e.g. hoata > hohoata 'colourless, the moon on the third day'

(b) reduplication of the first two syllables: $\sigma_1\sigma_1\sigma_2\sigma_2\sigma_3$, e.g. taweke > *tataweweke > ta:weweke 'slow, dilatory'

(c) reduplication of the first two syllables: $\sigma_1\sigma_2\sigma_1\sigma_2\sigma_3$, e.g. takai > takatakai 'wind round and round'

(d) reduplication of all three syllables: $\sigma_1\sigma_1\sigma_2\sigma_3\sigma_2\sigma_3$, matuku > *mamatukutuku > ma:tukutuku 'Reef Heron'

Note: The above list is adapted from Harlow (1991).

It is obvious that there are several redundancies in this analysis. However, before these are considered, a note must be made on the reduplicative types in (2b) and (2d). Although the starred form is the expected one given the description, only the rightmost form with an initial

[3] Other descriptions are made, as in Bauer (1981, 1993), Hohepa (1967) and Biggs (1969). Even so, Harlow's is the most extensive effort to integrate Maori reduplication into an exclusively phonological analysis, although his real aim is to prove a theory of consonant deletion. Also, Miriam Meyerhoff and Bill Reynolds have recently posted a paper on Rutgers Optimality Archive dealing with Maori reduplication (April, 1996).

long vowel ever occurs. Along with this, Harlow notes that forms like *pakaru* 'broken' have related forms with an initial long vowel: *pa:karu* 'break in pieces'. He goes on to suggest that these are indicative of a process called 'C-deletion' which requires consonants to delete in certain environments, thus deriving *pakaru* > **papakaru* > *pa:karu*. As this notion of C-deletion has repercussions not only for other phonological phenomena in the language but for the very descriptive summarisation of reduplication, it must be dealt with before any further progress is made towards an actual analysis of this word-formation process.

1.1 C-Deletion

Harlow's idea is not based on reduplication alone. Other forms also seem to exhibit deletion with concomitant lengthening. He first notes that the word *nga:i* alternates with *nga:ti* {tribal attributive} before certain words, as shown by '*Nga:i Te Rangi*' {tribal name} instead of *'*Nga:ti Te Rangi*'. From the data Harlow presents, it is evident that *nga:i* usually occurs when the following word begins with a /t/ (although '*Nga:i Ma:ua*' is an exception), leading him to conclude that the /t/ of *Nga:ti* has been deleted under the influence of the following word-initial consonant. Even so, the *nga:i* form is restricted to a small set of tribal terms, and many /t/-inital words follow *nga:ti* without any C-deletion, although Harlow explains this as being a result of an optional process. At this point, given the extremely restricted set of phrases employing *nga:i*, there is no good reason for supposing that a principled process of /t/-deletion actually took or still takes place; it is quite feasible that these forms are merely variants of *nga:ti*, altered over time for some other reason.

However, Harlow's argument does not depend on the above example alone. The causative prefix *whaka+* is noted to have an alternant *wha:+*, as shown by *whakainu* and *wha:inu*, both meaning 'to give to drink'. Again, Harlow argues that this is a case of optional C-deletion. The set of cases is again admittedly small — only 23 are listed. Despite this, Harlow formalises this deletion as a general rule of the type $C_1V\#C_1V \rightarrow V\#C_1V$, where '#' is a morphological boundary. Some further stipulations are required, such that C_1 is either /t/ or /k/, and that the deleted C_1 is not word initial and must also be at

least three morae from the end of the word. Combining this information, the following rule achieves the desired result:

$$(3) \quad t/k \rightarrow \emptyset \; / \; \#\sigma_O\sigma\_V_1+t/kV_1(C)V\sigma_O\#$$

Of course, this rule seems very complex, and difficult to reduce to manageable terms under any recent theoretical analysis.[4]

Leaving aside (3) for a moment, consider some further evidence for C-deletion — the passive suffix +Cia. Harlow notes that there are a set of twelve verbs where the phonological content of the stem alters when passivised, as shown by *kuti* 'pinch' > *ku:tia*. To deal with this, Harlow posits an intermediate step whereby the form reduplicates to become *kukuti*. After this, the first /k/ of the base deletes, resulting in *ku:tia*. However, this requires a slightly different formulation for C-deletion than (3). This time, it is the **second** consonant that deletes:

$$(4) \; \#C_1 \rightarrow \emptyset / \; \#C_1V_1+\_\_V_1\sigma\sigma_O\#$$

Despite a general similarity, terming both (3) and (4) 'C-deletion' obscures the differences between them. In (3) the first of two like consonants deletes, while in (4) it is the second. Also, (3) restricts the consonant to the two stops /t/ and /k/, whereas in (4) there is no such restriction. It seems that these are at least different processes, despite having one significant characteristic in common — both apply to an extremely small number of forms.

From a theoretical point of view, Harlow's suggestion is problematic. Most significant in this respect is the suggestion that consonants can 'see past' vowels. There is no vowel harmony in any Polynesian language, so separate V and C tiers are not an independently justifiable possibility. In fact, another process in Maori requires the featural content of vowels to access that of consonants.[5] With this in mind, it is impossible that a featurally identical consonant could provide an adequate and accessible environment for

[4] Assuming that the vowel to mora relationship is one to one, the deleted /t/ or /k/ must be two vowels or more from the end of the word. The subscript $_O$ indicates that any number of elements (in this case, syllables) can appear in this position, including none.

deletion. To retain the locality and adjacency assumptions of phonological theory, another answer must be provided to deal with these phenomena.

1.2 Another Answer for Ngati~Nga:i *and* Whaka~Wha:

A significant problem with the *whaka~wha:* alternation is that /k/ can delete before any other stem-initial segment.[6] As such, there is no principled conditioning environment for the rule. From this, it seems that *wha:+* is an unpredictable allomorph of *whaka+* in both morphological and phonological senses. In other words, a form would have to be lexically marked to take *wha:+*. Indeed, even if *wha:+* was formed from *whaka+*, /k/ deletion is only one option. If the final *syllable* was deleted, it could well be that the first vowel has lengthened either in compensation or to provide a minimal word. Given this, /k/ deletion is only one analysis of the problem, and principled /k/ deletion is untenable given the data.

Much the same argument can be made for *nga:ti* and *nga:i*. Again there are too few forms to provide adequate evidence for a principled process. At best, *nga:i* can only be seen as an unconditioned alternant of *nga:ti.*

1.3 Another Answer for Passivisation

Passivisation is an entirely different matter. This time, it is possible to propose a principled process to account for the forms. However, this process need not appeal to reduplication and an attendant deletion. Instead, the passive is formed from the stem without any reduplication whatsoever.

Generally throughout Polynesia, the passive suffix takes the form *+Cia* (Clark 1976, Hale 1968, Pearce 1964). However, there are a number of redundancies in the representation of this morpheme. Firstly, /i/ is the most common epenthetic vowel in Polynesian languages, so it may be assumed that it will fill any free nucleus position in a syllable. Secondly, the consonant is not part of the suffix, but determined by the stem. With

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[5] I am referring to the co-occurrence restriction of labial fricatives within a syllable — see Bauer (1993) and de Lacy (in preparation).

[6] The ones attested are before /i a o u/, /p t k/, /m ng/, and /r/. The omissions, /e n w/ and 'wh', are obviously accidental. Note that 'wh' is a digraph for a phonetically variable sound (Bauer 1993, de Lacy (in prep.)).

these facts in mind, instead of +*Cia* the passive suffix can be more adequately formulated in prosodic terms as $+\sigma_{\mu}[\sigma[a]]$, with a light syllable node taking the place of 'Ci' and another syllable node dominating the final /a/. This σ_{μ} will usually attach to the consonant at the rightmost edge of the stem, and the empty nucleus of the first syllable will be filled by an epenthetic /i/.

The situation differs somewhat when there is no stem-final consonant to which the suffix can attach. Instead, the syllable node seeks to fill its constituents with material from the stem itself. In the case of /kume/ 'pull, drag' it ends up dominating the entire final syllable. Thus, the morphological affiliation after passivisation is $[ku]_{S(tem)}[mea]_{Af(fix)}$. With /wau/ 'foolish', the light syllable can only attach to the /u/, resulting in $[wa]_{S}[ua]_{Af}$.[7] This has profound results for the stem. As in many other languages, the stem must form a Minimal Word, which has the practical result that every stem has to be at least two morae long. As such, with this type of passive suffixation the stem ends up with an unacceptable mono-moraic configuration. The most economical method of augmenting it to two morae is by vowel lengthening or, in prosodic terms, by adding a mora. Thus, the first vowel is forced to lengthen in all such forms:

(5) tungi 'kindle' > tungi+σa > $[tu]_{S}[ngia]_{Af}$ > [tu:][ngia]
noke > noke+σa > $[no]_{S}[ke]_{Af}$ > [no:][kea]

As a result, the partial reduplication and deletion analysis can be replaced by the proposal that these verbs do not have a stem final consonant to which the periphery of the passive suffix can attach, resulting in morphological reassignment of stem elements and concomitant lengthening. Of course, this analysis presupposes aspects of Maori phonology and morphology that have not yet been established in this paper. However, these will be shown to be essential to a proper understanding of all lengthening processes in the language.

1.4 Reduplicative Deletion

In sum, there is inadequate evidence for consonant deletion taking place in a principled

[7] The source of this form is Williams (1971), cf Harlow (1991).

manner for *whaka* and *nga:ti* while an alternative process accounts for the irregular passive forms. However, it is upon reduplication that Harlow's proposal most depends. Consider a simplified version of Harlow's reduplicative types:

(6) Bi-moraic stems:[8]

a) σ_μ + word: huti > <u>hu</u>huti 'hoist'

b) Foot(Ft) + word: poki > <u>poki</u>poki 'cover over'.

(7) Tri-moraic stems:

a) σ_μ + word: hoata > <u>ho</u>hoata, pakaru > *papakaru > pa:karu

b) σ_μ + word **and** σ_μ + rightmost Ft: taweke > *tataweweke > ta:weweke

c) Ft + word: <u>taka</u>takai

d) σ_μ + word **and** Ft + rightmost Ft: matuku > *mamatukutuku > ma:tukutuku

The assumption that all forms are prefixes is partly for the sake of analogical uniformity, but mostly for other considerations that will become apparent below. As for similarities between the reduplicative types, (6a) is much like (7a) except that C-deletion never applies to the former whereas it applies variably to the latter. In comparison, (6b) and (7c) are evidently identical processes. At this point, at least four types of reduplication have been identified. However, one reduplicative type has been missed in previous descriptions. Consider the following data:

(8) kaka 'stalk' > ka:kaka 'stem of the fern Pteridium Aquilinum'
kuku 'draw together' > ku:kuku 'tie up'
papa 'shell of molluscs' > pa:papa 'shell of eggs'
pepe 'moth' > pe:pepe 'moth, butterfly'
tata 'near of place or time' > ta:tata 'near'
titi 'stick in pegs, feathers, etc.' > ti:titi 'stick in'

These forms cannot be convincingly decomposed into two separate morphemes [CV:] and [CVCV]. In C-deletion terms *pepe* has an intermediate stage of full reduplication

(*pepepepe*), then the second /p/ deletes, resulting in [pe:pepe]. The main problem is that this deletion does not fit into either of the other deletion rules so far proposed. It is somewhat like rule (3), except that the value of C is unrestricted. The case for C-deletion is even less convincing when the numerous forms such as the following are considered:

(9) hau 'seek' > ha:hau 'seek'
honu 'deep' >ho:honu 'deep'
kano 'seed' > ka:kano 'seed, kernel, pip'
kopu 'galaxius fasciatus' > ko:kopu 'galaxius fasciatus'
taka 'roll' > ta:taka 'roll from side to side'
taki {adverbial prefix} > ta:taki {adverbial prefix}
tara 'make a rattling sound' > ta:tara 'rattle (N.)'
tike 'lofty, high' > ti:tike 'lofty, high'

The C-deletion analysis obviously fails when *tike* > *ti:tike* is considered. If C-deletion alone is at play here, then tike should produce **tiketike*, which in turn becomes **tietike*, not *ti:tike*. At this point, it is enough to note that C-deletion cannot deal with this process adequately and that this data does not fit into any of the reduplicative types so far proposed. As such, another type of reduplication must be recognised:

(10) $\sigma_{\mu\mu}$ reduplication: Prefix a $\sigma_{\mu\mu}$ to the word.

No line-crossing is permitted, so the second mora cannot cross /k/ to reach /e/. In this case, it is forced to lengthen the first vowel. Given this, there are at least five types of reduplication that need to be analysed. However, a consideration of the surface similarities between the types identified above shows that first stem vowel is lengthened in several forms. This occurs obligatorily in (7b) and (7d), and optionally in (7a). Indeed, it is surprising that an element of the base is deleted under the influence of the reduplicant in (7b)

[8] *anganga* has been omitted in this list. This will be discussed below.

and (7d).[9] Instead, it is profitable to assume for the moment that this lengthening is not actually reduplication and deletion, but a separate process, motivated elsewhere.

Given the above assumption regarding lengthening, the symmetry of the reduplicative processes in Maori is evident:

(11) Two morae stems: (a) σ_{μ} + Word/ Rightmost Ft
(b) Ft + Word/ Rightmost Ft
(c) $\sigma_{\mu\mu}$ + Word/ Rightmost Ft

(12) Three morae stems: (a) σ_{μ} + Word
(b) σ_{μ} + Rightmost Ft
(c) Ft + Word
(d) Ft + Rightmost Ft

In bi-moraic stems the nature of the unit to which the reduplicant attaches is ambiguous, with both the prosodic interpretation — the Rightmost Foot of the base — and the morphological one — the Word — equally accounting for the facts. However, this is a trivial point. More importantly (11a) and (11b) correspond to (12a/b) and (12c/d) respectively. This establishes the number of reduplicative processes at five:

(13)

Reduplication	RED=σ_{μ}	RED=Ft
Base=Word	Type I (10a/11a)	Type III (10b/11c)
Base=Right Ft	Type II (10a/11b)	Type IV (10b/11d)

The other type is Type V's $\sigma_{\mu\mu}$+Word (11c). The above table makes the two main dimensions of variation obvious — the reduplicant shape and the characteristic of the base.

At this point, a further refinement can be made. So far, the morphological category 'Word' has been chosen as the base. However, Maori reduplicants never attach to affixes, unlike many other languages.[10] Instead, they prefix to 'content' morphemes, or 'stems'.

[9] To avoid this, it could be claimed that the σ_{μ} suffixes to the first syllable. From here, it could also be claimed that the second reduplicant is also a suffix. This has further repercussions, and brings the system further away from symmetry, as shown below.
[10] e.g. Indonesian (Cohn & McCarthy 1995a:34,35).

This is shown well by Type V reduplication in the forms [*mangungu*]$_S$ 'chipped, grating' > *ma:ngu:ngungu* 'gritty' and [*whaka*]$_{Af}$[*whiwhi*]$_S$ 'wind round' > *whakawhi:whiwhi* 'entangle'. Note that $\sigma_{\mu\mu}$ attaches to the rightmost **foot** in the word here.[11] However, in [*papa*]$_S$[*koura*]$_S$ > *pa:papakoura* 'Epilobium microphyllum' the reduplicant attaches to the leftmost part of the **Word**. In this case, if the base of this latter example is termed the 'word' two separate reduplicative processes must be posited. Instead, it is evident that the $\sigma_{\mu\mu}$ prefix attaches to the rightmost foot in a morphological **stem**.[12] Indeed, the notion 'word' as a phonological base need not be retained for the other reduplicative types either, as the following compound words show:

(14) a) Second Stem: [pu:]$_S$aki[aki]$_S$ 'aythya novaeseelandiae'

b) Third Stem: [titi]$_S$[pa:]$_S$rera[rera]$_S$ 'violent, gusty'

c) First and Second Stems: ti:[ti:]$_S$kete[kete]$_S$[manawa]$_S$ 'cry of the robin'

d) First and Third Stems: ti:[ti:]$_S$[ha:]$_S$kore[kore]$_S$ 'cry of the robin'

From this, it is evident that the notion 'word' plays no part in reduplication; the morphological stem and the rightmost foot of a stem are the only divisions of the base permitted to figure in this process.

2 Prosodic Circumscription

One of the most significant questions that presents itself at this point is centred upon the infixing phenomena described above. Early Prosodic Morphology's process of circumscription provided an explanation for this phenomenon, albeit under a serial view of derivation.

The Prosodic Morphology Hypothesis requires that reduplicative morphemes be analysed in terms of prosodically defined templates (McCarthy & Prince 1986). There is no notion of 'infix' in this framework, with templates being either prefixing or suffixing. To account for infixes, the notion of Prosodic Circumscription is used. This applies an

[11] By 'foot' I mean 'parsable foot'. See below for further discussion.

[12] Thus, [whaka$_{Af}$ [whi:$_{\sigma\mu\mu}$[whiwhi$_{Stem}$]]]. Proof: bi-moraic forms: kuku > ku:kuku, kopu > ko:kopu.; tri-moraic forms: mangungu > ma:ngu:ngungu; compound words: whakawhiwhi> whakawhi:whiwhi, papakoura> pa:papakoura, [porotiti]$_{Stem}$ > poroti:titi. See Williams (1971) for glosses.

operation ϕ to a constituent at a designated edge of the base form, thereby splitting the base into two pieces — the kernel and the residue. With this division made, the reduplicative affix is free to attach.

In Maori, the two types of reduplication that affix to the base do not need to employ Prosodic Circumscription.[13] All that is required is specification of the shape of the reduplicant, σ_μ and Ft respectively, and that these are prefixes. For the types that attach inside the base, circumscription must come into play. Again the shape of the reduplicants are σ_μ and Ft, while the kernel of circumscription must be the rightmost foot. In many languages an actual pre-existing constituent is parsed out of the base. For example, Samoan reduplication requires the main stress foot on the rightmost edge proper to be circumscribed (Levelt 1990, McCarthy & Prince 1986, 1995b). However, in Maori there is no such pre-existing foot. This is shown by Maori stress, which is assigned first to the leftmost heavy syllable in a stem, otherwise to the leftmost syllable: maweke > (mawe)ke.[14] Since there is no foot on the right edge to circumscribe in tri-moraic stems, the circumscribing operation must **parse out** the desired constituent, as McCarthy & Prince (1995b:345) do for Arabic. The 'Minimality Hypothesis' also claims that circumscribed categories tend to be a Minimal Word. The most significant constraint on Minimal Words is 'Foot Binarity' which requires that a foot be binary at either the syllabic or the moraic level. This translates into the requirement of having at least two light syllables or a single heavy syllable in any stem.

In Maori, this constraint is shown most transparently by obligatory vowel lengthening when a mono-moraic form is said in isolation. In reduplication, the section of the base parsed out is also a Minimal Word — a single foot. Given this, the infixing reduplicative types can be expressed by the following operations with ϕ (Ft, Right):

(15) O:ϕ (taweke) = O (taweke:ϕ) * taweke/ϕ
= O (ta) *weke
= ta* σ_μ+weke
= ta<u>we</u>weke

[13] In theory, it is more consistent to claim that prosodic circumscription is an obligatory part of every reduplication; where reduplicants attach to the edges of the base, it is the base itself that is circumscribed.
[14] There is only one foot per stem in Maori. Feet are necessarily moraic trochees. See Bauer (1993).

(16) O:ϕ (matuku) = O (matuku:ϕ) * matuku/ϕ
= O (ma) *tuku
= ma* Ft+tuku
= matukutuku

(17) O:ϕ (mangungu) = O (mangungu:ϕ) * mangungu/ϕ
= O (ma) *ngungu
= ma* $\sigma_{\mu\mu}$+ngungu
= mangu:ngungu

The reduplicative prefix $\sigma_{\mu\mu}$+ has certain constraints put on it. It must reduplicate a contiguous substring of the base, so for *tohu* 'mark', it cannot output **toutohu*. Likewise, it respects constraints on syllabification, where codas are prohibited in the language: **tohtohu*. Given this, the only material to which the the second mora can attach is the segment dominated by the first mora, resulting in a long vowel.[15]

The above analysis adequately describes Maori reduplication. However, McCarthy & Prince (1993a, 1995b) ultimately reject it as inadequate for certain reduplicative phenomena. Indeed, a more adequate solution to the many types of Maori reduplication can be found within Correspondence Theory.

2.1 Correspondence Theory

As mentioned in the introduction to this paper, Correspondence Theory relies on the notion of a relation holding between two strings. Although this rejects a serial view of derivational circumscription, it will be concluded that a superficially similar circumscriptive device is indeed necessary for an adequate explanation of reduplicative processes.

Another significant idea proposed by McCarthy & Prince (1993a, 1994a,b; 1995a) is that morphological categories are minimal. In this conception, reduplicative templates are not entered in the lexicon as prosodic categories, but rather as **morphological** entities unspecified for prosodic structure. The morphological categories recognised are either the

[15] The assumption of McCarthy & Prince (1993a) that a second unassociated mora in a syllable is attached or related to the segment of the first mora could also be adopted.

Stem or the Affix.[16] This has a number of empirical consequences; most notably, it limits the options for reduplicant shape drastically.

The lack of phonological specification is also attended by the requirement that a reduplicative morpheme be in a correspondence relation with a 'base'.[17] The base is usually defined as the phonological structure to which the reduplicant attaches (McCarthy & Prince 1994a:6). Although this is adequate as a first approximation, more precision is necessary for the sake of circumscription phenomena. Firstly, the base is necessarily in a correspondence relation to phonological material. By this, I assume that the lexicon specifies morphological categories (Stem or Affix) for a morpheme through some relation, and then links a phonological complex and this morpheme through another such relation. Under this conception, there is no formal distinction (in phonological terms) between a base phonologically specified in the lexicon and a reduplicative morpheme — both are in correspondence relations with phonological material in the output. This has a number of significant implications. Firstly, Maori does not permit reduplicants to copy reduplicants. In contrast, the only specification in this case is that 'base' refers to a stem in correspondence with phonological information in the **input**. A language that does permit reduplication of reduplicants, such as Rarotongan (Buse 1963), defines 'base' as any stem in correspondence with phonological information in the **output**.

From this, a base is not strictly a **phonological** structure, but a unit that is in **correspondence** with a phonological structure.[18] However, this notion is still too loosely defined. For example, 'partial reduplication' is when a reduplicative morpheme copies only part of the base, as in *ta*tapi. Working off the 'phonological' definition of base, it could be claimed that the reduplicative morpheme (RED) has copied the entire base, and that the base was the first syllable of the stem — /ta/. Indeed, /ta/ is a unit in correspondence with phonological information, satisfying the definition. The significant aspect of this is the suggestion that the notion 'base' may be relativised, and even specified differently for each

[16] See specifically McCarthy & Prince (1994a:A2).

[17] I do not suppose that the lack of phonological information requires the morpheme to be in a correspondence relation with anything else, otherwise phonologically null, or empty, morphemes would be prohibited. To tidy up some terminology here, I will adopt McCarthy & Prince's notion that RED is the reduplicative morpheme, while the 'reduplicant' is the phonological material that serves as the exponent of RED.

[18] This also means that a phonological unit such as PrWd can be a base as it is in a correspondence relation with its segments.

reduplicative affix. A conservative view will be adopted here, with the assumption that the notion 'base' is defined absolutely. Whereas the base in Maori is permitted to only be a stem, for other languages 'base' may refer to any morphological category.[19] From this, I will assume that 'base' refers to an input stem in Maori. As such, it is a primitive in the system, and can be referred to within the constraint system.[20]

2.2 The Shape of the Reduplicative Morphemes

So far, the reduplicative morphemes (REDs) for types I and II have been described as a light syllable, while the 'foot' has been used to describe types III and IV. As mentioned above, the conceptions of morphological categorisation employed in this analysis reject such prosody-specific definitions. Firstly, the 'foot' can be redefined as a stem, which requires that it must obey all the constraints that the are placed on stems, most importantly Foot-Binarity (McCarthy & Prince 1993a). Also there is pressure for PrWd boundaries and stem boundaries to coincide.[21] In Maori, this pressure is significantly high — all stems have a PrWd. Given this, $[RED]_{Stem}$ must be dominated by a Prosodic Word (PrWd), thus functioning as a template. Further than this, note that the stress rule requires that feet be as left as possible within the form. This can be expressed as an alignment constraint:

(18) ALL-FT-LFT: Align (∀Ft, L, PrWd, L), 'All feet stand at the left edge of a Prosodic Word'.

Coupled with the requirement that syllables be parsed exhaustively into feet (PARSE-SYLL), the only form that can satisfy these two constraints is one with a Prosodic Word dominating a single foot — the Minimal Word. However, this seems to imply that only stems obeying the Minimal Word stipulation can be output. This is obviously not the case, as many tri-

[19] Beyond this, in phonological terms the base may be defined as the prosodic word, although this requires further complexity depending on whether 'Base' is taken to be a separate 'morpheme' that maps over or onto other constituents, or whether 'Base' is a descriptive term for 'Stem' or 'morphological category' or whatever, and as such has no validity as a primitive notion in the system. See below for further discussion.

[20] 'Primitive' is perhaps not the best term to use. I will return to this point below.

[21] This is expressed by the constraints Align (Stem, L/R, PrWd, L/R) which require that the left edge of a stem align with the left edge of a PrWd and likewise for the right edges. In fact, this same-edge alignment may only hold between PrWd and Stem (McCarthy & Prince 1994a:A4). Note that many of the constraints employed in this analysis are taken from McCarthy & Prince (1993-1995).

moraic stems exist. A specifically Correspondence Theory constraint can be invoked here requiring that all input elements have correspondents in the output:

(19) MAX-IO: 'Every segment in the input has a correspondent in the output.'

In Maori, this dominates all other constraints dealing with phonological proliferation and economy, ensuring that three-syllable stems are not pared down to Minimal Words.[22] Along with this, the constraint MAX-BR is invoked to ensure that the base has correspondents for all its elements in the Reduplicant. This is crucially subordinated to the constraints on word minimality, otherwise RED would copy all of the Base's material. As such, the need for a prosodic foot template is replaced with a morphological specification of RED.

Much the same can be done for the 'σ_{μ}' and '$\sigma_{\mu\mu}$' reduplicative morphemes. The output shape of the type I/II template is smaller than a minimal word, and therefore not a stem. Adopting the minimal view of prosodic categories, it must then be an Affix, and subject to the consequences of affix-hood. McCarthy & Prince (1994a:A9) note that affixes are subject to certain weight requirements — they can have either one mora (σ_{μ}) or two ($\sigma_{\mu\mu}$). Generally, affixes prefer to be mono-syllabic, as expressed by the constraint AFFIX: 'The phonological exponent of an affix is no larger than a syllable.' From here, the different constraints MAX-BR_A and MAX-BR_B must be distinguished from each other, with BR_A referring to the former σ_{μ} reduplication, and BRb referring to $\sigma_{\mu\mu}$ reduplication:

(20) Linearity, Adjacent-BR, Affix, No-Coda, Left-Anchor » MAX-BR_B » No-Long-V » MAX-BR_A

This ranking permits the Type V $[REDc]_{Af}$ ($\sigma_{\mu\mu}$) to have a long vowel as it dominates the constraint NO-LONG-V.[23] The type I/II $[REDa]_{Af}$ cannot have a long vowel, however, as it is crucially ranked below NO-LONG-V. The remaining constraints also affect the

[22] The only constraint that dominates it is NO-CODA, which prohibits codas. This way, words with stem final consonants need not realise them in the output. Only the passive suffix offers the environment in which they can be realised.

reduplicants. NO-CODA is a generalised undominated constraint on syllable type in the language, prohibiting syllable codas. Adjacent-BR is also an undominated requirement for reduplicative morphemes:

(21) ADJACENT-BR: The set of elements in the reduplicant and the set of their correspondents in the base are a contiguous subset of the entire form.

In practice this requires that the base elements copied and the reduplicant be strictly adjacent.[24] Linearity is a constraint on precedence structure: LINEARITY (R,B) requires that the Reduplicants' precedence structure is consistent with that of the Base. This principally prohibits metathesis. LEFT-ANCHOR requires the leftmost element of the reduplicant to be in correspondence with the leftmost element of the base (McCarthy & Prince 1994a, 1995a).[25]

In sum, all reduplicants must respect the precedence structure of the Base, and must be adjacent to the elements in the base that they reduplicate.

3 Correspondence Circumscription

So far, an adequate collection of constraints has been assembled for RED+Stem reduplication. However, the REDs which prefix to the rightmost Minimal Word in the Base present a different problem. These do not attach at the periphery of the Base, but instead to some subset of the Base. The problem lies in defining this subset within the principles posited for Correspondence Theory.

I will assume that such a subset **needs** to be defined and have some significant status in the grammar. It is arguable that this is not the case (see below), and that other

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[23] See (McCarthy & Prince 1994:A11). However, it does not require the affix to have a long vowel. This is caused, and ultimately subsumed, by separate considerations, as shall be demonstrated below.

[24] Not the same as CONTIGUITY (McCarthy & Prince 1994a:8, 1995a:118). ADJACENT-BR is hardly ever violated in languages — *kipatu > pakipatu hardly ever occurs. This could possibly be replaced by anchoring and other constraints; at this point I prefer to make this constraint transparent. Also see these references for LINEARITY and most of the other constraints.

[25] It has been suggested that this constraint could subsume the ALIGN constraints. Although their relatedness is obvious, it is not evident that ANCHORing and ALIGNment give the same results. Also, there is some small difference in the definitions offered for ANCHORing (McCarthy & Prince 1994b:7 cf 1995a:118). As such, I will employ ALIGN when alignment is required, and ANCHOR when there is a need to specify edge correspondents. I do not consider ANCHOR to designate whether a form is prefixing or suffixing.

constraints account for the phenomena adequately. However, once it is assumed that a subset of the base must be specified it is evident that reduplicants must stand adjacent to these subsets, and that they must be in an anchoring relation to them. As a preliminary approximation, circumscription of the base is a designation of a contiguous substring of the base that is or can be part of some morphological or phonological constituent, where that designated substring is in a correspondence relation with some other string (the reduplicant).

Firstly, this substring must be defined. In Maori, it is the rightmost foot, which is equivalent to the rightmost Minimal Word, which is also equivalent to the rightmost minimal **Stem**. Adopting a minimalistic view of matters, it can be supposed that circumscription is done in reference to a morphological category, limiting the possibilities to Stem and Affix. From here, some relation must be made between this category and the Base. A possible relation could be the constraint MAX, requiring that (in informal terms) {Stem constraints} » MAX (Base, Cr), where Cr is the set which contains the kernel of circumscription. This requires that a correspondence relationship exist between the base and some string Cr. At this point the process for designation of circumscription seems to be no different than that of reduplication.

A closer consideration of what is needed in the output form elucidates this latter point somewhat. In the case of circumscription, there is no correspondence of elements. This is shown by the fact that Cr's (the kernel's) elements and those of the base can never vary. This is obviously because of the fact that Cr's elements **are** those of the base. In this case, a constraint termed SUBSET must be employed, which simply requires that Cr be a subset of the Base. This ensures that the elements of Cr are those of the Base, and vice-versa. This is fundamentally different from a correspondence relation which specifies that for every subset s_x in set x there is a subset s_y in set y and the content of s_x is identical to the content of s_y. Thus, if s_x is a segment, then that segment and every feature (i.e. every subset of a s_x) contained within it must be identical to the segment s_y. Further refinements depend on the nature of the set s; IDENT(F) is a correspondence relation where the set s is a single feature. This allows the elements of the sets to vary independently, as in over- and under-application of processes. On the other hand, a subset relation between the Base and [Cr] is fundamentally different. With a correspondence relation, set x has no formal relation to the elements of set y and vice-versa despite the fact that various **relations** between their

members can hold. Significantly, this does not mean that their members are the same, or in other words that the corresponding members of x and y are the intersection of x and y. For the relation between the Base and [Cr] it is somewhat different. The members of Cr and the members of the Base are not distinct. In this way, a function is defined between the sets, and this function is not one of correspondence. Given this difference, (22) SUBSET (S_1,S_2) expresses the fact that $S_2 \subseteq S_1$. This precludes the need for correspondence constraints with respect to circumscription, but not the need for anchoring or contiguity.

For the problem in hand, this provides two points of reference for any [RED] — [Cr] and the Base. The set of elements in [Cr] is itself constrained within the boundaries of the Stem. However, the subset needs to be anchored at the left or right edge of the Base. In other words, given a string {matuku} [Cr] can be either /matu/ or /tuku/ as these are the only two contiguous strings from the Base that satisfy the properties of a stem. In this case, the constraint RIGHT-ANCHOR (Base, [Cr]) wins out and decides which of the possible sets is chosen by requiring that the rightmost element of the Base correspond to the rightmost element of the set [Cr]. Now, it is a simple matter to establish a correspondence relation is between the reduplicant and the morpheme [Cr]: (23) MAX (RED, [Cr]); LEFT-ANCHOR (RED, [Cr]).

As noted above, in that [Cr] is defined morphologically, it is permitted it to be only a stem or an affix. From an earlier theory, the Minimality Hypothesis requires that the constituent C in the Prosodic Circumscription parsing function ϕ (C, Edge) be a Minimal Word (McCarthy & Prince 1995b). The requirement that [Cr] be morphologically defined simulates this, but further predicts that [Cr] might also be an Affix. Differences abound between this conception of circumscription and the former serial sort.

At this point it is fruitful to develop the notion that correspondence permeates every part of the morphology. A morpheme is in fact the relation between a morphological category (Stem, Af) and phonological content. The requirement that there exist a relation between a morpheme, a morphological category (M) and phonological information (P) is an overriding condition on the **output** of the system.[26] Thus, a certain morpheme 'CAT' may designate a correspondence relation between M[Stem] and P/kæt/. A reduplicative

[26] In more precise terms, there must be a relation between a morpheme and a set P. P can only contain phonological information, but need not, thereby permitting a null realisation of morphemes.

morpheme has no P specified. Instead, P is a correspondence relation, referring to another P, which is that of what is termed the Base.[27] This P may be delimited by the morphology of the RED, and further delimited by an intervening morpheme in correspondence ([Cr]). Thus, in circumscription, a RED refers to another set [Cr] which has a morphological specification. RED relies on both [Cr] and the Base for its P, so any correspondence relation between the RED and [Cr] is also between RED and the base. As a concrete example, take reduplication of an affix to a rightmost Foot in the base: {$[\text{Base}]_S$, $[\text{Cr}]_S$, $[\text{RED}]_{Af}$}. Given SUBSET (Base,Cr), R-ANCHOR (Base, Cr) and L-ANCHOR (RED, Cr), then $[\text{ta}[\text{weke}]_{Cr}]_{Base}$ is the subcategorisation of {taweke}. ADJACENT-BR requires that the elements in the reduplicant and their corresponding elements in the base be adjacent, supplying either taweweke or taweweke. From the other types of reduplication, the constraint ALIGN (RED, R, Base, L) must hold, and so prefers the former over the latter candidate.[28] Note that these constraints that hold between the reduplicant and the base still affect the infixed constituent — in no way has the subset Cr become the 'base'.

This claim may not be the correct one. Consider McCarthy & Prince's (1994b:6) discussion of the notion 'base':

(24) "The Base B is the phonological material to which the reduplicant is attached ... the terms Reduplicant and Base refer specifically to structures present in candidate output forms — and not to characteristics of the input."

Consider what occurs in infixing: a morphological constituent is inserted between elements of another morphological constituent. Now, if 'base' simply refers to some stem, then any stem could be an acceptable base. In regard to matukutuku the stem has been divided in two. A significant question is whether matuku can still be seen as the one stem, or whether the infixed constituent has caused it to divide into two different stems, shown schematically by $[\text{ma}]_S[\text{RED}]_S[\text{tuku}]_S$ or $[\text{ma}[\text{RED}]_S\text{tuku}]_S$.[29] If the former is true, and 'base' refers to

[27] cf McCarthy & Prince (1994b): "Each pair R, B comes equipped with a correspondence relation between R and B that expresses the dependency between the elements of R and those of B."

[28] There may be no real need to align the RED with Cr — this could be achieved elsewhere. The crucial point here is that RED can refer to both Cr **and** the base, so Cr cannot be the base itself.

[29] I will argue below that this is the case for Maori, although there are most probably cases where this does not occur.

'output Stem', then the relation MAX (RED, Stem) is not violated. The problem is in locating RED in the first place. If a constraint is assumed to hold such as Align (RED, R, Stem, L), then RED could be prefixed anywhere within in the base as the residue will also become a stem: {RED+matuku, ma+RED+tuku, matu+RED+ku}. Again, this makes the point that the base must be an input notion in Maori, and not reliant on output forms.[30]

3.1 Constraints and Circumscription

There remains a few points in regard to how circumscription is actuated within a constraint-based system such as Optimality Theory. I will assume that the input does not just consist of one morphological item in complex words, but of as many morphemes as are necessary for the desired word-formation.[31] In other words, for $[RED]_{Af}$ reduplication of *puru* 'pulp', the input will consist of the unordered set $\{[RED]_{Af}, [puru]_S\}$. With circumscription the process follows the same principles. However, unlike the serialist notion of circumscription, the main characteristic does not depend upon a special marking of reduplicants as somehow 'activating' circumscription constraints. Instead, circumscription occurs when the morpheme [Cr] for Maori) is included in the input set: $\{[RED]_{Af}, [matuku]_S, [Cr]_S\}$. If $[Cr]_S$ is not part of the input, the constraints relating to it are vacuously satisfied.

This view is again radically different from earlier type of circumscription, which was a **process**. Instead, this $[Cr]_S$ conception of circumscription delegates responsibility to a number of separate areas. Circumscription relies on the lexical choices the speaker makes in the input, and upon the constraints related to it. Also, circumscription can be independent of reduplication — an input set such as $\{[pakaru]_S, [Cr]_S\}$ should be possible, and does indeed occur in Maori.

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[30] This may not be so for other languages. Also, the difference between whether affixes are reduplicated or not may depend on whether 'Base' refers to morphology or prosody. The distinction between Maori and languages that reduplicate affixes along with their bases may be that in Maori there is a correspondence relation between Stem and Base, while in the other languages there is such a relation between PrWd and Base — i.e. every element in a PrWd corresponds to one in the Base (PrWd is an output conception, of course). Thus, the slight differences in the near synonymy of PrWd and Stem can be used for advantage.

[31] Exactly how such complex word output is actuated is something that remains to be elucidated within Optimality Theory. Given a single constraint hierarchy, it is possible that all forms for an utterance are entered into the constraint system. This subgroup here is one subset of all these items, which I shall term the 'word' set. Another issue is whether an actual 'word' is entered from the lexicon, or a morpheme. I will assume the latter in this discussion.

4 Lengthening Phenomena

One of the most significant characteristics of Maori reduplication is the lengthening manifested in several of the types. As noted above, C-deletion is inadequately equipped to deal with this phenomenon. Ideally, lengthening should follow as a by-product of the reduplicative process.

A short digression is probably in order before the discussion in this section commences. The notion 'edge' in phonology and morphology is especially significant in many constraints — even essential. I agree with McCarthy & Prince (1995a) in that the 'edge' of a constituent cannot be seen as an abstract boundary. Instead, it is the **phonological element** on the left or right edge of a phonological string. This has repercussions in that a configuration [[Af]Stem] is difficult to conceptualise seeing that there is no notion of abstract boundary. Stem phonological elements (x) and affixal phonological elements (y) taken together result in the form /yyxxxx/. In this sense, the affix is not 'at the left edge' of the stem, it is at the right edge. It is possible to simulate such a situation by indexing for the same phonological set (see below). In Maori, there is no need to propose an analysis such that Af+Stem is at the left edge of the stem in a configuration [[Af]Stem] (cf McCarthy & Prince 1993b:2--Tagalog 'um').

The simplest method of achieving incidental lengthening with regard to stems is by the Foot Binarity constraint.[32] This suggests that lengthening is a direct result of reinterpretation of morphological constituency; instead of ma<u>tuku</u>tuku being interpreted as $[ma[RED]_S tuku]_S$ it is $[ma]_S[RED]_S[tuku]_S$. As such, $[ma]_S$ is subject to the Foot-Binarity constraints of a stem, and is lengthened accordingly: [ma:][tuku][tuku].[33]

The fact that every stem in Maori is dominated by a different PrWd attests to the validity of this morphological organisation, as shown by word and compound-word stress patterns. However, Maori (and most Polynesian languages) go much further than this stipulation by requiring that (25) every **morpheme** must be dominated by a different PrWd. This has profound consequences for the phonology, implying that every **Affix** as well as

[32] By 'incidental' lengthening, I refer to lengthening that is not specifically targeted by a constraint or a rule.

every Stem must be minimally bi-moraic or bi-syllabic. This is obviously not the case, suggesting that the above requirement is dominated by other constraints and considerations. Certainly, it is only every form greater than or equal to two morae in length that is treated phonologically like a Stem, thus having a PrWd.[34] To avoid mono-moraic affix lengthening under pressure from (25), Input-Output faithfulness must again be invoked (26) as a higher-ranked constraint. Thus, for best satisfaction a mono-moraic affix will violate (25) and satisfy the higher ranked (26). In comparison, bi-moraic affixes can satisfy both constraints, and be dominated by a PrWd.

Seeing that everything must ultimately be parsed into a PrWd, a mono-moraic affix will be parsed into the PrWd of its host Stem. Thus for prefixes (27) ALIGN (Af, R, Stem, L) also requires (28) ALIGN (Af, L, PrWd, L). (28) crucially dominates (29) ALIGN (Stem, L, PrWd, L). So, the most economical way for a mono-moraic prefix to satisfy (26), (27) and (28) is to align the left edge of the Stem's PrWd with the left edge of the prefix: $[[ku]_{Af}[kuti]_{S}]_{PrWd}$ 'contract (V)'. Bi-moraic affixes already have a PrWd, so (28) is satisfied without extending the Stem's PrWd; (27) and (29) are also satisfied, as shown by: $[whaka]_{Af}[noho]_{S} \rightarrow [whaka]_{Af,PrWd}[noho]_{S,\ PrWd}$ 'cause to sit'.

In comparison, when a $[RED]_{S}$ is infixed, it requires a separate PrWd from that of the Base Stem to dominate it. So $[matuku]_{S,PrWd}$ contrasts with $[ma]_{S,\ ??}$ $[RED]_{S,\ PrWd}[tuku]_{S,\ ??}$. The PrWd expected to dominate the stem *matuku* cannot dominate both [ma] and [tuku] as it would cross association lines with the PrWd of $[RED]_{S}$. In this case, if (25) is an output condition, the configuration will be $[[ma][tuku]]_{PrWd}[tuku]_{S,\ PrWd}$. On the other hand, all that is required for [ma] to gain its own prosodic word is for it to be recognised as a stem, falling under the requirements for Foot Binarity.

Although it is desirable that [ma] be recognised as a stem, this poses the question of whether it is valid to claim that any subset of a stem is also a stem. Such a stipulation seems to over-apply; if the subset [ma] still carries the designation 'Stem' then there is no reason why even smaller elements of a stem cannot carry the same designation: $[xyz]_{Stem}$ should mean that x is a stem, y is a stem, and z is a stem. Alternatively, the relation between PrWd

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[33] I am aware that such an analysis may be the opposite to one necessary for another language. However, this probably follows from morphological interactions with PrWd or other categories.

[34] Stress is a indicative of this — secondary stress occurs on every morphological form greater than or equal to two morae in length. See Bauer (1993:573ff).

and Stem could be seen as not simply requiring that every 'Stem' have a PrWd, but that **every element** of the Stem be in a relation to some PrWd.

Again, the main objection to this is that this would result in [xyz] having three different PrWds, one for each element. To avoid this proliferation of PrWds, a notion of economy is needed whereby a PrWd is required to dominate the maximum number of segments possible, subject to other constraints on Stem-PrWd relations. This can be expressed by the constraint MAXI (PrWd, segment). MAXI is an inclusiveness constraint; it requires that as many elements are included as possible within a given domain — a version of economy. This way, a candidate with each element having a separate PrWd will be less optimal than a candidate with one PrWd including every segment. Notably, this constraint is violated when two stems are adjacent: $[abc]_S$ $[def]_S$. In this configuration the requirement that two different stems have different PrWds dominates the inclusiveness of PrWd (MAXI). This has the result that if there are three elements xyz where x and z are in the same stem but y is not, then x and z are not in the same PrWd. In the case of reduplication, y is the reduplicant that comes between two stem elements, violating the contiguity of elements from the same stem within a PrWd. As an example, $[ta\underline{we}weke]_{PrWd}$ violates (25) (if (25) is seen as an input condition), but satisfies MAXI. Thus, satisfaction of the higher ranked (25) and minimal violation of MAXI is achieved by requiring that [ta], $[RED]_{Af}$ and [weke] are all dominated by different PrWds.

An objection to this proposal is that if 'stem-ness' is a property of each individual element, there is no way to tell adjacent stems apart. This is true if the term 'stem' is regarded as only referring to morphological features. However, the identity of a stem does not depend solely upon its members' morphological specifications, but on their phonological relationship. In one sense, the members of a phonological set in the lexicon are co-indexed for relatedness by virtue of being in the same set, permitting the elements' identification as a unit, which can also be termed '$stem_p$'. A following argument against this conception is that it seems to deny that the notion 'stem' is independent of the phonological material in it. How then can a $[RED]_{Stem}$ be a 'stem', and be affected by the constraints of a stem if a each individual element is the 'stem' itself? In this case what is essential to [RED] is that there is a **relation** between the morpheme [RED] and the morphological feature 'stem' for [RED]. Thus, any phonological material inserted will be marked for 'stemness'. In the mean time, a

phonologically empty morpheme [RED] is still a stem since a 'stem$_M$' is a morpheme that **bears a correspondence relation to the feature 'stem'**. In Maori an element cannot be marked for both 'stem' and 'affix' properties. Also, an element cannot be part of two different stems in this language — i.e. it cannot be co-indexed for two different phonological sets.

In sum, if the internal contiguity of a stem$_p$ is broken by the infixing of a morphological constituent, the subsets of the stem$_p$ have the same status as a stem$_p$. Given a requirement that every 'stem' have a different PrWd, the notion 'stem' referred to here is in fact the phonological **set** (i.e. stem$_p$) in correspondence with a morphological feature '**stem**'. This acts as a **bound** on the inclusion of segments into any one PrWd. In the case of Maori, the stipulation is more general, with every phonological set of any morpheme having a different PrWd. This is constrained by the phonological shape of the morpheme itself.

As such, there are many and varied uses of the notion 'stem'. In one sense, 'stem' is a morphological quality attributed to each of the elements of a string. In other words, [stem] is a feature (or is a feature in a correspondence relation) of the elements of the stem. Therefore, the independent characteristic of 'stemness' that each element has ensures its integrity as a stem. In another sense, a 'stem' can be identified as the phonological set of elements in correspondence with a morphological feature 'stem'. In short, PrWd maximises its inclusion, while respecting bounds placed on it with regard to stem$_p$.

In summary, the first syllable of a circumscribed tri-moraic stem lengthens in Maori because of the constraints that require every different stem$_P$ to have a(t least one) different PrWd and that every stem element (i.e. every phonological element in a morpheme with a relation to a morphological feature 'stem') be dominated by a PrWd. This necessitates that the 'residue' of circumscription — the initial syllable — be identified as a stem, therefore being dominated by a PrWd, thus lengthening. This also accounts for the lengthening of the passive form.

4.1 $s_{\mu\mu}$ Reduplication Revisited

(30) titi > ti:titi tohu > to:tohu

It was suggested above that the lengthening shown in (30) was a result of the prefixing of a heavy syllable morpheme. However, with the current constraint ranking there is no way to stipulate that this **must** be a heavy syllable. Instead, other pressures can be invoked to rid the system of the constraint NO-LONG-VOWEL — the morpheme is forced to be realised as a heavy syllable by requiring that the form be external to the Prosodic Word of the stem to which it attaches. In this case the RED must be dominated by another PrWd, else it cannot be realised.

It has been noted that constraints of the type ALIGN (Stem, R/L, PrWd, R/L) are necessary in the constraint system, as are similar constraints for Affixes: ALIGN (Af, R/L, PrWd, R/L). For the standard prefixing affixes that are included under their base's PrWd, (31) ALIGN (Af, L, PrWd, L) dominates (32) ALIGN (Stem, L, PrWd, L), which in turn dominates (33) ALIGN (Af, R, PrWd, R). By an application of a version of MAXI, which is ranked higher than both these, a configuration such as $[[Af][Base]]_{PrWd}$ is preferred over $[Af]_{PrWd}[Base]_{PrWd}$. In short, MAXI » (31) » (32). For the reduplication in question, (34) Align ($RED_{Af\text{-}V}$, R, PrWd, R) figures higher than MAXI. This way, the most harmonious situation is one in which a PrWd dominates both RED and its stem, passing (34), violating MAXI, and passing both (31) and (32). From this, the shape of the reduplicative affix is due to constraint ranking, and not its lexical properties.

As a final note on the topic of long vowels, it is interesting that Harlow notes that stems with an initial long vowel, such as *mo:nehu*, reduplicate as *mo:nehunehu*. However, if an initial σ_μ reduplication was posited, these would become **momo:nehunehu*. Because of this, Harlow is forced to conclude that the underlying form of the word is **monehu*, and that mo:nehu is derived from it. The analysis presented above needs no such hypothetical postulation. *Mo:nehu* is divided up as $[mo:]_S[nehu]_S[nehu]_S$. Since [mo:] already fulfils the conditions for stems and PrWds, it does not need to lengthen.

5 Circumscription and Lengthening

As mentioned above, there are a number of consequences in supposing that a process employing SUBSET exists. Most notably, circumscription without reduplication should be possible. This phenomenon does in fact occur in Maori, as the following data shows:

(35) anini 'giddy, aching' > a:nini 'giddy, aching'

pakaru 'broken' > pa:karu 'break in pieces

paroro 'threatening clouds' > pa:roro 'threatening clouds, storm'

takai 'wrap up' > ta:kai 'bandage'

This data can be understood by supposing that the input stem [pakaru] has been redefined in the output as $[pa]_S[karu]_S$, causing lengthening under Foot-Binarity to [pa:karu].

As a necessary digression, let us return to the discussion of the morpheme [Cr]. It was noted that [Cr] must be morphologically defined either as a Stem or an Affix. [Cr] is then applied to a phonological string termed the base (however the base is defined). This leaves a question as to the morphological status of [Cr]. Specifically, is the notion of [Cr] as a morphological set merely notional in that it has no repercussions on the morphological constituency of the Base, or does it actually affect the structure of the Base? In Maori, the latter answer is evidently the correct one — $[Cr]_S$ defines a set of phonological items as an actual output stem. In other words, in a set of phonological items {abcd} each with the features 'Stem, $_{P1}$', circumscription designates a new set, and gives each element of that set the features 'Stem, $_{P2}$'.[35] Thus, two stems are output from the one: The phonological string {pakaru} is circumscribed as $\{pa\{karu\}_{Cr}\}$ which provides the morphological output $[pa]_S[karu]_S$. Each stem is subject to the constraints on stems, inducing lengthening in *pa:karu*.

This may seem to proliferate matters somewhat. However, this proposal suggests that there is a limited number of ways in which a reduplicative process can vary. Firstly,

[35] Whether two elements can be co-indexed for different phonological sets or not is a matter for further research. In Maori this is not the case; the members of one stem cannot be used in computations involving members of another stem. This co-indexation ($_{P1, P2}$) is not morphological, but phonological, defining a phonological set.

there is the shape of the reduplicant. Secondly, there is whether circumscription is employed or not (i.e. whether or not [Cr] is included in the input), and whether Cr is a Stem or an Affix. Obviously alignment is another area of variation. The independence of these processes necessitates that reduplication can occur without circumscription, and that circumscription can occur without reduplication. The significance of Maori in this regard is that it shows a wide number of these possibilities:

(36)

Circumscription	Reduplicant	Example
No	Af	hohoata, papaki ‘slap’
Yes	Af	ta:weweke, papaki[36]
Yes	$[Af]_{PrWd}$	ti:titi, ma:ngu:ngungu
No	Stem	pakipaki ‘famous’ , paraparau ‘baffled’
Yes	Stem	ma:tukutuku, pakipaki
Yes	N/A	pakaru > pa:karu

The above table shows that the $[RED]_{Stem}$ appears both with and without circumscription and is not selective as to stem size, prefixing to both bi- and tri-moraic bases. The type V $[Af]_{PrWd}$ likewise occurs in three and two mora environments, although there is no variation on circumscription. The $[RED]_{Af}$ likewise occurs both with and without circumscription, and on both stem types. It is difficult to tell whether circumscription applies in the case of two-mora forms — even so, this is a trivial consideration. As such, no reduplicative type is limited to either bi-moraic forms to the exclusion of tri-moraic ones or vice-versa. The notion of circumscription is evidently at work independently in the language, as shown by the lowest form.

[36] Note that papaki and pakipaki are repeated in two different types each. This expresses the fact that it is impossible to tell which of the two types these belong to. However, it makes the point that all of these processes can occur to either bi- or tri-moraic stems.

To reiterate, unlike Prosodic Circumscription's category C, Cr is highly restricted, and the process of circumscription has application **independent** of reduplicative processes. More than this, circumscription is indicative of a type of constraint that can apply generally throughout the phonology whereas 'correspondence' designates a relation between the elements of set x and the elements of set y, permitting independent variation of elements in either set; SUBSET requires that the members of set y be an actual subset of set x.

5.1 Why is Circumscription Necessary?

There is an alternative to the mechanism of circumscription. On consideration of the data, it is evident that all the output's elements are parsed into feet, and that the reduplicant is always adjacent to a foot. This is shown by the most productive type of reduplication:

(37) (matu)ku > (ma:)(tuku)(tuku)

Considering this, there is a simple alternative to 'circumscription' as described and implemented above. A stipulation can be made such as AFX-TO-FT: 'Affix the Reduplicant to a foot'. Along with this, the pressure placed by a high-ranked PARSE-SYLL will also contribute to the full footing of the word (although PARSE-SYLL is not strictly necessary in this case). It only remains to specify which foot the reduplicant will align with. The difference between non-infixing reduplication and the infixing kind would be that one type aligns with the left-edge of the stem, while the other aligns with the right edge as much as possible, given that it is a prefix. Indeed, this is a workable proposal, and entirely predictable. Why, then, should it be necessary to introduce a notion of 'circumscription'?

The primary motivation for introducing this idea was not in fact reduplication but lengthening in Maori. Very few phonological processes such as deletion or insertion occur in this language. The only times that lengthening occurs systematically is when a mono-moraic particle is pronounced in isolation, in reduplication, and in the *pakaru* > *pa:karu* alternations.[37] The first is obviously an application of Foot-Binarity while the reduplicative

[37] /h/ loss also results in lengthening, but this is not systematic.

type is caused by infixation of a RED. This leaves the final type. One possible motivation for this process is that it involves an 'over-application' of PARSE-SYLL, requiring that every syllable in the word be parsed into some foot. This way, one of the syllables in a tri-moraic word must lengthen to stand as an independent foot. However, given this, *pakaru* > *pa:karu* is not the only alternative for fully footed forms; (paka)(ru:) is obviously valid in this regard. Thus, a further stipulation must be made as to which vowel lengthens. This is a difficult constraint to formulate in that it refers to the internal structure of feet. Another problem arises when we consider how the over-application of PARSE-SYLL can be implemented. Obviously, this overapplication does not affect many other tri-moraic stems. In this case, a small class of words must be isolated and marked in some way as to incur an overapplication of PARSE-SYLL.[38] So, it is not as simple as it first seems to implement such a proposal.

From another point of view, it is more economical to suggest that the same process that accounts for reduplicative lengthening also accounts for the pa:karu-type lengthening. This does not necessitate the designation of a class of words as permitting overapplication of a certain constraint, or permitting permutation of constraints such as ranking PARSE-SYLL over MAX-IO. Introducing a circumscriptive morpheme [Cr] into the input set in both types of lengthening makes their relatedness transparent.

There is a cost to go with this, such as the introduction of a new constraint type — SUBSET. Apart from this, the [Cr] morpheme is treated like any other, subject to the constraints on stems (or affixes), and being anchored in the word-complex. The question really hinges on whether SUBSET can be shown to be necessary elsewhere. Ultimately, this is a question that goes beyond the immediate concerns of this paper. However, it is certainly not unreasonable to posit such a constraint, as SUBSET expresses a relation that is a logical possibility within a concept of grammatical organisation such as that of Correspondence Theory. In other words, the subset relation is one that is basic to logic — it is non-complex in that it is a simple sub-categorisation directive. In comparison, the formulation of correspondence is more complex; it relies on a specialised type of

[38] One possible way of implementing this is to adopt Hammond's (1995) proposal that a lexical item is actually a constraint. In this way, the forms that obey PARSE-SYLL can be ranked below these it so that their phonological content can be altered. This simulates the marking of an item in the more standard

relation. The presence of a more complex relation at least permits the possibility that a more fundamental type, such as a subset relation, could be active within the grammar. With this in mind, the SUBSET type of relation suggested here is not an expansion of the constraint system as such, but the implementation of a logical possibility given the presence of a more complex relation such as correspondence.

In fact, SUBSET can be used in many other areas, especially categorisation. Consider the notion 'base'. 'Base' was noted to have a cross-linguistically variable interpretation within certain parameters (input/output, morphological category, and so forth). However, it was not explained where in the grammar this category originated from, nor how it was implemented. In a reasonably minimal view of the organisation of the grammar under Optimality Theoretic conceptions, the only components that exist are the lexicon and the constraint hierarchy. Circumscription has been shown to be an interaction between a lexical item — $[Cr]_S$ — and the constraints dealing with it. Notably, circumscription is sub-categorisation, as is the notion 'base'. Thus, the 'base' is subject to the same restrictions as [Cr]. It must therefore be a lexical item, and be acted upon by constraints. In the context of this analysis, assume that 'base' is a lexical entry without a correspondence relation to any phonological category. In order for it to be output, it must end up in a correspondence relation with a morphological feature and a phonological set. In Maori, the morphological part is already supplied — the base is marked as a stem. Since the base morpheme has no correspondence relation to phonological information, it enters into a SUBSET relation with a constituent that satisfies the Base's specifications (i.e. stemness). Unlike Cr, the base morpheme is not restricted to the minimal word by virtue of the constraints placed upon it. More specifically, the minimising restrictions on Stems are ranked below the correspondence constraints for 'Base' in Maori.[39] This may not necessarily be the case in other languages, however. It could be that some languages require the base to be a minimal word, in which case the constraint rankings are opposite to that of Maori. As such, if a notion of 'base' is to be used in the constraint system it must be supplied by the lexicon.

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conception. For other reasons, I prefer the standard conception of a lexicon and a GEN module that feeds EVAL.

[39] This expresses the point that the base is not a proper subset of the stem, but that the intersection of the base and the stem is equal to the union of the two sets. This does open the possibility for the base to be defined as a proper subset of a morphological constituent in another language.

Like other lexical items, it too is subject to constraints, and therefore must vary across languages.

The previous paragraph brings up another point. The crucial difference between [Cr] and [Base] is that [Cr] lacks the specification of a correspondence relation to phonological material. In comparison, a morpheme such as [RED] has a correspondence relation, but no phonological material. This fundamental variation is responsible for the ability for SUBSET to apply to Base and Cr, but not to RED.

In sum, although there are alternatives to utilising SUBSET and a specific [Cr] morpheme, these alternatives may prove to be less economical than employing this new relation. Certainly, it remains to be seen if SUBSET can be utilised in empirical circumstances apart from the ones used above. From the above discussion, it could be that SUBSET specifies subcategories whereas Correspondence specifies internal relations.

6 Yet Another Type of Reduplication?

Bauer (1993:525) also mentions the form *anga* 'face, turn to' > *anganga* 'respect' as a type of reduplication. This does not fit into any reduplicative category so far discussed. However, there are very few examples of this type of reduplication. None of the pairs found are transparently related; perhaps the least opaque is the above example given by Bauer. Apart from this, the few other candidates that presented themselves included *hake* 'unseemly', which may have a correlate in *hakeke* 'used of great disparity of age between husband and wife'. Others are *ara* 'arouse/ express surprise' with *arara* 'calling attention', and *taraha* with *tarahaha*. The problem with the last pair is that Williams gives no gloss for *taraha* while tarahaha is gleaned from an alternative source. Standard reduplication exists for this form, such as *taraha* > *ta:raharaha*. In sum, no pairs were found that suggested a systematic and/or transparent relation such as reduplication requires.

Even so, this does not mean to imply that such a type is impossible. Indeed, it is entirely predictable within the bounds set out for circumscription. In this case, a $[RED]_{Af}$ would attach to a circumscribed $[Cr]_{Af}$, creating the following structure: $[a]_S[nga]_{Af}[nga]_{Af}$. This configuration requires nothing more than a single PrWd, so there is no need for vowel lengthening of the initial [a].

7 Conclusion

The Maori language is a rich source of reduplicative processes. On the descriptive side, this paper identifies a hitherto unrecognised reduplicative type, as shown by *honu* > *ho*honu. From a theoretical point of view, the main argument of this analysis is that the notion of circumscription still plays a part in the grammar, albeit in a radically different manner than its serialist counterpart. This process requires recognition of a phonologically empty morpheme $[Cr]_{Stem}$ which is similar in form to the reduplicative morpheme $[RED]_{Stem}$. Significantly, circumscription requires recognition of a new constraint type, SUBSET, which contrasts with the correspondence relation. Crucially, the process of circumscription need not be linked to reduplication, but can occur independently. As such, there is no part of the circumscriptive process that is not realised in natural language. Even so, the validity of any constraint depends upon its universality. The effects of circumscription have been observed in a very limited fashion here; much remains to be explored.

PAUL DE LACY

University of Auckland.

Appendix A: A List of 's$_{\blacksquare\blacksquare}$'-type Reduplications

Note: The following forms are taken from Williams (1971). This is by no means a complete list. Where only one gloss is given, there is no difference given between the base and the reduplicated form by Williams.

hakeke > ha:ke:keke 'auricularia auricula-judea'

hau > ha:hau 'seek'

honu >ho:honu 'deep'

kahi > ka:kahi 'hyridella menziensi'

kaho 'sapling' > ka:kaho 'culm of reed grass'

kahu > ka:kahu 'garment'

kaka 'stalk' > ka:kaka 'stem of the fern Pteridium aquilinum'

kano > ka:kano 'seed'

kara+mea 'red ochre' > ka:karamea 'red coloured'

keke 'obstinate, stubborn' >ke:keke 'hold firmly, embrace'

kere+wai > ke:kerewai 'pyronota festiva'

kihi > ki:kihi 'indistinct'

kiki 'silenced by argument' > ki:kiki 'fool'

kohu+rangi > ko:kohurangi 'senicio kirkii'

kopu > ko:kopu 'galaxius fasciatus'

kori+mako > ko:korimako 'bell-bird'

kota 'cockle shell' > ko:kota 'bivalve molluscs'

kuku 'draw together' > ku:kuku 'tie up'

mangu > ma:mangu 'black'

mangungu 'chipped, crushed' > ma:ngu:ngungu 'grating'

miha 'heavy sea' > mi:miha 'whale'

mona > mo:mona 'fat, rich, fertile'

nene 'jest' > ne:nene 'be saucy'

paka 'dried provisions, be hot' > pa:paka 'crab'

paku 'dried' > pa:paku 'shallow'

papa > pa:papa 'shell'

papa+koura > pa:papa+koura 'Epilobium Microphyllum'

para 'blood relative' > pa:para 'true father'

pepe 'flutter' > pe:pepe 'moth, butterfly'

pipi 'cockle' > pi:pipi 'bivalve mollusc'

pokorua > po:pokorua 'pit, hollow'

popo > po:popo 'rotten, worm-eaten'

rangi 'chief' > ra:rangi 'rank'

rere 'leave' > re:rere 'run'

riri 'be angry' > ri:riri 'quarrel'

roro > ro:roro 'olea montana'

tahi 'throughout' > ta:tahi 'wide apart'

taka 'pass round' > ta:taka 'roll from side to side'

taki > ta:taki {adverbial prefix}

tara 'make rattling sound' > ta:tara 'rattle'

tari > ta:tari 'sieve'

tata > ta:tata 'flax garment'

teka 'lying' > te:teka 'numbed'

tere 'large, swollen' > te:tere 'trumpet'

tike > ti:tike 'lofty, high'

tiko 'evacuate the bowels' > ti:tiko 'a mollusc'

titi > ti:titi 'stick in'

toro+ngu: > to:toro+ngu: 'caterpillar'

toro+puku> to:toro+puku 'secret, stealthy'

turi+whati > tu:turiwhati 'pluvialis obscuris'

turu 'pole, post' > tu:turu 'fixed, permanent'

tutu 'preserve' > tu:tutu 'perform ceremony'

wau >wa:wau 'quarrel, wrangle'

whai 'pursue' > wha:whai 'be in haste'

whiwhi> whakawhi:whiwhi 'wind round, fasten'

Appendix B: Circumscription Only Types

This is a small selection, some repeated from Harlow (1991) and others taken from Williams.

anini 'giddy,aching' > a:nini [Wms lists these two as variants of the same form]

hapai (postulated) > ha:pai 'lift up raise' (cf hapahapai)

hokai (postulated) > ho:kai 'extended'

matoru 'benumbed' > ma:toru 'crowd'

mokai (postulated) > mo:kai 'pet bird or animal'

pakaru 'broken' > pa:karu 'break in pieces'

pakeke 'adult' > pa:keke 'adult'

paroro 'threatening clouds' > pa:roro 'threatening clouds'

parure 'confused, abashed' > pa:rure 'overcome, maltreat'

takai 'wrap up' > ta:kai 'bandage'

Appendix C: 'On Reduplication and Its Effects on the Base in Maori'

As this paper was progressing towards its final draft stage, Miriam Meyerhoff and Bill Reynolds posted a paper on the Rutgers Optimality Archive entitled '*On Reduplication and Its Effects on the Base in Maori*' (April, 1996). Although I could not incorporate a discussion of their paper into the body of this essay, I nevertheless wish to evaluate their argument as it makes very different claims about the reduplicative process in Maori.

Meyerhoff and Reynolds (M&R) identify four main types of reduplication, as exemplified by *mao* > *mamao*, *parau* > *paraparau*, *taraha* > *tarahaha*, *matapihi* > *matapihipihi*. There are a number of points to note about this. Firstly, M&R believe some

reduplication to be **suffixing**, while I believe all such processes to be **prefixing**. For me, this choice has empirical consequences. Under my analysis, lengthening of the initial vowel is caused by infixing of a $[RED]_{Stem/Af}$.

As for the data given by M&R, it is interesting that *tarahaha* is thus analysed. I have mentioned this form in a previous section along with its indeterminate nature. With all this in mind, I see no reason to include this type as part of Maori reduplication.[40] From here, M&R go on to point out that internal reduplication is rare. They suggest that one way of dealing with it is to suppose that reduplication occurs before lexical compounding or the affixation of a bound morpheme. Of course, such an analysis is unacceptable under mono-level parallelist conceptions of phonology. The idea that a bound morpheme is added to a reduplicated stem is also very suspect as there is evidently no predictable correlate between these supposed bound morphemes from reduplicated form to reduplicated form. Although there are not many instances of type II reduplication (such as *taweke* > *ta:weweke*), I accept this as a valid type of reduplication in Maori; whether it is still productive or not is another question — I will idealise the analysis and suppose that it is or at least supposes a previous time when it *was* productive.[41] However, given that it may not be productive, it is reasonable for M&R to ignore it in their analysis.

M&R also propose that the reduplicative morphemes should be defined prosodically as $Ft_{\mu\mu}$ and $Ft_{\sigma\sigma}$. As this paper has shown, there is no need to have such phonological specificity nor is it theoretically desirable, the morphological categories Stem and Affix being adequate to account for the data.

M&R also note a small number of forms that seem to shorten the first vowel such as *ha:pai* > *hapahapai*. I do not see this as especially significant; there are few of them, and it is reasonable to assume an underlying *hapai*, with a circumscribed form ha:pai and a reduplication *hapahapai*. Such morphemic analogical reanalysis is common among Polynesian languages.

M&R's conception of Maori reduplication requires the reduplicant to copy both prosodic and segmental features of the base. However, in full (i.e. MinWd) reduplication, the reduplicant will have a foot. From this, then, the portion of the base that it copies must

[40] Even so, this type does occur in other Polynesian languages.

also have a foot. This requires the base to be restructured in tri-moraic stems. As an example, kohiko is footed as (*kohi*)*ko*, but the reduplicant will then be (*kohi*)*ko*(*hiko*). The reduplicant has copied the segmental material *hiko* but not the prosodic material from the base. To rectify this, ko is lengthened to *ko:hiko*, thereby having a foot structure (*ko:*)(*hiko*). This way, the RED (*ko:*)(*hiko*)(*hiko*) copies both the segmental and the prosodic structure of the base. From this, M&R rely on the fact that there is a left-edge foot in most reduplicated bases. When this is not the case, as in *pa*(*hu:*), they point out that high-ranked constraint on foot position does predict that the lengthened form will be output. From the point of view of this paper, if lengthening is seen as a consequence of the reanalysis of morphological integrity prosodic structure is not significant in determining lengthening. This way, both CVCVCV and CVCV: forms can be dealt with by the same process.

The other case of reduplication (the type *hapahapai*) is dealt with by proposing a prosodic template for the reduplicant: a disyllabic foot. This contrasts with the bi-moraic foot for the other reduplicant. Again, this crucially relies on a prosodic template for the reduplicant. Moreover, it is difficult to translate M&Rs templates into morphological terms. The difference between a bi-moraic foot and a di-syllabic foot is truly prosodic, and therefore difficult to express in reduplication that permits only a morphological definition. From another point of view, *hapahapai* reduplication has obvious affinities with *matuku* > *matukutuku* reduplication in terms of its reduplicant. Given this, it seems strange that the two types should have a different reduplicant shape. Furthermore, from an empirical point of view, the form *ta:ki* > *ta:ta:ki* cannot then be accounted for, as the reduplicant must be disyllabic, whereas here it is mono-syllabic.[42]

In sum, although some aspects of M&R's analysis are certainly workable, and their work offers a valuable contribution to Maori studies, I cannot agree that it offers a parsimonious account of the many and varied forms of reduplicative and related processes in the language. From a theoretical point of view, I value an analysis employing morphological categorisation for reduplicants over prosodic categorisation. The fact that M&R's analysis

[41] Given that other Polynesian languages have this type of reduplication I see no reason not to suppose that at least pre-Maori had this as a productive process.

[42] We could say that this is two syllables, [a. a], but this results in a lack of distinction between bi-moraic and bi-syllabic reduplication anyway.

cannot be easily translated into such terms along with the assumptions regarding data leads me to reject their analysis.

Paul de Lacy, 18/4/1996.

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