

Cyclicity Revisited: A Correspondence-Theoretic Approach*

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Kim, Jin-Hyung. 1999. Cyclicity Revisited: A Correspondence Theoretic Approach. *Studies in Phonetics, Phonology and Morphology* 5, 123-146. This paper develops the hypothesis that morphologically-related words are required to be phonologically identical by ranked and violable constraints. In English affixation, pairs of morphologically-related surface forms are linked by output-to-output multiple correspondence relations, and affix-controlled distinct OO₁- and OO₂-identity constraints may force a derived word to deviate from the canonical segmental and stress patterns of English in order to be more like its output base. This approach obviates the traditional derivational analysis that misapplication of phonology in complex words is nothing more than by-product of cyclic rule application. Given multiple correspondence relations, total and partial cyclicity effects are captured in a more direct and unified way within nonprocedural Correspondence Theory. (Korea University of Technology and Education)

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1. Introduction

Since SPE, English phonology and morphology have been investigated in terms of rules and rule orderings. However, Optimality Theory, the theory of surface constraints and their interactions, permits only two levels, e.g. the underlying or lexical level and the surface phonetic level, but not any intermediate levels. Thus there is no room for any rules and their cyclic applications. Here arise two questions. The first question is: is it possible to convert the rule-based analyses of English phonology/morphology into the constraint-based ones? The second question is: what benefits can be obtained through constraint-based

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analyses? This paper argues that various cyclicity effects are indeed based on the multiple correspondence relations with one another, evading both intermediate lexical levels and any derivational account.

This paper is organized as follows. In the second section, we review previous serial approaches to cyclicity and their unsurmountable problems. In the third section, we discuss a number of cases in which multiple correspondence relations play a crucial role in explaining the different shapes of phonology in affixed words. We then go on to discuss the possibility of affix-controlled differentiation of OO-Identity constraints and their interaction with phonological markedness constraints. The final section considers some of the implications of the proposal and concludes the paper.

2. Cyclicity Effects in Derivational Approaches

The idea of cyclicity is that the same set of ordered phonological rules can apply several times to the same form, first to the innermost morphological constituent, then to the next larger constituent, and so on, until the maximum domain is processed. English stress is an important example of this principle. Consider the words in (1):

- (1) a. Root + Level 1 Affix + Level 1 Affix
 órigin ~ orígín-al ~ originál-ity
 sýnonym ~ synónym-ize ~ synonymize-átion
 tóne ~ tóne-al ~ tonál-ity
- b. Root + Level 1 Affix + Level 2 Affix
 póet ~ poét-ic ~ poétic-ize ¹⁾
 Móngol ~ Mongól-ian ~ Mongólian-ism
 átlete ~ athlét-ic ~ athlétic-ism

¹⁾We will assume *-ize* as 'dual class suffix,' implying that it has properties of both level 1 and level 2 suffixes. For example, the following shows that *-ize* can be both stress determining and stress neutral.

stress-determining <i>-ize</i>		stress-neutral <i>-ize</i>	
díalogize	diálogize	skéleton	skéletonize
sýnonym	synónymize	áphabet	áphabetize
nítrogen	nitrógenize	hóspital	hóspitalize

- c. Root + Level 2 Affix + Level 2 Affix
 heed ~ heed-less ~ heedless-ness
 péace ~ péace-ful ~ péaceful-ly
 stráight ~ stráight-en ~ stráighten-able

Lexical phonology/morphology assumes that level 1 stress-sensitive affixes come closer to the root than level 2 stress-neutral affixes, and that level 1 affixation precedes the cyclic stress assignment rules and level 2 affixation follows the cyclic stress assignment rules. The derivations are shown in (2).

(2)	underlying	/origin/
	Level 1	
	cycle 1 phonology	óorigin
	cycle 2 morphology	óorigin+al
	cycle 2 phonology	orígin+al
	cycle 3 morphology	orígin+al+ity
	cycle 3 phonology	orígin+ál+ity
	stress subordination	orígin+ál+ity
	output	[origináality]

This schema of cyclic application explains the above data in (1). In the traditional derivational analysis, where the multiple steps are sequentially ordered from smaller units to larger units, there can be many intermediate representations which have no chance to be realized as such that functions in real time. For example, there is no way the intermediate stages such as *óorigin+al*, *orígin+al+ity*, and *orígin+ál+ity* in (2) can be phonetically attested in everyday usages. In addition to this, there is no explanation in derivational operation why such form should be obtained rather than any other form, no capturing of conspiracy. Consider the following illustrative examples (Dunlap 1988):

(3) a.	graph	[grɛf]	b.	graphic	[græfik]
	psychopath	[saykɒpɛθ]		psychopathic	[saykɒpæθɪk]
	mass	[mɛs]		massive	[mæsɪv]
	class	[klɛs]		classical	[klæsɪkəl]

pass	[pEs]	passive	[pæsiv]
cann	[kEn]	cannibal	[kænəb]
		Janice	[jænis]
		cafeteria	[kæfətiria]
c. graphable	[grEfəb]		
massing	[mEsɪŋ]		
massable	[mEsəb]		
classing	[klEsɪŋ]		
classable	[klEsəb]		
classy	[klEsi]		
passable	[pEsəb]		
passing	[pEsɪŋ]		
laughable	[lEfəb]		
laughing	[lEfɪŋ]		
laugher	[lEfr]		
planner	[plEnr]		
scanner	[skEnr]		

In English dialects spoken in New York and Philadelphia, the low front vowel [æ] has tensed allophone [E] in closed syllables. In (2a), all forms have a following consonant which is tautosyllabic with underlying [æ], thus realized as [E]. In (2b) with level 1 affixes, the conditioning consonant is the onset to the following syllable and the vowel surfaces as [æ], which meets [æ]-Tensing rule. The alternations in (2a) and (2b) suffice to motivate a syllable-sensitive rule of [æ]-Tensing. The contrast between (2b) and (2c), however, appears inconsistent with such a conclusion. In (2c) with level 2 affixes, the root-final consonant is parsed as an onset to the following vowel-initial suffix. Since the alternating vowel is in an open syllable, tensing is not expected. But tensing unexpectedly applies, or overapplies; that is, the vowel is tensed even though it occurs in an open syllable. Put otherwise, the surface syllabification of (2b) and (2c) is identical, but the vowels surface differently. What distinguishes (2b) from (2c) is the morphological status of their suffixes. The forms in (2b) have level 1 suffixes, while those in (2c) have level 2 suffixes. What needs to be explained is the reason why [æ]-Tensing does not apply in the forms in (2b), but does

in the forms in (2c).

[æ]-Tensing rule is not structure preserving, as [E] is not in the underlying phoneme inventory and allophonic in English. Therefore, one might expect [æ]-Tensing to be a post-lexical rule. At the time of [æ]-Tensing application, there is no triggering environment present at level 2 affixed form, that is, no closed syllable, and it cannot apply at all. This failed derivational path is sketched below.

(4)	mass	massive	massing	
	/mæs/	/mæs/	/mæs/	input
		mass-ive		level 1 affixation
		mæ.siv		syllabification
			mass-ing	level 2 affixation
			mæ.sɪŋ	syllabification
				post-lexical [æ]-Tensing
	[mEs]	[mæ.siv]	*[mæ.sɪŋ]	output

As shown above, post-lexical [æ]-Tensing rule will not have any way of distinguishing vowel alternations between *massive* and *massing*. Lunlap(1988) argues, however, that [æ]-Tensing applies in the lexicon at level 2 on the word cycle prior to level 2 affixation rather than post-lexically, and that Structure Preservation holds only at level 1. In addition to [æ]-Tensing at level 2 affixed forms, she observes another group of forms which systematically do not undergo [æ]-Tensing.

(5) Base Form	Truncated Form
Janice [jænis]	Jan [jæn] * [jEn]
Cathy [kæθi]	Cath [kæθ] * [kEθ]
cafeteria [kæfətɪrɪə]	caf [kæf] * [kEf]
mathematics [mæθəmətɪks]	math [mæθ] * [mEθ]

The clipped or truncated forms in the right hand column are all exceptions to [æ]-Tensing, which is a case of underapplication; that is, the vowel is not tensed even though the consonants following [æ] are tautosyllabic with it and should therefore condition a change to [E].

Dunlap gives a derivation for the clipped form *Cath* from *Cathy* as in (6).

(6) level 1	cycle 1	kæ.θi	syllabification
level 2	cycle 0	_____	[æ]-Tensing
	cycle 1	kæθ	clipping

Since Dunlap conceives of clipping to be like affixation at level 2, [æ]-Tensing applies on the word cycle before the clipping, and so does not show any effect because its structural description is not met.

Although Dunlap might have presented a straightforward analysis²⁾ through the interaction of word level [æ]-Tensing with syllabification, there is no one-step explanation in her derivational operation why such form should be obtained rather than any other form. In the serial derivation, surface form is nothing more than the epiphenomenal result of serial rule application. That is, similarity effects between a derivative and its base at the expense of the structural well-formedness, which can be observed both in overapplication cases (*pass* [pEs] ~ *passable* [pEsəbl], *mass* [mEs] ~ *massing* [mEsɪŋ]), and in underapplication cases (*Cathy* [kæθ] ~ *Cath* [kæθ]), cannot be captured directly in the derivational approach. In the derivational model of grammar the only way in which one word can have a systematic effect on the structure of a morphologically related word is to embed the former in the derivation of the latter. This suggests that there is something fundamentally wrong with the operational phonology, and that all those rule orderings and cycles are the products of a mistaken theory.

Next, consider another cyclicity effect in English:

- (7) a. *divine-divinity*, *serene-serenity*, *profound-profundity*
 compete-competitive, *define-definitive*, *prime-primitive*
 clear-clarify, *type-typify*, *mode-modify*, *nation-national*
 b. *head-headlessness*, *odor-odorless*, *legal-legalism*,

²⁾There also arise some difficulties in explaining why [æ]-Tensing does not apply in *beg*[æ]n, *r*[æ]n, and *sw*[æ]m which fit the structural description for the rule. Furthermore, non-lexical words such as *c*[æ]n, [æ]m, *th*[æ]n, and *h*[æ]ve when bearing stress are also the exceptions to [æ]-Tensing.

peace-peacefulness, grateful-gratefully,
 c. ivory, nightingale, stevedore, Averell, Oberon

The data in (7a) undergo Trisyllabic Shortening, which is one of the most interesting phenomena in English phonology. It shortens a stressed vowel if followed by two vowels, the first of which is unstressed. Since Trisyllabic Shortening is subjected to Strict Cycle Condition, whose effect is to restrict cyclic rules in derived environments, it cannot affect the vowels in the first syllable of the postcyclic level derived words in (7b) or monomorphemic words in (7c), even though these vowels meet the structural description of Trisyllabic Shortening Rule.

In lexical phonology/morphology, the ordering of Trisyllabic Shortening should be between level 1 affixation and level 2 affixation, as the following derivation shows:

(8)	/div[i:]n/	/hi:d/	underlying
	divine + ity		level 1 affixation
	dɪv[i]nɪty		Trisyllabic Shortening
		heed+less+ness	level 2 affixation
	[dɪvɪnɪtɪ]	[hi:dlɪsnɪs]	output

The correct output can be obtained serially if Trisyllabic Shortening applies prior to level 2 affixation, satisfying only descriptive adequacy. But in a traditional cyclic analysis there lacks any prediction what form will be obtained or any explanation why its directionality should be always unidirectional, but never vice versa.³⁾ In other words, the conspiracy effect of foot form improvement can never be captured within the step-by-step derivational operation.

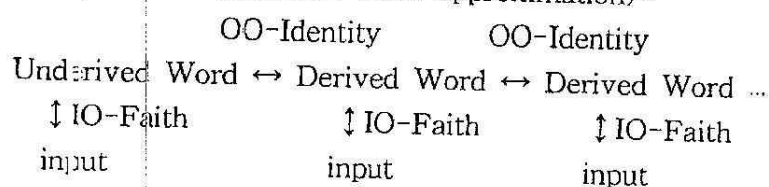
³In English it is assumed that foot forms have their own harmony scale such as (L'L), (H') > (H'L) > (H'H) > (L'H) > (L') (> means 'more harmonic than'), which is based on Prince (1990) and Hwangbo (1997). From this we can say that (L'L) foot is the least marked trochaic foot form, and that (L') is the least harmonic. This harmonic scale predicts that, should there happen some change in foot form, its directionality will always be to the left, but never vice versa. Accordingly, in *di(vi:ni)ty* → *di(vɪni)ty*, there emerges some foot form improvement from (H'L) into (L'L).

3. Multiple Correspondence Relations

McCarthy/Prince(1995) propose that faithfulness in Optimality Theory is regulated by correspondence relations, and different types of correspondence govern different types of linguistic relations. Faithfulness constraints on various correspondence relations interact with each other and with phonological markedness constraints.

Following suggestions made by McCarthy/Prince(1995), Benua(1997b), and Burzio(1998), we extend Correspondence Theory to cyclically affixed words, and propose that two output words that are related by morphological affixation enter into multiple faithfulness relations, shown schematically in (9).

(9) Multiple Correspondence (first approximation)⁴⁾



As can be seen in (9), only unaffixed word is related to its input string by IO-correspondence, and affixed words are related to each other by OO-correspondence. Thus, two types of faithfulness constraints, IO-Faith and OO-Identity, compete with the phonological markedness constraints to produce an optimal output.

The three types of phonology observed in morphologically complex words, which are normal application, overapplication, and underapplication, are all the results of the permuted rankings among IO-Faith, OO-Ident, and Phono-C, which constitute a factorial typology.

⁴⁾In this paper we will assume 'Word-based Morphology' following Aronoff 1976. The Word Based Hypothesis is formulated in the following terms:

All regular word-formation processes are word-based. A new word is formed by applying a regular rule to a single already existing word. Both the new word and the existing one are members of major lexical categories (Aronoff 1976: 21).

(10) Factorial Typology

- a. Normal Application: Phono-C \gg OO-Ident, IO-Faith
 b. Over- and Underapplication: OO-Ident, IO-Faith \gg Phono-C

(10a) is the ranking required in level 1 affixation, allowing the affixed form to be subject to the English-wide phonology. Trisyllabic Shortening is one type of normal application, in which a phonological process with respect to foot-form improvement can compel unfaithfulness to its base.⁵⁾

(11) Normal application of phonology (level 1 affixation)

[d vain] -/ity/	*(H'L)	OO-Ident[μ]	IO-Faith[μ]
a. di (vini)ti		*	
b. di(vaini)ti	*!		

OO-Identity with regard to $M_{AX}(\mu)$ demands that the underlying length be retained. But higher ranking of Phono-C with respect to CO-Identity makes OO-Identity have no effect on level 1 affixation. Candidate (11a) is selected as optimal by the well-formedness constraint *(H'L), even though it violates the faithfulness constraint OO-Ident[μ]. In other words, Trisyllabic Shortening takes place to improve foot-forms, sacrificing the weight identity. This effect is the emergence of the unmarked.

As can be seen in (10b), the 'covert' unity underlying over-and underapplication can be captured by the same ranking hierarchy. Concrete instances of (10b) come from level 2 affixation. [æ]-Tensing process observed in New York and Philadelphia dialects is an overapplication example of (10b), where the primary target of phonology is the stem. Since [æ]-Tensing constraint prohibits the lax alternant in closed syllable (*æC_o), the realization of tense [E] in underived words

⁵⁾Because our main concern is the relative ranking of OO-identity with respect to the structural well-formedness constraint, we will not be concerned with the detailed characterization of other constraints not crucially relevant to this discussion.

like *class*, *mass*, and *pass*, etc. and of lax vowel [æ] in level 1 affixed words like *classic*, *massive*, and *passive* is obtained by the normal application of [æ]-Tensing, that is, $*æC]_0 \gg$ OO-Ident, IO-Faith, as predicted in (10a). Words with level 2 affixes, in contrast, contain tense vowel [E], even though tensing is not conditioned in level 2 affixed words. On the basis of Benua's correspondence-theoretic analysis, we can obtain the optimal output through output-to-output correspondence with an unaffixed word.

With the multiple correspondence model in mind, the words *class*, *classic*, and *classy* have the following transderivational relations between two outputs:

- (12)
- | | | | | |
|----------------|----------|--------------|----------|---------------|
| | OO-Ident | | OO-Ident | |
| <i>classic</i> | ----- | <i>class</i> | ----- | <i>classy</i> |
| IO-Faith | | IO-Faith | | IO-Faith |
| [klEs]-ic | | /klæs/ | | [klEs]-y |

In spite of the fact that the [s] in *classy* is syllabified as an onset of the second syllable, the tense vowel [E], which appears regularly in the closed syllable, is copied. Such an overapplication effect in level 2 affixation is triggered by the undominated OO-Identity constraint, as shown below:

(13) Overapplication in the stem (level 2 affixation)

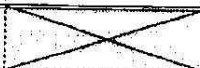

[klEs]-y	OO-Ident[tense]	IO-Faith[tense]	$*æC]_0$
a. klæs.y	* !		
b. klE.sy			

As shown in (13), *classy* bears output-to-output relation with the underived form *class* [klEs], but not with the input form /klæs/. In other words, IO-Faith is not relevant in (13) and does not have any direct effect on the selection of the optimal form. As a result, candidate (13b) is chosen as optimal, although it has a tense vowel in an open syllable.

Turning to another type of misapplication of phonology, consider how

the proposed correspondence relations and their ranking lead to the very desirable explanation of blocking effect in level 2 affixed words. Phonological impenetrability, that is, underapplication of phonology, is a paramount property of level 2 affixed words. Trisyllabic Shortening in level 2 affixed words is a typical example of underapplication (10b), where the primary target is the stem. The words with level 2 affixes such as *mightily*, *bravery*, *weariness*, *laborless*, *nationhood*, *faithfulness* are not affected by Trisyllabic Shortening, although they meet the structural description of the rule. As shown in the schematic multiple correspondence model (9), level 2 affixed word bears only output-to-output relation with its base. With simply reversing the ranking of $*(H'L)$ and $OO\text{-Ident}[\mu]$, we can neatly account for the fact that level 2 affixation witnesses much more phonological invariance than that of level 1. The interaction of the constraints is illustrated below, whose ranking is the same as in overapplication case.

(14) Underapplication in the stem (level 2 affixation)

mighty-ly [maiti]-/li/	OO-Ident[μ]	IO-Faith[μ]	$*(H'L)$
a. (m[i]ti)li	* !		
b. (m[ai]ti)li			*

The other type of underapplication identity effect, where the primary target of phonology is the affix itself, can be seen in Nasal Assimilation between the prefix and the stem in English. In English, negative prefix *in-* and *un-* are similar in their semantic content, but they show phonologically contrastive behavior at the morpheme juncture. In level 1 affixed words, such as *i[m]possible*, *i[m]balance*, *i[n]tolerant*, *i[l]legal*, and *i[r]regular*, etc., the nasal /n/ assimilates in point of articulation before stops, and in manner of articulation before liquids. In level 2 affixed words, however, there lacks Nasal Assimilation effect, as shown in *u[n]profitable*, *u[n]balanced*, *u[n]lawful*, *u[n]real*, etc.

In the multiple correspondence model, this phonological closure effect in level 2 affixes is produced by simple upward ranking of IO-Faith over Phono-C. (15) shows the level 2 paradigm of *unprofitable*, and the

Tableau in (16) demonstrates the interaction of these two constraints.

(15) Level 2 affixation




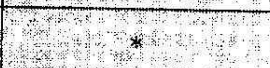
OO-Ident

profitable ----- un-profitable

| IO-Faith

/un/-profitable

(16) Underapplication in the affix (level 2 affixation)

/un/-profitable	OO-Ident	IO-Faith[place]	Nasal Assimilation
a. u[n]profitable		*!	
b. u[]profitable			

Candidate (16a), though obeying Nasal Assimilation, incurs a fatal faithfulness violation with respect to place feature. Thus, candidate (16b), which satisfies highly ranked IO-Faith constraint, is chosen as optimal. As shown in (13), (14), and (16), both affixes and stems in level 2 affixation are fully faithful to their bases, which is unexpected given the general rules or phonotactics of the language, English.

To sum up, when the phonological constraint crucially dominates the identity requirement as in level 1 affixation, its effects are felt in the affixed form. This is the emergence of the unmarked. On the contrary, when some phonological constraint is bottom-ranked, so it is superseded by identity requirement, it is inactive under the relevant conditions. That is, the otherwise well-behaved phonological processes are disrupted by the demands of identity constraint, as shown in the above level 2 affixation. It may happen that parallel uniform phonological change can occur in the affixed form, even though the triggering conditions are not found as in (13). Similarly, regular phonological effects may fail to appear in the affixed form, even though the relevant environment is found as in (14) and (16). The former is the case of overapplication, and the latter is that of underapplication. Even if ordering approach yields the right result, there exists no a priori reason for this particular ordering; it is just by stipulation. It can be best and directly captured by the constraint-based approach.

Multiple correspondence-theoretic approach offers a more direct analysis of phonological identity effects between morphologically related words in terms of a family of constraints requiring phonological identity between words that stand in certain morphological relationship. In particular, OO-Identity constraint evaluates candidate outputs for one word in parallel in terms of their similarity to the morphologically related base from which the word is derived. This approach to cyclicity effects obviates the need for unattested intermediate representations because comparison is made with the base as an independently occurring word rather than as a stage in the derivation of a complex word.

In this section, it has been argued that the rank of OO-Identity constraint determines the phonology of both levels of affixed words. In level 2 affixation, OO-Identity takes precedence over phonological markedness constraints, and forces misapplication of phonology in affixed words. OO-Identity can also be violated under domination; in level 1 affixation, phonological markedness constraint induces normal application of the phonology, and incurs violation of OO-Identity. In the next section, I suggest, following works by Burzio 1997, Benua 1997b, Alderete 1999, among others, that OO-Identity constraints need to be split into OO₁- and OO₂-Identity by affix-specific subcategorizational information, and the meta-ranking of OO₁-Identity and OO₂-Identity constraint produces different surface patterns in each level of affixed words.

4. Affix-Controlled OO-Identity

Segment-related phonology, such as Nasal Assimilation, [æ]-Tensing, Trisyllabic Shortening, etc. discussed in section 3, is characteristically closed in level 2 affixation, whose closure effects are produced by high-ranking of OO-Identity, while it applies normally and disrupts paradigmatic identity in level 1 affixation. However, there seems some identity effects to be found also in level 1 affixation. Consider the stress patterns in following data:

- (17) a. lòllapalóoza⁶⁾ Cánada
 Àlexànder Amériica
 àbracadàbra cínema
 Klìmanjáro ársenal
 Pènnsylvania análysis
- b. original ~ origináality sensátional ~ sensàtionáality
 arístocràt ~ arístocrátic démocràt ~ démocrátic
 ànecdòte ~ ànecdótal hòmicìde ~ hòmicídal
 fràternize ~ fràternizáation élement ~ èleméntary
- c. párent ~ párenthòod fáithful ~ fáithfulness
 Amériican ~ Amériicanism lábor ~ láborlèss
 pròpagànda ~ pròpagándist nàtion ~ nàtionhòod

In general, at level 1, morphological regularity is low (*compel* ~ *compulsive*, *curious* ~ *curiosity*, *describe* ~ *descriptive*, *problem* ~ *problematic*, *horizon* ~ *horizontal*, etc.) and phonological effects are extensive, while at level 2 both characteristics reverse: high morphological regularity (*compel* ~ *compelling*, *curious* ~ *curiousness*, *describe* ~ *describing*, etc.) and limited phonological effects. Aside from the morphological (ir)regularity problem, we will focus our discussion on the different phonological effects observable in level 1 and level 2 affixation in terms of English stress pattern.

In English nouns and adjectives, main stress is located on a heavy penult, else on the antepenultimate syllable, and secondary stress is canonically from the left edge of the word as in (17a). Abstracting details away, we can assume that primary stress is assigned by laying down moraic trochees from right-to-left, ignoring the final syllable; secondary stress is then derived by assigning trochees from the left edge of the word. Following Pater 1995, this can be characterized as the ranking below.

⁶⁾While secondary stress falls on the initial syllable in underived words with a pretonic string of light syllables, as in *lòllapalóoza*, it is violated when the second syllable is heavy, as in *Monòngahéla*, which would satisfy the weight-to-stress principle by stressing the heavy syllable.

(18) Stress in Monomorphemic English Words⁷⁾

- (a) *ALIGN-HEAD-RIGHT*: The foot head of the PrWd must coincide with the right edge of PrWd (McCarthy/Prince 1993a).

ALIGN-L: Every PrWd is aligned at its left edge with the left edge of some foot (McCarthy/Prince 1993a).

- (b) *ALIGN-HEAD-RIGHT* \gg *ALIGN-L*

Moving to the stress patterns in derived words, primary stress is still subject to *ALIGN-HEAD-RIGHT*, but secondary stress is not leftmost in level 1 affixed words as shown in (17b). Instead, secondary stress appears on the very vowel that bears primary stress in its immediate base, that is, the main stress of the base is preserved as a secondary stress in the derived word. This can be regarded as a cyclicity effect found in level 1 affixation. Unlike level 1 affixed words, level 2 affixed words are fully faithful to the base, that is, primary stress in the base form is retained in the affixed form as such, as can be seen in (17c).

On the basis of these different identity patterns exhibited by English level 1 and level 2 affixed words, we can assume that two kinds of affixation must be subject to distinct OO-Identity constraints. That is, there are at least two distinct OO-correspondence relations instantiated in English, one proper to level 1 affixation, and the other to level 2 affixation. Just as so-called level 1 and 2 affixes behave differently due to their subcategorization frames, so affix-specific lexically marked subcategorization information invokes *OO₁*-correspondence and *OO₂*-correspondence respectively. We will follow Benua 1997b and Alderete 1999 in proposing that level 1 affixes subcategorize for an *OO₁*-correspondence relation governed by *OO₁*-Identity constraint, and level 2

⁷⁾There are some other constraints which play an active role in determining the well-formedness of English metrifications. The operative constraints are as follows.

Foot Binarity: Feet are binary at some level of analysis (μ , σ).

Trochaic Rhythm Type: Feet are left-headed.

Non-Finality: No head of PrWd is final in PrWd.

These constraints are all ranked above *ALIGN-HEAD-RIGHT* and *ALIGN-L*. But for a simplicity these specific details are ignored here except where these do bear directly on the argument which follows.

affixes subcategorize for a distinct OO_2 -correspondence relation governed by OO_2 -Identity constraint. Thus multiple correspondence model in (9) can be further refined as follows.

(19) Multiple Correspondence

OO_1 -Identity		OO_2 -Identity	
Underived Word	↔ Level 1 Derived Word	↔ Level 2 Derived Word	
↓ IO-Faith	↓ IO-Faith	↓ IO-Faith	
input	input	input	

The finding that primary stress of the base is perfectly preserved in level 2 affixation but partially preserved in level 1 affixation drives us to the meta-ranking of OO_1 -Identity and OO_2 -Identity constraints: CO_2 -Identity \gg OO_1 -Identity.⁸⁾ The distinction between level 1 and level 2 affixation with respect to the stress pattern may now be modelled in terms of constraint interaction. The interspersing of the faithfulness constraints on the one hand and the phonological markedness constraints on the other hand constitutes a total ranking of constraints.

(20) Stress in Derived Words

- a. meta-ranking of faithfulness constraints:

CO_2 -Identity \gg OO_1 -Identity

- meta-ranking of phonological constraints:

$ALIGN-HEAD-RIGHT \gg ALIGN-L$

- b. full ranking:

CO_2 -Identity \gg $ALIGN-HEAD-RIGHT \gg$ OO_1 -Identity \gg $ALIGN-L$

This accounts for the typical patterns in level 1 and level 2 affixation. The local ranking of CO_2 -Identity \gg $ALIGN-HEAD-RIGHT$ brings the desired effect in level 2 affixation that the attachment of level 2 affix will not affect the placement of primary stress at all, and that the base and the affixed form will have primary stress in exactly the same

⁸Why there should be such a meta-ranking remains an open question. It seems likely that learnability issues are involved; such a ranking makes the system easier for the learner to master.

place, a kind of paradigm uniformity effect and misapplication of phonology. The ranking of $\text{ALIGN-HEAD-RIGHT} \gg \text{OO}_1\text{-Identity}$ provides a cogent explanation of non-uniform application of phonological process and non-preservation of base head foot in level 1 affixed words, which is the emergence of the unmarked. Finally, the ranking of $\text{OO}_1\text{-Identity} \gg \text{ALIGN-L}$ yields preservation of base prosody in a non-primary stress foot, with the result that leftward secondary stress footing misapplies. These stress patterns are illustrated in the tableaux given below.

(21) Stress Preservation in level 2 affixation

[párent]+/hood/ → párenthòod⁹⁾

[párent]-/hood/	OO ₂ -Idt [Stress]	ALIGN-H _D -R _T	OO ₁ -Idt [Stress]	ALIGN-L
a. pa(rént)hood	*!	*		*
b. (párent)hòod		**		

(22) Primary Stress Shift in level 1 affixation



[órigín]+/al/ → oríginal

[órigín]-/al/	OO ₂ -Idt [Stress]	ALIGN-H _D -R _T	OO ₁ -Idt [Stress]	ALIGN-L
a. (óri)gínal		***!		
b. o(rígi)nal		**	*	*

⁹⁾We assume that level 2 affixes constitute separate p-words and that they comprise the domain of word stress rules. For example, *parenthood* and *compartmentalization* contain two p-words (*parent*)_w (*hood*)_w, and three p-words (*compart*)_w (*mental*)_w (*ization*)_w respectively. Each p-word is stressed individually, and the relationship among the p-word stresses within the lexical word is determined by a general stress system.

(23) Partial Identity Effect in level 1 affixation

[orɪɡɪnəl]+ity → orɪɡɪnəlɪty

[orɪɡɪnəl]-/ity/	OO ₂ -Idt [Stress]	ALIGN-HEAD-RIGHT	OO ₁ -Idt [Stress]	ALIGN-L
a. (ðrɪ)ʔɪ(nəl)ty		**	*!	
b. o(rɪɡɪ)nəlɪty		**		*

In (21), the ranking OO₂-Identity \gg ALIGN-HEAD-RIGHT is all that is needed to place primary stress on the correct syllable of level 2 affixed word *parenthood*, producing stress-neutrality in level 2 words. In (22), however, OO₁-Identity is dominated by the constraint responsible for positioning primary stress, namely ALIGN-HEAD-RIGHT, so rightward main stress placement applies normally and disrupts OO₁-Identity in level 1 paradigms. There could be other possible candidates more agreeable to ALIGN-HEAD-RIGHT¹⁰ like *origi(nəl)* and *o(rɪɡɪ)nəl*, but these fatally violate the higher-ranked constraint Non-Finality and Trochaic Foot respectively (cf. fn. 6).

In (23), the primary stress is not preserved in the mapping from *original* to *originality*, which is contrasted with the pairs *párent* ~ *párenthood* of (21). However, level 1 affixation still does correlate with a preservation of secondary stresses, as shown in the above data (17b). Here the ranking OO₁-Identity \gg ALIGN-L plays a crucial role in determining the optimal form. While OO₁-Identity is dominated by ALIGN-HEAD-RIGHT, it is ranked above ALIGN-L, which is responsible for the placement of secondary stress, so leftward secondary stress placement misapplies.

By ranking OO₁-Identity constraint between ALIGN-HEAD-RIGHT and ALIGN-L as above, the non-uniform application of phonology, to use Prince's term, emerges. OO₁-Identity is matched in level 1 affixed words by a shifting of the secondary stress foot away from its canonical left-aligned position, thus sacrificing ALIGN-L. This nonuniformity or

¹⁰ALIGN-HEAD-RIGHT demands that the main stressed syllable be as close as possible to the right edge of the word, and therefore each syllable intervening between the head syllable and the edge should be counted as a violation, a gradient constraint. So with ALIGN-L.

inhomogeneity is an important argument for Optimality Theory. In rule-based or parametric theories, a language is or is not subject to its phonological well-formedness constraints. OT does not demand such a typological strictness. Left foot alignment is obligate normally as in *lollapalózu*, *Álexánder*, *àbracadábra*, *Kilimanjáro*, and *Pènnsylvania* etc., but it is disobeyed under the forced condition, OO₁-Identity here in level 1 affixation. This is a direct consequence of OT idea that a grammar is a hierarchy of ranked and violable constraints. To summarize, two distinct OO₁- and OO₂-Identity constraints, ranked differently with respect to phonological markedness constraints, produce the desired shapes of phonology.

Here arises a question. Why is it that in doubly affixed level 1 derived words as in *(óri)gin* ~ **o(rígi)nal* ~ *o(rígi)(náli)ty* paradigmatic identity is observed in only one of these pairs? A cursory glance reveals that there seems to be some asymmetry that *o(rígi)(náli)ty* mimics the stress feet of its base *o(rígi)nal*, but that *o(rígi)nal* is not faithful to the footing of its base *(óri)gin*. While many cases of cyclicity effect can be subsumed under OO-Identity, not all can; that is, apparently the primary stress generated on the previous cycle is never carried over on the next cycle often and often again, as exemplified below.

- | | |
|------------------------------|------------------------|
| (24) a. expéct ~ èxpectátion | telépathy ~ tèlepáthic |
| spécific ~ spècificity | mechánic ~ mèchanístic |
| phonétic ~ phònetician | cosmétic ~ còsmetician |
| pathólogy ~ pàthològical | diámeter ~ diàmétric |
| b. órigin ~ original | grámmar ~ grammárian |
| médicine ~ médicinal | cívil ~ civílian |
| máesty ~ majéstic | próphecy ~ prophétic |
| míracle ~ miráculous | nóvel ~ novélla |

Upon this, we propose the undominated constraint *CLASH is responsible for it. *CLASH is a general constraint that bans a too-near adjacency of prominences. When stress clashes arise in the course of morphological concatenation, Rhythm Rule or Stress Shift operates to remove clashes. If there can be found any landing site available as in

(24a), Move x applies; if not as in (24b), Delete x applies. More generally, the proposition that the clashes are disfavored can be thought of as one of the well-formedness constraints, namely 'eurhythmicity,' and can have influence on various aspects of word and sentence phonology.

From the $*CLASH$ perspective, examples illustrated in (24) can be adequately explained with the interaction of $*CLASH$ and the influence of base stress on derived words. Here undominated ranking $*CLASH$ plays a central role in controlling the secondary stress patterns. In addition, the relative ranking of other constraints in the hierarchy finds support once again. The interaction of constraints is illustrated below.

(25) [expéct]+ation \rightarrow èxpectátion

[expéct]-/ation/	$*CLASH$	OO ₂ -Idt [Stress]	ALIGN -H _D -R _T	OO ₁ -Idt [Stress]	ALIGN -L
a. ex(pèc)(tátion)	*!		*		*
b. (èxpec)(tátion)			*	*	

(26) [médicine]+al \rightarrow médicínal

[médicine]-/al/	$*CLASH$	OO ₂ -Idt [Stress]	ALIGN -H _D -R _T	OO ₁ -Idt [Stress]	ALIGN -L
a. (mè)(cíci)nal	*!		**		
b. me(díci)nal			**	*	*

In (25) and (26), (25a) and (26a) are more faithful to the metrification of the base than (25b) and (26b) respectively. But these candidates that match OO₁-Identity perfectly are rejected by highly ranked $*CLASH$. The constraint interaction leads to the selection of (25b) and (26b) as optimal.

In this section, we have shown that various stress-related behaviors between level 1 affixation and level 2 affixation result from the different ranking of two distinct OO₁- and OO₂-identity constraints with respect to the structural well-formedness constraints: $*CLASH \gg OO_2\text{-Identity} \gg \text{ALIGN-HEAD-RIGHT} \gg OO_1\text{-Identity} \gg \text{ALIGN-L}$. To sum up, in level 1

affixation ALIGN-HEAD-RIGHT responsible for the primary stress is more important than the faithfulness to the base prosody and the latter is more important than ALIGN-L responsible for the secondary stress, so words with level 1 affixes are only partially faithful to the base prosody. But in level 2 affixation the situation is on the contrary, that is, faithfulness to the base prosody is more crucial than obeying the structural well-formedness constraints, so words with level 2 affixes are fully faithful to the prosodic organization of the base. This brief sketch of English stress patterns is obviously incomplete, but it is sufficient to show that stress placement is affected by distinct identity requirements, and that different types of affixes exercise different identity effects.

5. Implications and Conclusions

In this paper we have argued that the correspondence-theoretic approach based on ranked and violable constraints is more restrictive in its predictions, when compared with previous derivational approaches in terms of cyclicity. In particular, affix-controlled multiple correspondence-based analysis makes possible a unified account of level-ordering cyclicity effects. By bringing the paradigmatic faithfulness relations into the foreground, segmental and accentual similarity effects found in morphologically related words are more directly captured. We have shown that both misapplication (over- and underapplication) of various segmental processes and misapplication of stress placement in affixed words are enforced directly by OO_1 - and OO_2 -Identity, rather than just the epiphenomena of serial operations.

Though so far we have accounted explanatorily for the phonological behavior across levels through constraint ranking and violability, there still remains an unanswered question. What does it mean that the constraints are so ranked? The answers to this question cannot be entirely internal to phonology, but must ultimately be grounded on functional motivation, in the broader sense of perception, production, and acquisition.

As language is in a state of tension, so is phonology. In phonology, structural well-formedness constraints can be seen as reflecting the easiness of the speaker's articulation, while faithfulness constraints can

be thought of as reflecting the discriminability of the hearer's perception and the paradigm leveling of the learner's acquisition. These constraints cannot be optimized simultaneously, that is, it is impossible for some output to have the desired structural properties and also be faithful to the input. Therefore they can conflict each other.

In level 1 affixation, the conflict is resolved in favor of the easiness of the speaker's production at the expense of hearer's discriminability and learner's paradigm leveling. But in level 2 affixation, uniform exponence is established at the expense of speaker's no effort economy principle. This tense trading relation between the two conflicting principles could arrive at the equilibrium in sometime and somewhere, and there should appear certain optimal output.

This paper is not closed, of course. Many different types of phonology need to be examined as well. In particular broader cross-linguistic study is needed to establish more securely the typological relations between the identity constraints and the various phonological constraints in morphologically complex words. It could be that there are indeed real gaps, uncovered and unpredicted by Correspondence Theory. Further empirical and formal investigation will undoubtedly sharpen the questions, and even provide answers.

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