NO RESTRUCTURING CONSTRAINT AND LEVEL CONDITIONS[1]

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1. Introduction

A constraint lain buried for long has come to be reinterpreted within the framework of Optimality Theory (OT; Prince & Smolensky 1993), specifically, Correspondence Theory (McCarthy & Prince 1995), which provides means to accomplish its explicit formalization. In Lee (1982), I proposed a constraint evolved from and intended to supplement Kiparsky's (1973) Revised Alternation Condition (1), in response to Kenstowicz & Kisseberth's (1977) indication that there are cases where non-automatic neutralization rules should apply in non-derived environments.

(1) Revised Alternation Condition (RAC)
Non-automatic neutralization processes apply only to derived forms.

A case in point is given us by the following derivations in Yawelmani:

(2) a. /ʔa:ml-hin/ 'helps'	b. /ʔa:ml-al/ 'might help'	
ʔa:mil-hin	_____	*i*-Epenthesis : ∅ → i / C ____ CC
_____	ʔaml-al	Shortening : V: → [-long] / ____ C{C,#}
[ʔa:mil-hin]	[ʔaml-al]	

Shortening, which is a non-automatic neutralization rule according to Kenstowicz & Kisseberth (1977: 212), should apply to the non-derived input string *a:ml* of /ʔa:ml-al/ to derive the expected output form *ʔaml-al* in (b). This clearly constitutes a counterexample to RAC.

On the basis of both the cases which led Kiparsky to motivate RAC and those which evidently go counter to it, the following constraint was proposed:

(3) No Restructuring Constraint
Phonological rules should not restructure a morpheme.

The Finnish data adduced by Kiparsky in support of RAC as well as the Yawelmani case were reconsidered in terms of No Restructuring Constraint. For example, in Finnish, to the morpheme-internal derived sequence *ti* in *veti* derived from /vete/ 'Nom. water' by the raising rule (i.e., e → i / ____ #), the non-automatic neutralization *t* ®*s* rule (i.e., t → s / ____ i) applies without violating it. Its application does not restructure the morpheme /vete/ to */vesi/, since the output form *vesi* has its allomorph *vete* in *vete-nä* 'Ess. water.' But the *t* → *s* rule should not apply to the morpheme-internal non-derived input sequence *ti* of /koti/ 'house.' The application would change every instance of *ti* of the morpheme /koti/ to *si*, thus causing its restructuring to */kosi/. This means that, unlike in the case of the /vete/ paradigm, the across-the-board change of /koti/ to **kosi* in its paradigm would compel the restructured underlying representation */kosi/ to supersede the earlier one /koti/. Hence, the rule is blocked from applying to the morpheme-internal input sequence *ti* of /koti/, constrained by No Restructuring Constraint. In contrast, Shortening converts the morpheme-internal non-derived input sequence *a:ml* of /ʔa:ml-al/ to *aml* in the Yawelmani example in (2b). Its application does not contravene No Restructuring Constraint, since there exists an allomorph *ʔa:mil* whose underlying long *a:* is not shortened in the output form *ʔa:mil-hin* in (2a) arising as a result of the application of *i*-Epenthesis.

[1] I am grateful to John McCarthy whose comments helped me get on the right track in shaping this work.

It has been shown, through this brief survey, that No Restructuring Constraint, which is correct descriptively, is capable of settling the recalcitrant problem. The rest of this article is laid out as follows. Section 2 introduces the preliminary OT version of No Restructuring Constraint (NRC), which roughly purports that phono-constraints may not apply in morpheme-internal input. In section 3, it is revised in such a way as not to be incompatible with the defiant 'idiosyncratic' morphemes, and ultimately it is split into NRC and P(aradigmatic)-NRC. In the course of argument, it will be shown that the morphemes not submissive to NRC, including the 'idiosyncratic' ones, are taken care of by P-NRC. Their output forms are appraised by it in terms of paradigmatic relation that holds between forms sharing the same root. In section 4, apparent counterexamples to NRC like the phono-constraints affecting abstract segments and those producing non-phonemic segments turn out to be its systematic exceptions. It is also shown that prosodic constraints assigning σ- and FT-structures, and the constraint responsible for vowel harmony have no bearing upon NRC despite their application in morpheme-internal non-derived input structure. And optional constraints that apply in morpheme-internal input are proven to be governed by P-NRC. Lastly, the forms to which phono-constraints should not apply in spite of their immunity to NRC are argued to fall under the control of another constraint that may be said to be its output version. Section 5 reinterprets emergence of the unmarked in reduplication from the vantage point of NRC.

In section 6, it is demonstrated that it is necessary to impose the level conditions OUTPUT, INPUT and INDIFFERENT (which includes both OUTPUT and INPUT) on phono-constraints according to which the levels at which they apply are determined. At first sight, this issue may seem to be distinct from the main theme of this article, but it proves to be inextricably connected with it. For not only NRC and P-NRC are based on the assumption that constraints may apply at the input level, but also it is necessary to impose level conditions upon the phono-constraints that should apply in morpheme-internal input without regard to NRC, apart from those treated in sections 3 and 4. Having set about exploring the issue of level conditions which concern NRC, we make its thoroughgoing investigation, illustrating with the data coming from a variety of languages. As a result, the phonological phenomena which have crucially depended on operational account of extrinsic rule-ordering are accounted for naturally by taking advantage of the level conditions. Then, it is shown that there is no possibility of imposing additional decomposed level conditions on the individual triggering or target segment of a phono-constraint. At the end of this section, it is demonstrated that it is also indispensable to impose the level conditions on the constraints assigning stress.

In section 7, it is argued that the phono-constraints responsible for satisfying the FTBIN requirement which apply in morpheme-internal input are in the charge of P-NRC and, furthermore, that NRC, together with P-NRC, predicts whether the device of <u>phonological reduplication</u> is relied upon or not in satisfying the FTBIN requirement in morpheme-internal input. And it is clarified on the basis of historical changes in Korean that the constraints which are syllabically-defined and therefore inherently OUTPUT are construed as applying in morpheme-internal input representation provided that they entail its change; moreover, this assumption is extended to any phono-constraint, whether its level condition is annotated or not, or whether it is inherently OUTPUT or not, whose morpheme-internal application brings about the change of the morpheme-internal input structure. In section 8, concluding remarks are made and residual problems are dealt with.

2. No Restructuring Constraint and Blocking in Morpheme-Internal Input

In Kiparsky (1993), RAC is transformed into a device relying on radical underspecification theory (for radical underspecification, see Kiparsky 1982, Archangeli 1984, 1988; Pulleyblank 1988). For instance, the Finnish *t* $\rightarrow$ *s* phenomenon is accounted for as in the derivations given in (4). Here the import of RAC that non-automatic neutralization rules should not affect morpheme-internal input is reflected with exactitude. (*T* and *E* denote segments unspecified for the features [continuant] and [high] respectively.)

(4) /veTE/	/veTE-nä /	/haluT-i/	/haluT-a/	/koti/	
veTi	_____	____	____	___	E $\rightarrow$ [+high] / ____ #
___	veTe-nä	____	____	___	E $\rightarrow$ [-high]
vesi	______	halus-i	____	___	T $\rightarrow$ [+cont] / ___ i

___	vete-nä	_____	halut-a	___	T → [-cont]
[vesi]	[vete-nä]	[halus-i]	[halut-a]	[koti]	

halus-i ‘wanted’ halut-a ‘to want’

Among others, the fully-specified *t* of the morpheme-internal non-derived sequence *ti* of /koti/ is exempted from the application of the structure-building *t* → *s* rule (i.e., T → [+cont] / ___ i). Needless to say, this is fully in accord with No Restructuring Constraint as well as with RAC, the prototype of the mechanism utilizing the radical underspecification.

OT, in particular, Correspondence Theory opens up a new way to establish correspondence between forms sharing the same root. For instance, McCarthy (1995) formulates a constraint which demands that output forms related paradigmatically have identical prosodic analysis, Benua (1995) states constraints demanding identity between truncated forms and the source forms, and Benua (1996) also posits a constraint taking advantage of transderivational correspondence. Hence, it is of significance to note that No Restructuring Constraint is based on transderivational relationship among forms that share the same root, too. We will now see how the Finnish *t* ® *s* phenomenon can be dealt with in OT by making up the tableaux where the paradigmatically-related output forms are appraised by No Restructuring Constraint.[2] The *t* → *s* rule and the *e* → i raising rule are translated into the constraint pairs *ti >> IDENT-IO (-cont) and *e]$_{LEXWD}$ >> IDENT-IO (-high) respectively.[3] The constraint ranking is: *ti >> IDENT-IO (-cont); *e]$_{LEXWD}$ >> IDENT-IO (-high).

(5) Tableau des Tableaux for the /vete/ Paradigm

/vete-.../	*ti	IDENT-IO (-cont)	*e]$_{LEXWD}$	IDENT-IO (-high)
/vete/ → ☞ [vesi]		*		*
/vete-nä/ → ☞ [vete-nä]				
/vete-sfx_n / → ☞ [vete-sfx_n]				

(6) Tableau des Tableaux for the /halut/ Paradigm

/halut-.../	*ti	IDENT-IO (-cont)
/halut-i/ → ☞ [halus-i]		*
/halut-a/ → ☞ [halut-a]		
/halut-sfx_n / → ☞ [halut-sfx_n]		

(7) Tableau des Tableaux for the /koti/ Paradigm

/koti-.../	*ti	IDENT-IO (-cont)
/koti-sfx_1/ → *[kosi-sfx_1]		*
/koti-sfx_2/ → *[kosi-sfx_2]		*
/koti-sfx_n/ → *[kosi-sfx_n]		*

In the tableau (7), unlike in the tableaux (5) and (6), we get the exceptionless incorrect output forms where the sequence *ti* is converted to **si* throughout the /koti/ paradigm. It is to be noticed that the phono-constraint *ti is satisfied non-vacuously across the board in the paradigm, forcing its conflicting faithfulness constraint IDENT-IO (-cont) to be violated across the board in the paradigm. The consequence is that the across-the-board non-vacuous satisfaction of the constraint *ti or the across-the-board violation of the faithfulness constraint IDENT-IO (-cont) in the /koti/ paradigm amounts to bringing about the restructuring of the morpheme /koti/ to */kosi/, since the sequence *ti* of every input form in the /koti/ paradigm is realized as **si*, the segment *s* is included in the phonemic inventory of Finnish and the

[2] This constraint is construed as an OT constraint until it is stated formally as such.

[3] Throughout this article, refer to McCarthy & Prince (1995) for the faithfulness constraints unless noted otherwise. And the category $_{LEXWD}$ specified in the constraint *e]$_{LEXWD}$ may be replaced with $_{PRWD}$, but this issue is not examined closely unless it is relevant to the discussion.

restructuring would result in no harmful effect anywhere in the grammar. In short, this is the very case that violates No Restructuring Constraint. On the contrary, in the tableaux (5) and (6), where the expected output forms are yielded, the constraint *ti is not satisfied non-vacuously across the board, therefore causing its conflicting faithfulness constraint IDENT-IO (-cont) not to be violated across the board; hence No Restructuring Constraint is made to lie idle. Thus, in order to make sure of the expected output forms, the constraint *ti which is responsible for the restructuring should be invisible in the constraint ranking in the tableau des tableaux for the /koti/ paradigm (7). Generalized, the phono-constraint which is satisfiable non-vacuously across the board in a paradigm is to be invisible in the constraint ranking, or equivalently, the faithfulness constraint which is violable across the board in a paradigm is to take precedence over its conflicting phono-constraint in the constraint ranking. Consequently, No Restructuring Constraint may now be stated formally in OT terms, making use of the results achieved in the tableaux above:

(8) N(o)R(estructuring)C(onstraint) (Preliminary)
A phono-constraint satisfiable in morpheme-internal input is ranked after its conflicting faithfulness constraint FAITH$_i$, iff FAITH$_i$ is violable across the board in a paradigm.

In conformity with this constraint, the constraint pair *ti >> IDENT-IO (-cont) employed in the tableau (7) is re-ranked as the constraint pair IDENT-IO (-cont) >> *ti, which gives the following reconstructed tableau des tableaux for the /koti/ paradigm:

(9) Reconstructed Tableau des Tableaux for the /koti/ Paradigm: IDENT-IO (-cont) >> *ti

/koti-.../	IDENT-IO (-cont)	*ti
/koti-sfx$_1$/ → ☞ [koti-sfx$_1$]		*
/koti-sfx$_2$/ → ☞ [koti-sfx$_2$]		*
/koti-sfx$_n$/ → ☞ [koti-sfx$_n$]		*

As is certified, the constraint *ti, dominated by its conflicting faithfulness constraint IDENT-IO (-cont) in line with NRC (8), is thus made to be ineffective in the morpheme-internal input, entailing the generation of the expected output forms.

Here we will cite no further data to confirm that NRC (8) stands the empirical test. For it will be revised shortly and, furthermore, empirical data will be discussed with reference to it, as they become relevant in the course of argument. Hence, we will close this section by merely remarking that the blocking effects in morpheme-internal input as regards rules like the Ruki rule of Sanskrit (Kiparsky 1973) and the Trisyllabic Laxing rule of English (Kiparsky 1982) are taken care of by NRC (8) or its prospective revised version.

3. 'Idiosyncratic' Morphemes

In this section, we will examine the 'idiosyncratic' morphemes which, though they occupy an extremely small, almost negligible, portion of morphemes of a language, refuse to conform to NRC (8). It will thus be revised in such a way as to accommodate differences.

3.1 Root-Affix Faithfulness Constraint

What is brought to mind above all with respect to 'idiosyncratic' morphemes is an English case. The constraint pair responsible for the *k* → *s* phenomenon, in which *k* converts to *s* when followed by nonlow front vowel, generates *a[k-sē]d* 'accede' and *re-[sē]d* 'recede' from the underlying representations /a[d-kē]d/ and /re-[kē]d/ respectively, both of which share the same root /kēd/ (Chomsky & Halle 1968, Borowsky 1986). The problem is that *k* of the morpheme-internal input sequence *kē* is uniquely realized as *s* throughout the /kēd/ paradigm, which is clearly antithetical to NRC (8). The results of the tableaux (10), (11) and (12) show that NRC (8) is rather an obstruction to getting the correct output forms. For convenience sake, the rule-based term *d*-Assimilation is adopted for the constraint responsible for the complete assimilation of the prefix-final *d* of /ad/ to the following root-initial consonant; the constraint pair responsible for the *k* → *s* phenomenon is formalized as *k[V, -back, -low] >> IDENT-IO (-ant, -cor, -cont).

The constraint ranking is: *k[V, -back, -low] >> IDENT-IO (-ant, -cor, -cont); *d*-Assim >> IDENT-IO (+ant, +cor).

(10) Tableau for /a[d-kē]d/

/a[d-kē]d/	*k[V, -back, -low]	IDENT-IO (-ant, -cor, -cont)	*d*-Assim	IDENT-IO (+ant, +cor)
☞ a[k-sē]d		*		*
a[k-kē]d	*!			*
a[d-kē]d	*!		*!	

(11) Tableau for /re-[kē]d/

/re-[kē]d/	*k[V, -back, -low]	IDENT-IO (-ant, -cor, -cont)
☞ re-[sē]d		*
re-[kē]d	*!	

(12) Tableau des Tableaux for the /kēd/ Paradigm

/...-[kē]d/	*k[V, -back, -low]	IDENT-IO (-ant, -cor, -cont)	*d*-Assim	IDENT-IO (+ant, +cor)
/a[d-kē]d/ → ☞ [a[k-sē]d]		*		*
/re-[kē]d/ → ☞ [re-[sē]d]		*		
.		*		
.		*		
.		*		

In the tableau des tableaux above, the faithfulness constraint IDENT-IO (-ant, -cor, -cont) is violated across the board in the /kēd/ paradigm. Hence, the constraint *k[V, -back, -low], which applies in the morpheme-internal input, should be made to be invisible in the constraint ranking in the paradigm in pursuance of NRC (8), with the result that we obtain incorrect output forms like **a[k-kē]d* and **re-[kē]d*. This is portrayed in the following reconstructed tableau des tableaux for the /kēd/ paradigm:

(13) Reconstructed Tableau des Tableaux for the /kēd/ Paradigm
IDENT-IO (-ant, -cor, -cont) >> *k[V, -back, -low]; *d*-Assim >> IDENT-IO (+ant, +cor)

/...-[kē]d/	IDENT-IO (-ant, -cor, -cont)	*k[V, -back, -low]	*d*-Assim	IDENT-IO (+ant, +cor)
/a[d-kē]d/ → *[a[k-kē]d]		*		*
/re-[kē]d/ → *[re-[kē]d]		*		

Nevertheless, we must not fail to notice that the across-the-board change of *[kē]d* to *[sē]d* in the /kēd/ paradigm as revealed in the tableau (12) does not cause the concomitant restructuring of the morpheme /kēd/, thus constituting no infringement of No Restructuring Constraint (3), which is correct descriptively and can be said to be the archetype of NRC (8). The initial segment *s* of the hypothetically-restructured morpheme */sēd/ cannot be the trigger of the assimilation of the prefix-final *d* of /ad/ to *k*. No segment but the input segment *k* of /kēd/ can be the trigger, that is, only the input correspondent *k* of the surface *s* can be the trigger of the assimilation. In a word, but for the underlying *k* of the morpheme /kēd/, there would be no way to derive the output form *a[k-sē]d* whose *k* is the reflex of the input *d* assimilated to the input correspondent *k* of the output *s*.

McCarthy & Prince (1995) provide a clear case where the reduplicant output forms preserve input material that is lost in its base, namely the case where I(nput)-R(eduplicant) correspondence holds between the input stem and the reduplicant. In Klamath, a phonological process reduces or deletes the first vowel of a prefix or stem, provided that vowel is preceded by at least one syllable in the word (Barker 1964, Clements & Keyser 1983:143). This vowel is reduced to ə in closed syllables but deleted in open syllables. And obstruents lose any distinctive laryngeal specification (voicing or glottalization) in coda position (Kingston 1985, Steriade 1988, Lombardi 1991). This point is exemplified by the output form *mbo-mpditk* derived from /DIST-mbody'-dk/ 'wrinkled up (dist.).' Moreover, this example illustrates that *b* and *o* in the reduplicant are related to *b* and *o* in the input; the reduplicant is more faithful to the input than to its base. Analogously, in the present case, the prefix-final *k* in the output form is related to the root-initial *k* in the input. This relation can be expressed by a constraint which requires the complete assimilation of the prefix-final *d* of /ad/ to the root-initial *k* of the input root /kēd/, the correspondent of *s* of the output *sēd*:

(14) DEP-A(ffix)L(exical root) (F)
The output prefix-final consonant and the input lexical root-initial consonant are identical in feature F.

Now the across-the-board violation of the faithfulness constraint IDENT-IO (-ant, -cor, -cont) in the tableau (12) can be counterbalanced by the satisfaction of the faithfulness constraint DEP-AL (F), which shares the same arguments (-ant, -cor, -cont) with the former. Accordingly, the tableaux (10) and (12) are reconstructed as follows, assuming for the moment that NRC (8) is not invoked where constraints like DEP-AL (F) are involved. The constraint ranking is: DEP-AL (F) >> *k[V, -back, -low] >> IDENT-IO (-ant, -cor, -cont); *d*-Assim >> IDENT-IO (+ant, +cor).

(15) Reconstructed Tableau for /a[d-kē]d/[4]

/a[d-kē]d/	DEP-AL (-ant, -cor, -cont)	*k[V, -back, -low]	IDENT-IO (-ant, -cor, -cont)	*d*-Assim	IDENT-IO (+ant, +cor)
☞ a[k-sē]d	√		*		*
a[k-kē]d	√	*!			*
a[d-kē]d	*!	*		*!	

(16) Reconstructed Tableau des Tableaux for the /kēd/ Paradigm

/...-[kē]d/	DEP-AL (-ant, -cor, -cont)	*k[V, -back, -low]	IDENT-IO (-ant, -cor, -cont)	*d*-Assim	IDENT-IO (+ant, +cor)
/a[d-kē]d/ → ☞ [a[k-sē]d]	√		*		*
/re-[kē]d/ → ☞ [re-[sē]d]			*		
.			*		
.			*		
.			*		

Even though the faithfulness constraint IDENT-IO (-ant, -cor, -cont) is violated across the board in the tableau des tableaux for the /kēd/ paradigm above, DEP-AL (-ant, -cor, -cont), which shares the same arguments with the former, is not. Ultimately, this leads us to restate NRC (8):

(17) NRC
A phono-constraint satisfiable in morpheme-internal input is ranked after its conflicting faithfulness constraint FAITH_i iff FAITH_i and the faithfulness constraint which shares the same argument(s) with FAITH_i, if any, are all violable across the board in a paradigm.

Accordingly, the tableau des tableaux (16) conforms to NRC (17), since DEP-AL (-ant, -cor, -cont), which shares the same arguments with IDENT-IO (-ant, -cor, -cont), is not violated across the board in the /kēd/ paradigm, even though the latter which is in conflict with the constraint *k[V, -back, -low] is.

On the other hand, consider the tableau des tableaux for the /kēl/ 'keel' paradigm, where the faithfulness constraint DEP-AL (F) is irrelevant:

[4] The check mark (√) is used to show that Root-Affix constraints like DEP-AL are satisfied non-vacuously.

(18) Tableau des Tableaux for the /kēl/ Paradigm: *k[V, -back, -low] >> IDENT-IO (-ant, -cor, -cont)

/[kē]l-.../	*k[V, -back, -low]	IDENT-IO (-ant, -cor, -cont)
/[kē]l/ → *[[sē]l]		*
/[kē]l-ed/ → *[[sē]l-ed]		*
/[kē]l-ing/ → *[[sē]l-ing]		*

The faithfulness constraint IDENT-IO (-ant, -cor, -cont) is violated across the board in the /kēl/ paradigm with no help of another faithfulness constraint like DEP-AL (-ant, -cor, -cont) which shares the same argument(s). Thus, the conflicting constraints are re-ranked to comply with NRC (17):

(19) Reconstructed Tableau des Tableaux for the /kēl/ Paradigm
IDENT-IO (-ant, -cor, -cont) >> *k[V, -back, -low]

/[kē]l-.../	IDENT-IO (-ant, -cor, -cont)	*k[V, -back, -low]
/[kē]l/ → ☞ [[kē]l]		*
/[kē]l-ed/ → ☞ [[kē]l-ed]		*
/[kē]l-ing/ → ☞ [[kē]l-ing]		*

The re-ranking of the constraints guarantees the correct output forms.

Consider next another English case in which the constraint DEP-AL (F) also plays an active role:

(20) Tableau des Tableaux for the /[kn]ow/ Paradigm[5]
NOCOMPLEX >> MAX-IO (k = [-ant, -cor, -cont]); DEP-AL (k = [-ant, -cor, -cont]), *d*-Assim

/...-[kn]ow.../	NOCOMPLEX	MAX-IO (k = [-ant, -cor, -cont])	DEP-AL (k = [-ant, -cor, -cont])	*d*-Assim
a. /[kn]ow/ → ☞ [[n]ow]		*		
b. /[kn]owledge/ → ☞ [[n]owledge]		*		
c. /a[d-kn]owledge/ → ☞ [a[k-n]owledge]		*	√	

/[kn]ow/ ‘know’ /[kn]owledge/ ‘knowledge’ /a[d-kn]owledge/ ‘acknowledge’

Despite the across-the-board violation of the faithfulness constraint MAX-IO (k = [-ant, -cor, -cont]), the satisfaction of another faithfulness constraint DEP-AL (k = [-ant, -cor, -cont]) in the form (c) which shares the same arguments with the former saves the output forms from being discarded as not being in compliance with NRC (17).

3.2 *Pterodactyl* and *Helicopter*

We will next consider the cases in which a phono-constraint applies in morpheme-internal input without infringing NRC (17), even though faithfulness constraints like DEP-AL (F), by which an element in output prefix is related to that in input root, are not relevant. Consider the following tableaux for the *pter~ter* alternation between the English words *pterodactyl* and *helicopter*:

(21) Tableau for /[pt]erodactyl/: NOCOMPLEX >> MAX-IO (p)

/[pt]erodactyl/	NOCOMPLEX	MAX-IO (p)
☞ [t]erodactyl		*
[pt]erodactyl	*!	

[5] For the constraint NOCOMPLEX, see Prince & Smolensky (1993).

(22) Tableau for /helico[p]ter/: NOCOMPLEX >> MAX-IO (p)

/helico[pt]er/	NOCOMPLEX	MAX-IO (p)
☞ helico[pt]er		
helico[t]er		*!

(23) Tableau des Tableaux for the /pter/ Paradigm: NOCOMPLEX >> MAX-IO (p)

/-[pt]er-/	NOCOMPLEX	MAX-IO (p)
a. /[pt]erodactyl / → ☞ [[t]erodactyl]		*
b. /helico[pt]er/ → ☞ [helico[pt]er]		

The morpheme-internal application of NOCOMPLEX in deriving the output form *[t]erodactyl* (a) in the tableau (23) above does not cause NRC (17) to be invoked to re-rank the two constraints in question. The reason is that the faithfulness constraint MAX-IO (p) in conflict with NOCOMPLEX is not violated in deriving the output form *helico[pt]er* (b) in spite of its violation in deriving the former. It is the faithfulness constraint MAX-IO (p) which is not violated across the board in the /pter/ paradigm that makes NRC (17) powerless.

Exactly the same phenomenon is found in Korean. Consider the following tableaux for the *ps'al* ~ *s'al* alternation. The first tableau is for the derivation /ps'al/ → [s'al] 'rice' and the second is for the derivation /čo-ps'al/ → [čo-ps'al] ' millet-rice → hulled millet.'

(24) Tableau for /ps'al/: NOCOMPLEX >> MAX-IO (p)

/ps'al/	NOCOMPLEX	MAX-IO (p)
☞ s'al		*
ps'al	*!	

(25) Tableau for /čo-ps'al/: NOCOMPLEX >> MAX-IO (p)

/čo-ps'al/	NOCOMPLEX	MAX-IO (p)
☞ čo-ps'al		
čo-s'al		*!

(26) Tableau des Tableaux for the /ps'al/ Paradigm: NOCOMPLEX >> MAX-IO (p)

/ps'al/	NOCOMPLEX	MAX-IO (p)
/ps'al/ → ☞ [s'al]		*
/čo-ps'al/ → ☞ [čo-ps'al]		

In the tableau (26) above, the morpheme-internal application of NOCOMPLEX does not incur the violation of NRC (17), because its conflicting faithfulness constraint MAX-IO (p) is not violated across the board in the /ps'al/ paradigm.

3.3 NRC Revised

In the meantime, what makes us feel uncomfortable and unsatisfactory about NRC (17) is that in order to confirm whether it is violated or not we have to search every nook and corner of a paradigm every time a constraint applies. In fact, in a language, the cases where the paradigmatic consideration is required are restricted, if any, to a few morphemes, for example, to those 'idiosyncratic' morphemes like /kēd/, /know/ and /pter/ in English, or /ps'al/ in Korean, or at most to those belonging to a certain sublexical categories. Thus, it is desirable and necessary to rid the notion paradigm of NRC (17). Disregarding such 'idiosyncratic' morphemes, we are left to concern ourselves with such cases as are given in the tableaux (5), (6) and (9) for Finnish. (We will later return to the issue which concerns the Yawelmani data given in (2).) For the Finnish data, the constraint *ti has only to comply with some version of NRC which ensures that it does not apply in morpheme-internal input. Hence, it will suffice to state NRC in such a way as to prevent a phonological constraint from applying in morpheme-internal input:

(27) NRC (Final)
A phono-constraint satisfiable in morpheme-internal input is ranked after its conflicting faithfulness constraint.

For instance, this constraint prevents the phono-constraint *ti from applying in the morpheme-internal input *ti* of /koti/ by re-ranking it after its conflicting faithfulness constraint IDENT-IO (-cont), as was illustrated in the tableau (9).

The remainder of NRC (17) takes up the task to take care of 'idiosyncratic' morphemes like those discussed in this section, which are marked with [$_{+PARA}$] lexically. This constraint is stated as follows:

(28) P(aradigmatic)-NRC
In a [$_{+PARA}$] morpheme, a phono-constraint may apply in morpheme-internal input iff its conflicting faithfulness constraint $FAITH_i$ and the faithfulness constraint which shares the same argument(s) with $FAITH_i$, if any, are not all violable across the board in a paradigm.

In the tableau des tableaux (16), for example, the faithfulness constraint IDENT-IO (-ant, -cor, -cont) which conflicts with the phono-constraint *k[V, -back, -low] is violated across the board in the /kē̄d/[$_{+PARA}$] paradigm, but another faithfulness constraint DEP-AL (-ant, -cor, -cont) which shares the same arguments with the former is not. The phono-constraint *k[V, -back, -low] thus applies in the morpheme-internal input without infringing P-NRC.

4. Apparent Counterexamples

In this section, we will mainly deal with the phono-constraints which apply in morpheme-internal input and therefore constitute seeming counterexamples to NRC. We will first clarify the exceptional character of phono-constraints involving abstract and non-phonemic segments with regard to NRC, with an eye to providing a formal means to stipulate a condition on it. Traditionally, prosodic constraints are considered to apply in morpheme-internal input as a matter of course. The formal answer will be given from the vantage point of NRC. Thirdly, vowel harmony will be touched upon. And it will be demonstrated that optional constraints are allowed to apply in morpheme-internal input, consistent with P-NRC. Lastly, the data against which both NRC and P-NRC are helpless are analyzed from a functional point of view.

4.1.1 Abstract Underlying Segments

Abstract underlying segments appear to provide counterexamples to NRC, since the phono-constraints which affect them may apply in morpheme-internal input (for abstract segments, see Kiparsky 1968). However, it must be admitted that there are abstract underlying segments which are well motivated grammar-internally.

According to Choe (1974), an abstract underlying segment should be posited in a Kyung-Sang dialect of Korean. This dialect has six surface vowels:

(29)
i		u
e	ə	o
		a

The four back vowels are fronted when followed by i, the latter being concomitantly deleted when there is no intervening consonant. Furthermore, the fronted *ü* and *ö* are unrounded and the fronted æ is raised to *e*, because front rounded vowels and front low vowel are not permitted as shown in (29) above. With this much preliminary, let us consider the following data:[6]

(30) a. /čuk-i/ → [čik-i] čuk 'die'
b. /sok-i/ → [sek-i] sok 'be cheated'
c. /sə-iu/ → [se-u] sə 'stand'
d /ča-iu/ → [če-u] ča 'sleep'

Fundamentally, fronting is accomplished by simply changing [+back] to [-back], since unrounding and raising are extraneous to the fronting phenomenon.

Consider further the following data, where the entity of **V** is yet to be explored:

(31) a. Fronting of **V** before i
/t'**V**-iu/ → [t'i-u] /k^h**V**-iu/ → [k^hi-u]
b **V** → ə Context-Freely
/t'**V**-ko/ → [t'ə-ko] /k^h**V**-ta/ → [k^hə-ta]
c. Deletion of **V** before Vowel
/t'**V**-ə / → [t'-ə] /k^h**V**-ə/ → [k^h-ə]

t'**V** 'float' k^h**V** 'big'

The surface i in (a) is the result of fronting. As fronting changes the single feature [+back] to [-back], we can unmistakably pinpoint the entity of **V**. The back vowel which differs from the front vowel i only in backness is no other segment than ɨ (i.e., [V, +high, +back, -round]). The underlying vowel ɨ is an abstract segment in the sense that it does not appear anywhere in surface.

Because *u* and **V** are both realized as i in (30a) and (31a) respectively by fronting, *u* might be considered as a candidate for the abstract vowel. Yet the comparison of the forms in (32a) and those in (32b) below will deny it:

(32) a. /čuk-ko/ → [čuk-ko] b. /t'**V**-ko/ → [t'ə-ko]
/čuk-či/ → [čuk-či] /t'**V**-či] → [t'ə-či]

The underlying *u* surfaces as *u* in (a), but the underlying **V** surfaces as ə in (b). Moreover, if *u* were posited as an underlying vowel for **V** of the forms in (32b), we could not accomplish the change of *u* to ə, leaving the underlying *u* in (32a) intact. Hence, *u* is banished from the consideration of the candidate for the abstract underlying segment.

As the underlying ə in (30c) is identical to the surface ə in (31b), it might be chosen as a candidate vowel for **V**. But the hypothetical ə would also fail, since it is fronted to *e* as shown in (30c), while the fronted surface instance of **V** is i as shown in (31a).

Except when it is fronted and deleted as in (31a) and (31c) respectively, **V** always surfaces as ə context-freely. We may thus wonder why the abstract underlying ɨ surfaces as ə rather than as any other vowel. Among the vowels i, *u* and ə which differ from ɨ by one feature, i is precluded from the candidates for the surface vowel of ɨ, because it would then merge into the fronted vowel i of ɨ. Now we are left to choose between the candidates *u* and ə . It is the ranking of featural markedness constraints *[+round] >> *[-high] that makes us choose the candidate ə before *u*.

As was mentioned at the outset of this section, although the argument so far may justify the abstract underlying segment ɨ, it is of importance to note that it is affected context-freely in morpheme-internal input, which presents a serious problem to NRC. Consider the following tableau where the context-free constraint *ɨ changes the abstract underlying segment ɨ to ə :

(33) *ɨ >> IDENT-IO (+high)

6 In dealing with Korean data, the results of the constraints producing non-phonemic segments are ignored unless they are relevant to the discussion under way.

/t'ɨ-ko/	*ɨ	IDENT-IO (+high)
☞ t'ə -ko		*
t'ɨ-ko	*!	

As the constraint *ɨ is satisfied in the morpheme-internal input, NRC obliges it and its conflicting faithfulness constraint IDENT-IO (+high) to be re-ranked as is shown in the following tableau:

(34) IDENT-IO (+high) >> *ɨ

/t'ɨ-ko/	IDENT-IO (+high)	*ɨ
(?) t'ə -ko	*	
t'ɨ-ko		*

As illustrated, the observance of NRC can never produce the expected output form.

Let us next turn to another case of abstract underlying segments, which is found in the Yawelmani dialect of Yokuts. On the basis of the analyses of many linguists (Newman 1944, Kuroda 1967, Kisseberth 1969, Kenstowicz & Kisseberth 1977, 1979; Archangeli 1984, 1991; Kenstowicz 1994), we will begin by assuming that the abstract underlying long vowels *u:* and *i:* are well motivated grammar-internally. Consider the following data:

(35) a. /ʔu:t-it/ → [ʔo:t-ut] ʔu:t 'steal'
b. /hiwi:t-hin / → [hiwet-hin] hiwi:t 'walk'

The abstract underlying long high vowels *u:* and i*:* are lowered to *o:* (a) and *e:* (b) respectively, the latter being further shortened by Shortening introduced in (2). For the present purpose, besides Shortening, we need the rule of vowel harmony that spreads [+round] to the vowels that have the same value for the feature [high] and the rule of lowering that lowers the abstract underlying long high vowels. These rules may be translated into the constraint and the constraint pairs given in the right column:

(36) Rules	Constraints
a. Vowel Harmony	
[V, αhigh] → [+round] / [V, αhigh, +round] C_o ____	ALIGN-R[7] Align (αhigh-span, R, [+round], R) "The right edge of every αhigh-span must coincide with the right edge of some [+round]."
b. Vowel Lowering	
V: → [-high]	*[V:, +high] >> IDENT-IO (+high)
c. Vowel Shortening (cf. (2)):	
V: → [-long] / ____ C{C,#}	$*V{:}C]_\sigma$ >> IDENT-IO (+long)

Supplied with these constraints, we can now have the following tableau:

[7] For the family of alignment constraints, see McCarthy & Prince (1993b); cf. Prince & Smolensky (1993).

(37) ALIGN-R (36a) >> {*V:C]$_\sigma$>> IDENT-IO (+long); *[V:, +high] >> IDENT-IO (+high)}

	ALIGN-R (36a)	*V:C]$_\sigma$[8]	IDENT-IO (+long)	*[V:, +high]	IDENT-IO (+high)
a. /ʔu:t-it/					
☞ ʔo:t-ut[9]					*
ʔu:t-ut				*!	
b. /hiwi:t-hin/					
☞ hiwet-hin			*		*
hiwi:t-hin		*!		*!	

Since the context-free constraint *[V:, +high] influences the abstract long high vowels *u:* and *i:* in the morpheme-internal input, the subsequent re-ranking of the constraints in accordance with NRC would obstruct the generation of the expected output forms. This Yawelmani case is identical to that of the abstract ɨ in a Kyung-Sang dialect of Korean. In brief, the context-free constraints against abstract underlying segments do not comply with NRC.

Why then is NRC not to be invoked when it comes to the matter of abstract underlying segments? The answer is simple: Because were the constraints concerned re-ranked in accordance with it, the abstract underlying segments which are well motivated grammar-internally would be invalidated and consequently they would never have any raison d'être in the grammar.

4.1.2 Non-Phonemic Segments

We will now examine the cases involving non-phonemic segments to demonstrate that abstract segments are not an isolated case in that the constraints concerned do not obey NRC. Let us begin by considering the palatalization phenomena in Korean. In Korean, alveolar consonants convert to palatals when followed by i and *y* (Lee 1976,1980):

(38)

i. Phonemic Palatalization	ii. Non-Phonemic Palatalization
a. Across Morphemes	
/kut-i/ → [kuč-i] cf. /kut-ə/ → [kut-ə]	/os-i/ → [oš-i] cf. /os-e/ → [os-e]
/katʰ-i/ → [kačʰ-i] cf. /katʰ-ɨn/ → [katʰ-ɨn]	/san-i/ → [sañ-i] cf. /san-ɨn/ → [san-ɨn]
kut 'hard' katʰ 'same'	os 'clothes' san 'mountain'
b. Morpheme-Internal	
/əti/ → [əti]	/kasi/ → [kaši] /koni/ → [koñi]
/pətʰi/ → [pətʰi]	/ənni/ → [əññi] /hullyuŋ/ → [huλλɯŋ][10]
əti 'where' pətʰi 'bear'	kasi 'thorn' koni 'swan'
	ənni 'elder brother/sister' hullyuŋ 'fine'

As the palatalization phenomena as a whole will be discussed later, here we will limit the discussion to the non-phonemic aspect of palatalization. The constraint pair responsible for palatalization is *ti (*t* represents alveolar consonants and i represents i and *y*) >> IDENT-IO (+ant). The constraint *š stands for the constraint against the non-phonemic segments, š, *ñ*, and *λ* (i.e., [+cor, -ant, {[+cont], [+son]}]). Consider now the following tableau:

[8] This constraint is assumed to apply at the output level to evade the invocation of NRC (see 6.1.2).

[9] It is assumed that *u:* of the input root triggers ALIGN-R (36a) (see 6.4.2).

[10] Non-geminate *l* is not palatalized.

(39) *ti >> *š >> IDENT-IO (+ant)

/kasi/	*ti	*š	IDENT-IO (+ant)
☞ kaši		*	*
kasi	*!		

The phono-constraint *ti which yields non-phonemic segment š applies in the morpheme-internal input. The consequence is that NRC is to be called in to re-rank the constraints in question. The re-ranking, however, would obstruct the generation of the expected output forms just as in the cases of abstract segments.

We will consider two more cases involving non-phonemic segments. In Korean, non-continuant plain obstruent[11] becomes non-phonemic voiced one in the context '[+voice] ___ V' as shown in (40i), and non-geminate *l* becomes non-phonemic *r* intervocalically as shown in (40ii) (Lee 1976):

(40) i. Voicing ii. Delateralization

a. Across Morphemes

i. Voicing	ii. Delateralization
/po-ko/ → [po-go]	/tal-i/ → [tar-i]
/ul-ta/ → [ul-da]	/pal-e/ → [par-e]
po 'see' ul 'weep'	tal 'moon' pal 'foot'

b. Morpheme-Internal

i. Voicing	ii. Delateralization
/koki/ → [kogi]	/uli/ → [uri]
/pata/ → [pada]	/nalu/ → [naru]
koki 'fish' pata 'sea'	uli 'we' nalu 'ferry'

For Voicing, we need the constraint pair *[+voice] CV (C = [C, -son, -cont, -voice, -asp, -glot]) >> IDENT-IO (-voice), and the constraint *[C, +voice] (C = [C, -son, -cont, -asp, -glot]) which prohibits the non-phonemic voiced obstruents. For Delateralization, we need the constraint pair *V [+lat] V >> IDENT-IO (+lat) and the constraint *r which prohibits non-phonemic segment *r*. With these constraints at our disposal, we can have the following tableaux:

(41) *[+voice] CV >> *[C, +voice] >> IDENT-IO (-voice)

/pata/	*[+voice] CV	*[C, +voice]	IDENT-IO (-voice)
☞ pada		*	*
pata	*!		

(42) *V [+lat] V >> *r >> IDENT-IO (+lat)

/uli/	*V [+lat] V	*r	IDENT-IO (+lat)
☞ uri		*	*
uli	*!		

What is true of the non-phonemic palatalization exactly applies to these two non-phonemic cases: compliance with NRC would prevent the generation of the expected output forms.

Nonetheless, it is to be noticed that even though the phono-constraints which yield non-phonemic segments apply in morpheme-internal input, they do not bring about the effects amounting to restructuring

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[11] The underlying inventory of obstruents in Korean is as follows (Lee 1976):

(i)

	Labial	Coronal	Palatal	Velar
Plain	p	t s	č	k
Aspirate	p^h	t^h	$č^h$	k^h
Glottalized	p'	t' s'	č'	k'

morphemes. For their output segments are non-phonemic and therefore non-contrastive. In other words, their application in morpheme-internal input does not violate No Restructuring Constraint (3), which is correct descriptively and can be said to be the prototype of NRC.

4.1.3 Conclusion

Here we will try to seek for something in common between the constraint ranking which affects abstract segments and that which produces non-phonemic segments, with a view to drawing some conclusion.

First, let us consider the constraint rankings which affect abstract segments. The constraint pair which changes the abstract segment ɨ to ə in a Kyung-Sang dialect of Korean is as shown in the tableau (33) and that responsible for changing the abstract long high vowels to mid vowels in Yawelmani is as shown in the tableau (37):

(43) a. Ranking for Abstract /ɨ/ in a Kyung-Sang Dialect of Korean
*ɨ >> IDENT-IO (+high)
b. Ranking for Abstract [V:, +high] in Yawelmani
*[V:, +high] >> IDENT-IO (+high)

These rankings can be encapsulated in the following skeletal ranking for abstract segments:

(44) Skeletal Ranking for Abstract Segments
Context-free constraint whose structural description (SD) contains *F >> FAITH-F

Next, we will consider the constraint rankings which produce non-phonemic segments. The constraint ranking in charge of producing non-phonemic segments š, ñ, and *l* in Korean is as shown in the tableau (39) and those in charge of producing non-phonemic voiced obstruents and *r* in Korean are as shown in the tableaux (41) and (42) respectively:

(45) a. Ranking for Non-Phonemic Palatalization in Korean
*ti >> *š >> IDENT-IO (+ant)
b. Ranking for Non-Phonemic Voicing in Korean
*[+voice] CV >> *[C, +voice] >> IDENT-IO (-voice)
c. Ranking for Non-Phonemic Delateralization in Korean
*V [+lat] V >> *r >> IDENT-IO (+lat)

These rankings can be encapsulated in the following skeletal ranking for non-phonemic segments, where *F-containing segments are non-phonemic ones:

(46) Skeletal Ranking for Non-phonemic Segments
Constraint which produces segment containing *F >> *F >> FAITH-F

It is no accident that this skeletal ranking conforms to McCarthy's (1995: 65) remark that in general if *F dominates FAITH-F, then the F-containing structure is not part of the phonological inventory of a language (see also Prince & Smolensky 1993: Chapt. 9, McCarthy & Prince 1995).

Finally, the skeletal rankings (44) and (46) can be collapsed as follows:

(47) Skeletal Ranking for Abstract and Non-phonemic Segments
{Context-free constraint whose SD contains *F; Constraint which produces segment containing *F >> *F} >> FAITH-F

Eventually, the skeletal ranking (47) enables us to state formally the exceptional character of the constraints involving abstract and non-phonemic segments as a condition on NRC: the context-free constraints whose SD contains *F and the constraints which produce segments containing *F defined in the ranking given in

(47) above do not subject themselves to NRC. Finally, an additional remark should be made that the context-free constraints whose SD contains *F are not limited to those affecting abstract segments.

4.2 Prosodic Constraints

Prosodic constraints assigning prosodic structures like σ- and FT-structures have nothing to do with NRC, even when they apply in morpheme-internal input. The fact is that no prosodic structures are specified underlyingly which they can change and therefore no faithfulness constraints are in conflict with them, so that there is no constraint pair which can be re-ranked to comply with it. In other words, it applies vacuously. However, it goes without saying that they are no exception to it when they come to affect the prosodic structures specified underlyingly.

4.3 Vowel Harmony

To see if NRC has a bearing upon vowel harmony we will examine the vowel harmony phenomenon in Yawelmani touched on with reference to abstract underlying segments in 4.1.1. In the following tableau, it is assumed just for the sake of argument that the second vowel of the root is specified with [-round] underlyingly:

(48) ALIGN-R (36a) >> {*[V:C]$_\sigma$ >> IDENT-IO (+long); *[V:, +high] >> IDENT-IO (+high)}[12]

/sudi:k-hin/	ALIGN-R (36a)	*[V:C]$_\sigma$	IDENT-IO (+long)	*[V:, +high]	IDENT-IO (+high)
☞ sudok-hun			*		*
sudik-hin	*!*		*	*	

sudo:k 'remove'

The constraint ALIGN-R (36a) responsible for vowel harmony changes the unrounded vowels i*:* of the root and i of the suffix to the rounded vowels *u:* and *u* respectively. Obviously, the change of i*:* of the morpheme-internal input to *u:* incurs the violation of NRC. Hence, it is assumed that the vowels to be affected by the constraint responsible for vowel harmony are not specified with the feature(s) contradictory to its triggering feature(s) in underlying representation. On this assumption, the tableau (48) is reconstructed as follows:

(49) Reconstructed Tableau for (48)

/sud[V:, k-hin/ +high]	ALIGN-R (36a)	*V:C]$_\sigma$	IDENT-IO (+long)	*[V:, +high]	IDENT-IO (+high)
☞ sud[V, k-hun -high, +round]			*		*
sud[V, k-hin +high]	*!*		*	*	

In deriving the optimal output form *sudok-hun*, there is no faithfulness constraint which is in conflict with ALIGN-R (36a) that applies in morpheme-internal input; hence no constraint pair to be re-ranked by NRC. That is, it applies vacuously. Here again, it is needless to say that the constraint responsible for vowel harmony that applies in morpheme-internal input cannot change opaque vowels, if any, without violating it.

4.4 Optional Constraints

[12] It is assumed that ALIGN-R (36a) applies at the input level (see 6.4.2 and refer also to footnote 9) and that the constraint *[V:, +high] which affects abstract segments also applies at the input level (cf. footnote 18).

Here we will try to make an answer to the question why optional constraints are immune to NRC in spite of their application in morpheme-internal input representation. For this purpose, let us consider the vowel-fronting phenomena in Korean. In Korean, back vowels are fronted when followed by i, the latter being deleted simultaneously where no consonant intervenes, much like the fronting phenomena in a Kyung-Sang dialect of Korean discussed in 4.1.1. We will limit our discussion to the fronting case where no consonant intervenes. The fronting constraint applies optionally in morpheme-internal input:

(50) a. Optional

/ai/ → [ai] ~ [æ] 'child'

/sai/ → [sai] ~ [sæ] 'gap'

cf. /nai/ → [nai] ~ *[næ] 'age'

b. Obligatory

/ča-iu/ → [čæ-u] ča 'sleep'

/sə-iu/ → [se-u] sə 'stand'

The fronting constraint may be stated with a condition added:

(51) Fronting: *[V, +back] i

Condition: optional in morpheme-internal input

Consider the following tableau des tableaux for the /ai/ paradigm:

(52) Tableau des Tableaux for the /ai/ Paradigm

a. UNIFORMITY >> Fronting (Obligatory)

/ai/	UNIFORMITY	Fronting
☞ ai		*

b. Fronting (Optional) >> UNIFORMITY

$/a_1i_2/$	Fronting	UNIFORMITY
☞ æ$_{1,2}$		*

The output form in (a) is yielded by the constraint pair, the faithfulness constraint UNIFORMITY >> the obligatory Fronting, which is re-ranked by NRC, and that in (b) is yielded by the constraint pair, the optional Fronting >> the faithfulness constraint UNIFORMITY. This tableau des tableaux shows that the faithfulness constraint UNIFORMITY which conflicts with Fronting is not violated across the board in the paradigm. Hence, the constraint Fronting is not within the range of NRC, but is transferred to P-NRC, which it does not violate. Conclusively, the forms whose morpheme-internal input is to be affected by optional constraints are marked with [$_{+PARA}$] lexically so that P-NRC may evaluate their tableau des tableaux.

4.5 Morphemic Integrity — Palatalization in Korean

We will return to the palatalization phenomena in Korean, the non-phonemic aspect of which was dealt with in 4.1.2. They may furnish a counterexample to both NRC and P-NRC in the negative sense of the term. This means that there are forms to which the constraint *ti should not apply despite the immunity of its application to both of them. For this purpose, we will consider the data presented in (38) again.

For the phonemic aspect of palatalization, we need the constraint pair *ti >> IDENT-IO (+ant). Consider first the following summary tableau for the forms in (38ia), where the constraint *ti applies across morphemes:

(53) *ti >> IDENT-IO (+ant)

	*ti	IDENT-IO (+ant)
a. /kut-i/		
☞ kuč-i		*
kut-i	*!	
b. /kat^h-i/		

☞ $ka\check{c}^h$-i		*
kat^h-i	*!	

With respect to the forms in (38ib), the phono-constraint *ti is satisfiable in morpheme-internal input, which incurs the invocation of NRC to re-rank the constraints employed in the tableau above, as is illustrated in the following tableau des tableaux:

(54) Tableau des Tableaux for the /əti/ Paradigm
IDENT-IO (+ant) >> *ti

/əti/	IDENT-IO (+ant)	*ti
/əti/ → ☞ [əti]		*
/əti-e/ → ☞ [əti-e]		*
/əti-lo/ → ☞ [əti-lo]		*

This summary sketch, together with the non-phonemic aspect of palatalization dealt with in 4.1.2, gives us an outline of the palatalization phenomena in Korean. The following data, however, show that we have not done with the issue of palatalization (Lee 1979):

(55) a. /t'ɨ-ko/ → [t'ɨ-ko] /t^hɨ-ko/ → [t^hɨ-ko]
b. /t'ɨ-ə/ → [t'-ə] /t^hɨ-ə / → [t^h-ə]
c. /t'ɨ-iu/ → [t'i-u] *([č'i-u]) /t^hɨ-iu/ → [t^hi-u] *([$\check{c}^h$i-u])

t'ɨ 'float' t^hɨ 'sprout'

The constraint *ti will yield the incorrect output forms **č'i-u* and *$\check{c}^h$i-u* rather than the correct *t'i-u* and *t^hi-u* for the forms in (c), because its application violates neither NRC nor P-NRC . This is shown in the following tableau. The constraint pair to accomplish fronting of ɨ-i to i is *[V, +back] i (the obligatory part of Fronting (51)) >> UNIFORMITY.

(56) *[V, +back] i >> UNIFORMITY >> *ti >> IDENT-IO (+ant)

/t'ɨ-iu/	*[V, +back] i	UNIFORMITY	*ti	IDENT-IO (+ant)
(?) č' i-u		*		*
t'i-u		*	*!	
t'ɨ-iu	*!			

In deriving the incorrect output form **č'i-u*, the constraint *ti does not violate NRC, since it does not apply in the morpheme-internal input. Furthermore, it does not violate P-NRC, either, even though the morpheme /t'ɨ/ is assumed to be marked with [$_{+PARA}$], as is shown in the following tableau des tableaux. (The constraint *Vɨ (mirror image) deletes ɨ before or after vowel.)

(57) Tableau des Tableaux for the /t'ɨ/ Paradigm
*[V, +back] i >> UNIFORMITY >> *ti >> IDENT-IO (+ant); *Vɨ (mirror image)

/t'ɨ/	*[V, +back] i	UNIFORMITY	*ti	IDENT-IO (+ant)	*Vɨ (mirror image)
/t'ɨ-ko/ → ☞ [t'ɨ-ko]					
/t'ɨ-ə/ → ☞ [t'-ə]					
/t'ɨ-iu/ → *[č'i-u]		*		*	

The faithfulness constraint IDENT-IO (+ant) which is in conflict with the constraint *ti is not violated across the board in the paradigm, so there is no question of P-NRC's interference in deriving the incorrect output form **č'i-u*.

Apparently, this state of affairs may thus undermine the well-established constraints NRC and P-NRC. Even though it violates neither NRC nor P-NRC, the derivation /t'ɨ-iu/ → (t'i-u →) *[č'i-u] should be blocked. As was mentioned at the start of this subsection, this constitutes a counterexample to both of them in the negative sense of the word.

From a functional point of view, the morphemic integrity of the root /t'ɨ/ is totally destroyed in **č'i-u*, as both *t'* and ɨ are transformed into *č'* and i respectively. Formally, both IDENT-IO (+ant) of *t'* and IDENT-IO (+back) of ɨ are violated. Subsequently, the following constraint may be proposed:

(58) MORPHINTEG (Preliminary)
The faithfulness constraints are ranked before their conflicting phono-constraints iff they are violable in every segment of a morpheme.

MORPHINTEG is to exercise its power to re-rank the constraint rankings employed in the tableau (56). The question now is which pair of the conflicting constraints should be re-ranked, *ti >> IDENT-IO (+ant) or *[V, +back] i >> UNIFORMITY, or whether both pairs should be re-ranked simultaneously. Preferably, one pair should be re-ranked. Then, which should be chosen over the other? The pair which affects the consonant *t'* or that which affects the vowel ɨ ? We may count on the ranking MAX-C >> MAX-V (McCarthy 1995) to re-rank the constraint pair *ti >> IDENT-IO (+ant):

(59) *[V, +back] i >> UNIFORMITY >> IDENT-IO (+ant) >> *ti

/t'ɨ-iu/	*[V, +back] i	UNIFORMITY	IDENT-IO (+ant)	*ti
☞ t'i-u		*		*
č'i-u		*	*!	
t'ɨ-iu	*!			

Nonetheless, there is a case which goes against MORPHINTEG (58). In Korean, stops assimilate to the following nasal consonant in nasality (Lee 1976):

(60)[13] /ip-na/ → [im-na] cf. /ip-ko/ → [ip-ko] ip 'wear'
/kut-ni/ → [kun-ni] cf. /kut-ɨn/ → [kut-ɨn] kut 'hard'
/nok-man/ → [noŋ-man] cf. /nok-i/ → [nok-i] nok 'rust'

By nasalization and *Vɨ (mirror image), for example, /po-ɨp-ni/ (po 'see') is realized as *po-m-ni*, in which the suffix morpheme /ɨp/ is converted to *m*, thus violating MORPHINTEG (58). But we may find a clue by taking notice of the difference between the constraint *ti and nasalization in the representations to which they apply. The former applies morpheme-internally, while the latter applies across morphemes. Accordingly, MORPHINTEG (58) is revised as follows:

(61) MORPHINTEG
The morpheme-internally satisfiable phono-constraint is ranked after its conflicting faithfulness constraint
iff faithfulness constraints are violable in every segment of a morpheme.

This constraint may be said to be an output version of NRC. Bearing the responsibility to ensure optimal output forms where NRC and P-NRC are helpless, this MORPHINTEG justifies the tableau (59), guaranteeing the optimal output form *t'i-u* formally.

On the other hand, consider the following tableau where non-phonemic segment is involved:

(62) *[V, +back] i >> UNIFORMITY >> *ti >> *š >> IDENT-IO (+ant)

/s'ɨ-iu/	*[V, +back] i	UNIFORMITY	*ti	*š	IDENT-IO (+ant)
☞ š'i-u		*		*	*
s'i-u		*	*!		

13 The output form [ip-ko] becomes [ip-k'o] by Glottalization.

s'ɨ 'write'

In deriving *š'i-u* from /s'ɨ-iu/, the constraint *ti violates MORPHINTEG (61). But recall that the constraints involving abstract and non-phonemic segments are exempted from NRC. Similarly, the constraints which produce segments containing *F defined in the ranking given in (47) do not obey MORPHINTEG (61), either.

5. NRC and Emergence of the Unmarked in Reduplication

In this section, it will be shown that a type of emergence of the unmarked may be reinterpreted in terms of NRC. In McCarthy & Prince (1994, 1995), the following skeletal ranking for emergence of the unmarked in reduplication is presented:

(63) Skeletal Ranking for Emergence of the Unmarked in Reduplication
I-O Faithfulness >> Phono-Constraint >> B-R Identity

The domination of Phono-Constraint by I-O Faithfulness makes its effects invisible in non-reduplicants, but its domination of B-R Identity makes it respected in reduplicants. This ranking thus results in emergence of the unmarked in reduplicants. The point is that the phonologically unmarked structure (unmarked in the sense that the structure obeys Phono-Constraint) emerges in reduplicants, even though it is violated in non-reduplicants. However, it is of significance to note that the ranking in (63) can be rewritten as in (64a), where Phono-Constraint conflicts with both FAITH_i -IO and FAITH_i -BR, without incurring any loss of the original import; moreover, the ranking in (64a) can further be simplified as that in (64b) on the assumption that, when reduplication is involved, the correspondence that holds is between input stem and output stem, and between base and reduplicant:

(64) Skeletal Ranking for Emergence of the Unmarked in Reduplication (Revised)
a. FAITH_i -IO >> Phono-Constraint >> FAITH_i -BR
b. FAITH_i >> Phono-Constraint >> FAITH_i

In the ranking (a), it is revealed that a single FAITH differing only in correspondence relation is stated as two unrelated constraints, and in the ranking (b), the duplication of the faithfulness constraint FAITH_i becomes salient.

A typical example of emergence of the unmarked in reduplication is cited from Balango. The reduplicant in Balango copies the first two syllables of the base except the final coda. As is illustrated in the following tableau, this exception arises as a consequence of the ranking MAX-IO >> NOCODA[14]>> MAX-BR, a specific instantiation of the skeletal ranking (63), (64a) or (64b). (The correspondence relation is displayed by means of indices.)

(65) Emergence of the Unmarked in Balango Reduplication

/RED-$t_1a_2g_3t_4a_5g_6$/	MAX-IO (g_6)	NOCODA	MAX-BR (g_6)
☞ $t_1a_2g_3t_4a_5$-$t_1a_2g_3t_4a_5g_6$		***	*
$t_1a_2g_3t_4a_5g_6$-$t_1a_2g_3t_4a_5g_6$		****!	
$t_1a_2g_3t_4a_5$-$t_1a_2g_3t_4a_5$	*!	**	

In the ranking employed in the tableau above the same duplication is detected as that detected in the skeletal ranking (64a): the same faithfulness constraint MAX (g_6) which differs only in correspondence relation is repeated. The two faithfulness constraints MAX-IO (g_6) and MAX-BR (g_6) may thus be simplified as a single constraint MAX (g_6) on the same assumption as that made with respect to the ranking (64b). NRC will then take care of the rest. This is illustrated in the following tableau:

[14] For the constraint NOCODA, see Itô (1986), Itô & Mester (1994).

(66) NRC >> NOCODA >> MAX (g_6)

/RED-$t_1a_2g_3t_4a_5g_6$/	NRC	NOCODA	MAX (g_6)
☞ a. $t_1a_2g_3t_4a_5$-$t_1a_2g_3t_4a_5g_6$		***	*
b. $t_1a_2g_3t_4a_5g_6$-$t_1a_2g_3t_4a_5g_6$		****!	
c. $t_1a_2g_3t_4a_5$-$t_1a_2g_3t_4a_5$	*!	**	*

NOCODA applies in reduplicants in both (a) and (c) without violating NRC, because the reduplicants are the exponents of RED and therefore are not morpheme-internal input representations. What is of importance is to note that NOCODA applies in non-reduplicant morpheme-internal input in (c), violating NRC fatally, but that it does not in (a) in conformity with it. As for the optimal output form (a), NRC is not violated either in the reduplicant or in the base; furthermore, it is where it is not relevant that the unmarked structure appears.

Another example of emergence of the unmarked in reduplication is cited from Akan reduplication (Christaller 1875 [1964], Welmers 1946, Schachter & Fromkin 1968). The reduplicant is CV prefix, the vowel of which is always high, agreeing with root vowel in [ATR], [back], and [nasal]. Emergence of the unmarked is accounted for straightforwardly by the ranking IDENT-IO (high) >> *[-HIGH] >> IDENT-BR (high), also a specific instantiation of the skeletal ranking (63), (64a) or (64b). The domination of the constraint *[-HIGH] by IDENT-IO (high) makes it violated in non-reduplicants, but its outranking IDENT-BR (high) makes it obeyed in the reduplicants:

(67) Emergence of the Unmarked in Akan Reduplication

/RED-soʔ/ 'seize'	IDENT-IO (high)	*[-HIGH]	IDENT-BR (high)
☞ su-soʔ		*	*
so-soʔ		**!	
su-suʔ	*!		

What is true of the Balango case applies here. The same duplication as that observed in Balango reduplication is observed in the ranking employed in the tableau above: the same faithfulness constraint IDENT (high) which differs only in correspondence relation is repeated. Hence, these two faithfulness constraints may be simplified as a single constraint IDENT (high) on the same assumption as that made with respect to the Balango constraint MAX (g_6). Here also, the rest is taken care of by NRC. The following tableau illustrates this point:

(68) NRC >> *[-HIGH] >> IDENT (high)

/RED-soʔ/	NRC	*[-HIGH]	IDENT (high)
☞ a. su-soʔ		*	*
b. so-soʔ		**!	
c. su-suʔ	*!		*

The constraint *[-HIGH] is obeyed in the reduplicants in both (a) and (c) without violating NRC. But it applies in non-reduplicant morpheme-internal input in (c), violating it fatally, whereas it does not in (a) in conformity with it. Here again, emergence of the unmarked is guaranteed where Phono-Constraint is beyond the reach of NRC, and the optimal output form appears when both the reduplicant and the base do not transgress it.

What is conspicuous is that in cases where NRC is invoked at the time when Phono-Constraint is satisfiable, the marked structure (marked in the sense that the structure violates Phono-Constraint) emerges, while, in every other case where Phono-Constraint applies without impinging upon it, the unmarked structure emerges. It is not a mere coincidence that the constraint pair FAITH_i >> Phono-Constraint in the ranking (64b) is identical to that re-ranked by NRC when a phono-constraint is satisfiable in morpheme-internal input. In fact, the constraint pair Phono-Constraint >> FAITH_i, which is generally obeyed in non-morpheme-internal input, including reduplicants, is re-ranked as the constraint pair FAITH_i >> Phono-Constraint by NRC, when Phono-Constraint is satisfiable in morpheme-internal input of the base. For instance, in deriving $t_1a_2g_3t_4a_5$-$t_1a_2g_3t_4a_5g_6$ (66a), the constraint ranking NOCODA >> MAX (g_6), a specific instantiation of the skeletal ranking Phono-Constraint >> FAITH$_i$ in the ranking (64b), applies in the reduplicant without infringing NRC, but it is re-ranked by it as MAX (g_6) >> NOCODA, a specific instantiation of the skeletal ranking FAITH$_i$ >> Phono-Constraint, when NOCODA is satisfiable in morpheme-internal input of the base.

Let us now turn to a case where reduplication is not involved, particularly, the case in which a phonological constraint applies across morphemes (i.e., in non-morpheme-internal representation) to the exclusion of morpheme-internal input. Palatalization in Korean discussed previously provides a proper example; the relevant data are those given in (38i). With respect to the constraint *ti, the output sequences *-č-i* and *-č^h-i* in (38ia) are a type of emergence of the unmarked, while the output sequences *-ti* and *-t^{h}i* in (38ib) are a type of emergence of the marked. The unmarked structure emerges when the constraint *ti applies in non-morpheme-internal input representations without violating NRC, but the marked structure emerges when it does not apply in morpheme-internal input in obedience to it. This parallels the cases above where reduplication is involved: the unmarked structure emerges when a phono-constraint applies in reduplicants, which are the exponents of RED and therefore are not morpheme-internal input representations, without violating NRC, but the marked structure emerges when it does not apply in morpheme-internal input representations of the base in obedience to it.

Interestingly enough, the palatalization phenomena in (38i) would have to be accounted for by the ranking analogous to that given in (64a) or (64b) but for NRC:

(69) [Morpheme-Internal Input] IDENT-IO (+ant) >> *ti
>> [Non-Morpheme-Internal Input] IDENT-IO (+ant)

	[MII] IDENT-IO (+ant)	*ti	[NMII] IDENT-IO (+ant)
a. /kut-i/			
☞ kuč-i			*
kut-i		*!	
b. /əti/			
☞ əti		*	
əči	*!		

Hence, it is no wonder that the same device is taken advantage of in Pater's (1995) exposition of nasal substitution in Indonesian. Consider the following data:

(70) a. /məN-pilih/ → [məmilih] 'to choose, to vote'
/məN-tulis/ → [mənulis] 'to write'
/məN-kasih/ → [məŋasih] 'to give'
b. əmpat 'four' untuk 'for' muŋkin 'possible'

A root-initial voiceless obstruent is replaced by a homorganic nasal by nasal substitution as shown in (a), but NC (nasal/voiceless obstruent) clusters are left unscathed root-internally as shown in (b). The constraint *NC is presented in (71a) and the tableau illustrating nasal substitution exemplified in (a) is given in (71b):

(71) a. *NC
No nasal/voiceless obstruent sequences

b. Nasal Substitution: *NC >> LINEARITY

/məN_1-$p_2$ilih/	*NC	LINEARITY
☞ mə$m_{1,2}$ilih		*
mə$m_1p_2$ilih	*!	

Nasal substitution, however, should be blocked in morpheme-internal input representations, as shown in (70b). For this purpose, Pater posits root-specific LINEARITY (ROOTLIN) and ranks it above *NC. The following tableau illustrates the blocking of nasal substitution in morpheme-internal input representations:

(72) Root-Internal NC Tolerance: ROOTLIN >> *NC >> LINEARITY

/əm$_1$p$_2$at/	ROOTLIN	*NC	LINEARITY
☞ əm$_1$p$_2$at		*	
əm$_{1,2}$at	*!		*

The constraint ranking employed in the tableau above can be rewritten as [Morpheme-Internal Input] LINEARITY >> *NC >> [Non-Morpheme-Internal Input] LINEARITY. This rewritten ranking is analogous to that employed in the tableau (69) which does not presuppose NRC. NRC can do away with the redundant constraint [MII] LINEARITY: the constraint pair *NC >> LINEARITY, where the redundant condition [Non-Morpheme-Internal Input] is eliminated, is re-ranked by NRC when *NC comes to apply within the root (i.e., in morpheme-internal input).

Now, let us compare the following rankings:

(73) a. FAITH$_i$ -IO >> Phono-Constraint >> FAITH$_i$ -BR (64a)
b. [MII] IDENT-IO (+ant) >> *ti >> [NMII] IDENT-IO (+ant) (cf. (69))
c. [MII] LINEARITY >> *NC >> [NMII] LINEARITY (cf. (72))

The skeletal ranking (73a) may be rewritten as the ranking [MII] FAITH$_i$ >> Phono-Constraint >> [NMII] FAITH$_i$, the specific instantiations of which are the rankings (73b) and (73c). Thus, it may be claimed that the constraint pair FAITH$_i$ -IO >> Phono-Constraint in the ranking (64a = 73a) is that re-ranked by NRC when Phono-Constraint is satisfiable in morpheme-internal input, including the base of reduplicants.

In sum, the constraint pair FAITH$_i$ -IO >> Phono-Constraint in (64a) or FAITH$_i$ >> Phono-Constraint in (64b), where reduplication is involved, arises as a result of re-ranking by NRC, when Phono-Constraint is satisfiable in the (non-reduplicant) morpheme-internal input. This exactly parallels the cases where the re-ranked constraint pair IDENT-IO (+ant, +cor) >> *ti, a specific instantiation of the skeletal ranking FAITH$_i$-IO >> Phono-Constraint or FAITH$_i$ >> Phono-Constraint, results, forced by NRC, when *ti is satisfiable in morpheme-internal input, and where the constraint pair LINEARITY >> *NC, also a specific instantiation of the self-same skeletal ranking, results from re-ranking of the constraint pair *NC >> LINEARITY in obedience to NRC. Conclusively, without NRC, the same kind of duplication of a faithfulness constraint as is exploited in the tableaux (65), (67), (69) and (72) would have to be repeated unavoidably every time a phono-constraint should be prevented from applying in morpheme-internal input. That is, recurrently, a single faithfulness constraint would have to be treated as two distinct faithfulness constraints within a framework without NRC.

6. Level Conditions on Constraints

As NRC prohibits phono-constraints from applying in morpheme-internal input, letting them apply freely elsewhere, a question arises whether there are no phono-constraints which should apply in morpheme-internal input in its defiance, apart from those constraints discussed in the previous sections. The answer is that there are such phono-constraints. Eventually, it will be proven that the solution to this problem lies in answering the question at which level of phonological representations those out of its range should then apply.

In accounting for opacity phenomena in OT, particularly in Correspondence Theory, McCarthy (1994) stipulates decomposed conditions to be imposed on decomposed phonological constraints. Specifically, the levels at which the decoupled conditions obtain are surface, underlying and indifferent. The indifferent level includes both surface and underlying. Following the proposal of McCarthy's tripartite distinction of levels, we may impose on phono-constraints as a whole the tripartite level conditions according to which the levels at which they apply are destined; the level conditions are OUTPUT (OUT), INPUT (IN) and INDIFFERENT (IND).

Having set about settling the problem of level conditions which concerns NRC, we will see if this tripartite distinction survives the examination of empirical data by making an exhaustive investigation within the framework of OT which denies serial derivation, besides answering the afore-mentioned question. At this juncture, we are to acknowledge that NRC and P-NRC are founded, though implicitly, on the assumption that phono-constraints may apply at the input level, as has been seen in their invocation to re-rank them. They may thus be in danger of being precarious in the absence of evidence supportable by empirical data that some phono-constraints are constrained to apply at the input level.

In addition, an aspect of dialectal difference accounted for formerly in terms of rule re-ordering is reinterpreted by the difference of level conditions imposed on the same phono-constraint. And it will be examined whether decomposed level conditions imposed on the individual triggering or target segment of a constraint are tenable. Lastly, it will be explored whether it is also possible to impose level conditions on the constraints assigning stress.

6.1 The Level Condition OUTPUT

Apparent counterexamples to NRC which defy an easy solution come from Chukchee and Yawelmani. They furnish cases where phono-constraints should apply in morpheme-internal input without regard to NRC, even though they have nothing to do with abstract segments, non-phonemic segments or 'idiosyncratic' morphemes. Obviously, the proper measure to take is not to make these constraints act in contravention of NRC. Hence, it will turn out to be necessary to impose the level condition OUTPUT on them that demands that they apply at the output level of representation. The result is that these OUTPUT constraints are not within the range of NRC which is inherently 'INPUT' by its very nature.

6.1.1 Chukchee

We will first examine the data coming from Chukchee, a language of Eastern Siberia (Krause 1979, Kenstowicz 1979, 1986). The following argument is based on what is presented in Kenstowicz (1994). Consider the following noun forms:

(74)	abs.sg.	abs.pl.	erg.	
	ceŋəl	cenle-t	cenle-te	'box'
	loŋəl	lonla-t	lonla-ta	'walrus fat'
	wiŋər	winri-t	winri-te	'hoe'

The language-internal evidence is claimed to justify underlying representations of roots like /ceŋle/, /loŋla/ and /wiŋri/, to whose morpheme-internal sequence ŋ*l* attention is to be paid. The following rules are also claimed to be motivated independently:

(75) a. Apocope: V → ∅ / ____ #
b. Epenthesis: ∅ → ə / C ____ C #
c. ŋ-Assimilation: ŋ is assimilated to the point of articulation of a following consonant.

The ergative suffix is exempted from Apocope (75a) and it is assumed to be blocked from applying when the final vowel is preceded by a cluster of coronal consonants.

Now we have the following illustrative derivations, where the rules are ordered extrinsically:

(76)	/ceŋle/	/ceŋle-ti/	/ceŋle-te/	
	ceŋl	ceŋle-t	_____	Apocope
	ceŋəl	_____	_____	Epenthesis
	____	cenle-t	cenle-te	ŋ-Assimilation
	[ceŋəl]	[cenle-t]	[cenle-te]	

It is to be noticed that ŋ-Assimilation applies in the morpheme-internal input. This evidently acts counter to NRC.[15]

Prior to making headway on the problem, the rules given in (75) are translated into the following OT constraint pairs, leaving ŋ-Assimilation as it is for convenience sake:

(77) a. Apocope: $*V]_{LEXWD}$ >> MAX-IO
b. Epenthesis: $*CC]_{LEXWD}$ >> DEP-IO

If the constraint ŋ-Assimilation were allowed to apply in the morpheme-internal input sequence ŋ*l* of roots such as /ceŋle/, /loŋla/ and /wiŋri/, we could not obtain the expected output forms because of NRC which re-ranks the constraint pair ŋ-Assimilation and its conflicting faithfulness constraint. After all, the best way conceivable is to constrain ŋ-Assimilation not to apply morpheme-internally at the level of input representations, freeing it of the control of NRC. In other words, it is to restrict its application to the output level, namely, to impose a condition on it that demands it apply at the output level. However, it may seem to be superfluous to impose the level condition OUTPUT on phono-constraints, since it is a matter of regular practice in OT that they apply at the output level. Nonetheless, it is indispensable to annotate the the level condition OUTPUT distinctly and explicitly to some phono-constraints, because NRC is founded on the assumption that phono-constraints may apply at the input level and, at any rate, the tripartite level conditions mentioned at the outset of this section are necessary, as will be clarified in the course of argument.

With the OUTPUT ŋ-Assimilation at our disposal, we can now draw up the following summary tableau:

(78) Summary Tableau for the /ceŋle/ Paradigm[16]

$*V]_{LEXWD}$ >> MAX-IO >> $*CC]_{LEXWD}$ >> DEP-IO; ŋ-Assimilation (OUT) >> IDENT-IO (-ant)

	$*V]_{LEXWD}$	MAX-IO	$*CC]_{LEXWD}$	DEP-IO	ŋ-Assim (OUT)	IDENT-IO (-ant)
a. /ceŋle/						
☞ ceŋəl		*		*		
cenəl		*		*		*!
cenl		*	*!			*!
ceŋl		*	*!		*!	
ceŋle	*!				*!	
b. /ceŋle-ti/						
☞ cenle-t		*				*
ceŋle-t		*			*!	
ceŋle-ti	*!				*!	
c. /ceŋle-te/						
☞ cenle-te						*
ceŋle-te					*!	

The constraint ŋ-Assimilation (OUT) derives the expected output forms without infringing NRC, because it is not permitted to refer to the input level by dint of its being OUTPUT.

6.1.2 Yawelmani

We return next to the constraint $*V{:}C]_{\sigma}$ in Yawelmani introduced in (2) and touched on in 4.1.1. This constraint is identical to Chukchee ŋ-Assimilation in that it should be constrained to apply at the output level. For the present purpose, another constraint pair is required. In Yawelmani, the vowel [V, +high] is epenthesized after the first consonant of the CCC cluster by *i*-Epenthesis also introduced in (2), for which

15 This remark can be pertinent on the assumption that ŋ-Assimilation is interpreted to be a constraint in OT.

16 Level conditions on constraints are left out of consideration unless they are relevant to the discussion.

the constraint pair $*CC]_\sigma$ >> DEP-IO ([V, +high]) is posited. Now consider the following data repeated from those given in (2):

(79) a. /ʔa:ml-hin/ → [ʔa:mil-hin]
b. /ʔa:ml-al/ → [ʔaml-al]

The whole picture is given by the following summary tableau where the constraint $*V{:}C]_\sigma$, which is constrained to apply at the output level, participates:

(80) *V:C]$_\sigma$ (OUT) >> IDENT-IO (+long); *CC]$_\sigma$ >> DEP-IO ([V, +high])

	*V:C]$_\sigma$ (OUT)	IDENT-IO (+long)	*CC]$_\sigma$	DEP-IO ([V, +high])
a. /ʔa:ml-hin/				
☞ ʔa:mil-hin				*
ʔamil-hin		*!		*
b. /ʔa:ml-al/				
☞ ʔaml-al		*		
ʔa:ml-al	*!			

If the constraint *V:C]$_\sigma$ were left to apply morpheme-internally at the input level, we could not get the expected output forms; worse still, it would infringe NRC.

6.2 The Level Condition INPUT

As has been seen in their invocation to re-rank phono-constraints, NRC and P-NRC are based on the assumption that phono-constraints are applicable at the input level. Inevitably, faithfulness constraints in general refer to that level, too. And as was discussed in 3.1, the reference to the input stem is essential in deriving the Klamath example *mbo-mpditk* and the English example *a[k-sē]d*. Likewise, it will be demonstrated that it is also necessary to impose the level condition INPUT on phono-constraints, in addition to the level condition OUTPUT established above.

6.2.1 Tangale

As a preliminary step to confirm whether the level condition INPUT is necessary, let us consider the data from Tangale, a Chadic language of Nigeria (Kidda 1985), which are presented in Kenstowicz (1994). (The suffix *nó* marks the 1sg. possessive.)

(81) a. /bugat-nó/ → [bugad-nó] ‘window’ /tugat-nó/ → [tugad-nó] ‘berry’
/aduk-nó/ → [adug-nó] ‘load’ /kúluk-nó/ → [kúlug-nó] ‘harp’
b. /lútu-nó/ → (lút-nó →) [lút-nó] (*[lúd-nó]) ‘bag’

As observed, an obstruent becomes voiced before a sonorant consonant only if the condition is met in the underlying representation. Hence, this leads us to depend on the imposition of a level condition on the constraint responsible for Regressive Voicing so that it may apply at the input level.

In derivational terms, Tangale has the following extrinsically-ordered rules:

(82) a. Regressive Voicing: [-son] → [+voiced] / ____] [+cons, +son]
b. Elision: V → ∅ / ____] X

Elision elides the stem-final vowel when some phonological material follows. The output form *lút-nó* in (81b) is derived by this rule. Converting the operational rules in (82) to the OT constraints, we have the constraints *[-son, -voice] [+cons, +son] (Regressive Voicing) which should be INPUT and *V] X (Elision). Supplied with an INPUT constraint, we are now in a position to find a solution to the opacity problem. This is illustrated in the following summary tableau:

(83) *[-son, -voice] [+cons, +son] (IN) >> IDENT-IO (-voice); *V] X >> MAX-IO

	*[-son, -voice] [+cons, +son] (IN)	IDENT-IO (-voice)	*V] X	MAX-IO
a. /bugat-nó/				
☞ bugad-nó		*		
bugat-nó	*!			
b. /lútu-nó/				
☞ lút-nó				*
lúd-nó		*!		*

The constraint *[-son, -voice] [+cons, +son] (IN) applies at the input level in (a), but its SD is not met at the input level in (b). Furthermore, it is assumed that <u>in case an output form whose input violates an INPUT phono-constraint still violates it at the output level, then that output form is reckoned as violating it</u>. This is why **bugat-nó* in (a) violates the INPUT constraint. Finally, it must be added that the morpheme-internal input sequence *tl* of *pítlá* 'ant' is exempted from the INPUT constraint due to NRC.

6.2.2 Korean

For another case in which an INPUT constraint participates, consider the following Korean examples (Lee 1976):

(84) a. /na-ɨni/ → [na-ni] na 'sprout' b. /nah-ɨni/ → [na-ɨni] (*[na-ni]) nah 'bear'
/po-ɨni/ → [po-ni] po 'see' /čoh-ɨni/ → [čo-ɨni] (*[čo-ni]) čoh 'good'

The constraint pair *Vɨ (mirror image) >> MAX-IO (ɨ) deletes ɨ in (a) as expected, but the opaque sequences are observed in (b). To leave the opaque output forms in (b) intact, the constraint *Vɨ (mirror image) should be INPUT. The following summary tableau certifies this straightforwardly. (For the intervocalic deletion of *h*, the constraint pair *VhV >> MAX-IO (h) is required.)

(85) *Vɨ (IN) >> MAX-IO (ɨ); *VhV >> MAX-IO (h)

	*Vɨ (IN)	MAX-IO (ɨ)	*VhV	MAX-IO (h)
a. /na-ɨni/				
☞ na-ni		*		
na-ɨni	*!			
b. /nah-ɨni/				
☞ na-ɨni				*
na-ni		*!		*

6.2.3 Serbo-Croatian

As a comprehensive example of the INPUT phono-constraints, we will consider a case which comes from the South Slavic language Serbo-Croatian. This apparently intricate case may seem to strike a decisive blow against OT which adheres to the non-serial generation. The following discussion is based on what is presented in Kenstowicz (1994: 90-94).

Consider first the following adjectival paradigms:

(86)

masc.	fem.	neut.	pl.	
mlád	mlad-á	mlad-ó	mlad-í	'young'
púst	pust-á	pust-ó	pust-í	'empty'
zelén	zelen-á	zelen-ó	zelen-í	'green'
čést	čest-á	čest-ó	čest-í	'frequent'

In this class of stems the stress falls on the last syllable of the word as shown above. (This abstracts away from the stress retraction in the standard dialect.) The stress is assigned by the following rule:

(87) Accent: V → v́ / ____ C_o #

Secondly, for the alternation between *l* and *o* observed in the stems given in (88a), which is motivated by considerations internal to the grammar of Serbo-Croatian, the *l*-vocalization rule (88b) is postulated:

(88) a.

masc.	fem.	neut.	pl.	
/debel/ → [debéo]	debel-á	debel-ó	debel-í	'fat'
/bel/ → [béo]	bel-á	bel-ó	bel-í	'white'
/mil/ → [mío]	mil-á	mil-ó	mil-í	'dear'

b. *l*-vocalization: l → o / ____ #

As shown in the following derivation, *o* derived by *l* must be skipped by Accent (87), which is made possible by means of extrinsic rule-ordering:

(89) /bel/
bél Accent (87)
béo *l*-vocalization (88b)
[béo]

Thirdly, for the ∅ ~ *a* alternation exemplified in the data given in (90a), the epenthesis rule (90b) which breaks up the obstruent-sonorant consonant cluster is required, and derivations like /dobr/ → [dóbar] illustrated in (90c) are brought about by the extrinsically-ordered rules, Accent (87) and Epenthesis (90b):

(90) a.

masc.	fem.	neut.	pl.	
/dobr/ → [dóbar]	dobr-á	dobr-ó	dobr-í	'good'
/jasn/ → [jásan]	jasn-á	jasn-ó	jasn-í	'clear'
/sitn/ → [sítan]	sitn-á	sitn-ó	sitn-í	'tiny'

b. Epenthesis: ∅ → a / C ____ [C, +son] #

c. /dobr/
dóbr Accent (87)
dóbar Epenthesis (90b)
[dóbar]

In the last place, the data given in (91a) provide evidence that the three rules discussed so far should be ordered extrinsically in derivational terms. The representative derivation in (91b), where all of these rules take part, summarizes the results of the above analyses:

(91) a.

masc.	fem.	neut.	pl.	
/okrugl/ → [okrúgao]	okrugl-á	okrugl-ó	okrugl-í	'round'
/obl/ → [óbao]	obl-á	obl-ó	obl-í	'plump'
/nagl/ → [nágao]	nagl-á	nagl-ó	nagl-í	'abrupt'

b. /okrugl/
okrúgl Accent (87)
okrúgal Epenthesis (90b)
okrúgao *l*-vocalization (88b)
[okrúgao]

With these analyses as background, we can now transform the operational rules into the OT constraints, two of which should have the level condition INPUT:

(92) Rules | Constraints

a. Accent (87): V → v́ / ____ C_o # | STRESS: Stress the word-final syllable (IN)

b. Epenthesis (90b): ∅ → a / C ____ [C, +son] # | $*C[C, +son]]_{LEXWD}$ (IN)

c. *l*-vocalization (88b): l → o / ____ # | $*l]_{LEXWD}$

With these INPUT constraints at our disposal, we can have the following tableau at long last:

(93) $*l]_{LEXWD}$ >> $*C[C, +son]]_{LEXWD}$ (IN) >> DEP-IO; STRESS (IN)

/okru$_1$g$_2$l$_3$/	$*l]_{LEXWD}$	$*C[C, +son]]_{LEXWD}$ (IN)	DEP-IO	STRESS (IN)
☞ okrú$_1$g$_2$ao$_3$			*	
okru$_1$g$_2$áo$_3$			*	*!
okru$_1$g$_2$aó$_3$			*	*!
okrú$_1$g$_2$o$_3$		*!		
okru$_1$g$_2$ó$_3$		*!		*!
okrú$_1$g$_2$al$_3$	*!		*	
okru$_1$g$_2$ál$_3$	*!		*	*!
okrú$_1$g$_2$l$_3$	*!	*		

STRESS should be INPUT; otherwise, the stressed word-final vowel of the input representation /okrugl/ would not be ensured. And the constraint $*C[C, +son]]_{LEXWD}$ should also be INPUT; otherwise, the word-final *o* derived from *l* would destroy the structure to which it can apply. This clearly demonstrates that the level condition INPUT to be imposed upon phono-constraints is of absolute necessity.

6.3 The Level Condition OUTPUT Again

6.3.1 Karok

We will return to the level condition OUTPUT. Differently from that discussed in relation to Chukchee and Yawelmani data that concern morpheme-internal representations, the level condition OUTPUT involved in the following data from Karok, an American Indian language (Bright 1957), concerns the phono-constraints that apply across morphemes. In the former case, the level condition OUTPUT was seen to be necessary, in particular, because of NRC. In the present case, NRC is not involved and so phono-constraints that are 'OUTPUT' as a matter of usual practice may seem to be sufficient. However, it is indispensable to stipulate the level condition OUTPUT even in this case, now that the level condition INPUT has been established and therefore it is necessary to differentiate between the two conditions.

The following argument is based on what is presented in Kenstowicz (1994). Consider the following Karok data:

(94) 1sg. | 3sg

a. /ni-si:tva/ → [ni-ši:tva] | /ʔu-si:tva/ → [ʔu-si:tva] | 'steal'

/ni-suprih/ → [ni-šuprih] | /ʔu-suprih/ → [ʔu-suprih] | 'measure'

b. <u>/ni-uksup/ → [ni-kšup] (*[ni-ksup])</u> | /ʔu-uksup/ → [ʔu-ksup] | 'point'

/ni-iskak/ → [ni-škak] | <u>/ʔu-iskak/ → [ʔu-skak] (*[ʔu-škak])</u> | 'jump'

The alternation between *s* and š is accounted for by Palatalization (95b). First of all, however, attention is to be paid to the underlined derivations above. Evidently, they show that Palatalization should apply at the output level. In derivational terms, the following two extrinsically-ordered rules are needed:

(95) a. Truncation : V → ∅ / V ______
b. Palatalization: s → š / i (C) ______

These rules are transformed into the constraint pairs *VV >> MAX-IO and *i(C)s >> IDENT-IO (+ant). Now compare the following summary tableaux (a), where the constraint *i(C)s is characterized as OUTPUT, and (b), where it is characterized as INPUT:

(96) a. *VV >> MAX-IO; *i(C)s (OUT) >> IDENT-IO (+ant)

	*VV	MAX-IO	*i(C)s (OUT)	IDENT-IO (+ant)
/ʔu-iskak/ → ☞ [ʔu-skak]		*		
/ni-uksup/ → ☞ [ni-kšup]		*		*

b. *VV >> MAX-IO; *i(C)s (IN) >> IDENT-IO (+ant)

	*VV	MAX-IO	*i(C)s (IN)	IDENT-IO (+ant)
/ʔu-iskak/ → *[ʔu-škak]		*		*
/ni-uksup/ → *[ni-ksup]		*		

The comparison demonstrates that on the constraint *i(C)s the condition OUTPUT should be imposed; if it were INPUT, there would be no way to prevent derivations like those given in (b) above on the assumption that the segment š that it generates is non-phonemic.

6.3.2 Dialectal Difference — Canadian English Dialects

In derivational phonology, an aspect of dialectal difference is explained in terms of the re-ordering of the same rules which apply to the same underlying representation. Canadian English dialects (Joos 1942, Chomsky & Halle 1968, Kenstowicz 1994) provide us with a proper example. These dialects have a raising rule which raises the low vowel nucleus of the diphthongs *ay* and *aw* before a voiceless consonant and Voicing Neutralization which changes the intervocalic *t* to *d*. Now compare the following derivations, where the same two rules ordered differently in two dialects apply to the same input representations:

(97) Dialect A

/rayt/ ‘write’	/rayt-ər/ ‘writer’	
rʌyt	rʌyt-ər	Raising
___	rʌyd- ər	Voicing Neutralization
[rʌyt]	[rʌyd-ər]	

Dialect B

/rayt/	/rayt-ər/	
___	rayd-ər	Voicing Neutralization
rʌyt	_____	Raising
[rʌyt]	[rayd-ər]	

The two dialects are distinguished from each other simply by the different ordering of the same two rules.
The rules involved may be converted to the following constraint pairs:

(98) Raising: *ay [-voice] >> IDENT-IO (+low)
Voicing Neutralization: *VtV >> IDENT-IO (-voice)

Compare now the tableau for Dialect A, where the constraint *ay [-voice] which produces non-phonemic segments should be INPUT, and the tableau for Dialect B, where it should be OUTPUT:

(99) Dialect A

*ay [-voice] (IN) >> IDENT-IO (+low); *VtV >> IDENT-IO (-voice)

	*ay [-voice] (IN)	IDENT-IO (+low)	*VtV	IDENT-IO (-voice)
a. /rayt/				
☞ rʌyt		*		
rayt	*!			
b. /rayt-ər/				
☞ rʌyd-ər		*		*
rayd-ər	*!			*

Dialect B

*ay[-voice] (OUT) >> IDENT-IO (+low); *VtV >> IDENT-IO (-voice)

	*ay[-voice] (OUT)	IDENT-IO (+low)	*VtV	IDENT-IO (-voice)
a. /rayt/				
☞ rʌyt		*		
rayt	*!			
b. /rayt-ər/				
☞ rayd-ər				*
rʌyd-ə r		*!		*

As observed, in OT terms, the dialectal difference is explained by the difference of the level conditions, INPUT and OUTPUT, imposed on one and the same phono-constraint which applies to the same input.

According to Chambers (1973), dialect B has disappeared, whereas "dialect A is ubiquitous throughout heartland Canada." Kenstowicz (1994) thus remarks that the opaque rule interaction has "nothing particularly unnatural or unstable." This remark may be reinterpreted in OT terms to mean that the change of the condition OUTPUT to the condition INPUT has "nothing particularly unnatural or unstable." This in turn suggests that the condition INPUT imposed on constraints are not particularly unnatural or unstable.

6.4 The Level Condition INDIFFERENT

In this subsection, we will examine whether the level condition INDIFFERENT, which includes the conditions OUTPUT and INPUT, is necessary, in addition to the conditions OUTPUT and INPUT.

6.4.1 Finnish

To see if the level condition INDIFFERENT is necessary, let us first return to the Finnish data discussed in section 2. To prevent derivations like **kosi* from /koti/ the constraint *ti should be INPUT; otherwise, there would be no way to invoke NRC to prevent it from applying in the morpheme-internal input. On the other hand, we must not neglect derivations like /vete/ → [vesi]. Now compare the following tableaux (a), where *ti is OUTPUT, and (b), where it is INPUT:

(100) a. *ti (OUT) >> IDENT-IO (-cont); $*e]_{LEXWD}$ >> IDENT-IO (-high)

/vete/	*ti (OUT)	IDENT-IO (-cont)	$*e]_{LEXWD}$	IDENT-IO (-high)
☞ vesi		*		*
veti	*!			*

b. *ti (IN) >> IDENT-IO (-cont); $*e]_{LEXWD}$ >> IDENT-IO (-high)

/vete/	*ti (IN)	IDENT-IO (-cont)	$*e]_{LEXWD}$	IDENT-IO (-high)
(?) veti				*
vesi		*!		*

In (b), the incorrect output form **veti* is evaluated as optimal by virtue of the constraint *ti being INPUT, while in (a), the expected output form *vesi* is evaluated as optimal due to it being OUTPUT. Given that *ti should be INPUT for derivations like /koti/ → [koti] but that it should be OUTPUT for those like /vete/ → [vesi], we are obliged to accept the fact that the condition INDIFFERENT, which should be imposed on the constraint *ti, is necessary. Furthermore, unlike the conditions INPUT and OUTPUT, it is not necessary to annotate the condition INDIFFERENT explicitly, it being default.[17]

6.4.2 Yawelmani

We will next discuss examples from Yawelmani. In the previous discussion, ALIGN-R (36a) was tacitly assumed to be INPUT as a matter of course. The comparison between the tableaux (a) and (b) below will certify that this is the case:

(101) a. ALIGN-R (36a) (IN) >> *[V:, +high] >> IDENT-IO (+high)

/ʔu:t-it/	ALIGN-R (36a) (IN)	*[V:, +high]	IDENT-IO (+high)
☞ ʔo:t-ut			*
ʔu:t-ut		*!	
ʔo:t-it	*!		

b. ALIGN-R (36a) (OUT) >> *[V:,+high] >> IDENT-IO (+high)

/ʔu:t-it/	ALIGN-R (36a) (OUT)	*[V:,+high]	IDENT-IO (+high)
(?) ʔo:t-it			*
(?) ʔo:t-ut			*
ʔu:t-ut		*!	

The hypothetical OUTPUT ALIGN-R (36a) is ineffective in choosing between **ʔo:t-it* and *ʔo:t-ut* in (b) above.

Consider further the following tableau where INPUT ALIGN-R (36a) is involved:

(102) ALIGN-R (36a) (IN) >> *CC]$_\sigma$ >> DEP-IO ([V,+high])

/ʔugn-hin/	ALIGN-R (36a) (IN)	CC]$_\sigma$	DEP-IO ([V,+high])
ʔugin-hun			*
ʔugun-hun			*

ʔugn 'drink'

It is to be noticed that ALIGN-R (36a), which should be INPUT with respect to forms like that in (101), affords us no means to choose between the two outputs above. Consider thus the following tableau in which INDIFFERENT ALIGN-R (36a) participates:

(103) ALIGN-R (36a) (IND) >> *CC]$_\sigma$ >> DEP-IO ([V, +high])

/ʔugn-hin/	ALIGN-R (36a) (IND) V$_1$	V$_2$	*CC]$_\sigma$	DEP-IO ([V, +high])
☞ a. ʔugu$_1$n-hu$_2$n				*
b. ʔugi$_1$n-hu$_2$n	*!			*

V$_1$ and V$_2$ of the form (a) satisfy the OUTPUT part of ALIGN-R (36a) and its INPUT part respectively, but V$_1$ of the form (b) violates its OUTPUT part. This clearly demonstrates that ALIGN-R (36a) should be INDIFFERENT.

17 However, the level condition INDIFFERENT will be annotated explicitly in order to distinguish the INDIFFERENT constraints from those whose conditions are not fixed definitely.

As a conclusive example, consider the following tableau, where the three level conditions on constraints are all mobilized:

(104) ALIGN-R (36a) (IND)>>{*V:C]$_\sigma$ (OUT) >> IDENT-IO (+long); *[V:,+high] (IN) >> IDENT-IO (+high)}

/sud [V:,+high]k-hin/	ALIGN-R (36a) (IND)	*V:C]$_\sigma$ (OUT)	IDENT-IO (+long)	*[V:,+high] (IN)	IDENT-IO (+high)
☞ a. sudok-hun			*		*
b. suduk-hun			*	*!	
c. sudok-hin	*!		*		*

The incorrect output form **sudok-hin* (c) is abandoned by the INPUT part of the INDIFFERENT ALIGN-R (36a) albeit it does not violate its OUTPUT part. In 6.1.2, it was already proven that *V:C]$_\sigma$ is OUTPUT. And the INPUT constraint *[V:, +high] guarantees the lowering of the input long high vowel.[18] If it were categorized as OUTPUT, the incorrect output form **suduk-hun* (b) could not be discarded.

6.5 Decomposed Level Conditions

Besides the level conditions imposed on constraints as a whole, it may be conceivable that additionally we posit the decomposed level conditions OUTPUT and INPUT to be imposed on the individual triggering or target segment of a constraint. In a way, this is similar to McCarthy's (1994) proposal of the decomposition of phonological constraints and their level conditions.

Additional decomposed conditions OUTPUT and INPUT on the individual triggering segment of an OUTPUT constraint are tautological and contradictory, respectively. The same is true of an INPUT constraint, *mutatis mutandis*. And the same thing may be said of the target segment of a constraint. It follows from this that an INDIFFERENT constraint can have neither the decomposed condition OUTPUT nor INPUT by dint of its intrinsic inclusion of the level conditions OUTPUT and INPUT.

6.5.1 Icelandic *u*-Umlaut

Nonetheless, there seems to be a case which defies the analysis based on our theory of level conditions, which denies the decomposed level conditions. It is the classic Icelandic *u*-Umlaut phenomenon presented in McCarthy (1994). Consider the following data (see also Anderson 1969, 1974; Orešnik 1977, Kiparsky 1993):

(105) a. Simple Case (Anderson 1974: 141)
/barn-üm/ → [börnüm] 'child (dat.)' cf. barn 'child'
b. Deleted *ü* as Trigger (Anderson 1974: 143)
/bagg-ül-i/ → [böggli] 'parcel (dat. sg.)' cf. baggi/böggüll 'pack/parcel'
c. Derived Adjacency (Anderson 1974: 142-143)
/katill-üm/ → [kötlüm] 'kettle (dat. pl.)' cf. ketill/katli 'kettle/(dat. sg.)'
cf. /akkerüm/ → [akkerüm] 'anchor (dat.pl.)'
d. Interaction with Vowel Reduction — Simple Case (Anderson 1974: 186)
/dómar-üm/ → [dómürüm] 'judge (dat. pl.)' cf. domari 'judge'
e. Interaction with Vowel Reduction — "Iteration" (Anderson 1974: 186, 1972: 16)
/bakar-üm/ → [bökürüm] 'baker (dat. pl.)' cf. bakari 'baker'
f. Epenthetic *ü* Not a Trigger (Anderson 1974: 192f.)
/akr/ → [akür] 'field' cf. akri/ökrüm 'field (dat.sg.) /(dat. pl.)'
/aldr/ → [aldür] 'age' cf. aldri/öldrüm 'age (dat. sg.) / (dat. pl.)'

By UMLAUT, *a* is realized as *ö* when followed by *ü* with C_o intervening. And the umlauted *ö* is reduced to *ü* in unstressed syllable. (In Icelandic, the initial syllable bears stress.) However, it must be noticed that the

[18] The constraints that affect abstract segments are inherently INPUT.

underlying *ü* in forms in (a-e) triggers umlaut but the epenthetic *ü* in forms in (f) doesn't. Forms in (a-e) are accounted for by the constraint *aC$_o$ü (IND), but forms in (f) present a knotty problem. McCarthy formulates UMLAUT in a decomposed version, in accordance with his stipulation mentioned at the beginning of this section. His decomposed constraint UMLAUT can be restated as in the following:

(106) UMLAUT: Any structure matching the following conditions violates Umlaut:

Conditions		Levels
a. Target:	*a*	OUTPUT
b. Trigger:	*ü*	INDIFFERENT
c. Linear Order:	*a* > *ü*	INPUT
d. Adjacency:	*a* to *ü*	INDIFFERENT

As the target *a* is always present in both OUTPUT and INPUT representations, its level condition can be changed to INDIFFERENT and the linear order condition INPUT can also be changed to a_{IND} > $ü_{IN}$. And the trigger condition *ü* can be changed to INPUT so that the epenthetic *ü* may not function as a trigger. In consequence, every condition is INDIFFERENT to the exclusion of INPUT *ü*. Hence, in terms of our theory of level conditions, UMLAUT is simply *aC$_o$$ü_{IN}$(IND). Our theory of level conditions, however, says that there are no constraints like *aC$_o$$ü_{IN}$ (IND), as the decomposed level condition INPUT imposed on the trigger *ü* and the level condition INDIFFERENT imposed on the constraint as a whole are mutually exclusive or tautological at best.

Nevertheless, consider, for the sake of argument, the following tableau taken from McCarthy to see how UMLAUT applies to the complex 'iteration' case (105e):

(107) Tableau for /bakar-üm/ → [bökürüm][19]

UMLAUT >> IDENT (-high), IDENT (+back), IDENT (+low), IDENT (-round)

/bakar-üm/	*[+back, -low]	*[-stress, -high, -low]	UMLAUT	IDENT (-high)	IDENT (+back)	IDENT (+low)	IDENT (-round)
☞ bökürüm				*	**	**	**
bükürüm				**!	**	**	**
bakarüm			*!				
bakürüm			*!	*	*	*	*
bakörüm		*!			*	*	*
bokurüm	*!*			*		**	**

On the assumption of the multiply-linked single *a* in the underlying structure /bakar-üm/, the underlying *ü* causes this single *a* to change to *ö* and the umlauted *ö* in the unstressed syllable reduces to *ü*. Significantly, it must not pass unnoticed that, if the derived *ü* in the unstressed syllable should itself function as a trigger of UMLAUT, it does not satisfy the decomposed condition $ü_{IN}$. This fact will have a bearing on what will be argued immediately below.

At this point, it may not be of no avail to recall MORPHINTEG (61) repeated below:

(108) MORPHINTEG

The morpheme-internally satisfiable phono-constraint is ranked after its conflicting faithfulness constraint
iff faithfulness constraints are violable in every segment of a morpheme.

Let us consider, for example, the hypothetical umlauted surface form **ökür* of /akr/ (105f). The umlauted *ö* violates IDENT-IO (+back), IDENT-IO (-round) and IDENT-IO (+low). The epenthetic *ü* violates DEP-IO (ü)

[19] Constraint rankings for Icelandic vowel system are as follows:
(ii) a. *[+back, -low] >> IDENT (+back) (cf. Anderson 1972: (24))
b. *[-stress, -high, -low] >> IDENT (-high) (cf. Anderson 1972: (11))

and the sequence *kür* violates LINEARITY. Moreover, UMLAUT applies in morpheme-internal sequence. In comparison, for example, the surface root *kötl* of /katill/ in the derivation /katill-üm/ → [kötlüm] (105c) violates faithfulness constraints more seriously, but no constraint is applicable in its morpheme-internal sequence. And as for the derivation /bakar-üm/ → [bökürüm] (105e), there is no constraint applicable in morpheme-internal sequence, either, on the assumption that UMLAUT applies to the multiply-linked single *a*.

According to Orešnik (1972; see also Kenstowicz 1994), *ü* in *dag-ür* and *hest-ür* is inserted by the rule given in (109a), and the underlying representation of the nom. sg. suffix in this declension class is *r*:

(109) a. ∅ → ü / C ___ r #

b.

nom. sg.	dag-ür	hest-ür	bæ-r
acc. sg.	dag	hest	bæ
	'day'	'horse'	'farmhouse'

In the representations in (b) above, the inserted *ü* is included in the suffix *r*, but it is worth noticing that in forms like *akür* derived from /akr/ the epenthetic *ü* has no place to go but to the 'prosodic' root. Just as the epenthetic *ü* in *akür* is included in the 'prosodic' root, so the epenthetic *ü* in the representations of nom. sg. in (109b) above, it is assumed, is included in the 'prosodic' root. To reiterate, the surface representation of the nom. sg. form of *dag* is assumed to be $[[\text{dagü}]_{PRRT}\ \text{r}]_{SFX}\ ]_{PRWD}$, which is consistent with the representation $[[\text{akür}]_{PRRT}]_{PRWD.}$ In consequence, if UMLAUT were to apply in nom. sg. forms like *dagü-r*, it would apply in the prosodic-root-internal representations, namely, in the morpheme-internal representations. In addition, the hypothetical umlauted output form **dögü-r* would then violate the three IDENT-IO constraints and DEP-IO. It would also violate LINEARITY, since the root-final *g* would be followed by the epenthetic *ü* root-internally.

We are now capable of adjusting MORPHINTEG (108) in a way applicable to this Icelandic case:

(110) MORPHINTEG

The morpheme-internally satisfiable phono-constraint is ranked after its conflicting faithfulness constraint iff faithfulness constraints are violable to an extreme degree in a morpheme.

Consequently, the constraint *aC_oü (IND) which does not utilize the decomposed level condition accounts for the umlaut phenomenon shown in (105), since it does not affect the forms in (105f) in pursuance of MORPHINTEG (110), not to speak of forms like *dagü-r*. Besides, in the tableau (107), the constraint UMLAUT is replaced with *aC_oü (IND), along with the assumption of the multiply-linked single *a* in the underlying structure /bakar-üm/ (for an alternative in Cognitive Phonology, see Lakoff 1993).

6.5.2 Tiberian Hebrew Spirantization

Hypothesizing several variations on the basis of the real example of Tiberian Hebrew spirantization, we will examine further the issue of the decomposed level conditions to see if they are viable within our theory of level conditions. Consider first the following data cited from McCarthy (1994) for Tiberian Hebrew post-vocalic consonant spirantization, which produces non-phonemic segments. For example, *k* is realized as *x* after a vowel:

(111) Spirantization in Tiberian Hebrew (see also Prince 1975; Malone 1993 and refs. cited there)

a. After a vowel
/malakīm/ → [məlāxīm] 'kings'

b. After an epenthetic vowel:
/malk/ → [melex] 'king'

c. After a deleted vowel
/malakē/ → [malxē] 'kings of'

In (a) the triggering vowel is present both underlyingly and at the surface, in (b) it is present only at the surface since it is epenthetic, and in (c) it is present only underlyingly since it is deleted. This spirantization phenomenon is accounted for straightforwardly by the INDIFFERENT spirantization constraint without recourse to any decomposed level condition (for an alternative in Containment Theory in OT, see Smolensky 1995).

As a hypothetical variation on Tiberian Hebrew spirantization pattern, McCarthy supposes a language where only underlying vowel, regardless of whether it is deleted or not, triggers spirantization. This would yield /malakīm/ → [məlāxīm] and /malakē/ → [malxē], but /malk/ → [melek]. For this pattern of spirantization, the level condition INPUT is imposed on the spirantization constraint as a whole..

Let us next consider McCarthy's another hypothetical variation on Tiberian Hebrew spirantization pattern. In this hypothetical language, spirantization is supposed to be observed only after the vowel present in both underlying and surface representations:

(112) /malakīm/ → [məlāxīm]
/malk/ → [melek]
/malakē/ → [malkē]

Our theory of the level conditions which recognizes no decomposed level conditions claims that this hypothetical Tiberian Hebrew is an impossible language.

Let us suppose still another hypothetical Tiberian Hebrew spirantization pattern. In this hypothetical language, spirantization is supposed to be observed only after an epenthetic vowel:

(113) /malakīm/ → [məlākīm]
/malk/ → [melex]
/malakē/ → [malkē]

Again, there is no way for the theory proposed here to account for this spirantization phenomenon which should take advantage of a decomposed level condition, thus predicting that this hypothetical language is also nonexistent.

Lastly, suppose a hypothetical Tiberian Hebrew in which spirantization is operative only after a vowel that is present underlyingly but not present in surface:

(114) a. /malakīm/ → [məlākīm]
b. /malk/ → [melek]
c. /malakē/ → [malxē]

This spirantization phenomenon which should exploit a decoupled level condition is unimaginable too in the theory proposed here.

So far we have seen that our theory of level conditions predicts that any of the logically possible decomposed level conditions imposed on the individual triggering segment of a phono-constraint is untenable.

6.6 Stress Assignment and the Level Conditions

We may recall that the stress rule in Serbo-Croatian discussed in 6.2.3 is INPUT. Here we will further explore the possibility of imposing the level conditions on the constraints responsible for assigning stress by reinterpreting a framework for describing stress-epenthetic interaction provided by Alderete (1995).

6.6.1 The Constraint HEAD (PCat)-DEP in Stress Assignment

Alderete accounts for the possible inactivity of epenthetic vowels in word stress by positing the constraint HEAD (PCat)-DEP (115), which is intended to furnish a means of relating the inactivity of epenthetic vowels in word stress with the failure of stressed vowels to undergo vowel reduction:

(115) HEAD (PCat)-DEP
Every segment contained in a prosodic head PCat in Output has a correspondent in Input.

If PCat is a prosodic head in Output, and PCat contains β, then β∈Range (ℜ).

Let us begin with the Dakota data (Shaw 1976, 1985). (The underlined vowels are epenthetic.)

(116) a. č[h]i-kté 'I kill you'
ma-yá-kte 'you kill me'
wič[h]á-ya-kte 'you kill them'
o-wíč[h]a-ya-kte 'you kill them there'
(cf. kté 'he/she, it kills')

b. /ček/ → čéka̲ 'stagger'
/khuš/ → khúža̲ 'lazy'
/čap/→ čápa̲ 'trot'

Stress regularly falls on the second syllable from the beginning of the word as shown in (a), but epenthetic vowels are not counted in determining the stress as shown in (b). As is exemplified in the following tableau, the dominant HEAD (σ)-DEP makes epenthetic vowels invisible in assigning stress:

(117) Avoiding of Stress in Epenthetic Vowel in Dakota: HEAD (σ)-DEP >> STRESS

/ček/	HEAD (σ)-DEP	STRESS
☞ čéka̲		*
čeká̲	a̲!	

In contrast, in Swahili, stress falls on the penultimate syllable irrespective of whether "a prosodic head PCat in Output" has an epenthetic vowel or not (Ashton 1944, Polomé 1967, Broselow 1982):

(118) a. jíko 'kitchen'
jikóni 'in the kitchen'

nilimpíga 'I hit him"
nitakupíga 'I shall hit him'

b. tíket ~ tikéti̲ 'ticket'
rátli ~ ratíli̲ 'pound'

Stress is assigned by reversing the constraint ranking employed in Dakota; STRESS is dominant, making HEAD-DEP ineffective:

(119) Metrical Activity of Epenthesis in Swahili: STRESS >> HEAD-DEP

/ratli/	STRESS	HEAD-DEP
☞ ratí̲li		*
ráti̲li	*!	

Lastly, in Selayarese, canonically stress falls on the penultimate syllable but the syllable-final epenthetic vowels are 'extrametrical,' as shown in (120a) and (120b) respectively. It is to be taken notice of, however, that in (120c) the penultimate epenthetic vowels are not exempted from the regular stress assignment (Mithun and Basri 1985):

(120) a. Canonical Penultimate Stress
állo 'day'
allónni 'this day'
pá:o 'mango'
paó:ku 'my mango'
já:ma 'work'
ri lassipañjamaʔámba 'when we were about to work for each other

b. Irregular Antepenultimate Stress
ká:tala̲ 'itch'
pó:tolo̲ 'pencil'
maNkássara̲ 'Macassar'
lámbere̲ 'long'
tú:lisi̲ 'write'
tú:lusu̲ 'go straight'

c. Penultimate Stress
sahalá̲kku 'my profit'
sahalá̲ʔmu 'your (fam.) profit'
sahalá̲tta 'your/our profit'
cf. sá:hala̲ 'profit'

For Selayarese stress assignment, the following two constraints are required besides HEAD (PCat)-DEP:

(121) a. ALIGN-R
Align (FT, R, PRWD, R)
"The right edge of all feet must coincide with the right edge of some prosodic word."
b. END RULE RIGHT (see Prince 1983)
The stress foot is the final foot in the prosodic word.

Now the Selayarese stress assignment is accomplished as in the following summary tableau. (Braces delimit stress foot and parentheses delimit foot.)

(122) Summary Tableau for Selayarese Stress: END RULE RIGHT >> HEAD (F)-DEP >> ALIGN-R (121a)

	END RULE RIGHT	HEAD (F)-DEP	ALIGN-R (121a)
a. /sahal-ku/			
☞ (saha){(lákku)}		*	
sa{(há:lak)}ku		*	ku!
{(sá:ha)}(laku)	*!		
b. /sahal/			
☞ {(sá:ha)}la			la
sa{(há:la)}		a!	

It has been seen so far that the ranking of the constraint HEAD (PCat)-DEP in the hierarchy plays a crucial part in determining whether or not to count epenthetic vowels in assigning stress in these languages. Boiled down, the constraint HEAD (PCat)-DEP simply comes to the requirement that in applying a constraint to output forms it refer to input to confirm that the segment that meets its SD is contained in input. To be concrete, when it precedes the constraint responsible for stress as in Dakota and Selayarese, its level condition is INPUT, whereas, when the ranking is transposed as in Swahili, it is OUTPUT.

6.6.2 Level Conditions on Stress Assignment

The categories LEXWD and PRWD that may be employed in stating the constraints responsible for stress assignment inherently denote the level conditions INPUT and OUTPUT respectively. In case these categories cannot be taken advantage of, the usual level conditions take their place. Thus, falling back upon the ordinary level conditions and the categories LEXWD and PRWD as the case may be, we are now able to reinterpret the framework relying on the constraint HEAD (PCat)-DEP (115) in assigning stress.

First, for Dakota stress, FTBIN (Prince 1980, McCarthy & Prince 1991, McCarthy & Prince 1993a) and the alignment constraint (123) are required besides HEAD (σ)-DEP, which may be replaced by the constraint σ́ (IN) which demands that the syllable to be stressed be present in the input representation.

(123) ALIGN-L (= ALL-FT-LEFT; McCarthy & Prince 1994)
Align (FT, L, PRWD, L)
"The left edge of all feet must coincide with the left edge of some prosodic word."

The Dakota stress assignment is now illustrated by the following summary tableau:

(124) Summary Tableau for Dakota Stress: ALIGN-L, σ́ (IN) >> FTBIN

	ALIGN-L	σ́ (IN)	FTBIN
a. /ček/			
☞ (čék)a			*
(čeká)		*!	
b. /ma-ya-kte/			

☞ (ma-yá-k)te			
ma-(ya-kté)	*!		

Secondly, for Swahili stress, ALIGN-R (121a) is needed in place of HEAD (PCat)-DEP. This constraint does not discriminate the rightmost epenthetic vowel i of forms like *tikéti̱* (118b) from the rightmost vowel i of forms like *jikóni* (118a) which is present in input. And for forms like *tikéti̱* and *ratí̱li* in (118b), FTBIN should be INDIFFERENT; otherwise, it would discard the feet $(\text{kéti̱})_F$ and $(\text{tí̱li})_F$. The following summary tableau illustrates the Swahili stress assignment:

(125) Summary Tableau for Swahili Stress: ALIGN-R (121a) >> FTBIN (IND)

	ALIGN-R (121a)	FTBIN (IND)
a. /jikoni/		
☞ ji(kóni)		
(jíko)ni	*!	
b. /tiket/		
☞ ti(kéti̱)		
(tíke)ti̱	*!	
c. /ratli/		
☞ ra(tí̱li)		
(ráti̱)li	*!	

In the third place, in assigning stress in Selayarese, another ALIGN-R (126) is substituted for HEAD (F)-DEP:

(126) ALIGN-R
Align (FT, R, LEXWD, R)
"The right edge of all feet must coincide with the right edge of some lexical word."

This constraint excludes the rightmost epenthetic vowels in forms like those in (120b) in forming foot. And FTBIN should be INDIFFERENT in view of forms like those in (120c). The stress assignment in Selayarese is now fulfilled as illustrated in the following summary tableau:

(127) Summary Tableau for Selayarese Stress: ALIGN-R (126) >> FTBIN (IND)

	ALIGN-R (126)	FTBIN (IND)
a. /sahal-ku/		
☞ saha(lá̱kku)		
(sá:ha)la̱ku	*!	
sa(há:la̱k)ku	*!	
b. /sahal/		
☞ (sá:ha)la̱		
sa(há:la̱)	*!	

At long last, we will turn to the Mohawk data, which are cited but not dealt with in Alderete (Michelson 1981, 1988). Consider the following:

(128) a. kohárhaʔ 'I attach it'   b. wáke̱ras 'It smells'
katirúthaʔ 'I pull'   waʔkyé:rite̱ʔ 'I accomplished it'

c. tekahsuté̱rhaʔ 'I am splicing'
waké̱nyaks 'I get married'

Stress regularly falls on the penultimate syllable but it falls on the antepenultimate syllable if the penultimate or ultimate syllable contains an epenthetic vowel as shown in (a) and (b) respectively. An epenthetic vowel, however, is stressed in the penultimate syllable provided that it is closed by oral (nonlaryngeal) consonants as in (c).

ALIGN-R (126) excludes the rightmost epenthetic vowel in forms like *waʔkyé:ritḛʔ* in (128b) in forming foot. And for forms like those in (c), the following constraint is needed:

(129) ALIGN-L
Align ([...C_{ORAL}]$_\sigma$, L, FT, L)
"The left edge of every [...C_{ORAL}]$_\sigma$ coincides with the left edge of some foot."

FTBIN in Mohawk should be INPUT to leave epenthetic vowels in forms like *wáke̱ras* in (128b) out of consideration in forming foot, and it is dominated by ALIGN-L (129) in order not to discard the forms in (128c). Now the Mohawk stress assignment is exemplified by the following summary tableau:

(130) Summary Tableau for Mohawk Stress: ALIGN-R (126), ALIGN-L (129) >> FTBIN (IN)

	ALIGN-R (126)	ALIGN-L (129)	FTBIN (IN)
a. /koharhaʔ/			
☞ ko(hárhaʔ)			
(kóhar)haʔ	*!		
b. /wakras/			
☞ (wáke̱ras)			
wa(ké̱ras)			*!
c. /waknyaks/			
☞ wa(ké̱nyaks)			*
(wáke̱nyaks)		*!	

It has been demonstrated that the alignment constraints ((121a), (123) and (126)) and FTBIN, which are required anyhow in assigning stress, and where the categories LEXWD and PRWD are employed or level conditions are imposed, make HEAD (PCat)-DEP unnecessary in stress assignment in the languages we have discussed up to now.

6.7 Conclusion

In this section, after setting about investigating the issue of level conditions which concerns NRC, we have argued in favor of imposing the three level conditions OUTPUT, INPUT and INDIFFERENT on phonological constraints within the framework of OT, which rejects serial derivations. Thus, it should by now be clear that it is of absolute necessity to impose these level conditions on phonological constraints for any satisfactory account of phonological phenomena and, at the same time, for coping with the sticky problem of the extrinsically-ordered derivations within the framework of OT. Moreover, the limited descriptive possibilities of our theory predict not only that the decomposed constraint for the Icelandic *u*-Umlaut phenomenon is unallowable but also that the three hypothetical languages, in which the decomposed level conditions are admitted, are impossible human languages. Lastly, it has been demonstrated that to account for stress assignment in the four languages discussed the level conditions, including the categories LEXWD and PRWD which intrinsically denote the level conditions INPUT and OUTPUT respectively, imposed on constraints are indispensable, too. Incidentally, it has also been shown that in OT certain dialectal difference may be explained by the difference of the level conditions INPUT and OUTPUT imposed on the same phonological constraint that applies to the same underlying representation.

Most importantly, it is assumed that provided the output form whose input violates an INPUT constraint still violates it at the output level, that output form is construed as violating it, and, furthermore, it is to be emphasized that the constraints to which no level condition is annotated explicitly are reckoned to be INDIFFERENT by default.

7. P-NRC and FTBIN

In this section, we will be mainly concerned with the role of P-NRC in relation to the FTBIN requirement, from which ensues the issue related with NRC. Besides, it will be demonstrated that NRC, together with P-NRC, predicts the inevitability of phonological reduplication for the satisfaction of the FTBIN requirement in Korean. Lastly, by way of a supplement, it will be clarified on the basis of historical changes in Korean whether the constraints which are syllabically-defined and therefore are intrinsically OUTPUT may refer to morpheme-internal input representations, since this issue has a bearing on NRC and P-NRC.

7.1 Phonological Reduplication in Korean

In Korean, some monosyllabic adjective and mimetic adverb roots are reduplicated phonologically to satisfy the constraint FTBIN. By 'phonological reduplication' we mean that the reduplicant is not the exponent of lexical RED but results from the interaction of constraints (for details, see Lee (in prep.)). Consider the following. (In what follows, reduplicated or epenthetic segments are underlined.)

(131) a. *ha*-adjectives

/kap-ha/ → [kapkap-ha] 'tedious'
/sim-ha/ → [simsim-ha] 'bored'
/tan-ha/ → [tantan-ha] 'hard'
/t'ak-ha/ → [t'akt'ak-ha][20] 'tough'

b. mimetic adverbs

/t^{h}al/ → [t^{h}alt^{h}al] 'with clatter'
/č^{h}əp/ → [č^{h}əpč^{h}əp] 'layer on layer'
/s'ak/ → [s'aks'ak] 'imploringly'
/p'ak/ → [p'akp'ak] 'vigorously'

As a representative example, we will consider the derivation /kap-ha/ → [kapkap-ha]. Adjective roots like /kap/ are always compounded with root /ha/ 'be, do' (hence, the compound adjective is dubbed *ha*-adjective) and the input [[[kap]$_{LEXRT}$]$_{LEXWD}$[[ha]$_{LEXRT}$]$_{LEXWD}$]$_{LEXWD}$ is realized as [[[kapkap]$_{PRRT}$]$_{PRWD}$[[ha]$_{PRRT}$]$_{PRWD}$]$_{PRWD}$ in the reduplication by the interaction of constraints. Specifically, it is to be taken note of that the constraint FTBIN plays a vital role in reduplicating roots like /kap/ and /t^{h}al/ phonologically:

(132) FTBIN >> DEP-IO

[[[kap]$_{LEXRT}$]$_{LEXWD}$ [[ha]$_{LEXRT}$]]$_{LEXWD}$]$_{LEXWD}$	FTBIN	DEP-IO
☞ (?) a. [[[kapkap]$_{PRRT}$]$_{PRWD}$[[ha]$_{PRRT}$]]$_{PRWD}$]$_{PRWD}$		***
b. [[[kap]$_{PRRT}$]$_{PRWD}$[[ha]$_{PRRT}$]]$_{PRWD}$]$_{PRWD}$	*!	

This tableau also serves as the tableau des tableaux for the /kap/ paradigm, because it is always realized as *kapkap* across the board in the paradigm by dint of its being invariably compounded with /ha/. The across-the-board violation of the faithfulness constraint DEP-IO in the prospective optimal form (a) above thus forces P-NRC to be invoked, blocking the expected derivation. At the same time, the expected output form [[[kapkap]$_{PRRT}$]$_{PRWD}$[[ha]$_{PRRT}$]]$_{PRWD}$]$_{PRWD}$ is derived by FTBIN by changing the input root structure [kap]$_{LEXRT}$ of [[[kap]$_{LEXRT}$]$_{LEXWD}$ [[ha]$_{LEXRT}$]$_{LEXWD}$]$_{LEXWD}$, violating NRC, on the assumption that the augmented phonological reduplicant, unlike the exponent reduplicant of the morpheme RED, is included in PRRT. As a result, the expected output form cannot be derived, not being compatible with either P-NRC or NRC.

The only way out of this difficulty is to fall back on a constraint similar to DEP-AL (F) (14) in making use of the correspondence relation which refers to the input root:

(133) MAX-R(oot)A(ugmented Reduplicant)
Every segment of the root has a correspondent in the augmented string.

Supplied with this constraint, we can have the following reconstructed tableau, which gives the expected output form without violating P-NRC. (V and C stand for epenthetic vowel and consonant respectively.)

---

[20] The sequence -*k*-*h*- coalesces into the aspirate k^h by the constraint *Ch (mirror image) (Lee 1976).

(134) FTBIN >> MAX-RA>> DEP-IO

/kap-ha/	FTBIN	MAX-RA	DEP-IO
☞ kapkap-ha		√k √a √p	*k *a *p
kapka-ha		*p!	*k *a
kapCV-ha		*k! *a *p	*C *V
kap-ha	*!		

The constraint MAX-RA performs a decisive function in choosing the expected output form out of the three augmented forms, not to mention its function in eliminating the interference of P-NRC.

In the tableau (134), the correspondence of the input root with the phonologically-augmented reduplicant is taken for granted, as was stated in MAX-RA (133). However, the correspondence of the base with the phonologically augmented reduplicant is equally possible. To clear up this point, we will examine the reduplication of adjective roots denoting primarily taste such as /pč'a/ 'salty' and /ps'ɨ/ 'bitter.' They are reduplicated phonologically in forming compound adjectives with *-l-ha*, *-l-ɨm-ha* or *-l-e-ha*, where *ha* is a root morpheme as in compounds like /kap-ha/. Consider the following hypothetical tableau, where the constraint MAX-B(ase)A requires that every segment of the base has a correspondent in the augmented string:

(135) NOCOMPLEX, FTBIN >>MAX-BA, DEP-IO

/pč'a-l-ha/	NOCOMPLEX	FTBIN	MAX-BA	DEP-IO
(?) a. č'apč'a-l-ha			√č' √a	*p! *č' *a
b. č'ač'a -l-ha			√č' √a	*č' *a
c. pč'apč'a-l-ha	*!		√ p √č' √a	*p *č' *a
d. č'a-l-ha		*!		

In the tableau above, the constraint MAX-BA, regardless of its ranking with respect to DEP-IO, has no effect whatsoever in giving us the expected output form *č'apč'a-l-ha* (a). It should thus be replaced by the constraint MAX-RA (133). This constraint, ranked over DEP-IO, fulfills the active role of deciding the optimal output form, besides making P-NRC impotent:

(136) NOCOMPLEX, FTBIN >> MAX-RA >> DEP-IO

/pč'a[$_{+PARA}$]-l-ha/	NOCOMPLEX	FTBIN	MAX-RA	DEP-IO
☞ č'apč'a-l-ha			√p √č' √a	*p *č' *a
č'ač'a-l-ha			*p! √č' √a	*č' *a
pč'apč'a-l-ha	*!		√p √č' √a	*p *č' *a
č'a-l-ha		*!		

In view of the consistency with the derivation *č'apč'a-l-ha* in which MAX-RA takes an active part, we are also to depend on it in deriving output forms like *kapkap-ha,* as was illustrated in (134), forsaking the constraint MAX-BA.

Still, we have a residual problem left to solve. In the tableau (136), NOCOMPLEX violates NRC in converting the morpheme-internal input /pč'a/ to *č'a*. Even though *č'a* is the unique output root throughout the paradigm, /pč'a/ should be posited as its input root. Otherwise, the reduplicated form *č'a pč'a-l-ha*, where *p* of *pč'a* reflects the initial consonant *p* of the input root /pč'a/, could not be derived. To work out the problem, consider the following summary tableau needed for the tableau des tableaux for the /pč'a/ paradigm:

(137) Summary Tableau: NOCOMPLEX >> MAX-IO

/pč'a-.../	NOCOMPLEX	MAX-IO
/pč'a-ko/ → ☞ (?) [č'a-ko]		*
/pč'a-či/ → ☞ (?) [č'a-či]		*
/pč'a-ta/ → ☞ (?) [č'a-ta]		*

When we take only this tableau into consideration, we are unable to get the expected output forms beginning with *č'a-...*, since the application of NOCOMPLEX invites the invocation of P-NRC as well as NRC. Hence, it is necessary to evaluate the following tableau des tableaux for the /pč'a/ paradigm in which the two tableaux (136) and (137) are put together:

(138) Tableau des Tableaux for the /pč'a/ Paradigm
{NOCOMPLEX >> MAX-IO (p)}, FTBIN >> MAX-RA >> DEP-IO

/pč'a-.../	NOCOMPLEX	MAX-IO (p)	FTBIN	a. MAX-RA (p) b. MAX-RA (č') c. MAX-RA (a)	DEP-IO (pč'a)
i. /pč'a-l-ha/ → ☞ [č'apč'a-l-ha]		*p		a.√p b.√č' c.√a	***
ii. /pč'a-ko/ → ☞ [č'a-ko]		*p			
iii. /pč'a-či/ → ☞ [č'a-či]		*p			
iv. /pč'a-ta/ → ☞ [č'a-ta]		*p			

Despite the across-the-board violation of the faithfulness constraint MAX-IO (p), the satisfaction of the faithfulness constraint MAX-RA (p) in the form (i), which shares the same argument with the former, saves the expected output forms from being deserted by P-NRC. Although non-reduplicant forms like *č'a-ko* per se do not bear directly on the constraint MAX-RA, as is shown in the tableau (137), they are spared from being thrown away by that very constraint, related with reduplicants like *č'apč'a-l-ha* paradigmatically. Finally, it must be added that such monosyllabic morphemes which constitute *ha*-adjectives and which belong to mimetic adverbs as /kap/ and /t^hal/ are marked with [$_{+PARA}$] lexically so that they may be governed by P-NRC rather than by NRC.

7.2 Incomplete Phase in Rotuman

We will examine another case, from the viewpoint of P-NRC, in which forms sharing the same root are related paradigmatically by faithfulness constraints. We will first present in an extremely concise manner what is exhaustively explored in McCarthy (1995). Rotuman has the morphological "phase" distinction in major-category words, the complete phase and the incomplete phase. Let us consider the following data. (Braces delimit the stress-foot of bimoraic trochee, the sequences *ue* and *ea* of the incomplete-phase forms in (b) are light diphthongs, and the sequences *ui* and *ei* of the incomplete-phase forms in (d) are diphthongs.)

(139)	Complete	Incomplete	
a. Deletion			
	{rɑko}	{rɑk}	'to imitate'
	to{kiri}	to{kir}	'to roll'
b. Metathesis			
	{pure}	{puer}	'to rule'
	se{sevɑ}	se{seɑv}	'erroneous'
c. Umlaut			
	{mose}	{mö̆s}	'to sleep'
	{futi}	{füt}	'to pull'
d. "Diphthongization"			
	pu{pui}	pu{pui}	'floor'
	le{lei}	le{lei}	'good'
e. No Distinction			
	{rī}	{rī}	'house'
	{sikɑ̄}	si{kɑ̄}	'cigar'

It is important to notice that the final two-syllable foot of the complete-phase forms is realized as a monosyllabic two-mora foot in the incomplete-phase forms. For the realization of the monosyllabic foot in the incomplete-phase forms, McCarthy proposes an alignment constraint:

(140) INC-PH
Align (Stem$_{INC.PH}$, R, $[\sigma]_{FT}$, R)
"Every incomplete-phase stem ends in monosyllabic foot (or heavy syllable)."

And following Kaye (1983), Kaye & Lowenstamm (1984) and Rosenthall (1994), he recognizes the constraint LIGHT-DIPH which requires that light diphthongs rise in sonority. Accordingly, *ue* and *ea* of the incomplete-phase forms in (139b) are licit light diphthongs.

For the incomplete-phase forms in (139a-b), we can now have the following summary tableau:

(141) LIGHT-DIPH, INC-PH >> MAX >> LINEARITY

	LIGHT-DIPH	INC-PH	MAX	LINEARITY
a. Deletion Case: /rak$_1$o$_2$/$_{INC.PH}$				
☞ {.rak$_1$.}			*	
{.ro$_2$k$_1$.}			*	*!
{.rao$_2$k$_1$.}	*!			*
{.ra.k$_1$o$_2$.}		*!		
b. Metathesis Case: /pur$_1$e$_2$/ $_{INC.PH}$				
☞ {.pue$_2$r$_1$.}				*
{.pur$_1$.}			*!	
{.pu.r$_1$e$_2$.}		*!		

Moreover, compare the following failed candidates for the incomplete-phase output form of /ra$_2$ko$_4$/$_{INC.PH}$ with the complete-phase output form {.ra$_2$.ko$_4$.} and the actual incomplete-phase output form {.rak.}:

(142) a. *.ra$_2$.{o$_4$k.} b. *.ra$_2$.{kō$_4$.} c. *.ra$_2$.{ko$_4$ʔ.} d. *.a$_2$.{ro$_4$k.}

To filter out these incorrect candidates, McCarthy posits a constraint permitted by a correspondence relation between the complete-phase output form and the incomplete-phase output form. On the assumption that any vocoid in the main-stressed nucleus is a prosodic head of the word, this constraint is stated as follows:

(143) HEAD-MAX

If α is the prosodic head of the word, then *f*(α) is the prosodic head of the word.

Even though the forms in (142) all satisfy INC-PH, they violate HEAD-MAX. Only the actual output form {.rak.} satisfies it. And it is needless to say that the incomplete-phase forms in (139) all satisfy it.

Nonetheless, it is to be noticed that the application of INC-PH in the morpheme-internal input brings about a result of violating NRC, because the output forms *rak* (139a) and *puer* (139b), for instance, are generated by changing the morpheme-internal input structures $/rako/_{INC.PH}$ and $/pure/_{INC.PH}$ respectively. The consequence is that INC-PH is to be ranked after its conflicting faithfulness constraints MAX and LINEARITY to comply with NRC. Then, the actual output forms of incomplete phase can never be generated. The same thing can be said of the output forms of incomplete phase in (139c-d). (But the incomplete-phase forms in (139e) are exempt from NRC, because their long vowels are non-phonemic.) However, we may rest assured. Consider the following tableau des tableaux for the /rako/ paradigm:

(144) Tableau des Tableaux for the /rako/ Paradigm

HEAD-MAX, LIGHT-DIPH, INC-PH >> MAX (o) >> LINEARITY

/rako/	HEAD-MAX	LIGHT-DIPH	INC-PH	MAX (o)	LINEARITY
$/rako/_{C.PH}$ → ☞ {.ra.ko.}					
$/rako/_{INC.PH}$ → ☞ {.rak.}				*	

It is to be observed that in the /rako/ paradigm, the faithfulness constraint MAX (o) which is in conflict with INC-PH is not violated across the board in the paradigm, with the result that its application in the morpheme-internal input is not hindered by P-NRC.

In the tableaux which follow, it will be confirmed that the output forms of the incomplete phase in (139b-d) are all legitimate forms which are generated without violating P-NRC, because the faithfulness constraints which conflict with INC-PH are not violated across the board in the respective paradigms.

(145) Tableau des Tableaux for the /pure/ Paradigm

HEAD-MAX, LIGHT-DIPH, INC-PH >> MAX >> LINEARITY, IDENT-IO (+voc)

/pure/	HEAD-MAX	LIGHT-DIPH	INC-PH	MAX	LINEARITY (r_1e_2)	IDENT-IO (+voc)
$/pure/_{C.PH}$ → ☞ {.pu.re.}						
$/pur_1e_2/_{INC.PH}$ → ☞ $\{.pue_2r_1.\}$					*	*

The faithfulness constraints LINEARITY (r_1e_2) and IDENT-IO (+voc) which are in conflict with INC-PH are not violated across the board in the paradigm.

(146) Tableau des Tableaux for the /mose/ Paradigm

HEAD-MAX, LIGHT-DIPH, INC-PH >> MAX >> LINEARITY, UNIFORMITY

/mose/	HEAD-MAX	LIGHT-DIPH	INC-PH	MAX	LINEARITY ($o_1s_2e_3$)	UNIFORMITY (o_1,e_3)
$/mose/_{C.PH}$ → ☞ {.mo.se.}						
$/mo_1s_2e_3/_{INC.PH}$ → ☞ $\{.m\ddot{o}_{1,3}s_2.\}$					*	*

In this tableau, the faithfulness constraints LINEARITY ($o_1s_2e_3$) and UNIFORMITY ($o_{1,}e_3$) which conflict with INC-PH are not violated across the board in the paradigm.

(147) Tableau des Tableaux for the /pupui/ Paradigm

HEAD-MAX, LIGHT-DIPH, INC-PH >> MAX >> LINEARITY, IDENT-IO (+voc)

/pupui/	HEAD-MAX	LIGHT-DIPH	INC-PH	MAX	LINEARITY	IDENT-IO (+voc)
/pupui/$_{C.PH}$ → ☞ pu{.pu.i.}						
/pupui/$_{INC.PH}$ → ☞ pu{.pui.}						*

In the tableau above, the faithfulness constraint IDENT-IO (+voc) which conflicts with INC-PH is not violated across the board in the paradigm.

Conclusively, it has been demonstrated that the incomplete-phase forms in Rotuman, which are to be marked with [$_{+PARA}$] lexically, are generated without violating P-NRC, even though INC-PH is satisfied by changing the morpheme-internal input.

7.3 Japanese Hypocoristics

We will examine the last case where the apparent violation of NRC is counterbalanced by the conformity with P-NRC. Based on Poser (1990), Mester (1990) and Itô (1990), Benua (1995) analyzes three Japanese hypocoristic patterns. In each pattern, ordinary names are truncated to minimal bimoraic words. She accounts for these phenomena by positing a correspondence relation between the truncated output and the output base, that is, between the two separate output forms related paradigmatically. Superficially, however, the truncated hypocoristic output forms in our re-analyses based on the data presented in Benua appear to constitute counterexamples to NRC, because they result from the application of phono-constraints in morpheme-internal input representations.

Consider first the ordinary Japanese hypocoristic pattern given below. The truncated stems are suffixed with the diminutive [-čaN].

(148) Ordinary Japanese Hypocoristics

Source Names	Truncated Hypocoristic Names				
	a.	b.	c.	d.	e.
Midori	Mido-čaN	Mii-čaN			
Yooko	Yoo-čaN				Yoko-čaN
Akira	Aki-čaN				
Hiromi	Hiro-čaN			Romi-čaN	
Mariko	Mari-čaN				Mako-čaN
JuNko	JuN-čaN				
Hanako	Hana-čaN	Haa-čaN	Hač-čaN		
Kazuhiko	Kazu-čaN				

The truncated stems of the ordinary hypocoristics are exactly a single bimoraic foot of one syllable or two. Geminates and nasals homorganic to a following stop allowed in codas contribute to forming bimoraic feet. (Place-less nasals represented as [N] are assimilated to the following consonants (see Itô 1986, Itô & Mester 1994).

The second pattern of hypocoristic truncation is the Geisha House Discretionary Client Names given in (149). In this case, source names are reduced to a monosyllabic foot. The truncated stems are affixed with honorific [o-] and [-saN].

(149) Japanese Geisha House Discretionary Client Names

Source Names	Truncated Names a.	b.	
Tanaka	o-Taa-saN		*o-Tana-saN
Koono	o-Koo-saN		
HoNda	o-Hoo-saN	o-HoN-san	
Saiki	o-Saa-saN	o-Sai-saN	

Lastly, in the case of the Rustic Girls' Names given in (150), the truncated hypocoristic forms consist of the first two moras of the source names. These nicknames take the honorific prefix [o-].

(150) Japanese Rustic Girls' Names

Source Names	Truncated Names		
Midori	o-Mido	*o-Mii	*o-Dori
Yuuko	o-Yuu	*o-Yuko	
Kaede	o-Kae		
Takie	o-Taki		
Hanako	o-Hana	*o-Haa	*o-HaN

As has been observed so far, the Japanese truncated names are all minimal or unmarked prosodic words. In analyzing Diyari reduplication, McCarthy & Prince (1994) develop a constraint-based analysis of "minimal word." According to them, the minimalization follows simply from the high rank of PARSE-SYLL and ALL-FT-LEFT/RIGHT without delimiting the size of reduplicants. Hence, all that is to be said about the size of the Diyari reduplicant is the following templatic constraint:

(151) Templatic Constraint (Diyari)
R = PRWD
"The reduplicant is a prosodic word."

Following McCarthy & Prince, we will now proceed to analyze the Japanese hypocoristics by positing the following templatic constraint without delimiting the size of the truncated forms:

(152) Templatic Constraint (Japanese Hypocoristics)
H = PRWD
"The hypocoristics is a prosodic word."

This templatic constraint applies equally to the three hypocoristic patterns.

With this much preliminary, we can now return to the data presented in (148). Besides Templatic Constraint (152), we need ALIGN-L (=ALL-FT-LEFT; (123)) and FTBIN (a) (153):

(153) FTBIN (a)
FTBIN = $[\mu\mu]_{FT}$
"Feet must be binary under syllabic or moraic analyses." (McCarthy and Prince 1993a)

First, the truncated names in (148a) are generated in the manner illustrated in the tableau (154). The faithfulness constraints IDENT-IO (V, -long) and IDENT-IO (C, -long) prohibit the respective lengthening of vowel and gemination of consonant. (In what follows, parentheses delimit foot.)

(154) H=PRWD, FTBIN (a) >> ALIGN-L (123), IDENT-IO (V, -long), IDENT-IO (C, -long), LINEARITY >> MAX-IO

$/m_1i_2d_3o_4r_5i_6/_{HYP}$	H = PRWD	FTBIN (a)	ALIGN-L (123)	a. IDENT-IO (V, -long) b. IDENT-IO (C, -long) c. LINEARITY	MAX-IO
☞ a. $(mido)_{PRWD}$					**
b. $(dori)_{PRWD}$			*!		**
c. $(mii)_{PRWD}$				a *!	****
d. $(m_1i_2r_5i_6)_{PRWD}$				c *!	**
e. $(mi\check{c})_{PRWD}$ čaN				b *!	****
f. $(midori)_{PRWD}$		*!			

The foot-final *č* of **mič-čaN* (e) results from the gemination of the initial *č* of the diminutive suffix *-čaN*.

Variation forms like *mii-čaN* and *haa-čaN* in (148b) are generated by re-assigning IDENT-IO (V, -long) to the same ranking with MAX-IO, those like *hač-čaN* in (148c) by re-assigning IDENT-IO (C, -long) to the same ranking with MAX-IO, and those like *romi* in (148d) by replacing ALIGN-L (123) with ALIGN-R (121a), respectively in the ranking employed in the tableau above.

With respect to the forms in (148e) which violate LINEARITY, it is to be observed that they end in *-ko*. The morpheme *ko*, which means 'child, son' is commonly suffixed in forming Japanese female names. So it seems that the *ko*-suffixed female names may behave differently in forming truncated names. It is thus desirable and necessary to posit another alignment constraint:

(155) ALIGN-FT-R (a)
Align (FT, R, $ko]_{SUF}$, R)
"The right edge of all feet must coincide with the right edge of some $ko]_{SUF.}$"

In addition, a second FTBIN is required:

(156) FTBIN (b)
FTBIN = $[[\mu]_\sigma[\mu]_\sigma]_{FT}$
"Feet must be binary under bisyllabic analysis."

With these additional constraints at our discretion, we can now have the following summary tableau which epitomizes the analysis. (V represents an epenthetic vowel.)

(157) H = PRWD, FTBIN (b), ALIGN-FT-R >> ALIGN-L (123), DEP-IO, IDENT-IO (V, -long) >> LINEARITY, MAX-IO

	H = PRWD	FTBIN (b)	ALIGN-FT-R (a)	a. ALIGN-L (123) b. DEP-IO c. IDENT-IO (V, -long)	LINEARITY	MAX-IO
a. $/yooko/_{HYP}$						
☞ (yoko)				c*		
(yVko)				b*	*!	*!
(yooko)		*!				
(yoo)		*!	*!			**
b. $/mariko/_{HYP}$						
☞ (mako)					*	**
(riko)				a*!		**
(mVko)				b*!	*	**
(mariko)		*!				

(mari)			*!			**

We will next consider the truncated forms in (149). For the forms in (149a), the alignment constraint (158) and a third FTBIN are required:

(158) ALIGN-FT-R (b)
Align (FT, R, Vowel, R)
"The right edge of all feet must coincide with the right edge of some vowel."

(159) FTBIN (c)
FTBIN = $[[\mu\mu]_{\sigma}]_{FT}$
"Feet must be binary under monosyllabic moraic analysis."

The hypocoristic forms in (149a) are now illustrated by the following summary tableau:

(160) H = PRWD, FTBIN (c), ALIGN-FT-R (b) >> ALIGN-L (123), DEP-IO, LINEARITY
>> IDENT-IO (V, -long), MAX-IO

	H = PRWD	FTBIN (c)	ALIGN-FT-R (b)	a. ALIGN-L (123) b. DEP-IO c. LINEARITY	IDENT-IO (V, -long)	MAX-IO
a. /tanaka/$_{HYP}$						
☞ (taa)					*	****
(tana)		*!				**
(tanaka)		*!				
(tan)			*!			***
b. /saiki/$_{HYP}$						
☞ (saa)					*	***
(sai)			*!			**
(saiki)		*!				
(saki)		*!		c*		*

In order to account for the forms in (149b), IDENT-IO (V, -long) should be ranked higher than MAX-IO, and ALIGN-FT-R (b) is invisibly ranked:

(161) H = PRWD, FTBIN (c) >> ALIGN-L (123), DEP-IO, LINEARITY, IDENT-IO (V, -long)
>> MAX-IO, ALIGN-FT-R (b)

	H = PRWD	FTBIN (c)	a. ALIGN-L (123) b. DEP-IO c. LINEARITY d. IDENT-IO (V, -long)	MAX-IO	ALIGN-FT-R (b)
a. /hoNda/$_{HYP}$					
☞ (hoN)				**	*
(hoo)			d*!	***	
(honda)		*!			
b. /saiki/$_{HYP}$					
☞ (sai)				**	*
(saa)			d*!	***	

In contrast to the optimal form *hoN* (149b) derived from /hoNda/, **taN* derived from /tanaka/ is not accepted. This disparity is accounted for by positing a variant of the constraint STROLE proposed in McCarthy & Prince (1993: Ch. 7, 1995):

(162) STROLE

A segment in hypocoristics and its correspondent in input must have identical syllabic roles.

Lastly, the truncated forms in (150) are generated by exactly the same procedure taken in generating those in (148a). The derivation of the incorrect truncated form **haN* is prevented by STROLE (162), as is **taN* in (149).

Despite the neat account of the Japanese hypocoristics so far, we have an unsolved problem left. As in the case of Rotuman, the solution lies in exploiting the correspondence relation that holds between forms sharing the same root. Without the paradigmatic relation with the source names, the truncated forms would violate NRC, since the morpheme-internal input structures are changed by the phonological constraint(s). As a representative example, consider the following tableau des tableaux for the /midori/ paradigm:

(163) Tableau des Tableaux for the /midori/ Paradigm

H = PRWD, FTBIN (a) >> ALIGN-L (123), IDENT-IO, LINEARITY >> MAX-IO

/midori/	H = PRWD	FTBIN (a)	a.ALIGN-L (123) b. IDENT-IO	LINEARITY	MAX-IO
/midori/$_{NON\text{-}HYP}$ → ☞ [midori]					
/midori/$_{HYP}$ → ☞ [mido]					**

This tableau illustrates that the faithfulness constraint MAX-IO which is in conflict with the constraints responsible for yielding the hypocoristic form is not violated across the board in the /midori/ paradigm. Hence, the truncated hypocoristic form *mido* is derived without violating P-NRC. And, here also, it goes without saying that the Japanese hypocoristic forms are marked with [$_{+PARA}$] lexically.

7.4 Augmentation and FTBIN Satisfaction

We are now in a position to raise the question why the device of phonological reduplication is chosen in *ha*-adjectives and some mimetic adverbs in Korean to satisfy FTBIN, rather than that of vowel lengthening or epenthesis. To work out the answer, consider first the following hypothetical tableau for the *ha*-adjective /kap-ha/, in which the output form whose vowel is lengthened is evaluated as optimal. (V stands for epenthetic vowel.)

(164) Tableau for the Hypothetical V-Lengthening

FTBIN >> DEP-IO >> IDENT-IO (-long)

/kap-ha/	FTBIN	DEP-IO	IDENT-IO (-long)
(?) ka:p-ha			*
kapV-ha		*!	
kapkap-ha		*!**	

The input root /kap/ is uniquely realized as *ka:p* throughout its paradigm by the constraint ranking given in the tableau above, as it is invariably compounded with the root /ha/. The faithfulness constraint IDENT-IO (-long) is thus violated across the board in the paradigm, which ultimately leads to violating P-NRC. At the same time, the application of FTBIN results in changing *a* of the morpheme-internal input root to *a:*, violating NRC. In consequence, vowel lengthening as a means to satisfy FTBIN in *ha*-adjectives is permitted neither by NRC nor by P-NRC.

Next, consider the tableau in which the hypothetical epenthesized form is evaluated as the optimal output form:

(165) Tableau for the Hypothetical Epenthesis

FTBIN >> IDENT-IO (-long) >> DEP-IO

[[[kap]$_{LEXRT}$]$_{LEXWD}$ [[ha]$_{LEXRT}$]$_{LEXWD}$]$_{LEXWD}$	FTBIN	IDENT-IO (-long)	DEP-IO
(?) [[[kapV]$_{PRRT}$]$_{PRWD}$ [[ha]$_{PRRT}$]$_{PRWD}$]$_{PRWD}$			*

[[[ka:p]$_{PRRT}$]$_{PRWD}$ [[ha]$_{PRRT}$]$_{PRWD}$]$_{PRWD}$		*!	
[[[kapkap]$_{PRRT}$]$_{PRWD}$ [[ha]$_{PRRT}$]$_{PRWD}$]$_{PRWD}$			**!*

With the knowledge that the input root /kap/ is uniquely realized as *kapV* throughout its paradigm by the constraint ranking given in the tableau above, we see the faithfulness constraint DEP-IO is violated across the board in the paradigm, resulting in the violation of P-NRC. Meanwhile, the application of FTBIN changes the input structure [kap]$_{LEXRT}$ to [kapV]$_{PRRT}$, compelling NRC to be violated. Here again, neither P-NRC nor NRC tolerates the generation of the hypothetical epenthetic form as a means to satisfy FTBIN in *ha*-adjectives.

As a last resort, we proceed to examine the tableau in which the input root /kap/ is realized as phonologically-reduplicated output form *kapkap*, the expected output form. As before, the following tableau also serves as the tableau des tableaux for the /kap/ paradigm:

(166) Tableau des Tableaux for the /kap/$_{[+PARA]}$ Paradigm
P-NRC >> FTBIN >> MAX-RA >> DEP-IO, IDENT-IO (-long)

/kap[$_{+PARA}$]-ha/	P-NRC	FTBIN	MAX-RA	DEP-IO	IDENT-IO (-long)
☞ a. kapkap-ha			√k √a √p	*k *a *p	
b. ka:p-ha	*!				*
c. kapV-ha	*!		*k *a *p	*V	

The optimal output form *kapkap-ha* (a) satisfies P-NRC; even though one faithfulness constraint DEP-IO (k,a,p), which is in conflict with FTBIN, is violated, another faithfulness constraint MAX-RA (k,a,p) which shares the same arguments with the former is not violated across the board in the paradigm. The incorrect output form **ka:p-ha* (b) violates P-NRC, because it violates the faithfulness constraint IDENT-IO (-long) across the board in the paradigm without having another faithfulness constraint which can compensate for the violation. Lastly, the incorrect output form **kapV-ha* (c) also infringes P-NRC, because it violates DEP-IO across the board in the paradigm with no faithfulness constraint which can invalidate the violation, besides impinging upon MAX-RA .

It thus follows as an inevitable consequence that the only way to satisfy FTBIN in *ha*-adjectives and monosyllabic mimetic adverb roots like /t^hal/ in Korean is to resort to phonological reduplication which infringes neither NRC nor P-NRC. Put in other words, these two constraints together predict the phonological reduplication as the one and only device to satisfy the requirement of FTBIN in such cases.

In comparison with the phonological reduplication in Korean, in Japanese hypocoristics discussed in 7.3, FTBIN is satisfiable by every means attainable, by vowel lengthening (e.g., *Mii-čaN* (148b), *o-Taa-saN* (149a)), vowel shortening (e.g., *Yoko-čaN* (148e)) and consonant gemination (e.g., *Hač-čaN* (148c)), unless forbidden by the constraint ranking. This is also predictable in light of NRC and P-NRC. In Korean, the satisfaction of the FTBIN requirement would entail the violation of NRC and P-NRC but for MAX-RA. On the other hand, in Japanese hypocoristics, it does not entail their violation even without recourse to faithfulness constraints such as MAX-RA, since the faithfulness constraints which are in conflict with FTBIN are satisfied in source names related with hypocoristic forms paradigmatically. Finally, the reason why the device of epenthesis is not relied upon in Japanese hypocoristics is that DEP-IO outranks IDENT-IO (V,
-long) and IDENT-IO (C, -long), which ranking seems to be default.

According to McCarthy & Prince (1993a, 1995), in Axininca Campa, a simple root /CV/ is augmented to satisfy the FTBIN requirement before the suffixed reduplicant; furthermore, the augmented base is copied in the reduplicant. (Epenthetic segments are underlined.)

(167) Root Root + RED
/na/ nata-nata 'carry'
*nata-na
*nana-nana
*na-na
/t^ho/ t^hota-t^hota 'kiss, suck'

*t^{h}ota-t^{h}o
* t^{h}ot^{h}o-t^{h}ot^{h}o
*t^{h}o-t^{h}o

Moreover, it is to be made a note of that these simple roots also augment when followed by a C-initial suffix:

(168) /na-piro/ → nata-piro -piro 'verity'
→ *nana-piro
→ *na-piro

As the reduplicant is also a C-initial suffix in Axininca Campa, McCarthy & Prince formalize the constraint responsible for the augmentation which requires that every suffix attach to a prosodic word. This requirement is expressed in an alignment constraint:

(169) ALIGN-SFX
Align (Suffix, L, PRWD, R)
"The left edge of every suffix coincides with the right edge of some prosodic word."
i.e., "The base of suffixation is a prosodic word."

This constraint ensures, through interaction with FTBIN and other prosodic constraints, that the structures satisfying it have a pre-suffixal prosodic word dominating a binary foot consisting of at least two moras. In addition, the following alignment constraint contributes to the augmentation of /CV/ roots to disyllabic feet in the pre-suffixal prosodic words:

(170) ALIGN-R
Align (Stem, R, σ, R)
"The right edge of every stem coincides with the right edge of some syllable."
i.e., "Every stem ends on a syllable edge."

With this much preliminary, let us now consider the following summary tableau, where "|" and "." stand for stem edge and syllable edge respectively:

(171) FTBIN >> ALIGN-SFX, ALIGN-R (170) >> DEP-IO, IDENT-IO (-long)

	FTBIN	a. ALIGN-SFX b. ALIGN-R (170)	a. DEP-IO b. IDENT-IO (-long)
i. /na-RED/			
☞ a. na |.ta]$_{PRWD}$-nata			a**
(?) b. na |.na]$_{PRWD}$-nana			a**
c. na | a.]$_{PRWD}$-naa		b*!	b*
d. na |.-na	*!	a*	
ii. /na-piro/			
☞ a. na |.ta]$_{PRWD}$-piro			a**
(?) b. na |.na]$_{PRWD}$-piro			a**
c. na | a.]$_{PRWD}$-piro		b*!	b*
d. na | .-piro	*!	a*	

It is also predictable from the viewpoint of the constraints NRC and P-NRC that the /CV/ root is augmented by means of epenthesis to satisfy FTBIN. Firstly, the violation of the faithfulness constraint DEP-IO in deriving the optimal forms (a) is counterbalanced by its satisfaction in the root /na/ in output forms like *no-na-nona* (Prefix-Root-RED), making P-NRC irrelevant; without the paradigmatic counterbalance, the phonological reduplicants would have to come to the fore to take the place of the means of epenthesis in order to conform to P-NRC. Secondly, the phonologically-reduplicated forms (b), which are construed simply as epenthesized forms in the ranking without faithfulness constraints like MAX-RA, are evaluated as less optimal than the usual default epenthesized forms (a). Thirdly, it is hardly necessary to say that the device of vowel shortening of /CV/ root to satisfy FTBIN is also precluded. In the fourth place, consonant gemination as a means to meet the FTBIN requirement cannot be depended upon, because no prosodic word can end in a consonant in Axininca Campa. Lastly, the forms (c) whose vowels are lengthened are discarded due to the interference of ALIGN-R (170). We are thus left with the optimal output forms (a) which make use of the device of epenthesis to meet the requirement of FTBIN. Moreover, the lexical marking of the /CV/ root with $[_{+PARA}]$ excludes the interference of NRC.

To sum up, it has been demonstrated that it is predictable in view of the constraints NRC and P-NRC whether the device of phonological reduplication for the satisfaction of the FTBIN requirement is chosen or not in a grammar. In case the satisfaction of FTBIN entails the across-the-board violation of its conflicting faithfulness constraint in a paradigm, the device of phonological reduplication is chosen, relying on such constraints as MAX-RA, with the result that its application does not invite the violation of P-NRC. Conversely, when FTBIN is satisfiable without incurring the across-the-board violation of its conflicting faithfulness constraint in a paradigm, thus being in observance of P-NRC, the device of phonological reduplication is not taken advantage of. And it is assumed that the morphemes to whose morpheme-internal input representations FTBIN is applicable are marked with $[_{+PARA}]$ lexically to exclude the intervention of NRC. Conclusively, the two constraints NRC and P-NRC are consolidated by the predictability of the manner by which the FTBIN requirement is satisfied.

7.5 The OUTPUT Constraint, NRC and P-NRC

Up to now, it has been assumed that the constraints with σ- or FT-structure specified in their SD's apply in morpheme-internal input, even though their SD's are not met, since σ- or FT-structure in general is not specified in input. They must be assumed to apply in morpheme-internal input, causing NRC or P-NRC to be invoked, provided that they apply morpheme-internally and thus entail the change of input structure. Hence, it is assumed, as has been so far, that, in case any constraint that applies morpheme-internally brings forth the change of morpheme-internal input structure, it refers to and applies in morpheme-internal input.

Historical changes in Korean give us cases in point. As a rule, restructuring of a morpheme arises as a result of morpheme-internal application of a phonological constraint, namely, when a phonological constraint applies in morpheme-internal input, disregarding NRC or P-NRC. In this light, let us consider the following historical changes: the morphemes of Standard Korean in (i) were restructured as those of Kyung-Sang dialects in (ii) (Lee 1993):

(172)

i. Standard Korean	ii. Kyung-Sang Dialects	
a. ps'al	s'al	'rice'
pč'a	č'ap	'salty'
ps'ɨ	s'ip	'bitter'
b. kyə	ke	'chaff'
p'yam	p'am	'cheek'
k'wak	k'ak	'tightly'
c. talk	tak^h/tak/tal	'chicken'
kaps	kap	'price'
nəks	nək	'soul'

In (a-b), the morpheme-initial consonant cluster and consonant-glide cluster were restructured as a single consonant, and in (c), the morpheme-final consonant cluster was restructured as a single consonant as well.

Obviously, the restructuring took place in consequence of morpheme-internal application of constraints $*[_\sigma CC$, $*[_\sigma CG$ and $*CC]_\sigma$ of NOCOMPLEX in (a), (b) and (c) respectively. However, as was mentioned above, the specification of syllable structure in these constraints makes it impossible for them to apply in the unsyllabified input structure. Even so, the syllabically-defined constraints applied in unsyllabified input structure, resulting in the restructuring of morphemes, as shown in (172) above. To reiterate, a morpheme is restructured when a constraint applies in morpheme-internal input, making its conflicting faithfulness constraint violated across the board in a paradigm, without regard to NRC or P-NRC. This rightly applies to the present cases. Consequently, we assume that even though they are inherently OUTPUT due to the specification of syllable structure in their SD's, the syllabically-defined constraints are construed as applying in morpheme-internal input structure in so far as their morpheme-internal application results in its change. Furthermore, although our focus has been on syllabically-defined constraints, this assumption is extended with equal force to any phono-constraint, whether its level condition is annotated or not, or whether it is inherently OUTPUT or not, whose morpheme-internal application brings about the change of the morpheme-internal input structure. This has been implicitly assumed in satisfying the FTBIN requirement in Korean *ha*-adjectives and mimetic adverbs, Rotuman incomplete phase, Japanese hypocoristics and Axininca Campa augmentation. For without this extended assumption the argument in this section regarding the roles NRC and P-NRC play in paradigmatically-related forms might be questioned.

7.6 Conclusion

The evidence and analyses we have presented in this section show that, in case the constraint FTBIN and the constraints assigning foot apply in morpheme-internal input representation, their conflicting faithfulness constraints and the faithfulness constraints, if any, that share the same argument(s) with them should not be violated across the board in a paradigm, in pursuance of P-NRC. And they also show that the morphemes whose morpheme-internal input is subject to FTBIN or to the constraints assigning foot, namely, those belonging to some well-defined classes are lexically marked with $[_{+PARA}]$ so that they may be governed by P-NRC rather than by NRC. In addition, it has been demonstrated that NRC, along with P-NRC, predicts whether or not to choose the means of the phonological reduplication to meet the FTBIN requirement. This in turn strongly justifies them. Lastly, it has been shown on the basis of historical changes in Korean that, provided the phono-constraint that applies morpheme-internally, in spite of its inherent level condition OUTPUT, results in the change of morpheme-internal input representation, it is reckoned to apply in morpheme-internal input.

8. Conclusion and Residual Problems

The basic theme of this article is the explicit formalization of NRC and its accompanying P-NRC that elaborate No Restructuring Constraint (3) evolved from RAC (1), within OT, in particular, Correspondence Theory. The unexpected gain is the development of the theory of level conditions which is seemingly distinct from but inextricably connected with the main subject. This theory has made it possible to account for the phonological phenomena that rested on the operational account of extrinsic rule-ordering in pre-OT theories, and that are not naturally accounted for in OT and hence are not generally treated in the OT literature. Finally, P-NRC has been found to play a significant role in governing the phono-constraints responsible for the satisfaction of the FTBIN requirement which apply in morpheme-internal input representation.

What makes us feel ill at ease and dissatisfied concerning MORPHINTEG (110) repeated below is its ambiguity. This constraint is an adjusted version of MORPHINTEG (61) to fit the Icelandic *u*-Umlaut phenomena.

(173) MORPHINTEG
The morpheme-internally satisfiable phono-constraint is ranked after its conflicting faithfulness constraint iff faithfulness constraints are violable to an extreme degree in a morpheme.

Let us first compare this constraint with NRC (27) also repeated below, with a view to extracting the feature common to both of them.

(174) NRC
A phono-constraint satisfiable in morpheme-internal input is ranked after its conflicting faithfulness constraint.

The common feature is that the constraint satisfiable morpheme-internally is ranked after its conflicting faithfulness constraint. By exploiting this property in common, we may combine these two constraints to state a new constraint:

(175) NRC (Revised)

A phono-constraint satisfiable morpheme-internally is ranked after its conflicting faithfulness constraint.

Another feature common to MORPHINTEG (173) and NRC (174) is that the phono-constraints which yield non-phonemic segments are exceptional to both of them.

Going a step further, we may trim away that part which calls for the re-ranking of the conflicting constraint pair from NRC (175). The simplified version is now stated as in the following:

(176) NRC (Final)

A phono-constraint may not apply morpheme-internally.

The problem now is how to make this final version of NRC (176) function as both NRC (174) and MORPHINTEG (173). The proper measure, however, is not far to seek. It is worth noticing that NRC (174) concerns morpheme-internal input and MORPHINTEG (173) may be said to be its output version. Hence, on NRC (176) we can impose the level conditions developed in section 6. In Canadian English dialects discussed in 6.3.2, we have seen that one and the same constraint *ay[-voice] can be INPUT or OUTPUT, depending on the dialect. Likewise, NRC (176) can also be INPUT or OUTPUT, depending on the language. It can be INPUT, which takes over the role of NRC (174), and it can be OUTPUT, taking over the role of MORPHINTEG (173). Naturally, it can be INDIFFERENT too, which includes both INPUT and OUTPUT.

For the present purpose, let us examine the following list:

(177) Languages	Constraints	Examples
i. Finnish	*ti (*t* → *s* phenomenon)	a. /koti/ → [koti] (9)
		b. /halut-i/ → [halus-i] (6)
		c. /vete/ → (veti →) [vesi] (5)
ii. Korean	*ti (Palatalization)	a. /əti/ → [əti] (54)
		b. /kut-i/ → [kuč-i] (53)
		c. /t'ɨ-iu/ → [t'i-u] (*[č'i-u]) (59)
iii. Icelandic	*aC_oü (*u*-Umlaut)	a.[21]
		b. /barn-üm/ → [börn-üm] (105a)
		c. /akr/ → [akür] (*[ökür]) (105f)

For languages like Finnish, NRC (176) is INPUT, since it should forbid the constraint *ti to apply in morpheme-internal input representations of forms like /koti/ (ia), while letting it apply in the morpheme-internal output representations of forms like *veti* (ic). In comparison, it should be INDIFFERENT for languages like Korean and Icelandic. In order to bar the constraint *ti from applying in the morpheme-internal input representations of forms like /əti/ (iia), it should be INPUT; at the same time, it should also be OUTPUT to prevent the constraints *ti and *aC_oü from applying in the morpheme-internal output representations of forms like *t'i-u* (iic) and *akür* (iiic) respectively. However, it appears that its logically-possible OUTPUT version which does not imply the INPUT version is non-existent empirically. Hence, only two level conditions INPUT and INDIFFERENT can be imposed on NRC (176). Besides, it is assumed that, in case the level conditions on NRC (176) and on a phono-constraint are contradictory to each other, it is the former that wins.

NRC (176), however, gives rise to two problems. First, phono-constraints exceptional to NRC must be added; they are prosodic constraints and those responsible for vowel harmony discussed in 4.2 and 4.3 respectively. Formally, the phono-constraints which do not have their conflicting faithfulness constraints are not subject to NRC (176). To solve the second problem, consider the following Finnish data (Kiparsky 1993):

[21] The morpheme-internal input sequence to which the constraint *aC_oü is applicable has not been found.

(178) a. /vaati-vat/ → [vaativat] (*[vaasivat]) ‘they demand’
b. /vaati-i-vat/ → (vaat-i-vat →) [vaativat] (*[vaasivat]) ‘they demanded’

The *t* → *s* phenomenon can be triggered by the past tense suffix i as in /halut-i-vat/ → [halusivat] ‘they wanted.’ And certain stem-final vowels, including i, are truncated before it as shown in the parenthesized form in (178b). The question now is how to block the derivation of **vaasivat* (178b), which does not in the least violate the INPUT NRC (176). Following Kiparsky’s (1993) idea, we assume that ‘vacuously derived environments’ (i.e., environments not distinct from the underlying environment which arise in the course of the derivation) count as underived. On this assumption, the sequence *t-i* of the truncated form *vaat-i-vat* (178b) is reckoned to be the morpheme-internal input sequence *ti*, which is not affected by the constraint *ti, constrained by the INPUT NRC (176).

Finally, it must be added that, concomitant with the final revision of NRC, necessary changes can be made as regards the argument centering around it in the main body of this article without impairing the claims made there.

A problem related with NRC (27) (or NRC (176)) and P-NRC waits to be clarified. The question inseparably connected with these constraints is whether there is something in common among the phono-constraints that should apply in morpheme-internal input, along with the forms they affect. These phono-constraints and the relevant data are listed in the following:

(179) Languages	Constraints	Examples
a. English	NOCOMPLEX	/[kn]ow/$[_{+PARA}]$ → [[n]ow] (20a)
b. Korean	NOCOMPLEX	/ps’al/$[_{+PARA}]$ → [s’al] (24)
c. Chukchee	ŋ-Assimilation (OUT) (75c)	/ceŋle-te/ → [cenle-te] (78c)
d. Yawelmani	$*V{:}C]_{\sigma}$ (OUT) (cf. (80))	/ʔa:ml-al/ → [ʔaml-al] (80b)
e. Serbo-Croatian	$*C[C, +son]_{LEXWD}$ (IN) (92b)[22]	/okrugl/ → [okrúgao] (93)

Among others, we failed to notice that the constraint $*C[C, +son]_{LEXWD}$ (IN) in (e) above is helpless against NRC (27) (or NRC (176)), because the latter blocks the application of the former to forms like /okrugl/. It is, however, remarkable that the phono-constraints enumerated in the list above, together with the forms to be affected by them, have properties strikingly in common. The phono-constraints all apply in morpheme-internal input to repair ill-formed syllable structure. Most importantly, their conflicting faithfulness constraints are not violated across the board in a paradigm. These common properties thus lead us to the following generalization: the morphemes whose morpheme-internal input is to be affected by phono-constraint(s) which applies morpheme-internally to conform to the well-formedness condition on syllable structure are marked with $[_{+PARA}]$ lexically so that they may be in the range of P-NRC. Moreover, this generalization is assumed to be extended to cases like Korean *ha*-adjectives and mimetic adverbs, Rotuman incomplete phase, Japanese hypocoristics and Axininca Campa augmentation which involve changing of morpheme-internal input structure to meet the FTBIN requirement so that the morphemes concerned may also be governed by P-NRC. This leaves morphemes like English /kēd/ to be lexically-marked with $[_{+PARA}]$ idiosyncratically in the literal sense of the term.

22 The level condition may be redundant, since the category LEXWD inherently denotes INPUT.

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