

# Alignment and Its Effect of Level Ordering

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Kim, Jong Shil. 1999. *Alignment and Its Effect of Level Ordering*. *Linguistics* 7-3, 175-195. Level ordering in the Lexical Phonology and Morphology has contributed to the analysis of morpheme sequencing, blocking effects, and conversion in morphology and strict cyclicity in phonology. In this paper, we take up the issue of level ordering and morphology-phonology interface in terms of Optimality theory. We analyze word level affixes to be outside a phonological word and rather to be subcategorized for one. By assuming prosodic exclusion of those affixes in terms of alignment, we claim that the so called level ordering can be replaced with different prosodic parsing. At the same time problematic cases of earlier analyses such as bracketing paradox and ordering paradox are shown to be natural consequences of mismatches between prosodic and morphological parsing. (Inje University)

## 1. Introduction

Alignment constraint family has been established as one of the most general and powerful constraint groups in the literature of Optimality theory and has continued to expand its effectiveness. One of its functions is to account for the interaction between morphology and phonology. McCarthy & Prince (1993a) gives insightful analyses on the prosodic morphology by utilizing the constraint hierarchy between alignment constraints and other prosodic constraints.

In this paper, we again take the alignment device to account for the level ordering effects of different groups of affixes. We show that not the level distinction but the aligned prosodic structures are the reason for different behaviors of affixes. Just as level distinction has been presumably assigned in the lexicon for each affixes in the level-ordered

analysis, the so called word level affixes are analyzed to be subject to external alignment which takes the phonological word as its base. Unlike the theory of Lexical Phonology and Morphology, other internal affixes don't have to be specified for where they belong but they are part of the general process of phonological parsing. Furthermore, the new analysis will solve some problematic cases like bracketing paradox and ordering paradox as natural consequences of the morphology-phonology interface under the alignment.

In the following sections, we will first discuss problems of earlier analysis based on the level ordering, followed by a summary on the alignment constraints. Then we will present the new analysis which utilizes the alignments and subsequent mismatch between morphological and phonological parsing.

## 2. Level Ordering-LPM Model

The level distinction of the Lexical Phonology and Morphology (Kiparsky, 1982 & 1985) (hereafter, LPM) has played a crucial role in analyzing morphology-phonology interface. Phonologically, the Strict Cyclicity has been incorporated into the theory as inherent property of lexical rules which are sensitive to derived environments. Morphologically, on the other hand, the LPM model has contributed to providing reasonable explanations on the grouping of different affixes. For instance, the level ordering is considered to reflect morpheme sequencing as in (1).

### (1) Morpheme sequencing.

- a. L-1 affixation: áthlete, athlétic, athléticism
- b. L-2 affixation: húman, humanítarian, humanítarianism
- c. home-less-ness vs \*home-ness-less,  
cheer-ful-ness vs \*cheer-ness-ful

Thus, the level ordering predicts how the layers of affixation would

ultimately come out to form a lexical word. It is also a good indicator for the productivity difference among affixes. For instance, the level-one affixes are more or less limited in distribution and have more exceptions in their paradigm whereas the level-two affixes are quite productive and regular in their meaning as in (2).

- (2) a. L-1 '-ous': abounding in, full of, characterized by,  
of the nature of; \*bottomous  
b. L-2 'X-less': without X; bottomless

The level distinction also makes it easy to explain the blocking effects: i.e., the special word formation occurs prior to the general one, thus making the later rule fail to apply to otherwise already concatenated form for the same meaning.

(3) Blocking effects.

- a. oxen, \*oxes  
b. sang, \*singed

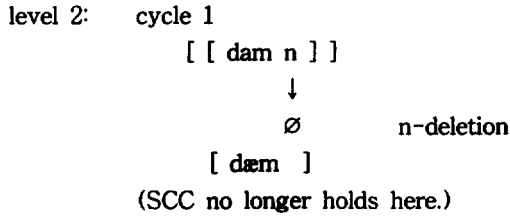
Conversion and stress difference can also be analyzed as the result of level distinction. In the level one, verb to noun shift occurs with stress assignment. In the level two, however, the noun to verb conversion cannot accompany stress shift since the stress is no longer assigned there.

(4) Level ordering and Conversion

- a. V --> N: L-1  
survéy[V] --> súrvey[N]  
b. N --> V: L-2  
páttern[N] --> páttérn[V], \*pattérn[V]

Phonologically the strict cyclicity has been considered to be the major characteristic of lexical rules in the LPM model. Morpheme





The above process has the property that the final element of the domain undergoes the rule. A closer look at the case with level two suffixes shows that the suffix is not included in the domain of phonological rules. London vernacular English and dentalization are similar cases where the phonological rules apply to the final element of the domain as in (8) and (9).

(8) London Vernacular English (Benua, 1997): [ou] → [ɔə] / \_ #

- a. non-final [ou]: pause, board, sauce, water, lord, dawn
- b. word final [ɔə]: paw, bore, poor, saw, soar, draw
- c. non-word final [ɔə]: paws, bored, poorly, poured, soars, draws

(9) Allophonic Dentalization (Benua, 1997):

[t, d, n, l] → [t̪, d̪, n̪, l̪] / \_ [θ, (ə)r]

- a. Dental before θ, (ə)r                      b. Alveolar elsewhere
- train    [t̪reɪn]                                      t̪ame    [teɪm]
- ladder    [læd̪ər]                                        loud    [laʊd]
- an̪them    [æŋθ̪əm]                                      elem̪ənt̪    [el̪əmənt̪]
- c. with level-1 suffix: elementary [el̪əməŋt̪riy],    san̪itary [sæŋt̪riy]
- d. with level-2 suffix: louder [laʊd̪ər],    later [leɪt̪ər]

Note that in (8.c) and (9.d) the level two affixes appear to stand outside the domain of rule application unlike those of level one (9.c).

On the other hand, the notion of derived environment should collectively exclude the type of structure-building rules like syllabification and stress assignment. Thus, the revised SCC is defined to incorporate the exceptional nature of structure-building processes and

word level.

(10) Revised SCC (Kiparsky, 1985)

If W is derived from a lexical entry W', where W' is nondistinct from XPAQY and distinct from XPBQY, then a rule A --> B / XP\_\_QY cannot apply to W until the word level.

The 'non-distinctness' indicates that the 'feature-building' rules and the 'word level' are excluded from this constraint. Then, we are left with the following questions. Are we entitled to stipulate the definition of the SCC in this way? Does this definition have any explanatory power?

Much more damaging argument against the level distinction comes from the morphological side. The most prominent problems are the cases of bracketing paradox and ordering paradox.

(11) Bracketing Paradox

a. Phonology

L-1 : [[grammatical]-ity]

↓

[grammaticality] (bracket erasure convention)

L-2 : [un[grammaticality]]

b. Morphology

un-[grammatical]Adj

[[ungrammatical]Adj-ity]N

(12) Ordering Paradox

read - abli - ity

L-2      L-1

In (11.a), phonologically the level one suffix is attached prior to the addition of the level two suffix whereas in (11.b) the morphological subcategorization of the prefix is an adjective, thus making the morphological bracketing differ from the phonological one. In (12),

simply the level two suffix comes before the level one suffix and this type of word formation is rather productive. Furthermore, the prosodic condition on a morphological process like English comparative and superlative seems to have exceptions as in (13.b).

- (13) a. happy, happier, happiest  
 b. unhappy, unhappier (\*more happy), unhappiest (\*most happy)  
 c. beautiful, more beautiful, most beautiful

In (13.b), the base to which the comparative suffix '-er' is attached seems to be rather 'happy' than 'unhappy' violating the condition that the base should be at most bisyllabic foot. Here the base for the comparative formation appears to be the stem only. In other words, the suffix is not a part of the morphological process. Considering that both affixes 'un-' and '-er' are level two affixes, there is no way that the grammatical form 'unhappier' is formed. In the same way, the following Korean examples (14) show that for certain group of affixes the stem appears not to interact with the affixes, thus making them outside the domain of phonological rule application.

(14) Korean

- |            |                             |
|------------|-----------------------------|
| a. /ʌps-i/ | b. /kaps#ul/                |
| ʌps'i      | kaps'ul~kabal <sup>1)</sup> |

The English examples and the Korean case in (14) with morphological irregularities above point out the fact that certain affixes just fall outside the domain of phonological rules. Thus the nonapplicability is the result of different domains not of the level ordering that different groups of affixes take.

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1) Here, instead of resyllabification across the stem and the nominal suffix, the stem final consonant clusters are simplified as if they are in the word-final position.

So far we have discussed the level ordering in the LPM model and the problematic cases. Phonologically, the strict cyclicity had to be stipulated to incorporate the notions of word level exceptionality and structure-building rules. Morphologically, on the other hand, there were counter-examples to the strictness of level ordering. Some analyses based on the Optimality theory tried to account for the effect of derived environment as the result of constraint conjunction. In this paper, we will mainly focus on the level ordering and attempt to provide an alternative analysis that does not need to stipulate the definition or doesn't show the exceptional cases of level ordering like bracketing paradox or ordering paradox. The main idea will involve 'alignment constraints.' In the following section, we will first discuss the general characteristics of the alignment.

### 3. Generalized Alignment

McCarthy & Prince (1993b) generalizes the family of alignment constraints to include all the cases where constituents (phonological and/or morphological) are joined to share an edge.

(15) Generalized Alignment (GA: McCarthy & Prince, 1993b)

Align(Cat1, Edge1, Cat2, Edge2) =def

$\forall$  Cat1  $\exists$  Cat2 such that Edge1 of Cat1 and Edge2 of Cat2 coincide.

Where                      Cat1, Cat2  $\in$  PCat  $\cup$  GCat

Edge1, Edge2  $\in$  {Right, Left}

According to the above constraint, any morphological or phonological category should match either edge (left or right) with other morphological or phonological category. In this way, morphological processes, phonological processes, and phonology-morphology interface are easily captured in a general manner. According to McCarthy & Prince, the actual application results in describing the following types.



(16) Descriptive results by applying the GA

- a. Footing patterns
- b. Infixability
- c. Prosody/Morphology correspondence
- d. Prosodic subcategorization

Among the four, the prosody/morphology correspondence and prosodic subcategorization are relevant functions of the alignment with respect to the analysis to be given in this paper. In terms of the prosody/morphology correspondence, the alignment accounts for the case where a phonological process is sensitive to the morphological concatenation. For instance, in Axininca Campa the epenthesis fails to apply word-initially but it does apply in stem-final position. The relevant alignment constraints and corresponding tableaux are given below.

(17) Align-L (McCarthy & Prince, 1993a)

$$]_{\text{stem}} = [_{\text{PrWd}}$$

The left edge of the Stem must coincide with the left edge of a PrWd.

(18) Axininca Campa

/oti-aanc <sup>n</sup> i/	Align-L	Onset	Fill
☞ [oti-			
[ʔoti-	*!		*

The non-application of epenthesis in Axininca Campa can be accounted for by the alignment constraint along with the ranking with other phonological constraints. On the other hand, epenthesis instead of coalescence in the case of suffixation can be analyzed due to yet another alignment constraint as in (19).

(19) Align (McCarthy & Prince, 1993a)

$$]_{\text{stem}} = ]_0$$

Every final stem-edge matches to a final syllable-edge.

(20) /iN-koma-i/

	Parse	Onset	Align	Fill
☐ .iŋ.ko.ma.l.Ti.		*		*
.iŋ.ko.ma.l.i.		**!		
.iŋ.ko.ma.l.<i>	*!	*		
.iŋ.ko.ma.li.		*	*!	

Namely, the two alignments have the opposite effects. The Align-L (17) prohibits the stem-initial epenthesis whereas the Align (19) bans the stem-final coalescence. Thus in Axininca Campa the application of epenthesis is conditioned by morphology and that is well captured by the alignment constraints.

The fourth point of the GA (16.d) is especially crucial in this paper. In Axininca Campa the augmentation happens to fulfill the requirement that the base of suffixation should be a prosodic word. In addition to the alignment below (22), the foot-binarity constraint makes the base be augmented to a prosodic word.

(21) Axininca Campa: Suffix-to-PrWd (McCarthy & Prince, 1993a)

The Base of suffixation is a Prosodic Word.

a. Suffixation of /na/

/na/	FtBin	Sfx-to-PrWd	Fill
na piro]		*!	
na] piro	*!		
☐na[A] piro			**

b. Reduplication of /na/

/na/	FtBin	Sfx-to-PrWd	Align	Fill
na.na		*!		
na.} na	*!			
na[A.} naA			*!	**
☐na.[A.} na.AA				****

(22) Align-Sfx (McCarthy & Prince, 1995)

Align (Suffix, L, PrWd, R)

"The left edge of every suffix coincides with the right edge of some PrWd."

i.e. "The base of suffixation is a PrWd."

That is, the suffix is subcategorized for a prosodic unit: namely, a prosodic word. Thus, the root [na] is augmented to the bisyllabic prosodic word [nata] to be concatenated with the suffix. This analysis is quite important in that for the first time the prosodic unit is recognized as being subcategorized for a morphological unit.<sup>2)</sup> This idea of phonological subcategorization for affixes are crucial in this paper, which we will discuss in the next section.

So far, we have investigated and shown that the multiple aspects of the GA family that often works on the morphology-phonology interface.

#### 4. Different Affixes and Alignment

In this section, we will show that the alignment constraints and their interaction with phonological constraints can replace the level distinction of the LPM model. The analysis will mainly focus on the English data. In addition, the new analysis will present some solutions on the paradoxes discussed earlier.

Extensive work on prosody has established prosodic constituents and their hierarchy which is assumed to obey strict layering. Thus from a foot to a phrase, prosodic units are regarded to be parsed into higher units exhaustively. The strict layer hypothesis (23) states that generalization.

(23) Strict Layer Hypothesis (Selkirk, 1984):

A prosodic unit of a given level of the hierarchy is composed of one or

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2) We may say that this is something similar to the notion of prosodic template.

more units of the immediately lower prosodic unit, and is exhaustively contained in the superordinate unit of which it is a part.

This hypothesis disallows cases like non-exhaustive layering, contradictory bracketing among the constituents with different prosodic levels, or recursivity. The licensed prosodic units are then subject to various phonological processes.

In Prince & Smolensky (1993), the phonological parsing of a lexical word is given by the following constraint.

(24)  $\text{LexWd} \approx \text{PrWd}$

A member of the morphological category  $\text{MCat}$  corresponds to a  $\text{PrWd}$ .

This constraint makes it certain that the morphological units be aligned with prosodic units in order to be prosodically parsed. That way, we can explain why prosodically problematic words do not exist in some languages. For instance, Latin does not have monomoraic word since the phonological word with one mora cannot fulfill the requirement of foot-binarity.

Obviously a lexical word does not necessarily have only one prosodic word as was discussed in the literature of Prosodic Phonology (Selkirk: 1980, Nespor & Vogel: 1986, Inkelas: 1989, etc.). Compounds often form two distinct phonological words and certain affixes are considered to form phonological words of their own. Selkirk (1995) formulates the alignment constraint on prosodic words as in (25).

(25)  $\text{GAlign-R}$  (Selkirk, 1995)<sup>3)</sup>

Align ( $\text{PrWd}$ ,  $R$ ,  $\text{Lex}$ ,  $R$ )

Align the right edge of every prosodic word with the right edge of some lexical word ( $N$ ,  $V$ , or  $A$ )<sup>4)</sup>

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3) This constraint is rather general in contrast to other affix-specific alignments to be given later and is named as such. In Selkirk (1995), it is called 'Align.'

According to the GAlign-R (25), when the lexical word contains suffixes, the domain of a phonological word will be extended to the suffixes. We can say the same thing about prefixed words. There are, however, instances which show distinct phonological words for affixes and stems in compounds. In English, level one affixes appear to be within the same phonological word with the stem whereas level two affixes are outside the phonological word domain. In any case, in the similar pattern to the GAlign-R (25) we suggest the general alignment for prefixed stem as in (26).

(26) GAlign-L

Align (PrWd, L, Lex, L)

Align the left edge of every prosodic word with the left edge of some lexical word.

We will use the cover term GAlign-Pwd to imply that a morphological word with affixation gets overall prosodic structure, that is, a prosodic word, via the alignments (25) and (26).<sup>5)</sup>

In the case of level one affixes, the above general alignments for the phonological word are enough to make sure that the lexical word is within the domain. However, the level two affixes are definitely outside the domain of the phonological word. These external affixes<sup>6)</sup> are subcategorized for a phonological word and therefore they are not included in the phonological word. We assume that these affixes are marked as such in the lexicon just as they were regarded to have inherent level distinction in the LPM model. The relevant constraints are given in (27).

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4) A lexical word designates a morphosyntactic word  $N_0$ ,  $V_0$  or  $A_0$ . (Selkirk, 1995)

5) In a sense, the effect of the GAlign-Pwd is similar to that of (24),

6) I follow Grijzenhout & Krämer (1999) for the use of the term 'external affixes' to designate affixes that are outside the domain of a prosodic word.



(30) English stress and Alignment constraints (McCarthy & Prince, 1993b)

a. Align(PWd, L, Ft, L):

Each PWd begins with a Ft. (aka AL-Pwd<sup>8</sup>: Initial Dactyl)

b. Align(Ft, R, PWd, R):

Every foot stands in final position in the PWd. (aka AL-Ft)

c. Non-final: The final element is not included in the prosodic constituent.

(31) 'origin-al'<sup>9</sup>: with level-1 suffix

'original'	Non-final	GAlign-Pwd (27 & 28)	AL-Ft (30b)	AL-Wd (30a)	EXH <sub>o</sub>
σ(o<rfgi>n al)			*		
(<ðri><g nal>)	*!				
(<ðri>g nal)			**!		
(o<rfgin>) al	*!		*		*

The '-al' in (31) is an internal suffix. Thus it is subject only to general alignment given in (27) and (28). Other constraints determine the footing patterns of stress assignment in this word. Here, AL-Wd (30.a) and AL-Ft (30.b) combined with non-finality constraint for extraprosodicity (30.c) account for the optimal form.

(32) 'interest-ing': with level-2 suffix

'interest'	Align-ext	Non-final	GAlign-Pwd (27 & 28)	AL-Ft (30a)	AL-PWd (30b)	EXH <sub>o</sub>
σ(<inte>rest ing)			*	*		*
(<inte><rést ing>)	*!					
(<inte><rést> ing)	*!			*		

8) We changed the name of the constraint AL-PwD from the Align-PwD (McCarthy & Prince, 1993b) so that it won't be confused with other alignment constraints given in this work.

9) ( ) designates 'a prosodic word.' < > is for a 'foot' and | for a morpheme boundary.

In the case of external affixes, however, the Align-Sext (27) plays a crucial role and dominates other constraints. Since all the phonological rules apply within the domain of a phonological word, the Align-Sext results in ruling out the cases where the suffix is inside the whole prosodic word and thus not subcategorized for the prosodic word. On the other hand, the forms with internal suffixes do not violate the constraint (27).

In the case of 'damnation' and 'damning' of (6), the n-deletion does not apply in the former since the [n] is not the final segment of the phonological word. [n] is deleted in 'damning,' just as in 'damn,' not because the strict cyclicity does not hold any longer for this form but because the [n] gets to be located at the final position of the phonological word as in 'damn' and thus undergoes the deletion. The relevant constraints and tableaux are as follows.

(33) \*mn) : The [mn] sequence is prohibited at the final position of the prosodic word.

(34) damnation vs damning

a. 'damnation': with level-1 suffix

/dæmn-eyʃən/	Align-ext	GAlign-Pwd	*mn)	IO-Max	EXH <sub>o</sub>
↖(dæmn   eyʃən )					
(dæm   eyʃən )				*!	
(dæmn)   eyʃən		*!	*		*
(dæm)   eyʃən		*!	*	*	*

b. 'damning': with level-2 suffix

/dæmn-ɪŋ/	Align-ext	GAlign-Pwd	*mn)	IO-Max	EXH <sub>o</sub>
(dæmn   ɪŋ )	*!				
(dæm   ɪŋ )	*!			*	
(dæmn)   ɪŋ		*	*!		*
↖(dæm)   ɪŋ		*		*	*

Here, of course, the general GAlign-Pwd and exhaustivity should be



violated in (34.b) in favor of specific Align-ext. In (34.a) the [mn] sequence inside the prosodic word should not be subject to the n-deletion whereas in (34.b) the [n] is realized as [∅] since it is at the final position of the prosodic word and thus drops to satisfy the constraint (33) despite it violates the IO-Max constraint.

In prefixes, things are similar as in (35).

(35) a. \*NC: Nasal and obstruent sequence with different place of articulation is not allowed.

b. 'impossible': with level-1 prefix

/in-possible/	Align-ext	GAlign-Pwd	*NC	Ident(pl)	EXH <sub>o</sub>
( in   possible)			*!		
∅(im   possible)					
in   (possible)		*!			*
im   (possible)		*!			*

c. 'unpopular': with level-2 prefix

/un-popular/	Align-ext	GAlign-Pwd	*NC	Ident(pl)	EXH <sub>o</sub>
(un   popular)	*!				
(um   popular)	*!				
∅un   (popular)		*			*
um   (popular)		*		*!	*

The nasal assimilation applies to level one affix since it is inside the domain of a phonological word whereas the level two affix is outside the domain and thus is not subject to the process. This way, the application or nonapplication of phonological processes can be uniformly accounted for. For the cases mentioned in (8) and (9), the same analysis can be given.

Now the problematic cases of earlier analysis can be re-examined within this framework. In fact the bracketing paradox between phonology and morphology is the natural result of the alignment differences. Morphologically the prefix and the suffix can be

concatenated at the same time. On the other hand, the phonological parsing is done independently by the alignment. As in (36), the optimal form is something that has distinct prosodic structure for the suffix and the prefix respectively. Thus in this analysis, bracketing paradox is just one of possible mismatches between phonological and morphological parsing.

(36) 'ungrammaticality': with level-2 prefix and level-1 suffix

/un-grammatical-ity/	Align-ext	GAlign-Pwd	*NC	Ident (pl)	EXH <sub>o</sub>
(un   grammatical   ity)	*!				
(uŋ   grammatical   ity)	*!				
un (grammatical   ity)		*			
uŋ (grammatical   ity)		*		*!	

In the case of ordering paradox, we assume that the morpheme sequence is the result of morphological subcategorization not of the level ordering. Thus as long as the grammatical category matches with the designated subcategorization, any word formation should be fine. Prosodically, the word can have a recursive structure as in (37).

(37) ((read)able-ity)

Since the suffix 'able' is attached to a verb and the nominal suffix 'ity' is concatenated to an adjective, the word is qualified in terms of morphological subcategorization. Phonologically the external affix 'able' lies outside the prosodic word 'read' and at the same time the suffix 'ity' should be included inside the whole phonological word. We know that the external suffix does not participate in the stress assignment due to its external nature. It does, however, get the stress for some native speakers of English in this case as 'readability.' In other words, the external affix which usually does not form its own prosodic word is realized as one when it is inside the recursive structure. This way, the

violability of constraint 'recursivity' and alignment constraint presents extension to the analysis of otherwise exceptional cases of English. The candidates of the prosodic structure of (37) are presented in the following tableau.

- (38) i. NON-REC: Prosodic constituent should not be recursive.  
 ii. prosodic structure of 'readability'

candidates	Align-ext	GAlign-Pwd	NON-REC
a. □((read) able   ity)			*
b. (((read) able) ity)			**!
c. ((read   able) ity)	*!		*
d. (read   able) ity	*!		*
e. (read   able   ity)	*!		*
f. (read) able   ity		*!	

In the above tableau, (38.a) does not violate Align-ext and GAlign-Pwd with minimal violation of Non-recursivity. Forms like (38.c & d & e) violate Align-ext since the level-2 suffix '-able' does not take prosodic word for its base. The candidate in (38.f) violates GAlign-Pwd since the whole lexical word lacks alignment with a prosodic word. (38.b) satisfies both Align-ext and GAlign-Pwd but contains too many recursive structures. Thus the optimal form is the one with appropriate morphological concatenation and prosodic parsing and it is definitely not a counter-example as suggested in the framework of the LPM.

So far we have shown that the level distinction can be replaced by the alignment constraints in the Optimality theory. We have also shown that the new analysis is an improvement over the earlier level-based analysis in that it accounts for the different behaviors of affixes as the matter of mismatches of morphological and phonological parsing without relying on other extra phonological theory like Prosodic Phonology as the LPM model had to. It could be done due to the effect of morphology-phonology interface which is one of the inherent

characteristics of the alignment. Furthermore the new analysis has even presented plausible explanations on the problematic cases of the level ordering like the bracketing paradox and the ordering paradox.

## 5. Conclusion

In this paper we looked at the alignment and its effect as level ordering of affixes. We showed that the level one affixes don't necessarily have to be specified for its prosodic parsing since the general alignment assumes the role of assigning the prosodic constituent for any lexical word. On the other hand, the external level-two affixes had to be specified for its alignment which takes the phonological word as its base. That is, the alignment constraints enabled the morphology to look directly at the prosodic unit for its affixation process. We could also separate the morphological parsing and phonological parsing and that distinction helped to account for the bracketing paradox and the ordering paradox as natural results of the alignment constraint hierarchy.

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