ON THE RELATIONSHIP BETWEEN MORPHOLOGY AND PHONOLOGY: INTERACTIONISM VS. NONINTERACTIONISM

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0. Introduction

Since its introduction in 1982, Lexical Phonology has contributed to an increased understanding of language. The segmental phonology of several languages have been analyzed in this framework including Korean by Ahn (1985), Malayalam by Mohanan (1986), English by Borowsky (1986), Basque by Hualde (1988), and Japanese by Ishihara (1991). Pulleyblank (1986) applied Lexical Phonology to analyses of tone in African languages. Since 1982, the tenets of the theory such as level-ordered morphology and phonology have been challenged and the model itself has been modified to accommodate new findings.

Volume 4 of Phonetics and Phonology edited by S. Hargus and E. M. Kaisse is an outcome of a workshop on Lexical Phonology held at the University of Washington in 1990. The book, consisting of three parts, contains sixteen articles. The articles in Part I deal with the relation between morphology and phonology. The papers contained in Part II discuss some basic tenets of the theory such as structure preservation, the derived environment condition, and the strict cycle condition. Finally, the articles in Part III discuss application of the theory to historical change.

* I would like to thank Peter R. Petrucci for checking English and suggesting stylistic improvements. I am also grateful to two anonymous reviewers for their comments and suggestions to an earlier draft of this article. All remaining errors are of course my own.
Since I do not have enough space to present a detailed review of the entire book, I will put the focus of this article on the first part. More specifically, I will review two articles: “Deriving Cyclicity” by S. Inkelas and “Interaction between Modules in Lexical Phonology” by D. Odden. Each author proposes a new version of the theory. There are two conflicting hypotheses about the relation between morphology and phonology. Inkelas assumes that morphology and phonology interact: phonological rules may apply before morphological processes. By contrast, Odden posits that morphology and phonology do not interact: morphology exclusively precedes phonology.

This review article has the following organization. Before reviewing the papers, I will present a summary for each part in Section 1. Then, I will review Inkelas’ paper in Section 2 and Odden’s article in Section 3. Section 4 presents concluding remarks.

1. Summary

Since its introduction in 1982, fundamental hypotheses of Lexical Phonology including the Strict Cycle Condition and Level Ordering Hypothesis have been under attack from different directions. As a consequence, some of these hypotheses have been modified and/or reformulated. Although the theory has been challenged, it has contributed to development of other kinds of studies related to phonology. For example, the framework of the theory has been applied to diachronic phonology. The articles in this book reflect changes in the formulation and understanding of these hypotheses. This book consists of an introduction and three parts. A brief summary of each part is presented below.

The first part, titled “the Interaction of Morphology and Phonology”, contains six articles by G. Booij and R. Lieber, S. Hargus, S. Inkelas, D. Odden, K. D. Rice, and R. Sproat. The authors deal with questions pertaining to the interaction of morphology and phonology. These questions have been addressed since early researches in Generative Phonology such as Chomsky and Halle (1968). Odden is the only one among the contributors who follows Chomsky and Halle in claiming that phonological rules should apply only after all morphological concatenations have taken place. His argument is based on analyses of data from Maltese. By contrast, using data from Finnish, Dutch, German, and other languages, Hargus shows that phonological
rules may precede morphological rules in some cases. In other words, phonology and morphology interact. Also, Borowsky's article in Part II argues that morphology precedes and feeds phonology cyclically at the Stem level, whereas all the phonological processes take place prior to all morphological operations.

Some of the articles discuss problems which were not addressed by the classical model of Lexical Phonology. Like Booij and Lieber, Inkelas argues that phonological and morphological structures are built in tandem, but they need not be isomorphic with each other. That is, word-internal phonological domains are independent of morphological structures. She also posits that cyclicity is the consequence of automatic application of phonological rules upon construction of a new prosodic constituent. Sproat shows that English /l/-Darkening, supposed to be a postlexical rule, refers to the internal structures of words. Finally, Rice proposes that Slave has three types of word-internal phonological domains.

The second part, titled "on Some Basic Tenets of the Theory", includes five articles by T. Borowsky, L. M. Hyman, G. K. Iverson, P. Kiparsky, and W. J. Poser. The articles address questions concerning basic hypotheses assumed by the advocates of classical Lexical Phonology such as Strict Cycle Condition and Structure Preservation. First of all, Kiparsky proposes that the Strict Cycle Condition should be disposed of since its effect referred to as Nonderived Environment Blocking (NDEB) can actually be derived from segmental underspecification. His argument crucially depends on the distinction between structure-building and structure changing rules. In contrast, Iverson claims that strict cycle effects, or NDEB, are properties of neutralization rules. Non-neutralizing rules are not concerned with the condition. Finally, Poser proposes that a concatenation requirement and a requirement of phonological rule application should be distinguished when application of a phonological rule refers to a derived environment condition.

The crux of Structure Preservation is that lexical rules preserve basic underlying segments and their arrangements as well as the tonal inventory of a language. Borowsky, however, suggests that the constraint does not hold at the word level and as a result new allophones can be created in the lexicon. In other words, some lexical rules may not be structure-preserving. In contrast, Hyman shows that the effect of Structure Preservation may be extended to the postlexical
component. According to him, the application of one postlexical tonal rule in Dagbani which would create contour tones is blocked, whereas the application of another postlexical tonal rule is not blocked and contour tones are created. If Hyman’s account is correct, this asymmetric application of blocking suggests that Structure Preservation holds for certain rules but not for others at the same postlexical component. Consequently, these two cases lead us to doubt the credibility of the hypothesis. Something must be done with Structure Preservation to provide adequate explanations of cases like these two.

The last part, titled “Applying the Theory to Historical Change”, contains three articles by B. E. Dresher, E. M. Kaisse, and D. Zec. The authors apply findings in Lexical Phonology to diachronic phonological changes. Both Kaisse and Zec claim that a phonological rule that would bring about a diachronic change in a phonological representation is added postlexically and gradually moves up in the lexicon. Once the rule has become lexical and remains at a certain level, according to Kaisse, it could begin spreading or moving its domain downward to other levels or to the postlexical component.

As the brief summary of each part suggests, there have been challenges to the central claims of Lexical Phonology. For example, Booij and Rubach (1987) have shown that not all lexical rules are cyclic. In addition, Sproat (this volume) demonstrates that a postlexical rule may distinguish word-internal structures. Inkelas (1989/1990, this volume) even proposes a new model which is referred to as Prosodic Lexical Phonology. This book presents the most recent challenges to and advocacy of the basic tenets of the theory. In the following two sections, I will review two articles pertaining to the relationship between morphology and phonology.

2. Prosodic Lexical Phonology

In this section, I will review Inkelas’ “Deriving Cyclicity” as a representative of phonological theories which posit that morphology and phonology interact. This article presents an overall picture of a theory known as Prosodic Lexical Phonology (PLP), introduced in Inkelas (1989/1990). This theory has developed from (Standard) Lexical Phonology (SLP) introduced in Kiparsky (1982). Thus, Inkelas assumes a level-ordered lexicon. In what follows, I first present an outline of PLP and offer arguments for the theory presented
in her article. Then, I will briefly discuss a problem known as the bracketing paradox and propose a solution to the problem.

2.1. The model

The main difference between PLP and SLP is that in the former theory, phonological rule domains and morphological structures are represented separately. In other words, a structure created by a morphological operation is not the place where phonology takes place as assumed in SLP and other theories of Phonology. A domain in which phonological rules apply is formed by an algorithm. Such a domain is called a prosodic constituent (p-constituent). The P-Constituent Formation Algorithm (PCF) depicted in (1) creates a p-constituent which corresponds to a morphological constituent (m-constituent).

\[
\text{(1) P-CONSTITUENT FORMATION ALGORITHM (Figure (9) on p. 82)}
\]

\[
[x]_m \rightarrow [x]_m \quad [x]_p
\]

Inkelas assumes that there is a parallel m-constituent formation, referred to as the M-Constituent Formation Algorithm (MCF), which has functions comparable to Selkirk's (1982) rewrite rules for morphology. The MCF has the following schema:

\[
\text{(2) M-CONSTITUENT FORMATION ALGORITHM (Figure (10) on p. 82)}
\]

\[
x \rightarrow [x]_m
\]

Thus, when a phonological rule applies to a stem, the form has the following representation.

\[
\text{(3) } [\text{stem}]_m \\
[\text{stem}]_p
\]

The rule applies within the p-constituent only after the PCF creates a domain and the rule never refers to the m-constituent.\(^1\)

PLP follows SLP in assuming a level-ordered lexicon. Thus, PLP needs to provide distinct types of lexical p-constituents. That is, it will need a mechanism to generate such constituents in the appropriate order. To create such a mechanism, Inkelas revises both the PCF and the MCF in the following way:

\(^1\) The PCF raises the following question: Does it create a derived environment? If so, how can the Derived Environment Condition or Elsewhere Condition prevent feature changing rules like Trisyllabic Shortening from applying to non-derived stems such as nightingale and ivory?
(4) PCF (revised) (Figure (9) on p. 82)
\[ [x]_{mi} [x]_{pi-1} \rightarrow [x]_{mi} [x]_{pi} \]

(5) MCF (revised) (Figure (10) on p. 82)
\[ [x]_{mi} \rightarrow [x]_{mi+1} \]

The index \( i \) in (4) and (5) indicates a level in the lexicon. Following Inkelas, I use variables such as \( \alpha \) and \( \beta \), with \( \alpha \) being the lowest, to mark the lexical levels.

To clarify the revised algorithms, I have quoted the following sample derivation from Inkelas (Figure (11) on p. 82), which shows the assignment of level 1 (\( \alpha \)), level 2 (\( \beta \)), and word level (\( w \)) structure of a simple stem.

(6) Underlying representation: stem

<table>
<thead>
<tr>
<th>Level 1</th>
<th>MCF</th>
<th>[stem]_{m\alpha}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PCF</td>
<td>[stem]_{p\alpha}</td>
</tr>
<tr>
<td></td>
<td>phonological rules</td>
<td>[stem]_{p\alpha}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 2</th>
<th>MCF</th>
<th>[stem]_{m\beta}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PCF</td>
<td>[stem]_{p\beta}</td>
</tr>
<tr>
<td></td>
<td>phonological rules</td>
<td>[stem]_{p\beta}</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Word level</th>
<th>MCF</th>
<th>[stem]_{m\omega}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PCF</td>
<td>[stem]_{p\omega}</td>
</tr>
<tr>
<td></td>
<td>phonological rules</td>
<td>[stem]_{p\omega}</td>
</tr>
</tbody>
</table>

The sample derivation demonstrates that the level-2 p-constituent is formed only after the level-2 m-constituent is created out of the level-1 m-constituent. This mechanism plays a crucial role in English as I will show later. Within a single level, both the MCF and the PCF may apply cyclically. That is, an affixed form undergoes formation of a m-constituent and a p-constituent in the stem cycle and formation of both constituents after affixation.

2.2. Arguments for PLP

So far I have only described the outline of PLP and presented no convincing argument for the preference of the theory to SLP. Inkelas offers two such arguments with respect to the representation of words: mismatch of the two constituents and double subcategorization. I will first present her arguments for PLP with respect to mismatches between morphological and prosodic structures. Then, I will present Inkelas' argument for the preference of PLP with respect to double subcategorization.
2.2.1. Mismatch

There are, according to Inkelas, two kinds of mismatches between morphological and prosodic constituents. One concerns number of prosodic constituents created in compounding. The other kind of mismatch pertains to invisibility of phonological units.

2.2.1.1. Compounds

A difference in the behavior of compounds provides PLP with an argument for its preference over SLP. As described in Mohanan (1986) and Nespor and Vogel (1986), some languages have two types of compounds. One type of compounds has only one phonological domain while the other type has two domains. For example, compounds in Greek and compounds in Italian behave differently for phonological purposes (see Nespor and Vogel for detail). Every compound in Greek has one primary stress. In other words, compounds in this language form a unitary domain for stress rules. On the other hand, every compound in Italian has two primary stresses. Thus, we can conclude that Italian compounds create two domains for stress assignment although they function as a unit morphologically.

PLP offers better accounts of this behavioral difference in the two kinds of compounds than SLP does. As outlined above, PLP assumes a double domain where prosodic and morphological constituents are represented separately. Under this view, compounds of the type found in Greek have a representation as illustrated in (8a), while compounds of the type found in Italian are represented as in (8b).

(8) Two types of compounds (Figure (12) on p. 83)

\[
\begin{align*}
a. & \quad [\text{kukl}a]_m \quad [\text{ku}l]a_p \quad \text{‘doll’} \\
& \quad [\text{spiti}]_m \quad [\text{spiti}]_p \quad \text{‘house’} \\
& \quad [\text{kuklas}piti]_m \quad [\text{kukl}as\text{piti}]_p \quad \text{‘doll’s house’} \\
b. & \quad [\text{tost}a]_m \quad [\text{tosta}]_p \quad \text{‘toaster’} \\
& \quad [\text{pane}]_m \quad [\text{p\text{Á}n\text{É}}}e]_p \quad \text{‘bread’} \\
& \quad [\text{tostapane}]_m \quad [\text{tosta}]_p[\text{p\text{Á}n\text{É}}}e]_p \quad \text{‘bread toaster’}
\end{align*}
\]

Since stress assignment (and other phonological rules) applies within a single p-constituent, a compound with representation like the one in (8b) contains two domains for the rule. Therefore, it will have a primary stress in each prosodic domain. As a result, the compound itself will have two primary stresses. On the other hand, a compound with representation like the one in (8a) contains only one domain for stress assignment. Consequently, only one primary stress is contained
by the compound. Furthermore, each type of compound has only one m-constituent, indicating that it functions as a single unit morphologically.

In contrast, SLP, which does not assume “double representation”, cannot offer an adequate representation for a compound which has one morphological constituent and two phonological constituents. Under the theory, the Italian compound may be represented as either [tɔstapane] or [tɔsta][pane]. The former does not show that the word has two phonological domains; the latter implies that the compound may not behave as a morphological unit since its constituents are separated. As demonstrated above, PLP does not have this kind of representational problem. Thus, we can conclude that PLP is preferable to SLP.

2.2.1.2. Invisibility

There is another source of mismatch between morphological and prosodic structures. This concerns the behavior of some phonological units such as segments or syllables. In this phenomenon which has been known as “extrametricality” or “extraprosodicity”, such a unit may not be scanned for phonological rules when it occurs at an edge. For example, English has a final-syllable extrametricality as reported in Hayes (1981). The final syllable in “camera” is not seen in stress assignment which goes from right to left. As a result, the primary stress is placed on the initial syllable, which is the head of the left-headed (or trocheic) foot. If the final syllable were not extrametrical, English stress rule would assign the stress on the penultimate syllable, which would be the head of the foot.

PLP offers the following account for extrametricality. As illustrated below, when the p-constituent does not contain a phonological element at the right edge, there occurs a mismatch between the m-constituent and the p-constituent. As a consequence, the final element becomes invisible and should not be scanned for a phonological rule.

(9) Invisibility of the final syllable
    [camera]_m  [came]_p ra

2 Ito (1986) presents examples of extrasyllabicity of segments.
3 See also Halle and Vergnaud (1987) for diacritic marking of extrametricality.
It is clear now that the peripherality condition of extrametricality follows naturally from the double representation in which invisible material is external to the p-constituent although the m-constituent contains the corresponding material. Under this view, a mismatch always takes place at an edge. Thus, only the initial or the final element will be invisible.

The way of representing extrametricality provides another argument for preference of PLP to SLP which does not assume the representation with double constituents. PLP predicts that no element in the middle will be invisible. Otherwise, a stem would have a discontinuous p-constituent as depicted in (10) since the syllable in the middle is external to both the first and the second p-constituents.

(10) Invisibility of a medial syllable

\[ \text{[camera]}_m \quad \text{[ca]_p} \quad \text{me} \quad \text{[ra]}_p \]

On the contrary, such a prediction cannot be made for representation of extrametricality where an extrameral element is represented with a diacritic marking such as angled brackets (see Halle and Vergnaud (1987) for instance) as illustrated in (11a). Under this diacritic-marking approach, however, it is also possible to mark a medial element as extrametrical as illustrated in (11b).

(11) a. final extrametricality b. medial extrametricality

\[ \text{[came <ra>]} \quad \text{[ca <me> ra]} \]

Notice that there is no discontinuous constituent in the representation in (11b) since the constituent boundaries are located before the first element and after the last element. A theory with such a representation of extrametricality has no mechanism to prevent such a marking.

2.2.2. Morpheme Classification

In the preceding subsection, I have argued for PLP by presenting what its dual representations can say about an asymmetry in compounds and about extrametricality. In this subsection, I will present another argument for PLP presented in Inkelas. It is related to the classificatory power of PLP.

Languages have four types of morphemes: stem, affixes, (bound) roots, and clitics. Among the four types, stems are free. That is, a stem such as nation in English can occur as a word by itself. The other three types are bound or dependent. Inkelas classifies these four types of morphemes in the following way, referring to their morphological and/or prosodic (phonological) dependence.
Classification of morphemes (Figure (22) on p. 86)

<table>
<thead>
<tr>
<th>m-DEPENDENT</th>
<th>NOT m-DEPENDENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>p-DEPENDENT:</td>
<td>Affix</td>
</tr>
<tr>
<td>Not p-DEPENDENT:</td>
<td>Root</td>
</tr>
<tr>
<td>Stem</td>
<td>Stem</td>
</tr>
</tbody>
</table>

A stem, which is a free morpheme, is neither m-dependent nor p-dependent. A clitic, which can attach to both nouns and verbs, is p-dependent but not m-dependent. A root, which has to attach to another root to form a word, is m-dependent but not p-dependent. Finally, an affix, which has to be attached to a stem of a certain syntactic element, is both m-dependent and p-dependent.

This classification in fact reveals properties of the morphemes. That a clitic is p-dependent but not m-dependent is indeed the main property of clitics. For example, a possessive clitic -z can attach to a noun like *the man's hat* or a verb like *in the man I know's hat*. All it requires to occur is that the base it is attached to has phonological content. Since a root is m-dependent, it cannot produce a m-constituent by itself. As a result, no p-constituent is created because a p-constituent is formed corresponding to a m-constituent. Since there is not any p-constituent, no phonological rules should apply to a root.

That bound stems do not constitute phonological rule domains on their own has been observed in past research (Kiparsky (1982), Brame (1974), and Harris (1983), among others). However, the version of SLP expounded in Kiparsky predicts that cyclic phonological rules apply after each morphological process, including the insertion of bound roots. On the contrary, PLP does not make such a false prediction. Finally, since an affix is both m-dependent and p-dependent, it has to have a double subcategorization such as the one depicted in (13).

(13)  a. m-subcategorization  b. p-subcategorization

\[
\begin{align*}
\text{a. } & N \{ \text{ma al}_\text{ma} \} \quad \text{b. } [ \text{pa al}_\text{pa} ]
\end{align*}
\]

Morphological subcategorization (henceforth m-subcat) indicates that the suffix -al is attached to a Level-\(\alpha\) noun like *nation* to make a Level-\(\alpha\) adjective like *national*. Prosodic subcategorization (henceforth p-subcat), on the other hand, says that the suffix is attached to a Level-\(\alpha\) p-constituent to make another Level-\(\alpha\) p-constituent. This double subcategorization is crucial for the argument for PLP presented in the next subsection.

To sum up, the four-way classification of morpheme types depicted in (12) follows from the representation assumed by PLP in which
morphological and prosodic constituents are represented separately. SLP, which does not assume such representation, cannot come up with such a classification. Thus, it is obvious that PLP is preferable to SLP.

2.3. Prosodic Level Designation

The preceding section presented the outline of Prosodic Lexical Phonology introduced by Inkelas and offered a few arguments for its preference to Standard Lexical Phonology. From what has been discussed thus far, PLP seems to be a more promising theory than SLP. In this section, however, I will present a problem that PLP must deal with and propose a solution to the problem.

Since the establishment of SLP, the ordering of some affixes has been a subject of controversy among scholars of phonology (see Selkirk (1982), Sproat (1985), and Mohanan (1986) among others). For example, SLP of English has the following well-known problem concerning the ordering of some affixes. To produce *ungrammaticality*, a level-1 (L1) suffix *-ity* has to be affixed to *ungrammatical* which is an outcome of word formation at Level 2; the prefix *un-*, which was affixed in the previous cycle, is a level-2 (L2) affix. This kind of problem has been known as the bracketing paradox. As a solution to this problem, Mohanan proposes the notion of the loop. According to him, a form derived in Level \( n \) morphology can go back to Level \( n-1 \) morphology. In the case of the present example from English, *ungrammatical* which is produced at Level 2 goes back to Level 1 so that the suffix *-ity* is combined with the stem. However, this account instantly raised this question: If the loop is allowed, why is the level-ordered morphology needed? PLP does not seem to come up with a convincing solution to the problem of the bracketing paradox. Since it follows SLP in the assumption that the lexicon has some kind of levels as demonstrated by the sample derivation in (6), it may have to rely on the notion of loop to derive words such as *ungrammaticality* where level-\( \alpha \) affix is attached to a level-\( \beta \) constituent.

The assumption of double representation appears to offer a solution to the bracketing paradox if we combine SLP and PLP and make the following modification to accommodate both models. Levels in the lexicon are designated only in the phonological component. The morphological component has nothing to do with level ordering in the lexicon. Under this assumption, an affix which is m-dependent and p-dependent has the dual subcategorization as illustrated in (14).
m-subcat designates only the morphological category of the host, while the p-subcat designates the level. Thus, a L1 suffix -al, for instance, has the following subcategorizations:

(14) a. m-subcategorization
     A [N [ ] al]
  b. p-subcategorization
     [[ ]p1 al]p1

The m-subcat only states that the suffix is attached to a noun to form an adjective, while the p-subcat states that it must be affixed to a L1 stem. Let us refer to the level designation by p-subcat as Prosodic Level Designation.

Prosodic Level Designation derives the controversial words such as ungrammaticality as follows. First, the L2 prefix un- is attached to the L1 stem grammatical as in (15) to produce ungrammatical. Since m-subcat only designates the category of the host of affixation, a L2 affix can be attached to a L1 stem in the m-constituent as long as the concatenation meets the subcategorization frame. However, since the prefix belongs to Level 2, the affixation of un- cannot produce a p-constituent containing the prefix.

(15) m-constituent     p-constituent
     [ungrammatical]A     [grammatical]p1

This intermediate form is then combined with a L1 suffix -ity and the outcome is as follows:

(16) m-constituent     p-constituent
     [ungrammatical-ity]N     [grammaticality]p1

Since -ity is a L1 affix, a p-constituent is constructed containing the suffix. At this stage, cyclic phonological rules applying in Level 1 take effect. A p-constituent containing the L2 prefix is not constructed because the stem is still at Level 1. This asymmetrical form exits the level and enters the next level.

When the form represented as in (16) enters the phonological component at Level 2, a L2 p-constituent is constructed.

(17) m-constituent     p-constituent
     [ungrammaticality]N     [grammaticality]p2

At this stage, the L2 prefix un- can produce a L2 p-constituent containing the affix and L2 phonological rules apply in the constituent. This final output of the derivation has the following representation:

(18) m-constituent     p-constituent
     [ungrammaticality]N     [ungrammaticality]p2

In summary, the derivational process above presents a convincing solution of the bracketing paradox without referring to the loop. This
is only possible with the assumption of double representation and
double subcategorization. Following the previous models, the new
model also assumes that the Lexicon is level-ordered. But it defers
from them in positing that level ordering is designated by phonology
rather than morphology.

2.4. Summary

I have outlined the theory of PLP as the representative of phonol-
ogical theories which assume that morphology and phonology interact.
As I have argued, PLP has a clear preference to other theories which
do not assume double representation. Furthermore, Inkelas (1989)
presents an account of a phonological process in English referring to
the assumption of the morphology-phonology interaction. The stem
final nasal in *condemn* deletes when the word has not undergone any
affixation or a suffix of the type $\beta$ (i.e. a L2 suffix) such as -*ing* is
attached to the stem.

(19) a. condemn b. condemning c. condemnation

When a suffix of type (i.e. L1 suffix) such as -*ation* is affixed, the stem
final nasal does not delete as demonstrated by the example in (19c).

She has the following account.4 When the stem enters level-$\beta$ pho-
nological component, a p-constituent is constructed. Then the deletion
rule applies before the -*ing* suffixation. As a result, the word in (19b)
is pronounced without the stem final nasal being articulated. On the
contrary, the nasal in *condemnation* does not delete. Since the form
has been produced in the previous level, the rule which deletes the
stem final nasal cannot apply. This account illustrates that a phonol-
ogical rule may apply before a morphological process takes place.
This seems to be only possible if we assume that morphology and pho-
nology interact.

In the next section, I will review a theory which does not have the
assumption as PLP does.

3. Noninteractive Lexical Phonology

In this section, “Interaction Between Modules in Lexical Phonology”
by D. Odden will be reviewed. I will first outline the theory he pro-

4 Mohanan (1986) presents a similar account of stem-final nasal deletion.
3.1. The Model

Odden argues for preference of another version of Lexical Phonology presenting paradoxes raised by properties of SLP. In this paper, he posits that morphology and phonology do not interact in such a way that phonological rules may apply prior to some morphological processes. According to this theory, which is referred to as Noninteractive Lexical Phonology (NLP), morphology exclusively PREcedes phonology; no morphological process takes place after any phonological rule. (Halle and Vergnaud (1987) also adopt the ordering of morphology before phonology.) In this respect, NLP crucially differs from PLP (and SLP), which posits that morphology and phonology interact. However, NLP agrees with PLP and SLP in the assumption that the morphological component and the phonological component are both level-ordered. The new version of lexical phonology has the schema as illustrated in (20).

(20) NLP schema (Figure (3) on p. 113)
According to this model, after the final morphological process is completed, the morphological form goes into the phonological component. Then, rules of Lexical Phonology apply.

Odden argues that the domain in which lexical rules of a level apply extends to the outermost brackets constructed in the level. In other words, L1 lexical rules apply to the entire domain created in Level 1 and L2 rules apply to the entire domain created in Level 2. In the latter case, the phonological rule domain will be the entire word since L2 brackets contain L1 brackets. I have presented a sample derivation of domains in (21).

\[(21) \quad \left[\left[\text{nation}\right]_{L1} \alpha \left[\text{ity}\right]_{L1} \text{es}\right]_{L2}\]

In the word, L1 rules apply to nationality and L2 rules apply to nationality-es.

He presents arguments for this domain construction. I discuss only one case from rules of Kimatuumbi phonology. The language has a phonological process in which a high vowel becomes a corresponding glide when another vowel follows. This rule, referred to as Glide Formation (GF), desyllabifies a prevocalic high vowel and lengthens the following vowel for compensation. The examples presented in (22), which are cited from Odden, illustrate GF.

\[(22) \quad \begin{align*}
\text{a. } /\text{kj-yl/} & \rightarrow \text{kyyl} \quad \text{‘frog’} \\
& \text{Cl.7-fron} \\
\text{b. } /\text{my-anju/} & \rightarrow \text{mwaanj} \quad \text{‘in the firewood’} \\
& \text{Loc.-firewood}
\end{align*}\]

In (22b), no compensatory lengthening takes effect since the vowel following the high vowel is already long.

The cases in which two prevocalic vowels occur in sequence provide

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5 Halle and Vergnaud (1987) have a different assumption on application of phonological rules. They posit that cyclic rules apply after every cyclic morphological process. Thus, stress assignment rules cyclically apply to [nation], [national], and [nationality].

6 Odden shows the following paradox. Initial Tone Insertion (ITI) in the language refers to phonological and morphological properties of the preceding word. Thus, ITI should not be lexical. However, the rule must apply before Glide Formation, which is a lexical rule. In other words, ITI should be lexical. This paradox is a counter-example to a hypothesis of SLP which claims that lexical phonology has no access to the output of the syntax. He also demonstrates that the phonology of glides in Classical Arabic and overapplication of Glide Formation in Kihehe reduplication do not necessarily argue for interactionism. Both rules can actually be accounted for with Noninteracting Lexical Phonology.
the argument for the phonological rules domain that extends to the entire form constructed in a certain level. Compare the two examples in (23) cited from Odden.

(23) a. /mʊ-i-ʊtɛ/ → myiɻɛ ‘you should pull it’ 2pl-them(Cl.9)-pull
b. /mʊ-i-ʊlɑ/ → myʊʊɻɑ ‘in the frogs’ Loc.-Cl.8-frog

It should be noted that each form has a triplet of vowels. Odden presents the following account of the different application of GF. The two forms have the morphological structures as depicted in (24).

(24) a. [mʊ-i-ʊtɛ]  
    b. [mʊ [i-ʊlɑ]  ]

The two prefixes in (23a) both belong to Level 2 as (24a) shows. Thus, the entire form is the domain for L2 rules including GF. Since the rule applies from left to right, the first prevocalic high vowel gets desyllabified and becomes a glide. As a result, the high front vowel is lengthened. On the contrary, the two prefixes in (23b) belong to different levels as (24b) shows: the outer one to Level 3 and the inner one to Level 2. The outer prefix is out of the domain for L2 rules. As a consequence, the form contained by the inner brackets in (24b) is the domain for L2 rules. Thus, the high front vowel gets desyllabified and becomes a glide. Then the following high back vowel is lengthened.

The assumption that morphology and phonology interact cannot present an adequate account of the example in (23a). Instead, it predicts a wrong application of GF. Since lexical phonological rules are supposed to apply after every morphological process, GF is predicted to apply after the first prefixation. Then, the high front vowel would be desyllabified and the following high back vowel is compensatorily lengthened. However, this is not the case. The GF applies after every L2 morphological process is completed. This observation leads us to conclude that morphology precedes phonology.

To sum up, Odden’s NLP posits that morphology and phonology do not interact. Phonological rules apply after every morphological process in the lexicon is completed. The rule of Glide Formation appears to argue for the preference of NLP to SLP and other theories which assume morphology-phonology interaction. In the next subsection, however, I will present phonological processes in English that NLP has difficulties with.
3.2. Problems

There seem to be some problems that Noninteractive Lexical Phonology must deal with. This section presents three of them from English: the loop, stem final nasal deletion, and a consequence of cyclic stress assignment.

The first problem is that NLP cannot come up with a convincing solution for the bracketing paradox. Following SLP, NLP assumes a level-ordered lexicon. As long as the negative prefix un- and other affixes remain as being members of L2 affixes, some L1 affixes may be attached to the stem with a L2 affix. That is, a morphological process of Level 2 may go back to the previous level for L1 affixation. NLP does not have any mechanism to prevent such a loop nor can it offer any adequate explanation for the ordering of affixation.

The stem-final nasal deletion was discussed in Section 1.4. As described in the section, a stem-final nasal deletes when it follows another nasal. I have repeated the examples below.

(25) a. condemn b. condemning c. condemnation

Since the L2 rule applies after every morphological process is completed, its application takes place after the affixation of the suffix in (25b). Then, two nasal deletion rules will be required since the forms in (25a) and (25b) do not share an identical environment. One rule deletes the word-final nasal, whereas the other one deletes the stem-final nasal when it occurs between another nasal and a vowel. In this way, the language would unnecessarily have two rules for one phonological process. This is because NLP does not assume that phonological rules may apply before morphological processes. With such an assumption, only one rule is needed as explained in Section 2.4.

The third problem concerns stress assignment and vowel reduction. As argued in Halle and Vergnaud (1987), English requires cyclic application of stress rules as exemplified by the derivation of the examples in (26). I have also presented bracketing structures of the forms. It should be noted that in each example the outermost affix belongs to Level 1.

(26) a. côndêmánção b. cômpensáțión
c. [[condemn]ation] d. [[compensate]ion]

According to them, the difference seen in the second syllable in each example is due to the stress assignment in the previous cycle as illustrated in (27).
(27) a. condénse b. cómponsâte

What this derivation shows is that the domain of the L1 stress rules does not extend to the outermost brackets in each example in (26). This rule application goes against NLP’s claim that the domain of Ln rules extends to the outermost brackets constructed in the level. If the stress assignment would apply as NLP predicts, there would be no difference between the two examples since they both have exactly identical syllable structures and syllables are stress bearing units in English.

3.3. Summary

NLP seems to present an adequate model for phonology as far as Kimatuumbi is concerned. Glide Formation rule in the language requires that lexical phonological rules do not apply after every cycle of morphological processes. However, phonology of English requires that the rules apply after every cycle of word formation. Moreover, the stem-final nasal deletion suggests that phonological rules may apply before morphological processes. This observation offers an argument against Odden’s thesis that morphology exclusively precedes phonology.

4. Conclusion

I have reviewed two articles which discuss the relation between morphology and phonology. These papers present conflicting theses on the issue based on phonological analyses of different languages. When each theory is applied to another language, it will have some difficulty in accounting for phonological processes in the language. This suggests that we may need to have some kind of reconciliation of the two theories. I would propose that interactionists adopt Odden’s claim that level-n phonological rules apply after every level-n morphology is completed in some languages. That is, lexical rules like Kimatuumbi Glide Formation may not apply after every cycle of morphological processes. This suggests the following ordering of morphology and phonology. First, every process in L1 morphology is finished, then L1 phonological rules apply. Second, L2 morphological processes take place before L2 rules of phonology take effect. Under this view, cyclic application of phonological rules is parametrized or optional. This parametrization may lead to an integrated model of Lexical Phonology together with the dual representation posited by PLP.
Although I put my focus on two articles in Part I dealing with morphology-phonology interaction, other papers in the part as well as those in Part II and Part III also provide us with insights into Lexical Phonology of other languages. I would strongly recommend this book since it presents the most recent developments in Lexical Phonology.

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