Augmentation and Reduplication in Natural Derivational Phonology

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1. Introduction

The augmentation of prosodic words and reduplication will be explored within the framework of Natural Derivational Phonology proposed in Lee (2009a). Section 2 will give an outline of Natural Derivational Phonology. In section 3 efforts will be put forth to untangle the complicated and bewildering problems encountered in the augmentation of prosodic words and reduplication in Axininca Campa. And section 4 will deal with the augmentation of prosodic words in Lardil.

2. Natural Derivational Phonology[1]

In Natural Derivational Phonology a constraint pair (C-pair) and an unpaired deriving markedness constraint (unpaired constraint) perform phonological derivation. A C-pair consists of a dominating markedness constraint M and the dominated faithfulness constraint F in the form of M » F. It is satisfied provided that the markedness constraint is satisfied and at the same time its paired faithfulness constraint is violated. Constraints may apply singly or multiply to any candidate (underlying or not), resulting in serial derivation.[2] The natural ranking of universal ranking principles (URP's) determines the ranking of constraints. Evaluation constraints (E-constraints), which may be ranked, evaluate the outputs of constraints. Only the candidates derived by the qualified constraints except the underlying candidate are presented in a tableau of Natural Derivational Phonology. Natural Derivational Phonology may be succinctly summed up as a system in which constraints apply in obedience to the natural ranking of URP's, letting E-constraints evaluate their outputs.

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[1] The readers who have read Lee (2009a) may skip this section.
[2] 'Constraint' will be used interchangeably with 'unpaired constraint', 'markedness constraint' of a C-pair and 'C-pair'.

URP's, the constraint on URP's and the derivedness constraint schema, which are the fundamentals on which Natural Derivational Phonology is structured, will be introduced. The terms to be employed need to be defined. The constraints whose SD's meet the overlapping structure in the same input candidate are said to stand in an *overlapping* (*O*-) relation, and the constraints whose SD's meet the non-overlapping structures in the same input candidate are said to stand in a *non-overlapping* (*NO*-) relation. Derivatively, constraints can be said to *be O-related* or *NO-related*, to *O-apply* or *NO-apply*, and to *O-derive* or *NO-derive a candidate*.

We are now in a position to introduce the fundamentals:

(1) Apply-M Principle (AMP)

Apply M.

- M represents a constraint. Not only does AMP allow constraints to apply singly but also it allows more than one constraint to apply simultaneously.

(2) Maximal Feeding Principle (MFP)

Apply M_α if and only if M_α M-feeds M_β.

Definition: M_α M-feeds M_β if M_α can derive the candidate with a structure S_{n+1} from the candidate with a structure S_n, where S_n and S_{n+1} are identical except the change(s) to be made by constraint(s), and both S_n and S_{n+1} meet the SD of M_β.

(3) No Reanalyzing Principle (NRP)[3]

Apply M_N if and only if there is no other M may apply than M_N that is NO-related with itself.

Definition: The neutralization M whose SD is met in S_I is M_N, where S_I = intramorphemic structure, i.e., the structure in the context $\mu_i[\ldots\_\_\_\_\_\ldots]\mu_i$, μ = morpheme.

- The constraint ranked according to NRP is said to be N-ranked.

3 Neutralization M's are those which do not yield an allophonic segment.

(4) Complex Constraint Principle (CCP)

Apply M whose SD is more complex if and only if the SD's of two M's meet exactly the same structure with non-phonetic context ignored.

- It is certain that if the number of the features specified in the SD of one M is larger than that specified in the SD of the other M, the former overrides the latter according to CCP. Naturally, the non-phonetic context specified in the SD of a constraint is counted in assessing its complexity. The constraints ranked according to CCP are said to be C-ranking and C-ranked.

(5) Constraint on URP's (C-on-U)

Apply M_O's individually to the same candidate.

Definitions: 1. M that derives a candidate that violates at least one E-constraint is M_E.

2. O-related M's at least one of which is M_E are M_O's.

- M_O's derive the candidates numbered identically, since they apply to the same input candidate and they are ranked according to the same URP. As a result, the candidates constitute multiple candidate rows (MCR's). If a constraint that constitutes MCR's is constrained by a LOOK-AHEAD (LA) E-constraint, it must be checked whether the candidate it derives violates an LA E-constraint (see (30) for $_{LA}$E-constraint schema). The candidates in MCR's are evaluated by the E-constraint(s), the winner chosen. As a matter of course, URP's yield to C-on-U.

- In the cases of MFP, CCP and C-on-U alike, the constraints to be ranked by the same URP, which is checked by the natural ranking of URP's, are qualified to stand in an M-feeding relation and in a C-ranking relation, and to be M_O's. And once the M-feeding constraint, the C-ranking constraint and M_O's are established, they may apply with other constraints according to the URP that ranks them previous to their establishment.

(6) Derivedness Constraint (DC) Schema

Neutralization M must

(a) apply to S_D if its SD is met in S_I, or

(b) apply only to S_D.

Where S_D = the structure derived phonologically.

Condition: S_D can be S_D by a specific M.

The natural ranking of URP's introduced above is: NRP » MFP » CCP » AMP. And if a candidate violates an E-constraint crucially, derivation resumes from the nearest correct candidate (in such a way that the same E-constraint is not violated), and derivation resumes from the winner in MCR's (in the same way).

3. Axininca Campa

In this section I will make efforts to tackle the problems encountered in the augmentation of prosodic words and reduplication in Axininca Campa in Natural Derivational Phonology. Velar glide deletion and stress assignment will be handled in addition. This research is entirely based on the data adduced and the OT (Optimality Theory) analyses made in McCarthy & Prince (1993; henceforth, M & P) (see also Spring 1990a, b, c, Black 1991a, b and McCarthy & Prince 1995: 3. 7).

3. 1 Separate Levels in M & P

The phonological grammar of Axininca Campa consists of three separate levels in OT in M & P: Prefix Level ⇒ Suffix Level ⇒ Word Level. Each level constitutes its own "mini-phonology", specifying its own constraint ranking, and the winners become inputs for the next level. PARSE, which is undominated at the suffix level, is violated at the prefix and word levels. At the prefix level the disallowed sequences C-C and V-V are resolved by the deletion of a segment from the prefix in violation of PARSE (e.g., /ir-sai-k-i/ → iϕ-sai-k-i 'will sit', /no-ana-ni/ → nϕ-ana-ni 'my black eye').[4] And the velar glide ɰ is deleted between short vowels in violation of PARSE at the word level (e.g., /haɰ-akiro/ → haakiro 'he has taken it', /ic^{h}inaɰ-iro/ → ic^{h}inairo 'he raised it').[5] In addition, the constraints for stress assignment must operate at the word level. They take the output of the suffix level as its input. The output at the suffix level (e.g., /kow-RED-wai-ak-i/ → [[[kow**a**]-kow**a**]-wai-**t**ak-i] → … 'has continued to search more and more') (the bold-faced segments are epenthetic) is submitted to the word-level constraint system after Bracket Erasure that applies at the interface between suffix level and word level has reduced the structure of the output of the suffix level. All in all, these facts are sufficient to constitute the major reasons for the separation of levels.

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[4] The hyphen '-' represents the morpheme boundary '+'.

[5] The abutting vowels resulted from the deletion of the velar glide ɰ coalesce into a long vowel or a diphthong. The underlined *aa* and *ai* are respectively a long vowel and a diphthong.

In Natural Derivational Phonology, however, there is no need to posit separate levels. Constraints have only to apply in a serial or simultaneous manner in accordance with the natural ranking of URP's at a single level.

3. 2 Constraints

At the outset the constraints established in M & P will be introduced below. Their introduction will greatly simplify the discussion. They will afford an adequate foundation on which constraints and E-constraints are to be built in Natural Derivational Phonology, and two of them, as are formulated, will serve as E-constraints. And they will furnish the right key to the solution of the intricate problems.

(7) Constraints Established in M & P

a. CODACOND: A coda consonant is a nasal homorganic with the following stop or affricate.

b. ONSET: $*[_\sigma V$ (Onsetless syllable is not allowed.)

c. ALIGN-L: The left edge of the stem, which encompasses the root plus any prefixes, must coincide with the left edge of a prosodic word.

d. ALIGN: Every right stem-edge must coincide with right edge of a syllable.

e. SFX-TO-PrWd: The base of suffixation is a prosodic word.

f. ANCHORING-L: In B(ase) + R(eduplicant), the initial element in R is identical to the initial element in B.

g. ANCHORING-R: In B(ase) + R(eduplicant), the final element in R is identical to the final element in B.

h. MAX: R(eduplicant) = B(ase) (R is phonologically identical to B.)

i. R(eduplicant) ≤ ROOT: R contains only the root.

j. DISYLL: R(eduplicant) is minimally disyllabic.

k. RED(uplicant) = SFX: The morpheme RED is a suffix.

l. FOOT BINARITY (FTBIN): Feet must be binary under moraic analysis.

m. FTFORM: Feet are iambic.

n. NONFINALITY: The prosodic-word-final syllable is unstressed.

o. WSP: The heavy syllable is stressed.

PARSE and FILL may be added to these constraints.

ALIGN (7d) and R(eduplicant) ≤ ROOT (7i) are respectively revised as in (8) and (9) to fit in with the general structure of this paper:

(8) ALIGN-R

The underlying V-final stem-edge must coincide with the right edge of a syllable.

(9) R(eduplicant) = ROOT

R must contain only the root in toto.

On the basis of the constraints introduced above we may state three unpaired constraints and a C-pair to be employed in Natural Derivational Phonology:

(10) Unpaired Constraints and a C-pair in Natural Derivational Phonology

a. $*[\mu]_{PW}$: The monomoraic prosodic word must be augmented to be bimoraic.
b. C-RED: The reduplicative morpheme RED must copy the base.
c. *HIATUS: The sequence VV is not allowed.
d. $*C]_{PW}$ » DEP: The C-final prosodic word must have a segment added.

According to Spring (1990a:140-163, 1990b: 501, 1991), the base of reduplication is a prosodic word (cf. Black 1991b: 10). And Payne (1981: 145) observes that C-initial suffixes evoke bimoracity just as reduplication does. Going a step further, we may make a general statement that every suffix evokes bimoracity whether the suffix begins with a consonant or with a vowel, or it is the reduplicative suffix RED (cf. SFX-TO-PrWd (7e)). A new stem is created recursively by suffixation, and each stem is assigned the prosodic-word boundary (i.e.,]) in underlying representations.[6] A prosodic word must contain at least one foot, which must be bimoraic or disyllabic (M & P; see also Prince 1980, Broselow 1982, and McCarthy & Prince 1986, 1990, 1991a, b). As a consequence, the monomoraic prosodic word preceding a suffix must become bimoraic. The constraint $*[\mu]_{PW}$ takes care of the augmentation of monomoraic stems. It augments a monomoraic stem to a bimoraic prosodic word, since Axininca Campa is a quantity-sensitive language. It applies in the prosodic-word-final position rather than in the prosodic-word-initial position by default. And it may add a mora, or one or two segments to make a prosodic word meet the requirement of bimoracity condition. The constraint C-RED makes the reduplicative morpheme RED copy the preceding base in toto or in part (cf. MAX (7h)). The constraint *HIATUS replaces ONSET (7b). It may delete a vowel (long or short) or a diphthong, insert a consonant, or metathesize the sequences C_1V_2 and V_3C_4 to V_2C_1 and C_4V_3 respectively to remedy the hiatal structure

[6] Underlying representations here may be equivalent to the fully faithful candidates (FFC's) in McCarthy (2002).

$(C_1)V_2V_3(C_4)$ minimally. The onsetless initial syllable of the leftmost prosodic word in a word has nothing to do with it. Finally, the C-pair *C]$_{PW}$ » DEP, which is grounded on the fact that a prosodic word does not end in a consonant, adds a vowel.

In satisfying the constraints that insert segment(s) the unmarked vowel *a* or the unmarked consonant *t* is chosen, and the mora added to a vowel is represented as the same vowel as the vowel to which it is added. And the resultant syllable structure is assumed to be well-formed by virtue of the E-constraints responsible for well-formed syllable structure.

The constraints in (10) are to be constrained by E-constraints. A variant instantiation of the DC schema is required. DEP replaces FILL, and the addition of a mora also acquires its one violation mark (cf. (13)). The other E-constraints are ANCHORING-R (7g), DISYLL (7j), ALIGN-R (8) and R = ROOT (9). The ranked E-constraints that constrain the constraints are presented below:

(11) Ranked E-constraints

a. E-constraints on *[μ]$_{PW}$: ALIGN-R » DEP

b. E-constraints on C-RED: ANCHORING-R » $_{<LA>}$DISYLL » R = ROOT

c. E-constraints on *HIATUS: ANCHORING-R, DC » DEP

Reduplicants must never violate ANCHORING-R; hence, it constrains both C-RED and *HIATUS when they deal with reduplicants. The E-constraint $_{<LA>}$DISYLL on C-RED expands to $_{LA}$DISYLL and DISYLL; the former will be discussed in subsection 3. 4. If *HIATUS deletes a vowel or a diphthong, it must be constrained by the DC on itself. The neutralization constraint *HIATUS must adopt a variant instantiation of the DC schema. The DC on *HIATUS demands that *HIATUS delete the segment(s) only in S_D. But the highest ranking E-constraint on *HIATUS that prohibits metathesis is not considered.

If an E-constraint discards candidates invariably, that E-constraint, which may be termed an *absolute* E-constraint, is undominated in a ranking. It outranks *relative* E-constraints but no ranking obtains among absolute E-constraints. ANCHORING-R in (11b, c) and DC in (11c) are absolute E-constraints. The rankings ALIGN-R » DEP in (11a) and DISYLL » R = ROOT in (11b) will be verified in (13) and (26) respectively. In Axininca Campa E-constraints are ranked only among those which constrain the same constraint.

3. 3 Augmentation in Non-Reduplicative Prosodic Words

Now that the constraints and their E-constraints are presented, I will examine the real-life data. In this subsection I will discuss augmentation in non-reduplicative prosodic words and other related problems.

I will consider subminimal stems; they augment minimally to satisfy the requirement of bimoracity condition of a prosodic word. The stems consisting of /CV/ and /C/ respectively augment to a disyllabic prosodic word (i.e., *CV.**ta***) and to a prosodic word with a single heavy syllable (i.e., *C**aa***). This is exemplified in the following forms:

(12) Forms with a Subminimal Root

/[[na]-piro]−.../	→	[[na**ta**]-piro]−...	/na/	'carry on shoulder'	/piro/	'verity'
/[[p]-wai]−.../	→	[[p**aa**]-wai]−...	/p/	'feed'	/wai/	'Cont.'

The brackets "[" and "]" mark prosodic-word boundaries and the bold-faced ***t*** and ***a*** are epenthetic. The epenthetic vowel identical to the preceding vowel with no intervening syllable boundary adds a mora. The tautosyllabic sequence V_iV_i is thus equivalent to the long vowel $V_{\mu\mu}$. Stems have the following morphological constituent structures: Prefix - Root = Stem, and Stem - Suffix = Stem. And as mentioned above, prosodic-word boundary is recursively assigned after every stem in underlying representations. Hence, every base (or stem) preceding a suffix in a word has the status of prosodic-word-hood (cf. SFX-TO-PrWd (7e)). A subminimal stem must therefore undergo $*[\mu]_{PW}$: it must be bimoraic in satisfaction of $*[\mu]_{PW}$.

The augmentation of the forms in (12) is taken care of by the constraints $*[\mu]_{PW}$ and $*C]_{PW}$, and the E-constraints ALIGN-R and DEP. We can now construct the tableau for them. In a tableau candidates are arranged in the order of their derivation. The candidate identical to the underlying representation is numbered *0*, the candidate derived from it is numbered *1*, and so on. A horizontal dotted line demarcates the candidates with the identical number in MCR's. And a vertical thick line demarcates E-constraints and constraints.

(13) Tableau for the Forms with a Subminimal Root

	ALIGN-R	DEP	*C]$_{PW}$ » DEP	*[μ]$_{PW}$
a. /[[na]-piro]−.../				
1. [[na**a**]-piro]−...	*!	*		√
1. → [[na**ta**]-piro]−...		**		√
b. /[[p]-wai]−.../				
1. [[p**a**]-wai]−...			√	
2. [[p**ata**]-wai]−...		**!		√
2. → [[p**aa**]-wai]−...		*		√

Naturally, if the instantiations of the same M whose SD's meet exactly the same structure yield different structures, they each are qualified to be independent M's in constituting MCR's in conformity with C-on-U. Consequently, in (a-b), as two instantiations of *[μ]$_{PW}$ yield different outputs, applying to exactly the same input structure of the same candidate, they each are qualified to be independent M's. Each of them is M_E, and they are O-related and ranked according to the same URP (i.e., AMP). They are thus qualified to be M_O's, being able to constitute MCR's in conformity with C-on-U.[7] In (a), the loser violates higher-ranking ALIGN-R crucially and the winner violates only shaded DEP. In (b), *C]$_{PW}$ derives [1]. In MCR's, the winner beats the loser that has more violation marks of DEP. Note that each mora of a long vowel is treated as an independent element with regard to the constraint *[μ]$_{PW}$ and the E-constraints on it.[8]

We have seen that the prosodic words [na] and [p] respectively augment to a disyllabic prosodic word (i.e., [na**ta**]) and to a prosodic word with a single heavy syllable (i.e., [p**aa**]) by *[μ]$_{PW}$ (and *C]$_{PW}$). Subminimal prosodic words augment minimally to satisfy the requirement of bimoracity condition of a prosodic word.

I will now examine the non-reduplicative prosodic words that have nothing to do with augmentation but may present some knotty problems. I will first consider the long forms in which C-final stems are followed by a C-initial suffix:

(14) Long Forms with C-C Cluster[9]

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7 See Lee (2009a: section 18) for the necessity of C-on-U.

8 In (a-b), *[μ]$_{PW}$ may generate the candidates *[[na.**a**]-piro]-…* and *[[pa.**a**]-wai]-…*. But they are discarded by the absolute E-constraint *HIATUS on *[μ]$_{PW}$.

9 The prefixes *n-/no-/no-N-* in the data that will follow are '1st-Fut.'. The C-pair that can be transformed

/[[[no-N-$\check{c}^h$ik]-wai]-i]/	→	no-ñ-$\check{c}^h$ik**a**-wai-**t**i	'I will continue to cut'
/[[[no-N-tasoŋk]-wai]-i]/	→	no-n-tasoŋk**a**-wai-**t**i	'I will continue to fan'

/wai/ 'Cont.' /i/ 'Agr.'

The C-C cluster is resolved by the C-pair *C]$_{PW}$ » DEP as in deriving [1] in (13b). This is exemplified by the following tableau. (The insertion of *t* to remedy the hiatal structure is not considered (but see (22)).)

(15) Tableau for a Long Form with C-C Cluster

/[[[no-N-$\check{c}^h$ik]-wai]–.../	*C]$_{PW}$ » DEP
1. → [[[no-ñ-$\check{c}^h$ik**a**]-wai]–...	√

The surface form is derived by the C-pair *C]$_{PW}$ » DEP.

Secondly, I will discuss the roots suffixed with a V-initial suffix. They pose a problem in M & P, since they must lose the status of prosodic-word-hood in the output of the suffix level. Examine the following examples to see where the problem lies:

(16) Subminimal Roots with a V-initial Suffix

/na-aanc^{h}i/	→	na**t**-aanc^{h}i	/na/	'carry on shoulder'	/aanc^{h}i/	'infinitive'
/$\check{c}^h$ik-aanc^{h}i/	→	$\check{c}^h$ik-aanc^{h}i	/$\check{c}^h$ik/	'cut'		
/p-aanc^{h}i/	→	p-aanc^{h}i	/p/	'feed'		

The roots *nat*, *$\check{c}^h$ik* and *p* do not maintain the status of prosodic-word-hood before a V-initial suffix in the output of the suffix level.

The reason for its loss is explained in the following OT tableau in M & P. Here the ranked constraints ONSET, FTBIN » SFX-TO-PrWd » FILL take part:

(17) OT Tableau for Subminimal Roots with a V-initial Suffix in M & P

from CODACOND (7a) is in charge of the nasal assimilation.

	ONSET	FTBIN	SFX-TO-PrWd	FILL
i. /na-aanc^{h}i/				
a. na.]-aan.c^{h}i	*!	*!		
b. na.**ta**.]-aan.c^{h}i	*!			**
c. na.-aan.c^{h}i	*!		*	
d. na.**ta**.]**t**-aan.c^{h}i			*	**!*
e. → na.**t**-aan.c^{h}i			*	*
ii. /č^{h}ik-aanc^{h}i/				
a. č^{h}i.k**a**.]-aan.c^{h}i	*!			*
b. č^{h}i.k**a**.]**t**-aan.c^{h}i			*	*!*
c. → č^{h}i.k-aan.c^{h}i			*	

The subminimal stems suffixed with a V-initial suffix must not maintain the status of prosodic-word-hood, as is apparent from the choice of the expected surface forms. The intent is to avoid the violation of higher-ranking ONSET. Indeed ONSET is violated in candidates (ia-b, iia), whose stems maintain the status of prosodic-word-hood. That the stems in the expected surface forms must lose it, however, runs counter to the generalization that every stem is a prosodic word.

The problem can be settled by recourse to the established constraints $*C]_{PW}$, $*[\mu]_{PW}$ and *HIATUS in cooperation with the E-constraints on them under the strict supervision of the natural ranking of URP's in Natural Derivational Phonology.

Before constructing the tableau for the forms in (16) it is necessary to introduce a constraint schema. In Axininca Campa constraints apply rightward from the leftmost prosodic word, and after the constraints applicable have all applied in a prosodic word, derivation moves to the next prosodic word. This accords with SFX-TO-PrWd (7e) that says the base of suffixation is a prosodic word. In short, constraints apply iteratively starting from the leftmost prosodic word. The iteration can be accomplished by an instantiation of the iterative constraint schema on constraints proposed in Lee (2009b):

(18) Iterative Constraint (IC) Schema (Mirror Image)

M must apply to α_1 and then to α_2 and so on in the sequence $\alpha_1\alpha_2\ldots\alpha_n$.

The instantiations of the IC schema choose the non-mirror-image version by default. And it is natural that the order of elements in the non-mirror-image version should be reversed in the mirror-image version. In Axininca Campa every constraint that ranks over BRACKET ERASURE (BE) (46) to be established in subsection 3. 6. is an instantiation of M in the IC schema. And it chooses the non-mirror-image version by default and α is PRWD. Hence, the following instantiation of the IC schema:

(19) Iterative Constraint on M (IC-on-M) in Axininca Campa
M that ranks over BE must apply to PRWD$_1$ and then to PRWD$_2$ and so on in the sequence PRWD$_1$ PRWD$_2$…PRWD$_n$.

We can construct the tableau for the forms in (16) with the aid of IC-on-M:

(20) Tableau for the (16) Forms

	ALIGN-R	DEP	DC	DEP	*C]$_{PW}$	*[μ]$_{PW}$	*HIATUS
a. /[[na]-aanc^{h}i]/							
1. [[na**a**]-aanc^{h}i]	*!	*				√	
1. [[na**ta**]-aanc^{h}i]		**				√	
2. [[na**ta**]-ϕϕnc^{h}i]			*!				√
2. [[na**ta**]-**t**aanc^{h}i]				*!			√
2. → [[na**t**ϕ]-aanc^{h}i]							√
b. /[[č^{h}ik]-aanc^{h}i]/							
1. [[č^{h}ik**a**]-aanc^{h}i]					√	√	
2. [[č^{h}ik**a**]-ϕϕnc^{h}i]			*!				√
2. [[č^{h}ik**a**]-**t**aanc^{h}i]				*!			√
2. → [[č^{h}ikϕ]-aanc^{h}i]							√
c. /[[p]-aanc^{h}i]/							
1. [[p**a**]-aanc^{h}i]					√		
2. [[p**ata**]-aanc^{h}i]		**!				√	
2. [[p**aa**]-aanc^{h}i]		*				√	
3. [[p**aa**]-ϕϕnc^{h}i]			*!				√
3. [[p**aa**]-**t**aanc^{h}i]				*!			√
3. → [[pϕϕ]-aanc^{h}i]							√

In (b), in deriving [1], as the AMP-ranked constraints *C]$_{PW}$ and *[μ]$_{PW}$ are O-related in the first underlying prosodic word, they O-apply according to AMP, each deriving the same candidate *č^{h}ik**a***, and the same candidates converge on the single candidate *č^{h}ik**a***. In (c), *C]$_{PW}$ derives [1]. In (a, c), two instantiations of *[μ]$_{PW}$ constitute the first MCR's in the first prosodic word in conformity with IC-on-M and C-on-U. In (a), the loser violates ALIGN-R crucially, since the underlying stem-edge *a* does not match with its syllable-edge ***aa***. The winner violates only shaded DEP. In (c), the loser is beaten by the winner, since it has more violation marks of DEP. Three instantiations of *HIATUS constitute the second MCR's in (a, c) and the only MCR's in (b) in the second prosodic word in conformity with IC-on-M and C-on-U. The losers violate DC or DEP. The winner violates neither DC nor DEP, since *HIATUS deletes the epenthesized segment. Note that the single segment *aa* is deleted by *HIATUS in deriving *[[na**ta**]-ϕϕnc^{h}i]* [2] in (a).

Lastly, I will examine the long forms where a V-final stem is followed by a V-initial suffix recursively, as a consequence of which recursive hiatal structures arise:

(21) Forms with the Recursive V-V Sequence

/[[i-N-koma]-i]/	→ i-ŋ-koma-**t**i	'he will paddle'
/[[[i-N-koma]-aa]-i]/	→ i-ŋ-koma-**t**aa-**t**i	'he will paddle again'
/[[[i-N-koma]-ako]-i]/	→ i-ŋ-koma-**t**ako-**t**i	'he will paddle for'
/[[[[[i-N-koma]-ako]-aa]-i]-ro]/	→ i-ŋ-koma-**t**ako-**t**aa-**t**i-ro	'he will paddle for it again'

As is observed, the recursive hiatal structures are rectified by the insertion of ***t*** by *HIATUS.

*HIATUS and the E-constraints on it, aided by C-on-U and IC-on-M, construct the tableau for the last form in (21):

(22) Tableau for a Form in (21)

/[[[[[i-N-koma]$_{PW1}$-ako]$_{PW2}$-aa]$_{PW3}$-i]$_{PW4}$-ro]$_{PW5}$/	DC	DEP	*HIATUS
1. [[[[[i-ŋ-komϕ]$_{PW1}$-ako]$_{PW2}$-aa]$_{PW3}$-i]$_{PW4}$-ro]$_{PW5}$	*!		√
1. [[[[[i-ŋ-koma]$_{PW1}$-ϕko]$_{PW2}$-aa]$_{PW3}$-i]$_{PW4}$-ro]$_{PW5}$	*!		√
1. [[[[[i-ŋ-koma]$_{PW1}$-**t**ako]$_{PW2}$-aa]$_{PW3}$-i]$_{PW4}$-ro]$_{PW5}$		*	√
2. [[[[[i-ŋ-koma]$_{PW1}$-**t**akϕ]$_{PW2}$-aa]$_{PW3}$-i]$_{PW4}$-ro]$_{PW5}$	*!		√
2. [[[[[i-ŋ-koma]$_{PW1}$-**t**ako]$_{PW2}$-ϕϕ]$_{PW3}$-i]$_{PW4}$-ro]$_{PW5}$	*!		√
2. [[[[[i-ŋ-koma]$_{PW1}$-**t**ako]$_{PW2}$-**t**aa]$_{PW3}$-i]$_{PW4}$-ro]$_{PW5}$		*	√
3. [[[[[i-ŋ-koma]$_{PW1}$-**t**ako]$_{PW2}$-**t**ϕϕ]$_{PW3}$-i]$_{PW4}$-ro]$_{PW5}$	*!		√
3. [[[[[i-ŋ-koma]$_{PW1}$-**t**ako]$_{PW2}$-**t**aa]$_{PW3}$-ϕ]$_{PW4}$-ro]$_{PW5}$	*!		√
3. → [[[[[i-ŋ-koma]$_{PW1}$-**t**ako]$_{PW2}$-**t**aa]$_{PW3}$-**t**i]$_{PW4}$-ro]$_{PW5}$		*	√

The instantiations of *HIATUS apply in PRWD$_2$ in compliance with IC-on-M, constituting the first MCR's in compliance with C-on-U. In the same way they apply in

PRWD$_3$ and PRWD$_4$, constituting the second MCR's and the third MCR's, respectively. In each MCR's, the losers violate the higher-ranking DC on *HIATUS, whereas their rival winner violates the shaded lower-ranking DEP on *HIATUS.

First, in deriving the winners, *[μ]$_{PW}$ adds the sequence *ta* in (13a), while it adds the single vowel *a* in (13b). This is because ALIGN-R that outranks DEP plays a decisive role in the former, but DEP plays a decisive role in the latter, where ALIGN-R is not involved. Second, subtableau (13a) proves that ALIGN-R must be observed at the risk of violating DEP, which establishes the ranking ALIGN-R » DEP. Third, in (20a), for instance, we might derive *[[natϕa]-aanc^{h}i]* by *C]$_{PW}$ from the winner in the second MCR's. But after passing a prosodic word, derivation cannot return to it. Fourth, tableau (20) demonstrates that the deletion of a derived segment by *HIATUS is preferable to the insertion of a segment by it, since it does not incur the violation of DC that outranks DEP. Meanwhile, tableau (22) demonstrates that the insertion of a segment by *HIATUS in violation of DEP is preferable to the deletion of a non-derived segment by it in violation of DC. Lastly, in (20), the first prosodic words in the surface forms do not satisfy the requirement of bimoracity condition of a prosodic word. (And hence the surface forms in (b-c) are identical to the respective underlying representations.) But note that *HIATUS is not constrained by the E-constraint that requires it to satisfy the requirement.

3. 4 Reduplication

In this subsection the patterns of verbal reduplication will be handled. The base preceding the reduplicative suffix RED must satisfy the requirement of bimoracity condition of a prosodic word, as must the base preceding other suffixes.[10]

First, I will consider the reduplicated forms with a C-initial long root (i.e., C-initial root with two syllables or more). The base is totally reduplicated, with prefixes excluded if it is prefixed:

(23) Reduplication of the Forms with a C-initial Long Root

[10] The following four-way classification is based on M & P.

Unprefixed	Prefixed		
č^{h}ik**a**-č^{h}ik**a**-…	*no-ñ*-č^{h}ik**a**-č^{h}ik**a**-…	/č^{h}ik/	‘cut’
tasoŋk**a**-tasoŋk**a**-…	*no-n*-tasoŋk**a**-tasoŋk**a**-…	/tasoŋk/	‘fan’
t^{h}aaŋki-t^{h}aaŋki-…	*no-n*-t^{h}aaŋki-t^{h}aaŋki-…		‘hurry’
kawosi-kawosi-…	*no-ŋ*-kawosi-kawosi-…		‘bathe’
kint^{h}a-kint^{h}a-…	*no-ŋ*-kint^{h}a-kint^{h}a-…		‘tell’

The reduplicants are generated by C-RED. The stem minus the prefixes is reduplicated in the prefixed forms. Here the E-constraint R = ROOT on C-RED plays an important role.

The derivations of the (23) forms are exemplified in the following tableau:

(24) Tableau for the Reduplication of the Forms with a C-initial Long Root

	ANCH-R	DISYL/ R = RT	*C]$_{PW}$	*[μ]$_{PW}$	C-RED
a. /[[č^{h}ik]-RED]-…/					
1. [[č^{h}ik**a**]-RED]-…			√	√	
2. [[č^{h}ik**a**]-č^{h}i]-…	*!	*/*			√
2. → [[č^{h}ik**a**]-č^{h}ik**a**]-…		/*			√
b. /[[no-ñ-č^{h}ik]-RED]-…/					
1. [[no-ñ-č^{h}ik**a**]-RED]-…			√		
2. [[no-ñ-č^{h}ik**a**]-no-ñ-č^{h}ik**a**]-…		/**!**			√
2. → [[no-ñ-č^{h}ik**a**]-č^{h}ik**a**]-…		/*			√
c. /[[tasoŋk]-RED]-…/					
1. [[tasoŋk**a**]-RED]-…			√		
2. [[tasoŋk**a**]-taso]-…	*!	/**			√
2. [[tasoŋk**a**]-soŋk**a**]-…		/**!*			√
2. → [[tasoŋk**a**]-tasoŋk**a**]-…		/*			√
d. /[[no-n-tasoŋk]-RED]-…/					
1. [[no-n-tasoŋk**a**]-RED]-…			√		
2. [[no-n-tasoŋk**a**]-no-n-tasoŋk**a**]-…		/**!**			√
2. → [[no-n-tasoŋk**a**]-tasoŋk**a**]-…		/*			√
e. /[[t^{h}aaŋki]-RED]-…/					
1. [[t^{h}aaŋki]-t^{h}aa]-…	*!	*/***			√
1. → [[t^{h}aaŋki]-t^{h}aaŋki]-…					√

f. /[[no-n-t^{h}aaŋki]-RED]-…/					
1. [[no-n-t^{h}aaŋki]-no-n-t^{h}aaŋki]-…		/*!**			√
1. → [[no-n-t^{h}aaŋki]-t^{h}aaŋki]-…					√
	ANCH-R	DISYL/ R = RT	*C]$_{PW}$	*[μ]$_{PW}$	C-RED

In (a), *C]$_{PW}$ and *[μ]$_{PW}$ O-derive [1] according to AMP (see [1] in (20b)).[11] In (b-d), *C]$_{PW}$ derives [1]. In (a-f), the instantiations of C-RED constitute MCR's in conformity with C-on-U. The loser in (a, e) and the first loser in (c) crucially violate ANCHORING-R. The loser in (b, d, f) crucially violates R = ROOT, since its reduplicant contains the prefixes *no-n* (in addition, the loser in (b, d) contains the epenthetic *a*). In (c), the second loser has more violation marks of R = ROOT than the optimal candidate. It has three violation marks of R = ROOT: the reduplicant does not copy the root-initial sequence *ta* besides containing the epenthetic *a*. If the constraint R(eduplicant) ≤ ROOT (7i) were adopted, the optimal candidate would be unable to defeat it. In (a), the winner violates only shaded R = ROOT. In (b-d), the winner violates R = ROOT vacuously. In (e-f), the winner violates no E-constraint.

Second, the reduplicated forms with a C-initial short root (i.e., C-initial root with one syllable or less) will be handled. The base is totally reduplicated whether prefixed or not:

(25) Reduplication of the Forms with a C-initial Short Root

	Unprefixed	Prefixed		
a.	naa-<u>naa</u>-…	*no*-naa-<u>*no*-naa</u>-…		'chew'
b.	na**ta**-<u>na**ta**</u>-…	*no*-na-<u>*no*-na</u>-…	/na/	'carry on shoulder'
	t^{h}o**ta**-<u>t^{h}o**ta**</u>-…	*no*-*n*-t^{h}o-<u>*no*-*n*-t^{h}o</u>-…	/t^{h}o/	'kiss, suck'
	paa-<u>**paa**</u>-…	*no*-w**a**-<u>*no*-w**a**</u>-…	/p/	'feed'

The sequence *no-w* of the last prefixed form in (b) is derived from /no-o-p/: *p* is lenited to *w* due to the causative prefix *o* and the sequence *o-o* is reduced to *o*.

The constraints and the E-constraints participated in constructing tableau (24), and ALIGN-R are sufficient for the (25) forms. This is illustrated in the following tableau:

[11] Henceforward it will not be mentioned in which prosodic word constraints apply unless necessary. And losers may not be presented exhaustively in MCR's; hence, in (b), the losers *[[no-ñ-č^{h}ik**a**]-no-ñ-č^{h}i]-*... (2) and *[[no-ñ-č^{h}ik**a**]-ñ-č^{h}i]-*... (2) that crucially violate the E-constraints are not presented.

(26) Tableau for the Forms with a C-initial Short Root (M = M-fed)

	AL-R	DEP	AN-R	DISYL	R = RT	$*C]_{PW}$/ $*[\mu]_{PW}$	C-RED
a. /[[naa]-RED]-…/							
1. [[naa]-na]-…			*!	*	*		√
1. → [[naa]-naa]-…				*			√
b. /[[no-naa]-RED]-…/							
1. [[no-naa]-naa]-…				*!			√
1. → [[no-naa]-no-naa]-…					**		√
c. /[[na]-RED]-…/							
1. [[na**a**]-RED]-…	*!	*				/√	
1. [[na**ta**]-RED]-…		**				/√	
2. [[na**ta**]-na]-…			*!	*			√
2. → [[na**ta**]-na**ta**]-…					**		√
d. /[[no-na]-RED]-…/							
1. [[no-na]-na]-…				*!			√
1. → [[no-na]-no-na]-…					**		√
e. /[[p]-RED] -…/							
1. [[p**a**]-RED] -…						√/	
2. [[p**ata**]-RED] -…		**!				/√	
2. [[p**aa**]-RED] -…		*				/√	
3. [[p**aa**]-p**a**] -…			*!	*	*		√
3. → [[p**aa**]-p**aa**] -…				*	**		√
f. /[[no-o-p]-RED]-…/							
1. [[no-ϕ-w]-RED]-…						M/	
2. [[no-ϕ-w**a**]-RED]-…						√/√	
3. [[no-ϕ-w**a**]-w**a**]-…				*!	*		√
3. → [[no-ϕ-w**a**]-no-w**a**]-…					***		√

In (e), $*C]_{PW}$ derives [1]. In (f), the constraints responsible for the lenition of *p* and the reduction of the sequence *o-o* O-derive [1], and the former M-feeds $*C]_{PW}$. The constraint for *p*-lenition M-feeds $*C]_{PW}$, since it can derive the candidate *[[no-ϕ-w]-RED]-...* [1] with the structure *w]* from the candidate /[[no-o-p]-RED]-…/ with the structure *p],* where the structure *p]* and the structure *w]* are identical except the change to be made by the constraint for *p*-lenition (i.e., p → w), and both the structure *p]* and the structure *w]* meet the SD of *C]$_{\text{PW}}$. M-fed *C]$_{\text{PW}}$ and *[μ]$_{\text{PW}}$ O-derive [2] according to AMP (see [1] in (20b)). The instantiations of C-RED constitute the only MCR's in (a-b, d, f) and the second MCR's in (c, e) in conformity with C-on-U. The loser in (a, c, e) violates ANCHORING-R crucially. The loser in (b, d, f) violates DISYLL. The reduplicant of the loser in (b) violates DISYLL though it satisfies the requirement of bimoracity condition of a prosodic word, which proves that DISYLL is indispensable. It must outrank R = ROOT in order that the winner may beat the loser. In (c, e), the instantiations of *[μ]$_{\text{PW}}$ constitute the first MCR's in conformity with C-on-U. The loser in (c) violates ALIGN-R and the loser in (e) violates DEP crucially. In MCR's in (a-d, f) and in the second MCR's in (e), the winner violates only shaded E-constraint(s), and in the first MCR's in (e), the winner incurs one violation of DEP vacuously,

Third, I will consider the reduplicated forms with a V-initial long root (i.e., V-initial root with three syllables or more). In reduplication the onsetless first syllable of the root is excluded, with the prefix excluded if the base is prefixed:

(27) Reduplication of the Forms with a V-initial Long Root

Unprefixed	Prefixed		
osaŋkina-saŋkina-…	*n*-osaŋkina-saŋkina-…		'write'
osampi-sampi-…	*n*-osampi-sampi-…		'ask'
oiriŋk**a**-riŋk**a**-…	*n*-oiriŋk**a**-riŋk**a**-…	/oiriŋk/	'lower'
aacik**a**-cik**a**-…	*n*-aacik**a**-cik**a**-…	/aacik/	'stop'
amin**a**-min**a**-…	*n*-amin**a**-min**a**-…	/amin/	'look'

The onsetless first syllable of the root does not emerge in reduplicants as a consequence of the application of *HIATUS. Note that the E-constraint ANCHORING-L (7f) cannot be imposed on C-RED owing to the derivation of these reduplicants in Natural Derivational Phonology (cf. (32-33)).

The following tableau evidences that *HIATUS, which is fed by C-RED, derives the reduplicants with the onsetless first syllable of the root not copied. Recall that the E-constraints on C-RED are ANCHORING-R » DISYLL » R = ROOT and those on *HIATUS are ANCHORING-R, DC » DEP. The candidates that violate DISYLL are not presented.

(28) Tableau for the Forms with a V-initial Long Root

	ANC-R/ DISYL	R = RT	ANC-R	DC/ DEP	C-RED	*C]PW/ *HIAT
a. /[[osampi]-RED]-…/						
1. [[osampi]-osa]-…	*!/	***			√	
1. [[osampi]-osampi]-…					√	
2. [[osampϕ]-osampi]-…			*!	*!/		/√
2. [[osampi]-**t**osampi]-…				/*!		/√
2. → [[osampi]-ϕsampi]-…						/√
b. /[[n-osampi]-RED]-…/						
1. [[n-osampi]-n-osampi]-…		*!			√	
1. [[n-osampi]-osampi]-…					√	
2. [[n-osampϕ]-osampi]-…			*!	*!/		/√
2. [[n-osampi]-**t**osampi]-…				/*!		/√
2. → [[n-osampi]-ϕsampi]-…						/√
c. /[[oiriŋk-RED]-…/						
1. [[oiriŋk**a**]-RED]-…						√/
2. [[oiriŋk**a**]-oiri]-…	*!/	**			√	
2. [[oiriŋk**a**]-oiriŋk**a**]-…		*			√	
3. [[oiriŋkϕ]-oiriŋk**a**]-…			*!			/√
3. [[oiriŋk**a**]-**t**oiriŋk**a**]-…				/*!		/√
3. → [[oiriŋk**a**]-ϕϕriŋk**a**]-…						/√
d. /[[n-oiriŋk]-RED]-…/						
1. [[n-oiriŋk**a**]-RED]-…						√/
2. [[n-oiriŋk**a**]-oiri]-…	*!/	**			√	
2. [[n-oiriŋk**a**]-n-oiriŋk**a**]-…		**!			√	
2. [[n-oiriŋk**a**]-oiriŋk**a**]-…		*			√	
3. [[n-oiriŋkϕ]-oiriŋk**a**]-…			*!			/√
3. [[n-oiriŋk**a**]-**t**oiriŋk**a**]-…				/*!		/√
3. → [[n-oiriŋk**a**]-ϕϕriŋk**a**]-…						/√

In (c-d), *C]PW derives [1]. In (a-d), the instantiations of C-RED constitute the first MCR's in conformity with C-on-U. The loser in (a, c) and the first loser in (d) violate ANCHORING-R crucially. The loser in (b) and the second loser in (d) crucially violate R = ROOT. In (a-b), the winner does not violate any E-constraint. In (c), the winner violates only shaded R = ROOT. In (d), the winner incurs one violation of R = ROOT vacuously. In (a-d), the instantiations of *HIATUS constitute the second MCR's in conformity with C-on-U. The first loser in (a-b) violates DC besides violating ANCHORING-R, since the base-final *i* not derived by a constraint is deleted by *HIATUS. The first loser in (c-d) violates ANCHORING-R, though the base-final vowel *a* derived by $*C]_{PW}$ is deleted by *HIATUS without violating DC. In (a-d), the second loser violates DEP. The winner defeats the competing candidates without violating any E-constraint, since it is derived by *HIATUS that deletes the onsetless first syllable of the reduplicant derived by C-RED.

Fourth, the reduplicated forms with a V-initial short root (i.e., V-initial root with two syllables or less) will be treated. The base is totally reduplicated whether prefixed or not:

(29) Forms with a V-initial Short Root

Unprefixed	Prefixed		
[asi][asi-…	*n*-asi-*n*-asi-…		'cover'
[apiϕ][apii-…	*n*-apii-*n*-apii-…		'repeat'
[ook**a**][ook**a**-…	*n*-ook**a**-*n*-ook**a**-…	/ook/	'abandon'
[ak**a**][ak**a**-…	*n*-ak**a**-*n*-ak**a**-…	/ak/	'answer'
[i**ta**][i**ta**-…		/i/	'precede'

The unprefixed reduplicated form *[asi][asi*-…, for example, is a prosodic-word compound with the structure *[asi]$_{ROOT}$]$_{STEM}$ [asi]$_{ROOT}$]$_{STEM}$*-…; namely, the reduplicant *asi* is a root, not a suffix. This is contrary to the usual reduplicative suffixation in Axininca Campa. According to Payne (1981; cf. Spring 1990a), there are several evidences that the base and the reduplicant of the unprefixed forms in the left column must be segregated into separate prosodic words. First, there is no hiatus between the base and the reduplicant as there is no hiatus between independent prosodic words. Second, the two prosodic words constitute two distinct stress domains: the prosodic-word-final syllables are not stressed as in *[ási][asíwaitaki]*.[12] Third, the two prosodic words are treated as independent domains with respect to the prosodic-word-final vowel shortening as in *[apiϕ][apii*-… of /[apii]-RED]-…/.[13] Consequently, we are in need of establishing the unpaired constraint R = PRWD for the formation of the prosodic-word compounds. This constraint demands that the reduplicative suffix RED preceded by the base consisting of VCV be given the status of prosodic-word-hood, the reduplicative-

[12] Stress assignment will be discussed in subsection 3. 6.
[13] The shortening of the long vowel will be discussed in subsection 3. 5.

initial suffix boundary converted to the prosodic-word boundary. It replaces RED = SFX (7k), which fulfills the same function by the mechanism of constraint ranking in M & P.

From the candidate *[[n-asi]-asi]-…* derived from /[[n-asi]-RED]-…/ by C-RED *HIATUS may derive the candidate *[[n-asi]-ϕsi]-…* that contains the wrong monosyllabic reduplicant *ϕsi]*. Hence, we may establish the E-constraint on C-RED that says that C-RED must not yield the disyllabic reduplicant that contributes to forming a hiatal structure. In point of fact, the proposed E-constraint is intended to prevent the subsequent derivation of the candidate that contains a monosyllabic reduplicant. We can therefore rely on a LOOK-AHEAD (LA) E-constraint DISYLL on C-RED ($_{LA}$DISYLL on C-RED), making use of the existing E-constraint DISYLL on C-RED. The E-constraints $_{LA}$DISYLL on C-RED and DISYLL on C-RED collapse into the E-constraint $_{<LA>}$DISYLL on C-RED.

At this point we may introduce the LOOK-AHEAD E-constraint schema established in Lee (2009a: (202)):

(30) LOOK-AHEAD E-constraint Schema ($_{LA}$E-constraint Schema)
If candidate$_x$ subsequent (immediately or not) to candidate$_n$ derived by M_i contains α that M_i and the subsequent constraint(s) conspired to derive, $_{LA}$E-on-M_i marks candidate$_n$, candidate$_x$ and the in-between candidate(s) with a violation mark.

The LA E-constraint at issue, namely, $_{LA}$DISYLL on C-RED is an instantiation of $_{LA}$E-constraint schema, where M_i = C-RED, and α = monosyllabic reduplicant. $_{LA}$DISYLL on C-RED now says: If candidate$_x$ subsequent (immediately or not) to candidate$_n$ derived by C-RED contains the monosyllabic reduplicant that C-RED and the subsequent constraint(s) conspired to derive, $_{LA}$DISYLL on C-RED marks candidate$_n$, candidate$_x$ and the in-between candidate(s) with a violation mark.

$_{LA}$DISYLL on C-RED now helps the tableau for the (29) forms to be constructed:

(31) Tableau for the Reduplication of the Forms with a V-initial Short Root

	AL-R	DEP	AN-R	<LA>DISYL	R = RT	*C]$_{PW}$/ R = PRWD	*[μ]$_{PW}$/ C-RED	*HIAT
a. /[[asi]-RED]-…/								
1. [[asi][RED]-…						/√	/M	
2. [[asi][a]-…			*!	*	**		/√	
2. → [[asi][asi]-…							/√	
b. /[[n-asi]-RED]-…/								
1. [[n-asi]-n-a]-…			*!	*	***		/√	
1. → [[n-asi]-n-asi]-…					*		/√	
1. [[n-asi]-asi]-…				*$_{<LA>}$!			/√	
2. [[n-asi]-ϕsi]-…				*$_{<LA>}$				√
2. [[n-asϕ]-asi]-…								√
2. [[n-asi]-**t**asi]-…								√
c. /[[ak]-RED]-…/								
1. [[ak**a**]-RED]-…						√/	√/	
2. [[ak**a**][RED]-…						/√	/M	
3. [[ak**a**][a]-…			*!	*	*		/√	
3. → [[ak**a**][ak**a**]-…					*		/√	
d. /[[n-ak]-RED]-…/								
1. [[n-ak**a**]-RED]-…						√/	√/	
2. [[n-ak**a**]-n-a]-…			*!	*	**		/√	
2. → [[n-ak**a**]-n-ak**a**]-…					**		/√	
2. [[n-ak**a**]-ak**a**]-…				*$_{<LA>}$!	*		/√	
3. [[n-ak**a**]-ϕk**a**]-…				*$_{<LA>}$				√
3. [[n-akϕ]-ak**a**]-…								√
3. [[n-ak**a**]-**t**ak**a**]-…								√
e. /[[i]-RED]-…/								
1. [[i**i**]-RED]-…	*!	*					√/	
1. [[i**ta**]-RED]-…		**					√/	
2. [[i**ta**][RED]-…						/√	/M	
3. [[i**ta**][i]-…			*!	*			/√	
3. → [[i**ta**][i**ta**]-…					**		/√	

In conformity with C-on-U, the instantiations of C-RED constitute the only MCR's in (a, c), the first MCR's in (b, d) and the second MCR's in (e). And the instantiations of *[μ]$_{PW}$ constitute the first MCR's in (e). RED is preceded by the base consisting of VCV in the underlying representation in (a), [1] in (c) and the winner in the first MCR's in (e); hence, R = PRWD is induced to apply, M-feeding CRED. In (c-d), *C]$_{PW}$ and *[μ]$_{PW}$ O-derive [1] according to AMP (see [1] in (20b)). *HIATUS cannot apply across prosodic-word boundaries in [2] in (a) and [3] in (c, e). Now for the question of candidates in MCR's. The loser in (a, c) and in the second MCR's in (e) violates ANCHORING-R. In (b, d), since C-RED that constitutes the first MCR's is constrained by $_{LA}$DISYLL on C-RED, it must be checked whether the candidate it derives violates an LA E-constraint. Hence, the instantiations of *HIATUS constitutes the second MCR's. If the candidate that violates an LA E-constraint is included in MCR's, only that candidate is qualified to be candidate$_x$. The first candidate in the second MCR's (= candidate$_x$) subsequent to the last candidate in the first MCR's derived by C-RED (= candidate$_n$) contains the monosyllabic reduplicant that C-RED and the subsequent constraint *HIATUS conspired to derive; hence, $_{LA}$DISYLL on C-RED marks the last candidate in the first MCR's and the first candidate in the second MCR's with a violation mark. In (e), the loser in the first MCR's violates ALIGN-R crucially.[14] The winner in MCR's in (a) does not violate any E-constraint and the winner in each MCR's in (b-e) violates only shaded E-constraint.

In subtableaux (24b-d, f) the E-constraint R = ROOT on C-RED discharges an essential function in making the stem minus the prefix copied. In subtableaux (26b, d, f) the prefixed stem is totally reduplicated due to the E-constraint DISYLL on C-RED. In tableau (28) *HIATUS deletes the onsetless first syllable of the reduplicant without violating the E-constraint DC on itself, since it is derived by C-RED. And in tableau (31) the unprefixed stem and prefixed stem are both totally reduplicated, which is indebted to the constraint R = PRWD that instructs the prosodic-word compounds to be formed and to $_{LA}$DISYLL on C-RED.

In M & P the ranking ANCHORING-L » ONSET » DISYLL » R = SFX » MAX can derive prosodic-word compounds. It constructs the following tableau (cf. (31a)):

(32) Tableau for /asi-RED- ~/ → [asi][asi]- ~ in M & P

/asi-RED-…/	ANCHORING-L	ONSET	DISYLL	R = SFX	MAX
a. [[asi]-**t**asi]-…	*!	*			
b. → [asi][asi]-…		*][*		*	

The optimal prosodic-word compound *[asi][asi]-…* is secured impeccably. The same

[14] See footnote 8 for the candidate *[[i.**i**]-RED]-…* that may be derived from the underlying representation.

constraints of the same ranking nonetheless do not guarantee the derivation of the expected surface forms when the base of a reduplicated form whose initial and final elements are both vowels consists of more than two syllables. This is proven in the following tableau (cf. (28a)):

(33) Tableau for /osampi-RED- ~/ → [[osampi-ϕsampi]- ~ in M & P

/osampi-RED-…/	ANCHORING-L	ONSET	DISYLL	R = SFX	MAX
a. (?) [[osampi]-ϕsampi]-…	*!	*			*
b. [osampi][osampi]-…		*][*		*	

The expected surface form *[[osampi]-ϕsampi]-…* violates the highest-ranking ANCHORING-L like the discarded *[[asi]-**t**asi]-…* in (32).

Before closing this subsection I will consider an example where prosodic-word boundaries are assigned inconsistently in M & P:

(34) Inconsistent Recursion of the Prosodic-Word Boundary in M & P
/na-RED-wai-ak-i/ → [[[na**ta**]-na**ta**]-wai-**t**ak-i] /na/ 'carry on shoulder' /wai/ 'Cont.' /ak/ 'Tense' /i/ 'Agr.'

The augmented root *na**ta*** and the stem suffixed with the reduplicant *na**ta*** respectively maintain the status of prosodic-word-hood before the reduplicant and the continuative suffix *wai*. The remaining suffixes *ak* and *i*, however, do not impose prosodic-word-hood on the respective preceding stems. In M & P, as mentioned in subsection 3. 2, if a stem is suffixed with a V-initial suffix, it must not maintain the status of prosodic-word-hood whether it ends in a vowel or in a consonant, or whether it is a longer one or a subminimal one. Its maintenance would incur the violation of ONSET.

The following tableau for the (34) form demonstrates that the surface form is derived in keeping with the generalization that every suffix imposes prosodic-word-hood on the preceding stem in Natural Derivational Phonology. (E-constraints are not presented, and only the candidates that defeat the possible rival candidates are presented.)

(35) Tableau for the (34) Form

/[[[[[na]$_{PW1}$-RED]$_{PW2}$-wai]$_{PW3}$-ak]$_{PW4}$-i]$_{PW5}$/	*C]$_{PW}$	*[μ]$_{PW}$	C-RED	*HIAT
1. [[[[[na**ta**]$_{PW1}$-RED]$_{PW2}$-wai]$_{PW3}$-ak]$_{PW4}$-i]$_{PW5}$		√		
2. [[[[[na**ta**]$_{PW1}$-na**ta**]$_{PW2}$-wai]$_{PW3}$-ak]$_{PW4}$-i]$_{PW5}$			√	
3. [[[[[na**ta**]$_{PW1}$-na**ta**]$_{PW2}$-wai]$_{PW3}$-**t**ak**a**]$_{PW4}$-i]$_{PW5}$	√			√
4. → [[[[[na**ta**]$_{PW1}$-na**ta**]$_{PW2}$-wai]$_{PW3}$-**t**akϕ]$_{PW4}$-i]$_{PW5}$				√

In conformity with IC-on-M, *[μ]$_{PW}$ derives [1] in PRWD$_1$. C-RED derives [2] in PRWD$_2$. *C]$_{PW}$ NO-derives [3] by adding the vowel ***a*** to the stem …*-ak* with *HIATUS that adds ***t*** in PRWD$_4$. *HIATUS derives [4] in PRWD$_5$.

In the tableau above, *HIATUS inserts ***t*** in deriving [3], while it deletes the derived ***a*** in deriving [4]. It cannot delete the non-derived diphthong or vowel without violating higher-ranking DC in the former case but it can delete the derived vowel without violating it in the latter case.

3. 5 Deletion of Velar Glide ɰ

The behavior of the stems with the final velar glide ɰ is no different from that of those with other stem-final consonants in regard to the constraints established so far except that ɰ is deleted in the appropriate environment.

Firstly, consider the following data, which will give some idea as to how ɰ behaves:

(36) Forms with the Stem-Final Velar Glide ɰ[15]

a. Velar Glide ɰ Lost Between Short Vowels

/itaɰ]-akiro/	→	itaϕ-akiro	'he has burned it'
/haɰ]-akiro/	→	haϕ-akiro	'he has taken it'
/hiraɰ]-antawori/	→	hiraϕ-antawori	'(reason) that he mourned it'
/naɰ]-RED-waitaki/	→	naϕ**a**-naϕ**a**-waitaki	'I will continue to take more and more'
/ontaɰ]-waitiroota/	→	ontaϕ**a**-waitiroota	'she might continually burn it'
/ic^{h}inaɰ]-iro/	→	ic^{h}inaϕ-iro	'he raised it'
/aɰ]-RED-waitaki/	→	aϕ**a**][aϕ**a**-waitaki	'has continued to take more and more'

b. Velar Glide ɰ Preserved in the Context V _____ V$_{μμ}$]$_{\text{MIRROR IMAGE}}$ [16]

[15] Henceforth the division between prefix and root, or between suffixes may not be made except between the ɰ-final stem and the immediately following suffix, since the data are cited from those handled in the word-level phonology in M & P and they are the outputs of the 'suffix-level phonology'.

/taɰ]-aanc^{h}i/	→	taɰ-aanc^{h}i	‘to burn’
/itaɰ]-aiyironi/	→	itaɰ-aiyironi	‘they burned it’
/hoyaaɰ]-akiro/	→	hoyaaɰ-akiro	‘he has inserted it’
/oyaaɰ]-aanc^{h}i/	→	oyaaɰ-aanc^{h}i	‘to insert’
/oyaaɰ]-waitiroota/	→	oyaaɰ**a**-waitiroota	‘she might continually insert it’

The velar glide ɰ is deleted between short vowels (a), whereas it is preserved in the context V _____ $V_{\mu\mu}]_{\text{MIRROR IMAGE}}$ (b).

The C-pair *ɰ » MAX takes charge of the deletion of ɰ, and *ɰ is a context-free neutralization constraint, which is ranked according to NRP. The underlined *aa* and *ai* in (36a) are respectively a long vowel and a diphthong. The C-pair $*V_iV_i$ » UNIF coalesces the two identical vowels into a long vowel. In the SD of the markedness constraint $*V_iV_i$ vowel length does not matter and the second V_i includes the nucleus of a diphthong. The C-pair for the formation of the diphthong will be presented shortly. Due to the forms in (36b) an E-constraint on *ɰ must be stated. The E-constraint $*V.V_{\mu\mu}]_{\text{MIRROR IMAGE}}$ on *ɰ may rule out the candidates that contain the sequence $V.V_{\mu\mu}]_{\text{MIRROR IMAGE}}$ resulted from the deletion of the velar glide ɰ by *ɰ, but this E-constraint does not explain why this sequence is not allowed. We can thus rely on the LA E-constraint $*[\mu\mu\mu]_\sigma$ on *ɰ ($_{\text{LA}}*[\mu\mu\mu]_\sigma$-on-*ɰ) that prohibits the three-moraic syllable. $_{\text{LA}}*[\mu\mu\mu]_\sigma$-on-*ɰ is an instantiation of $_{\text{LA}}$E-constraint schema, where M_i = *ɰ, and α = three moraic syllable. $_{\text{LA}}*[\mu\mu\mu]_\sigma$-on-*ɰ now says: If candidate$_x$ subsequent (immediately or not) to candidate$_n$ derived by *ɰ contains the three moraic syllable that *ɰ and the subsequent constraint(s) conspired to derive, $_{\text{LA}}*[\mu\mu\mu]_\sigma$-on-*ɰ marks candidate$_n$, candidate$_x$ and the in-between candidate(s) with a violation mark.

The constraint *ɰ and $_{\text{LA}}*[\mu\mu\mu]_\sigma$-on-*ɰ participate in constructing the tableau for the forms in (36):

(37) Tableau for the Forms with the Velar Glide ɰ (*HIATUS = (1), $*C]_{PW}$ = (2), R =

[16] $V_{\mu\mu}$ represents both a long vowel and a diphthong.

PRWD = (3); N = N-ranked, C = C-ranked)

	AN-R	DIS/ R = RT	DC/ DEP	LA*[μμμ]σ	(1), (2), (3)	*[μ]PW/ C-RED	*ɰ/ *V_iV_i
a. /itaɰ]-akiro/							
1. itaɰ**a**]-akiro					√(2)		N/
2. itaɰ**a**]-φkiro			*!/		√(1)		N/
2. itaɰ**a**]-**t**akiro			/*!		√(1)		N/
2. itaɰφ]-akiro					√(1)		N/
3. ita.φφ]-akiro							√/
4. → i.taφφ]-a.kiro					(1)C		/√
b. /taɰ]-aanc^{h}i/							
1. taɰ**a**]-aanc^{h}i					√(2)	√/	N/
2. taɰ**a**]-φφnc^{h}i			*!/		√(1)		N/
2. taɰ**a**]-**t**aanc^{h}i			/*!		√(1)		N/
2. → taɰφ]-aanc^{h}i					√(1)		N/
3. ta.φφ]-aanc^{h}i				*<LA>			√/
4. .taφφ]-aan.c^{h}i				*<LA>	(1)C		/√
c. /naɰ]-RED]-wai-…/							
1. naɰ**a**]-RED]-wai-…					√(2)	√/	N/
2. naɰ**a**]-na]-wai-…	*!	*/*				/√	N/
2. naɰ**a**]-naɰ**a**]-wai-…		/*				/√	N/
3. na.φ**a**]-na.φ**a**]-wai-…							√√/
4. → naφ**a**.]-naφ**a**.]-wai-…					(1)C(1)C		/√√
d. /itaɰ]-aiyironi/							
1. itaɰ**a**]-aiyironi					√(2)		N/
2. itaɰ**a**]-φφyironi			*!/		√(1)		N/
2. itaɰ**a**]-**t**aiyironi			/*!		√(1)		N/
2. → itaɰφ]-aiyironi					√(1)		N/
3. ita.φφ]-aiyironi				*<LA>			√/
4. i.taφφ]-ai.yironi				*<LA>	(1)C		/√
e. /aɰ]-RED]-wai-…/							
1. aɰ**a**]-RED]-wai-…					√(2)	√/	N/
2. aɰ**a**][RED]-wai-…					√(3)	/M	N/
3. aɰ**a**][a]-wai-…	*!	*/*				/√	N/
3. aɰ**a**][aɰ**a**]-wai-…		/*				/√	N/

4. a.ɸ**a**][a.ɸ**a**]-wai-…							√√/
5. → aɸ**a**.][aɸ**a**.]-wai-…					(1)C(1)C		/√√
f. /oyaaɰ]-wai-…/							
1. → oyaaɰ**a**]-wai-…					√(2)		N/
2. oyaa.ɸ**a**]-wai-…				*$_{<LA>}$			√/
3. o.yaaɸ**a**.]-wai-…				*$_{<LA>}$	(1)C		/√
	AN-R	DIS/ R = RT	DC/ DEP	$_{LA}$*[μμμ]$_σ$	(1), (2), (3)	*[μ]$_{PW}$/ C-RED	*ɰ/ *V_iV_i

In the derivations of [1-2] in (a-d), [1-3] in (e) and [1] in (f) N-ranked *ɰ is overridden by other constraints. In (a, d, f), *C]$_{PW}$ derives [1]. In (b-c, e), *C]$_{PW}$ and *[μ]$_{PW}$ O-derive [1] according to AMP (see [1] in (20b)). In (e), R = PRWD derives [2], M-feeding C-RED. In (a-b, d), the instantiations of *HIATUS constitute MCR's in conformity with C-on-U. In (c, e), the instantiations of C-RED constitute MCR's in conformity with C-on-U. The losers in (a-b, d) violate DC or DEP. The loser in (c, e) violates ANCHORING-R crucially. N-ranked *ɰ derives [3] in (a-d), [4] in (e) and [2] in (f). Furthermore, [3-4] in (b, d) and [2-3] in (f) violate $_{LA}$*[μμμ]$_σ$-on-*ɰ. For instance, in (b), candidate [4] subsequent to candidate [3] derived by *ɰ contains the three-moraic syllable that *ɰ and *V_iV_i conspired to derive; hence, $_{LA}$*[μμμ]$_σ$-on-*ɰ marks candidates [3] and [4] with a violation mark. In the derivation of the last candidate in (a-f)) C-ranking *V_iV_i overrides C-ranked *HIATUS in accordance with the natural ranking CCP » AMP.

Secondly, the final long vowel of a polysyllabic word becomes shortened. This is observable in the following examples:

(38) Vowel Shortening

a. Velar Glide ɰ Loss and Vowel Shortening

/howamaɰ-a/	→	howamaɸɸ	'he killed himself'
/ic^{h}inaɰ-a/	→	ic^{h}inaɸɸ	'he lifted his body part'
cf. /aɰ]-[aɰawaitaki/	→	aɸa]-[aɸawaitaki	'has continued to take more and more'
/imitaɰ-i/	→	imitaɸ-i	'he jumped'
/ampokaɰ-i/	→	ampokaɸ-i	'we will come back'

b. Vowel Shortening in Noun

	Noun	'my' + Noun	
/sampaa/:	samp<u>aϕ</u>	no-sampaa-ti	'balsa'
/sawoo/:	saw<u>oϕ</u>	no-sawoo-ti	'case'
/c^himii/:	c^him<u>iϕ</u>	no-c^himii-ti	'ant'

The final long vowel produced by *V_iV_i, which is fed by *ɰ, is shortened (a) and that of a noun is shortened too (b). Still, the long vowel of the monosyllabic prosodic word and the word-final diphthong in the cf. forms in (a) are immune to the process of shortening.

For the shortening of the final long vowel of polysyllabic words we may state the C-pair *σ$CV_{\mu\mu}$## » MAX (μ), where $V_{\mu\mu}$ represents a long vowel only (cf. footnote 16). But the markedness constraint does not explain why the long vowel of the monosyllabic prosodic word is not shortened. We therefore split the C-pair into a C-pair and an E-constraint on it: the C-pair *$V_{\mu\mu}$## » MAX (μ), where $V_{\mu\mu}$ represents a long vowel only, and the E-constraint *[μ]PW on *$V_{\mu\mu}$## (*[μ]PW-on-*$V_{\mu\mu}$##), which prohibits the mono-moraic prosodic word derived by *$V_{\mu\mu}$##. Besides, the C-pair *V**i** » IDENT (voc) is required for deriving diphthongs like *ai* in the cf. forms in (38a).

We can now construct the tableau for the (38) forms. Subtableau (37e) is reinterpreted as subtableau (b), which shows how *[μ]PW-on-*$V_{\mu\mu}$## functions.

(39) Tableau for Velar Glide ɰ Loss and Vowel Shortening

	*[μ]PW	*C]PW	*HIAT	*$V_{\mu\mu}$##	*V_iV_i	*V**i**	*ɰ
a. /ic^hinaɰ]-a/							
1. ic^hinaɰ**a**]-a]		√					N
2. ic^hinaɰϕ]-a]			√				N
3. ic^hi.na.ϕϕ]-a]							√
4. ic^hi.naϕϕ]-a]			C		√		
5. → ic^hi.naϕϕ]-ϕ]				√			
b. /aɰ]-RED-…/							
5. → [aϕ**a**.][aϕ**a**-…			CC		√√		
6. [aϕϕ.][aϕ**a**-…	*			√			
c. /ampokaɰ]-i/							
1. ampokaɰ**a**]-i]		√					N
2. ampokaɰϕ]-i]			√				N
3. ampo.ka.ϕϕ]-i]							√
4. → ampo.kaϕϕ]-i]			C			√	

d. /sampaa/							
1. → sam.paϕ				√			
	*[μ]PW	*C]PW	*HIAT	$*V_{\mu\mu}\#\#$	$*V_iV_i$	*V**i**	*ɰ

In (a, c), *C]PW and *HIATUS respectively derive [1] and [2], overriding N-ranked *ɰ.[17] N-ranked *ɰ derives [3]. The C-ranking constraints $*V_iV_i$ and *V**i** respectively derive [4] in (a) and [4] in (c), overriding C-ranked *HIATUS in accordance with the natural ranking CCP » AMP. $*V_{\mu\mu}\#\#$ derives the surface forms in (a, d). In (b), $*V_{\mu\mu}\#\#$ derives [6], but it violates *[μ]PW-on-$*V_{\mu\mu}\#\#$.

Lastly, the velar glide ɰ must not be deleted if it gives rise to the candidate in which a root and a suffix are wholly included in a single syllable. M & P therefore state the following constraint:

(40) RT-SFX-SEGREGATION

A root and a suffix cannot be wholly contained in a single syllable.

In the following data the velar glide ɰ is preserved by virtue of RT-SFX-SEGREGATION:

(41) Velar Glide ɰ Preserved[18]

Root	Suffixed Form	
/aɰ/	naɰi	'I will take'
	naɰiri	'that I will take'
	haɰiro	'he took it'
/taɰ/	itaɰa	'he burned himself'
	itaɰiro	'he burned it'
/maɰ/	amaɰi	'we will sleep'

The output of the application of *ɰ to the expected surface form *[[n-aɰ]-i]* must be ruled out, because the resultant diphthong *ai*, which consists of the root vowel *a* and the suffix vowel *i*, will be wholly contained in a single syllable as a consequence of the application of *V**i**. In M & P, RT-SFX-SEGREGATION is responsible for ruling out the

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[17] In Lee (2009a: subsections 17. 5 and 17. 9) $_{LA}$E-*UNDO, an instantiation of $_{LA}$E-constraint schema, is proposed. It says that $constraint_x$ subsequent (immediately or not) to $constraint_n$ must not undo the change that $constraint_n$ made. But it has nothing to do with these derivations, since *C]PW and *HIATUS apply in the different prosodic words.

[18] The velar glide ɰ is realized as *y* before *i*.

wrong output. In Natural Derivational Phonology an LA E-constraint on *ɰ must be resorted to: RT-SFX-SEGREGATION serves as the LA E-constraint on *ɰ ($_{\text{LA}}$RT-SFX-SEGR-on-*ɰ). *V_iV_i and *V**i** may apply to the output of *ɰ, causing $_{\text{LA}}$RT-SFX-SEGR-on-*ɰ to be invoked. $_{\text{LA}}$RT-SFX-SEGR-on-*ɰ is also an instantiation of $_{\text{LA}}$E-constraint schema, where M_i = *ɰ, and α = syllable in which a root and a suffix is wholly contained. $_{\text{LA}}$RT-SFX-SEGR-on-*ɰ now says: If candidate$_x$ subsequent (immediately or not) to candidate$_n$ derived by *ɰ contains the syllable in which a root and a suffix is wholly contained that *ɰ and the subsequent constraint(s) conspired to derive, $_{\text{LA}}$RT-SFX-SEGR-on-*ɰ marks candidate$_n$, candidate$_x$ and the in-between candidate(s) with a violation mark.

$_{\text{LA}}$RT-SFX-SEGR-on-*ɰ takes part in constructing the tableau for the (41) forms:

(42) Tableau for the Forms with the Velar Glide ɰ Preserved

	$_{\text{LA}}$RT-SFX-SEGR-on-*ɰ	DC	DEP	*C]$_{\text{PW}}$/ *HIAT	*[μ]$_{\text{PW}}$/ *ɰ	*V_iV_i/ *V**i**
a. /[[n-aɰ]-i]/						
1. [[n-aɰ**a**]-i]				√/	√/N	
2. [[n-aɰ**a**]-ϕ]		*!		/√	/N	
2. [[n-aɰ**a**]-**t**i]			*!	/√	/N	
2. → [[n-aɰϕ]-i]				/√	/N	
3. [[n-aϕϕ]-i]	*$_{<\text{LA}>}$				/√	
4. [[.n-aϕϕ]-i.]	*$_{<\text{LA}>}$			/C		/√
b. /[[i-taɰ]-a]/						
1. [[i-taɰ**a**]-a]				√/	/N	
2. [[i-taɰ**a**]-ϕ]		*!		/√	/N	
2. [[i-taɰ**a**]-**t**a]			*!	/√	/N	
2. → [[i-taɰϕ]-a]				/√	/N	
3. [[i-taϕϕ]-a]	*$_{<\text{LA}>}$				/√	
4. [[i-.taϕϕ]-a.]	*$_{<\text{LA}>}$			/C		√/

In (a-b), N-ranked *ɰ is overridden by other constraints in the derivations of [1-2]. *C]$_{\text{PW}}$ derives [1]; furthermore, in (a), it O-applies with *[μ]$_{\text{PW}}$ (see [1] in (20b)). The instantiations of *HIATUS constitute MCR's in compliance with C-on-U. The losers violate the DC or DEP on *HIATUS. The winner does not violate any E-constraint. *ɰ derives [3]. In (a), *V**i** derives [4]. In (b), *V_iV_i derives [4]. In (a-b), candidate [4] subsequent to candidate [3] derived by *ɰ contains the syllable in which a root and a suffix is wholly contained that *ɰ and the subsequent C-ranking constraint conspired to derive; hence, $_{LA}$RT-SFX-SEGR-on-*ɰ marks candidate [3] and candidate [4] with a violation mark.

First, in subtableaux (37b, d, f) $_{LA}$*[μμμ]$_{σ}$-on-*ɰ prevents the derivation of the candidate with a three-moraic syllable that may arise as a consequence of the application of *ɰ. Second, we might derive *ic^{h}inaɰϕ**a**]-a]* and *ampokaɰϕ**a**]-i]* by *C]$_{PW}$ from [2] in (39a) and [2] in (39c) respectively. After passing the first prosodic word, however, derivation cannot return to it (cf. (20a)). For the same reason *C]$_{PW}$ cannot derive *[[n-aɰϕ**a**]-i]* and *[[i-taɰϕ**a**]-a]* from the winners in MCR's in (42a) and (42b) respectively. Third, in subtableau (39b) *[μ]$_{PW}$-on-*V$_{μμ}$## prevents the derivation of the monosyllabic prosodic word. Fourth, in tableau (42) $_{LA}$RT-SFX-SEGR-on-*ɰ forbids the velar glide ɰ to be deleted in case the application of *ɰ causes the candidate in which a root and a suffix are wholly included in a single syllable to be derived.

3. 6 Stress Assignment[19]

The constraints for stress assignment are presented below in the first place. The unpaired constraint ASSFT replaces FTBIN (7*l*) and the constraints in (7m-o) are slightly modified.

(43) Unpaired Constraints for Stress Assignment

a. ASSFT: Assign binary foot to a prosodic word under moraic analysis.
b. WSP: The heavy syllable in a foot (i.e., (…V$_{μμ}$)$_{FT}$) is stressed.[20]
c. FTFORM: The foot that consists of light syllables (i.e., (VV$_{μ}$)$_{FT}$) is iambic.
d. NONFINALITY: The foot whose second syllable in the context _____ ## is light (i.e., (VV$_{μ}$)$_{FT}$##) is trochaic.

In Axininca Campa the stress pattern is basically iambic and the iambic foot type is Light-Heavy, Light-Light or Heavy in accordance with universal stress theory (McCarthy & Prince 1986, Hayes 1987, 1991).

Secondly, the iterative constraint on ASSFT is required. The iterative constraint on ASSFT, an instantiation of M in the IC schema, chooses the non-mirror-image version

[19] M & P observe that they do "not attempt to deal with the various complications in the *prominential* aspect of Axininca stress." Hence, the discussion in this subsection will lie within the limit.
[20] V$_{μμ}$ represents both a long vowel and a diphthong.

by default and α is $V_\mu V_\mu$ or $(V_\mu)V_{\mu\mu}$. Hence, it is stated as follows:

(44) Iterative Constraint on ASSFT (IC-on-ASSFT)

ASSFT must apply to α_1 and then to α_2 and so on in the sequence $\alpha_1\alpha_2\ldots\alpha_n$, where $\alpha = V_\mu V_\mu$ or $(V_\mu)V_{\mu\mu}$.

In compliance with the universal stress theory and IC-on-ASSFT, ASSFT assigns foot from left to right iteratively.

In the last place, it is necessary to reconsider Bracket Erasure presented in M & P (cf. 'deforestation' of Liberman & Prince 1977; see also Pesetsky 1979, Kiparsky 1982, Mohanan 1982 and Inkelas 1989):

(45) Bracket Erasure in M & P[21]

$[X\ [Y]_\alpha\ Z]_{PrWd} \rightarrow [XYZ]_{PrWd}$, $\alpha = \{Ft, PrWd\}$

Bracket Erasure erases prosodic-word-internal foot and prosodic-word structures. In Natural Derivational Phonology, however, it erases only prosodic-word-internal prosodic-word structures, since foot structures are not constructed as yet. Hence, it is revised as follows:

(46) BRACKET ERASURE (BE) in Natural Derivational Phonology

Erase prosodic-word-internal prosodic-word structures.

The unpaired constraint BE does not affect prosodic-word-internal morphological structures and it does not erase prosodic-word compound structures (e.g., [asi][[[[asi]-wai]-**t**ak]-i]) → [asi][asi-wai-**t**ak-i]). BE is ranked after all the constraints applicable, including N-ranked constraints, by default. And ASSFT is ranked after BE by default.

Having established the constraints and IC-on-ASSFT, we can first turn to the forms with the velar glide ɰ:

(47) Velar Glide ɰ Loss and Stress Assignment

/[[howamaɰ]-a]/	→	howáma	'he killed himself'
/[[icʰinaɰ]-a]/	→	icʰína	'he lifted his body part'
/[[imitaɰ]-i]/	→	imìtái	'he jumped'
/[[ampokaɰ]-i]/	→	ampòkái	'we will come back'

[21] It is remarkable that Bracket Erasure is the only constraint that *derives* candidates in OT.

As the constraints in (43b-c) say, stress is basically iambic and diphthongs are stressed.

With the help of IC-on-AssFt the constraints in (43) for stress assignment and BE enable the tableau for the forms in (47) to be constructed. (The E-constraints on the constraints are not presented.)

(48) Tableau for Stress Assignment

	*C]$_{PW}$/ *Hiat	*V$_{\mu\mu}$##	BE/ AssFt	WSP/ FtForm	*V$_i$V$_i$/ *V**i**	*ɰ
a. /[[howamaɰ]-a]/						
1. [[howamaɰ**a**]-a]	√/					N
2. [[howamaɰϕ]-a]	/√					N
3. [[howama.ϕϕ]-a]						√
4. [[howa.maϕϕ]-a]	/C				√/	
5. [[howa.maϕϕ]-ϕ]		√				
6. [howa.maϕϕ-ϕ]			√/			
7. [(howa.)maϕϕ-ϕ]			/√			
8. → [(howá.)maϕϕ-ϕ]				/√		
b. /[[imitaɰ]-i]/						
1. [[imitaɰ**a**]-i]	√/					N
2. [[imitaɰϕ]-i]	/√					N
3. [[imita.ϕϕ]-i]						√
4. [[imi.taϕϕ]-i]	/C				/√	
5. [imi.taϕϕ-i]			√/			
6. [(imi.)(taϕϕ-i)]			/√√			
7. → [(imì.)(táϕϕ-i)]				√/√		

In (a-b), BE is ranked after all the constraints except AssFt by default, which is in turn ranked after the former by default. *C]$_{PW}$ and *Hiatus respectively derive [1] and [2], overriding N-ranked *ɰ. N-ranked *ɰ derives [3]. The C-ranking constraints *V$_i$V$_i$ and *V**i** respectively derive [4] in (a) and [4] in (b), overriding C-ranked *Hiatus, in accordance with the natural ranking CCP » AMP. In (a), *V$_{\mu\mu}$## derives [5], BE derives [6], AssFt derives [7] and FtForm derives [8]. In (b), BE derives [5], and AssFt derives [6], applying iteratively in compliance with IC-on-AssFt. FtForm and WSP NO-derive [7].

I will next examine an 'overall' stress system of Axininca Campa. Consider the following examples:

(49) ‘Overall’ Stress System

a. Canonical Stress

(hinó)ki	‘arriba (por el río)’
(ičʰì)(kakí)na	‘él me ha cortado’
(iráa)(wanà)ti	‘su caoba’
(apà)(nirói)ni	‘solo’
(añàa)(wái)(tirì)ka	‘cuando hablamos con él’
(kitì)(šità)(kotái)	‘la mañana les sobrevino’
(àa)(tái)	‘iremos’

b. Disyllabic Words of Short Vowels

(círi)	‘brea de árbol’
(máto)	‘polilla’
(cʰími)	‘colpa’

c. Monosyllabic Words with a Long Vowel

(míi)	‘otter’
(sóo)	‘sloth’
(šáa)	‘anteater’

What is said of the forms in (47) is almost applicable to these forms. Besides, short vowels in final syllables are not stressed; hence, stress in bisyllabic words that do not contain a final diphthong is trochaic.

We can now construct the tableau for the forms in (49). (The ‘underlying representations’ are the outputs of BE.)

(50) Tableau for Stress Assignment

	ASSFT	WSP	FTFORM	NONFINALITY
a. /[hinoki]/				
1. (hino)ki	√			
2. → (hinó)ki			√	
b. /[iraawanati/				
1. (iraa)(wana)ti	√√			
2. → (iráa)(wanà)ti		√	√	
c. /[kitišitakotai]/				
1. (kiti)(šita)(kotai)	√√√			
2. → (kitì)(šità)(kotái)		√	√√	

d. /[ciri]/				
1. (ciri)	√			
2. → (círi)			C	√
e. /[.mii.]/				
1. (.mii.)	√			
2. → (.míi.)		√		
	ASSFT	WSP	FTFORM	NONFINALITY

In (a-e), ASSFT derives [1]; furthermore, in (b-c), it applies iteratively in conformity with IC-on-ASSFT. In (a-c), the iambic stress is assigned by FTFORM. The diphthong in the last foot in (c) and the long vowel in (b, e) are assigned stress by WSP. In (d), C-ranking NONFINALITY assigns trochaic stress, overriding C-ranked FTFORM, in accordance with the natural ranking CCP » AMP.

Tableaux (48, 50) demonstrate that WSP and FTFORM ensure that stress is basically iambic and heavy syllables are stressed. And it is noteworthy that in subtableau (50d) trochaic stress is assigned by virtue of the natural ranking CCP » AMP that ranks NONFINALITY over FTFORM.

4. Lardil

In this section I will discuss the problems confronting us in the augmentation of prosodic words in Lardil, a Pama-Nyungan language of Australia, within the framework of Natural Derivational Phonology. And the alternations of some suffixes will also be treated. The discussion is based on Prince & Smolensky (1993: Chapter 7; henceforth, P & S; see also Hale 1973, Klokeid 1976, Kenstowicz & Kisseberth 1977, Wilkinson 1988 and Kirchner 1992).

Let us examine the following data cited from P & S. They form the core of the discussion that will follow. In Lardil a prosodic word must be minimally bimoraic. Therefore subminimal prosodic words are augmented and bimoraic prosodic words must not undergo the constraint responsible for truncating the word-final vowel. Attention is also called to the alternations of the suffixes in non-future accusative and future accusative forms. (The bold-faced segments are epenthetic.)

(51) Augmentation, Truncation and Inflections in Lardil

	Nom.	Nonfut. Acc.	Fut. Acc.	
a. Monosyllabic Roots				
/yak/:	yak**a**	yak-in	yak-uṛ	‘fish’
/ṛelk/:	ṛelk**a**	ṛelk-in	ṛelk-uṛ	‘head’
/maṛ/:	maṛ**ṭa**	maṛ-in	maṛ-uṛ	‘hand’
/ṛil/:	ṛil**ta**	ṛil-in	ṛil-uṛ	‘neck’
/kaŋ/:	kaŋ**ka**	kaŋ-in	kaŋ-**k**uṛ	‘speech’
/t^yaŋ/:	t^yaŋ**ka**	t^yaŋ-in	t^yaŋ-**k**uṛ	‘some’
b. Bisyllabic Roots				
/wiṭe/:	wiṭe	wiṭe-φn	wiṭe-φṛ	‘inside’
/mela/:	mela	mela-φn	mela-φṛ	‘sea’
/keṇṭi/:	keṇṭe	keṇṭi-φn	keṇṭi-**w**uṛ	‘wife’
/papi/:	pape	papi-φn	papi-**w**uṛ	‘father’s mother’
/ŋiṇi/:	ŋiṇe	ŋiṇi-φn	ŋiṇi-**w**uṛ	‘skin’
c. Long Roots				
/muřkunima/:	muřkuniφφ	muřkunima-φn	muřkunima-φṛ	‘nullah’
/ŋawuŋawu/:	ŋawuŋaφφ	ŋawuŋawu-φn	ŋawuŋawu-φṛ	‘termite’
/muŋkumuŋku/:	muŋkumuφφφ	muŋkumuŋku-φn	muŋkumuŋku-φṛ	‘wooden axe’
/ṭupalan/:	ṭupalan	ṭupalan-in	ṭupalan-**k**uṛ	‘road’
/yaraman/:	yaraman	yaraman-in	yaraman-**k**uṛ	‘horse’

The subminimal nominative forms are augmented. The suffix-initial vowel in the nonfuture accusative forms is deleted after the stem-final vowel. And the future accusative suffix /uṛ/ is realized in various forms.[22]

In the first place, I will discuss the augmentation of the nominative underlying monomoraic words in (51a). They are augmented minimally (the nominative ending is

[22] See Lee (2009a: section 16) for the treatment of the alternations observed in nominative forms in (51b-c).

null). The same unpaired constraint $*[\mu]_{PW}$ that is employed in Axininca Campa is responsible for the augmentation. But the prosodic-word boundary is assigned only word-finally in the underlying representations. $*[\mu]_{PW}$, which says that the monomoraic prosodic word must be augmented to be bimoraic, applies in the prosodic-word-final position rather than in the prosodic-word-initial position by default. It adds one or more segments to make the requirement of bimoracity condition of a prosodic word satisfied.

In addition, it is necessary to introduce the constraints established in P & S that will serve as E-constraints in Natural Derivational Phonology:

(52) Constraints in P & S

a. CODACOND (see also Wilkinson 1988)
   A coda consonant can have only Coronal place or else no place specification of its own at all.

b. ALIGN
   The final edge of the Stem corresponds to the final edge of a syllable.

CODACOND and ALIGN function as the E-constraints on $*[\mu]_{PW}$.

The E-constraints DEP and *DOR, which militates against *k*, also constrain $*[\mu]_{PW}$. CODACOND is an absolute E-constraint. The ranking of the E-constraints is CODACOND » ALIGN » DEP, *DOR.

In satisfying $*[\mu]_{PW}$ the unmarked vowel *a* or the unmarked consonant *t*, or the consonant *k* is chosen, as the case may be. And the resultant syllable structure is assumed to be well-formed due to the E-constraints responsible for well-formed syllable structure.

The constraint $*[\mu]_{PW}$ and the E-constraints on it allow the tableau for the nominative forms in (51a) to be constructed:

(53) Tableau for the Nominative Forms in (51a)

	CODACOND	ALIGN	DEP	*DOR	$*[\mu]_{PW}$
a. /yak/					
1. yak.**ta**	*!		**		√
1. → ya.k**a**		*	*		√
b. /ṛelk/					
1. ṛelk**ta**		*	**!		√
1. → ṛel.k**a**		*	*		√
c. /maṛ/					

1. maɽ.**ka**			**	*!	√
1. ma.**ɽa**		*!	*		√
1. → maɽ.**ʈa**			**		√
d. /kaŋ/					
1. kaŋ.**ta**	*!		**		√
1. ka.**ŋa**		*!	*		√
1. → kaŋ.**ka**			**	*	√
	CODACOND	ALIGN	DEP	*DOR	*[μ]$_{PW}$

In (a-d), the instantiations of *[μ]$_{PW}$ constitute MCR's in compliance with C-on-U. As they yield different outputs, applying to exactly the same input structure of the same candidate, they each are qualified to be independent M's. And each of them is M_E and is O-related with another M (i.e., another M_E), and they are ranked according to the same URP (i.e., AMP). Hence, they are qualified to be M_O's, being capable of constituting MCR's in accordance with C-on-U. In (a), the loser violates the highest-ranking CODACOND crucially. In (b), the loser violates DEP crucially; besides, it seems to violate some absolute E-constraint due to its consonant cluster *lkt*. In (c), the losers *maɽ.**ka*** and *ma.**ɽa*** respectively violate *DOR and ALIGN crucially. The added apicodomal ***ʈ*** of the winner is the result of the assimilation to the preceding apicodomal *ɽ*. In (d), the losers *kaŋ.**ta*** and *ka.**ŋa*** respectively violate CODACOND and ALIGN crucially. In (a-d), the winner violates the shaded E-constraints or violates the E-constraints vacuously.

In the tableau above, subtableau (a) proves that CODACOND must outrank ALIGN, and subtableaux (c-d) prove that ALIGN must outrank DEP and *DOR, which confirms the ranking presented above. And the absolute E-constraint CODACOND that outranks other E-constraints fulfills an important function in the different augmentations in (c) (with *ʈa*) and (d) (with *ka*). The initial consonants of the respective augmenting sequences make the preceding coda consonants satisfy CODACOND.

In the second place, I will consider the alternations of the suffixes observed in nonfuture accusative and future accusative forms in (51). Because onset is obligatory, the hiatal structure VV must be resolved. The C-pair *HIATUS » MAX is required. And the unpaired constraint *V[V, +high]]$_{\text{MIRROR IMAGE}}$ (GF_{MI}) demands that the structure of the high vowel in the hiatal sequence V[V, +high]]$_{\text{MIRROR IMAGE}}$ spread to form a glide that is to occupy the onset position. The non-mirror-image subconstraint of the mirror-image constraint overrides its mirror-image subconstraint (see Lee 2009a: footnote 22).

Besides, the C-pair *Nu » DEP is required for future accusative forms; it inserts a segment between the root-final nasal consonant and the suffix *uṛ*.[23] The E-constraints on the constraints are now to be established. The absolute E-constraint *nt on *Nu filters out the output of *Nu that contains the cluster *nt* and it outranks the relative E-constraint *DOR. The E-constraint *iṛ on *HIATUS rules out the candidate that contains the sequence *iṛ* derived by *HIATUS from the structure of the *i*-final stem plus the suffix *uṛ*. The E-constraint *σ_3 on GF_{MI} rules out the output of GF_{MI} that has three syllables or more. The absolute E-constraint CODACOND also constrains *Nu. And the absolute E-constraint *iṛ on *HIATUS outranks the relative E-constraint *σ_3 on GF_{MI}.

The established constraints and E-constraints construct the tableau for the nonfuture accusative forms and the future accusative forms in (51):

(54) Tableau for the Nonfuture Accusative Forms and Future Accusative Forms

	CODACOND	*nt	*ir	*σ_3	*HIATUS	GF_{MI}	*Nu
a. /keṇṭi-in/							
1. keṇṭi-**y**in				*!		√	
1. → keṇṭi-ϕn					√		
b. /mur̆kunima-in/							
1. mur̆kunima-**y**in				*!		√	
1. → mur̆kunima-ϕn					√		
c. /keṇṭi-uṛ/							
1. keṇṭi-ϕṛ			*!		√		
1. → keṇṭi-**w**uṛ				*		√	
d. /mur̆kunima-uṛ/							
1. mur̆kunima-**w**uṛ				*!		√	
1. → mur̆kunima-ϕṛ					√		
e. /kaŋ-uṛ/							
1. kaŋ-**t**uṛ	*!						√

[23] If the sequence *Nu* occurs in intramorphemic environments, the markedness constraint *Nu may have to be constrained by the DC on itself.

1. → kaŋ-**k**uṛ							√
f. /ṭupalan-uṛ/							
1. ṭupalan-**t**uṛ		*!					√
1. → ṭupalan-**k**uṛ							√
	CODACOND	*nt	*ir	*σ_3	*HIATUS	GF_{MI}	*Nu

In (a-d), *HIATUS and GF_{MI} constitute MCR's in compliance with C-on-U. The winner in (a-b, d) and the loser in (c) are derived by *HIATUS. GF_{MI} derives the loser in (a-b, d), which violates *σ_3. In (c), the loser violates *iṛ that outranks *σ_3, which the winner derived by GF_{MI} violates with impunity. In (e-f), the two instantiations of *Nu constitute MCR's in compliance with C-on-U. The winner does not violate any E-constraint. In (e), the loser violates CODACOND, and in (f), it violates *nt.

In the tableau above, in (a-b, d), *HIATUS may be satisfied by deleting the root vowel. The meta-constraint ROOT-FAITH » AFFIX-FAITH (McCarthy & Prince 1995), however, offers a satisfactory solution. It may function as two E-constraints on *HIATUS: it forces *HIATUS to delete the suffix vowel in preference to the root vowel. In (c) and (d), *iṛ on *HIATUS and *σ_3 on GF_{MI} respectively play a definite role in discarding the losers even if the affected structures have the same underlying V-V structure. And in (f), *nt must outrank *DOR in order for the winner to be able to beat the loser.

Lastly, I will consider two CV stems: /ṛu/ 'body fat, grease' and /tʲa/ 'foot' (P & S: 102, footnote 58; see also Hale 1973: 428 and Klokeid 1976: 55). They have the following forms: *ṛu**wa***, *ṛu**yin***, *ṛuuṛ*[24] and *.tʲ**aa**.*, *tʲ**ayin***, *tʲ**awuṛ***[25]. Note especially that /ṛu/ is augmented to *ṛu.**wa*** but /tʲa/ to *.tʲ**aa**.*, as is indicated in P & S (118, footnote 64). In addition to the constraints and the E-constraints established already we are in need of a new C-pair: the C-pair *V_iV_i » UNIF demands that the identical two vowels coalesce into a single long vowel as in Axininca Campa.

The newly established constraint *V_iV_i together with the constraints employed up to this point constructs the following tableau:

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[24] P & S observe that "the form *ṛuuṛ* (unattested: constructed from Klokeid's description) raises an issue about VV sequences; perhaps it is really *uwu*, with the *w* of low perceptibility in the *u* __ *u* environment."

[25] It seems that *tʲ* = *tʸ*.

(55) Tableau for Subminimal Stems

	DEP	*DOR	*[μ]$_{PW}$	*HIATUS	GF$_{MI}$	*V_iV_i
a. /r̩u/						
1. r̩u.**ta**	**!		√			
1. r̩u.**ka**	**!	*!	√			
1. r̩u.**a**	*		√			
2. → r̩u.**wa**				C	√	
b. /tʲa/						
1. tʲa.**ta**	**!		√			
1. tʲa.**ka**	**!	*!	√			
1. tʲa.**a**	*		√			
2. → tʲa**a**				C		√
c. /r̩u-in/						
1. → r̩u-**y**in				C	√	
d. /tʲa-in/						
1. → tʲa-**y**in				C	√	
e. /r̩u-ur̩/						
1. → r̩u-**w**ur̩				C	√	C
f. /tʲa-ur̩/						
1. → tʲa-**w**ur̩				C	√	

In (a-b), the instantiations of *[μ]$_{PW}$ constitute MCR's in compliance with C-on-U. The losers crucially violate DEP; furthermore, *r̩u.**ka*** [1] in (a) and *tʲa.**ka*** [1] in (b) violate *DOR besides. The winner incurs only one violation of DEP, which makes it win over the losers. In (a), the C-ranking mirror-image subconstraint of GF$_{MI}$ derives the surface form, overriding C-ranked *HIATUS, in accordance with the natural ranking CCP » AMP. In (b), C-ranking *V_iV_i derives the surface form, overriding C-ranked *HIATUS, in accordance with the natural ranking CCP » AMP. In (c-f), C-ranking non-mirror-image subconstraint of GF$_{MI}$ derives the surface form, overriding C-ranked *HIATUS in accordance with the natural ranking CCP » AMP. Furthermore, in (c), the non-mirror-image subconstraint of GF$_{MI}$ overrides its mirror-image subconstraint, and in (e), C-ranking GF$_{MI}$ overrides C-ranked *V_iV_i in addition.[26]

In the tableau above, the underlying /CV/ stems in (a) and (b) respectively augment to a disyllabic prosodic word and to a prosodic word with a single heavy syllable. This is

[26] The subconstraints collapsed in a mirror-image constraint do not O-apply and do not constitute MCR's.

because the winner in MCR's in (a) has the structure to which GF_{MI} can apply but that in (b) has the structure to which $*V_iV_i$ can apply instead. And it depends on the nature of the triggering high vowel of GF_{MI} whether the onset glide is realized as *y* or *w*, as is evidenced in the (c-f) forms.

5. Conclusion

In Axininca Campa, the intricate and perplexing problems confronting us in the augmentation of prosodic words and reduplication, among others, have been demonstrated to be solved in a natural fashion within the framework of Natural Derivational Phonology. And it deserves special mention that LA E-constraints discharge an important function.

In Lardil, subminimal prosodic words are also augmented to meet the requirement of bimoracity condition in satisfaction of $*[\mu]_{PW}$ within the framework of Natural Derivational Phonology. And tableaux (54-55) verify that the three constraints *HIATUS, GF_{MI} and $*V_iV_i$ conspire to resolve the hiatal structure VV.

Both in Axininca Campa and Lardil it is noticeable that C-on-U plays a vital role in constructing tableaux and that a number of E-constraints restrict the application of constraints.

The two languages unrelated genetically possess the same unpaired constraint $*[\mu]_{PW}$ for the augmentation of prosodic words. But the typological distinction is drawn by the prosodic-word boundary assigned to different positions in underlying representations and by the different E-constraints imposed on it.

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