

Ordering of Phonological Rules: A Cognitive Phonology Approach*

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Kang, Yongsoon. 1997. Ordering of Phonological Rules: A Cognitive Phonology Approach. *Studies in Phonetics, Phonology, and Morphology*, 3, 45-55. The purpose of this paper is to show that rule ordering in phonology is unnecessary under the framework of Cognitive Phonology (Lakoff 1993). Rule ordering has been regarded as inevitable under the generative phonology, but the complexity of the rule ordering gave many students of phonology a doubt that these derivations have any psychological reality. Cognitive Phonology (CP) approach seems to suggest a solution for this problem. Unlike generative phonology, CP does not allow unlimited number of intermediate levels, but only three (Lakoff 1993:120). They are morphemic (M), phonemic or word (W), and phonetic level (P). Instead of generative rules, there are well-formedness conditions within and across levels. I illustrate the point with two languages: Korean and English. In Korean, three phonological rules are examined: Lateralization, /-Nasalization, and Stop Nasalization. The second data come from English. In English, three phonological rules, Spirantization, y-Insertion, and Palatalization, are examined and alternative analysis under CP framework is suggested. The feeding and the bleeding effects are obtained by the level difference of the model. (Sung Kyun Kwan University)

1. Introduction

The purpose of this paper is to show that rule ordering in phonology is unnecessary under the the framework of Cognitive Phonology (Lakoff 1993).¹⁷ This will be shown by the example of two languages: Korean and English. Rule ordering has been regarded as inevitable in the generative phonology. For a long time since SPE, main task of

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phonologists was to find the underlying representation, phonological rules, and rule ordering relationship between the rules. All of them were assumed to exist in the mind of a native speaker of a language, i.e. psychologically real.

The complexity of the rule ordering relations, however, gave many students of phonology a doubt that these derivations have any psychological reality. According to Kim-Renaud (1974), for instance, Korean has about 50 phonological rules and their rule ordering relations almost look like a spider web. Jensen (1993), on the other hand, suggests 18 lexical rules and 14 postlexical rules for English and their rule ordering is not that simple, either.

Rule ordering relations are in fact the by-products of phonological rules. Without the rules, there would be no ordering relations. Recently the idea of removing the rules forms the basis of new theories like Optimality Theory (OT) (Prince and Smolensky 1993) and Cognitive Phonology (CP). In syntax the transformational rules have already been reduced to a rule, Move- α , and the grammaticality of a sentence is determined by universal principles and constraints on the s-structure. (Chomsky 1981) In phonology, however, this process has been slow and now seems to be the high time to reflect on the status of phonological rules.

The two new theories, OT and CP, are the same in that they do not allow any phonological rules but well-formedness constraints on the levels. But in many other respects, they are different. In the following section I will briefly present the theoretical framework of CP and in section 3, three Korean phonological rules, Lateralization, l-Nasalization, and Stop Nasalization, will be discussed in terms of their rule ordering relations. In section 4, I will show that the rule ordering relations of three English phonological rules, Spirantization, y-Insertion and Palatalization, are unnecessary under the CP model. In section 5, I will offer a full discussion of CP and OT and their theoretical implications. In the final section, I will present some concluding remarks.

2. Cognitive Phonology

In this section, I will briefly present the theoretical tenets of CP.

Unlike Generative Phonology (GP), CP does not allow unlimited number of intermediate levels, but only one: the word level (W-level), which connects the morphemes (M-level) to phonetic sequences (P-level). All the 'generative rules are replaced by *constructions*, which state well-formedness conditions within levels and correlations across levels.' (Lakoff 1993: 118)

A good example is found in the analysis of Lardil by Lakoff himself. (1993: 23) In Lardil, an underlying form /#tjumputjumpu#/ surfaces as [tjumputju#] as a result of the following three rules.

- (1) Apocope: $V \rightarrow \emptyset / VC_1VC_2 ___\#$
 Cluster simplification $C \rightarrow \emptyset / C ___\#$
 Nonapical Deletion: $[-\text{syll}, -\text{apical}] \rightarrow \emptyset / ___\#$

Since all of the rules in (1) apply at the end of a word, they constitute a so-called feeding relation. The derivation of the word is as follows.

- (2) #tjumputjumpu#
 tjumputjump Apocope
 tjumputjum Cluster Simplification (CS)
 tjumputju Nonapical Deletion (ND)
 [tjumputju]

The application of Apocope results in the feeding environment of CS and the result makes the input for ND. Here rule ordering is critical and the reverse of the rule application would lead to the wrong result as (3) shows.

- (3) #tjumputjumpu#
 ----- ND
 ----- CS
 tjumputjump Apocope
 *[tjumputjump]

In CP, the rules are stated as in (4).

(4) a. Apocope	b. Cluster Simplification	c. Nonapical Deletion
M: V C ₁ V C ₁ V #	C C	[-syll, -apical]
W: Ø	Ø #	Ø #

Apocope applies in word-final position of M-level while the other two constructions have the word boundary at level W. The crossed lines of the rules terminate to the left of the W-level word boundary, and thus the three constructions can apply simultaneously.

(5) M: # t j u m p u t j u m p u #
W: t j u m p u t j u #

Note that word boundary at level W guarantees the application of CS and NI) and there is no need to assume the ordering of the rules.

3. Korean

In this section, I will examine three phonological rules¹ in Korean, Lateralization, *l*-Nasalization, and Stop Nasalization (SN), and will show that their rule ordering relations can be done without if we adopt the analysis of CP. First I will show their rule ordering relations are critical in GP and later suggest a CP analysis.

In Korean, Lateralization changes the alveolar nasal to a lateral adjacent to a lateral.

(6) Lateralization

- a. [+cor, +nas] → [+lat] / % ____ [+lat]
 b. chenli → che[ll]i 'a thousand miles'
 yenlak → ye[ll]ak 'liason'
 konlan → ko[ll]an 'trouble'

¹ Yale Romanization is adopted in this paper. Phonetic symbols will be given, when necessary, though.

nonlan	→	no[lɪ]an	'controversy'
thulni	→	thu[lɪ]i	'false teeth'
chalna	→	cha[lɪ]a	'a moment'
selnal	→	se[lɪ]al	'the New Year's Day'

There is another rule, *l*-Nasalization, which changes a lateral to alveolar nasal after consonants.

(7) *l*-Nasalization

- a. [+lat] → [+nas] / [+cons, -lat] ____
- b. simli → sim[n]i 'psychology'
- konglon → kong[n]on 'empty argument'
- peplyeng → pe[mn]yeng 'statute'
- sipli → si[mn]i 'ten miles'
- phokli → pho[ɲn]i 'illegal interests'
- phoklo → pho[ɲn]o 'disclosure'

In (7)b, we can see the effect of the third rule, SN, which changes stops to nasals before nasal segments.

(8) Stop Nasalization

- a. [-conti] → [+nas] / ____ [+nas]
- b. hakmwun → ha[ŋ]mwun 'learning'
- pepmang → pe[m]mang 'net of law'
- kwuknay → kwu[ŋ]nay 'domestic'

It is clear that from the examples of (7)b, *l*-Nasalization feeds SN. The derivation of the rule 'sipli' is as follows.

- (9) /s i p l i/ 'ten miles'
- n *l*-Nasalization
- m Stop Nasalization
- [s i m n i]

The reverse ordering of the rules leads to the wrong surface form as shown in (10).

- (10) /s i p l i/

----- Stop Nasalization
 n l-Nasalization
 *[sipni]

Besides, Lateralization should precede the l-Nasalization because the former bleeds the latter. For example, chenli 'a thousand miles' becomes che[lli], instead of che[nn]i.

- | | |
|-------------------------------|--------------------------|
| (11) a. /c ^h ənli/ | b. /c ^h ənli/ |
| l Lateralization | n l-Nasalization |
| --- l-Nasalization | --- Lateralization |
| [c ^h əlli] | *[c ^h ənni] |

To summarize, the ordering relations of the rules are like the following.

- (12) Lateralization
 l-Nasalization
 Stop Nasalization

In CP framework, however, phonological rules like the above do not exist. Instead, the phonological rules are replaced by the constraints on the levels and the correlations between the levels. First, Lateralization rule is represented as a correlation between the M-level and the W-level.

- (13) Lateralization
 M [+nas, +cor] % [+lat]
 |
 W [+lat]

An alveolar nasal on the M-level is realized as a lateral when adjacent to lateral. We also find that l-Nasalization is represented at the same levels as Lateralization, but the conditioning environment exists at W-level.

(14) *l*-Nasalization

M	[+lat]
W	[+cons, -lat] [+nas]

No ordering relation is necessary between the two constructions. They apply simultaneously without making any wrong surface form.

(15) M # c^h ə n l i #

W # c ^h ə l l i #	

(14) cannot apply here because the structural description does not meet. But it can produce the correct surface form of simli 'psychology' as follows.

(16) M # s i m l i

W # s i m n i #	

The last rule, SN, can be represented as a correlation between W and P level. When a nasal sound follows a stop sound at W-level the stop segment becomes a nasal at P-level.

(17) Stop Nasalization

W	[-cont][+nas]
P	[+nas]

The derivation of sipli [simni] 'ten miles' will show the whole picture of the representations.

(18) M # s i p l i

W # s i p n i #	
P # s i m n i #	

As we can see from the above examples, no ordering relations are necessary and all the constructions can apply at the same time.

4. English

In this section, I will examine three phonological rules in English, spirantization, palatalization, and y-Insertion. First, in English like in many languages Palatalization takes place before the high front glide [y], as shown in (19).

(19) Palatalization (Jensen 1993: 200-201)

- a. [+cor, -son] → [-ant,+strid] / ____ [-cons, +high, -back] V
- b.
- | | |
|-----------|-------------|
| express | expression |
| supervise | supervision |
| gas | gaseous |
| space | spacial |
| confuse | confusion |
| office | official |

Palatalization is fed by Spirantization, which changes coronal obstruents to fricatives before glide /y/. This feeding relation is illustrated in (20)b as (21) shows.

(20) Spirantization (Jensen 1993: 205)

- a. [-son, +cor] → [+conti, +str] / { [+son], [-conti] } ____y
- b.
- | | |
|--------|-----------|
| delete | deletion |
| decide | decision |
| part | partial |
| react | reaction |
| Egypt | Egyptian |
| exempt | exemption |
| extend | extension |

(21) /dili:t + yən/

- | | |
|------------|--------------------------|
| s | Spirantization |
| f | Palatalization |
| [dili:fən] | other rules ² |

However, Spirantization does not apply if *y* is inserted by *y*-Insertion, which is shown in (22)b.

- (22) *y*-Insertion (Jensen 1993:194)
- a. $\emptyset \rightarrow y / ___\text{[+high, +back, -round]}$
- b. habit habitual * $[\text{h}\text{ə}\text{b}\text{i}\text{f}\text{u}\text{əl}]$
 grade gradual * $[\text{g}\text{r}\text{æ}\text{g}\text{u}\text{əl}]$

This leads to the ordering relation in (23)

- (23) Spirantization
 y-Insertion
 Palatalization

The derivation of 'habit' is illustrated in (24).

- | | |
|---|--|
| (24) a. $[\text{h}\text{ə}\text{b}\text{i}\text{t} + \text{i}\text{ə}\text{l}]$ | b. $[\text{h}\text{ə}\text{b}\text{i}\text{t} + \text{i}\text{ə}\text{l}]$ |
| ----- | |
| | Spirantization |
| y | y |
| y | y-Insertion |
| tʃ | s |
| tʃ | Palatalization |
| Palatalization | f |
| other rules | other rules |
| * $[\text{h}\text{ə}\text{b}\text{i}\text{f}\text{ə}\text{l}]$ | * $[\text{h}\text{ə}\text{b}\text{i}\text{f}\text{ə}\text{l}]$ |

In (24), Spirantization counterfeeds *y*-Insertion. It is clear from the above examples that ordering relations are essential in the generative framework.

In CP, however, the ordering relations can be thrown away. Two out of three phonological rules are represented as correlations between M-level and W-level as follows:

- | | |
|------------------------------|--------------------------------------|
| (25) a. Spirantization | b. <i>y</i> -Insertion |
| M [+son] [-son, +cor] + y | $\emptyset + [\text{+bk, +hi, -rd}]$ |
| [-cont] | |
| W [+cont, +str] | y |

2 One of the rules involved here is *y*-Deletion (Jensen 1993:203).

$y \rightarrow \emptyset / [\text{+cor, -ant}] ___\text{V}$

Palatalization, on the other hand, can be represented as a correlation between W-level and P-level.

(26) Palatalization

W	[+cor, -son]V
P	[-ant, +str]

All of three constructions apply at the same time to derive the 'deletion' as follows:

(27) M	# d i l i : t + y ə n #
W	s y
	³
P	# d i l i : f ə n #

Counterfeeding relation between y-Insertion and Spirantization is also easily explained without strict rule ordering.

(28) M	# h ə b i t + i ə l # ⁴
W	t y
F	# h ə b i tʃ ə l #

In (28), Spirantization does not apply because the structural description does not meet. Besides, the inserted glide [y] which motivated Palatalization of the alveolar stop is not realized at the P-level due to the palatal affricate adjacent.

³ y-Deletion would be represented as follows in CP model.

W	y	V
P	[+cor, -ant]	Ø

⁴ I will not deal with the rule, i-deletion, which is not directly relevant to the present discussion.

In this section, three phonological rules of English were examined and reanalyzed under the framework of CP. It was shown that rule ordering relations were not necessary if we assume the framework of CP.

5. Optimality Theory and Cognitive Phonology

As was mentioned in the first section, OT and CP share many things in common. Both in OT and CP, all phonological rules are removed and well-formedness constraints on the level constitute the grammar of phonology. They agree in that generative phonology approach is inappropriate to explain the phonological process of human mind, but they show differences in their suggesting the substitute for the generative model.

In OT, well-formedness constraints take the place of phonological rules. All the constraints are violable and the hierarchical rank between the constraints explains the linguistic variations. Here we find that rule ordering relations in GP still remain in the model, but this time in the name of constraint ranking. The constraint ranking plays a crucial role in OT to determine the surface form. The table in (29) illustrates the point.

(29)

	Const1	Const2	Const3
Cand1			*
Cand2		*!	
Cand3	*!		

In (29) all the candidates violate a constraint, so they have equal status with respect to the number of violations. But they go to the different way by what constraint they violated. Here the first candidate is chosen, because it violates the lowest one and the other two are not selected.⁵

⁵ Constraint rank plays far more important role than the number of violations does. So in this matrix, if the first candidate violates the constraint 3 two times, it is still regarded as optimal.

OT claims that their model is better than GP in that there is no phonological rules. But the comparison of the two models does not look that simple. One of the problems found in OT is the rank relation between the constraints. In (29) only three constraints were shown, but in reality we are not sure yet how many more constraints will be found. In fact, OT makes use of constraint rank in many different ways. First, constraint ranking determines the parametric differences of languages. Second, it also explains the dialectal differences of a language (Sells, Rickford and Wasow 1994). Even the idiolectal difference means the rank difference in OT. In this respect, constraint ranking in OT is very similar to ordering relations of phonological rules in GP. So it leads to the same dilemma for which GP model was criticized.

In CP, however, all the constructions apply simultaneously and there is no ordering relation between the constructions. Instead, they explain all the ordering relations by the constraints on the level and correlations between the levels. When a linguistic process is explained by two different theories, it would be natural for us to select the simpler one.

6. Conclusion

In this paper, I tried to show that CP model can get rid of the complex ordering relations in GP framework. The data was chosen from two languages, Korean and English. Our concern being the ordering relation of the phonological rules, especially the rules which show the feeding, bleeding, and counterfeeding relations were examined.

Suppose that all the phonological processes are psychologically real, the very complex ordering relation doesn't seem to exist in our brain. From this point of view, OT doesn't show much. For it also contains the ordering relation between the constraints. For ordering, CP suggests a solution, in which all the constructions apply at the same time and the speaker of a language does not worry about the ordering relation at all.

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