Reanalysis of Dissimilation in Harmonic Phonology

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The purpose of this paper is to show that when we consider the analytical ways of Dissimilation, it becomes clear that it is insufficient to deal with it in just linear and nonlinear ways. Thus within a new framework to be introduced in this paper, Harmonic Phonology, we will reanalyze the phenomenon. We will also consider how the Obligatory Contour Principle (hereinafter, OCP) is used as both rule trigger and rule blocker in rule application, and works as a universal constraint, that is, a filtering device of ill formed representation. As we also consider it under the new framework, we can show the application position and motivation of rules appropriately and represent the phenomenon synthetically. (Yosu National University)

I. INTRODUCTION

This paper will consider Dissimilation by the past two approaches, linear and nonlinear. A linear approach analyzes the phenomenon by SPE, which is a system based on a sequence of rule applications. But this approach seems to be a problem because, if a sound is preceded by a continuant sound like /s/ sound, it is necessary to modify the order between rule application, that is, not to apply a spirantization but a palatalization. Despite such a modification in rule application, there is also an additional problem to be solved.

As an alternative, Clements′ way (1985) is a nonlinear approach, which is based on features geometry. This method shows that the articulation manner and place of glides have an effect on the preceding segment on the feature structure. If we apply this method to a word, first spirantization and then palatalization, the results appear

in a correct phonetic representation. But if we apply this method to the same examples dealt with in SPE, there arises ill-formed representations. From these results, we need to find other ways to explain them appropriately, which is Borowsky (1987) & Yip (1988)'s method. Their approach analyzes the phenomenon on a segmental tier, in which the OCP acts as a rule-blocker, and the result produces a correct phonetic representation from the application of palatalization instead of spirantization.

In spite of the proper explanation of Borowsky & Yip, Borowsky himself admitted that he couldn't clearly explain if the application of the OCP occurred in certain assimilation aspects. This paper tries to suggest an alternative for the matter. Although these explanations about Dissimilation have a little satisfaction, there isn't any way to show the two operations of the OCP synthetically and nor any device to appear evident relationship between the OCP and rule application. Therefore I will adopt the Harmonic approach for explaining the raised problems clearly.

II. PREVIOUS ANALYSES

In this section, we will review the previous analyses of the Dissimilation. First, we will consider the analysis of SPE, which was a linear approach and involved two phonological rules, spirantization and palatalization. After this, we will consider Clements' representation. Clements explained the phenomenon on the feature geometry. But since there are problems with his analysis, we are compelled to find an alternative way. In the method to be suggested, we know that it is necessary to introduce the OCP, because the OCP plays an important role in applying rules when we explain Dissimilation. Borowsky & Yip (1988) depend on this principle and they explain the phenomenon in a total identity. First, we will consider the SPE analysis.

1. SPE mode

In SPE system, Dissimilation is explained by applying a sequence of phonological rules to segments of a word. The result of these rule applications is that two segments each become different, and a correct phonetic representation is made. For example, consider *permit > permission, corrode > corrosion*. For the /t/ of *permit*

to become /š/ or, for the /d/ of *corrode* to become /ž/, this is explained by applying spirantization as shown in (1).

(1) spirantization

$$
\begin{bmatrix} +cor \\ +ant \\ -son \end{bmatrix} \rightarrow \begin{bmatrix} +cont \\ +strid \end{bmatrix} \quad / \quad \begin{bmatrix} \begin{bmatrix} \underline{\quad} \\ -voice \\ \underline{\quad} \end{bmatrix} + \begin{bmatrix} -cont \\ -back \\ -stress \end{bmatrix} \\ \quad + \quad y \end{bmatrix}
$$

After applying (1) above, /s/ and /z/ should be applied by palatalization (2) below for each correct phonetic representation.

(2) palatalization

$$
\begin{bmatrix} -son \\ +cor \end{bmatrix} \rightarrow \begin{bmatrix} -ant \\ +strid \end{bmatrix} \quad / \quad \underline{\quad} \begin{bmatrix} -back \\ -voc \\ -cons \end{bmatrix} \begin{bmatrix} -cons \\ -stress \end{bmatrix}
$$

By applying the above rule, /s/ and /z/ become /š/ and /ž /, and thus each correct phonetic form is *permit > permission* [pərmıšən]*, corrode > corrosion* [kərəužən]. We can see such examples in (3) below. (3a) are words that include a final consonant ending with /t/, (3b) are examples that end with /d/.

(3) a. permit > permission   b. corrode > corrosion
       inhibit > inhibition   evade > evasion
       remit > remission   divide > division
       prohibit > prohibition   allude > allusion
       devote > devotion   collide >collision
       project > projection   persuade > persuasion

But problems arise when we apply the SPE method to a few similar examples. This paper will focus on these very important examples, given in (4).

(4) a. question, digestion, bastion, congestion, exhaustion, combustion, Christian, indigestion, suggestion
    b. celestial, bestial

The examples in (4) above are classified according to suffix forms. Now if we apply the SPE method to the data in (4), we will have wrong phonetic representations. For example, first, if we apply the spirantization to them, the /t/ sound will become /s/, and thus words such as *question* and *digestion* will appear in the output as *quession [kwesšən], *digession [dayžesšən], rather than as [kwesčən], digession [dayžesčən].

For this reason, SPE modifies the spirantization (1) above by blocking the application of the rule in obstruents that are preceded by /s/. In other words, only in cases when a segment can be applied by spirantization (1) above, can the segment to be under the rule application be preceded by a segment such as sonorant or non continuant. Thus if we reanalyze (4a, b) above according to the modified rule, the segment to come under the rule is preceded by /s/, and from this fact, the application of the rule doesn't occur. Instead, the palatalization of (2) above can be applied to /t/ of (4). From the result of application of palatalization, /t/ becomes [č], and all the examples in (4a, b) are likely to be as follows: [kwesčən], [dayžesčən], [ɪgzɔsčən], [basčən], [kənʒesčən], [kəmbʌsčən], [krysčən], [indayʒesčən], [sʌgʒesčən], [silesčəl], [besčəl].
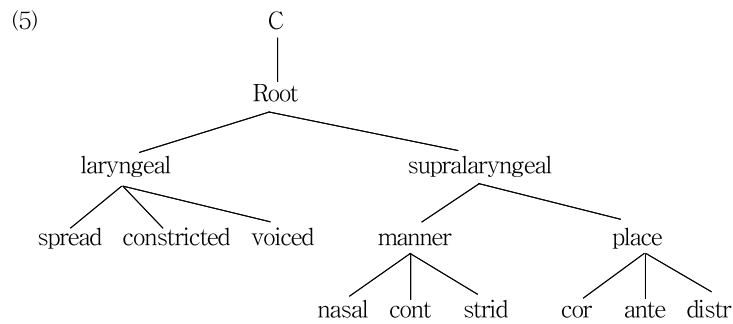
1) SPE′s problem

Up to now we have attempted to explain the Dissimilation occurring in a word according to SPE mode, but there are a few problems to consider. First, the spirantization rule needed for a correct surface form is not an easy condition to apply. Secondly, the motive for applying the rule is not clearly suggested. Thirdly, to explain the examples such as (4a, b), SPE artificially generalized the modified spirantization that blocks the application of the rule in obstruents that are preceded by /s/. Furthermore, SPE expanded the application limits to prevent the rule from applying after other continuant obstruents.

But such an explanation seems to be overgeneralized because, by considering a few related examples, we can't find any other continuant obstruents besides /s/, and thus we can say that SPE′s mode is overgeneralized about the rule application.
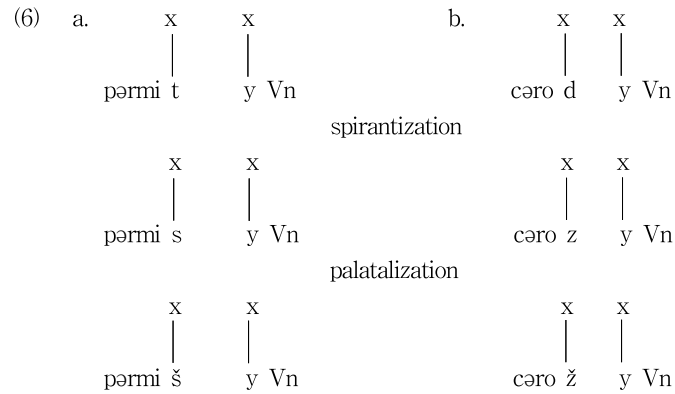
2. Clements′ approach

Clements attempted to explain the palatalization on the feature geometry.

According to Clements, two processes are involved in explaining the palatalization. One of them is spirantization, in which /t, d/ preceding a vowel or glide become /s, z/ by application of the rule. The other is palatalization, in which the place of articulation and the manner of articulation are all assimilated to a preceding consonant. In this case, the segments to come under the rule, /s, z, t, d/ become /š, ž, č, ʒ/. To understand Clements' explanation, we need to consider the structure of feature geometry. He said that the hierarchical organization of a segment has the formal structure of a tree diagram rooted in one or more elements of the CV tier. A consonant of his feature geometry is as follows:

(5)

```
                        C
                        |
                       Root
             _____/  _____
        laryngeal              supralaryngeal
         /  |  \                  /        \
   spread constricted voiced   manner      place
                               / | \        / | \
                          nasal cont strid cor ante distr
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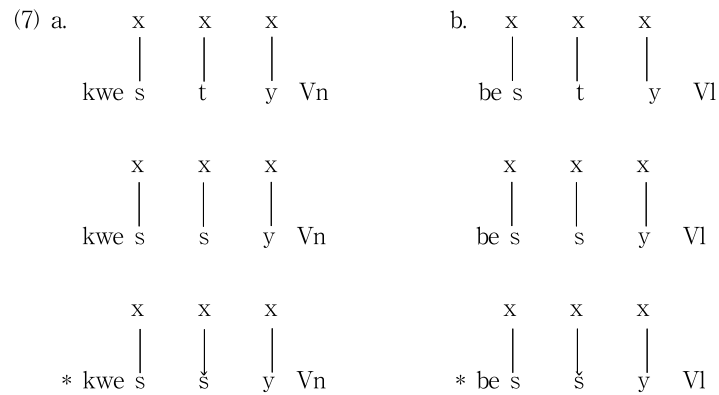
To begin with, let's consider the reason why Clements saw the spirantization and palatalization in this way. It is because of this fact that the [+cont, +strid] of the manner tier of glide not only affects a preceding segment, but also transfers to a stop or a fricative sound preceding the place node of the glide, and recategorizes the relevant segment to [-ant, +distr]. By this interpretation, Clements' explanation seems to be a kind of rule interaction, and when we apply Clements' way to *permit > permission* and *corrode > corrosion* among the examples of (3) above, we can see the feature structures of those examples as in (6) below.

But there arises a problem when we apply the rule of spirantization and palatalization applied in (6a, b) below to (4a, b). The way Clements saw palatalization was that the rule affects a preceding segment in the place of articulation as well as the manner of articulation on the feature geometry.

(6)   a.   x   x   b.   x   x
                 | | | |
           pərmi t   y Vn   cəro d   y Vn

                           spirantization

                 x   x   x   x
                 | | | |
           pərmi s   y Vn   cəro z   y Vn

                           palatalization

                 x   x   x   x
                 | | | |
           pərmi š   y Vn   cəro ž   y Vn

    Unfortunately, when we tryto apply such a method to (4a, b) above, a few problems arise. Let's consider why the problems arise when these rules are applied. First, if we apply spirantization to them, /t, d/ will become /s, z/, and

(7) a.   x   x   x   b.   x   x   x
             | | | | | |
         kwe s   t   y Vn   be s   t   y Vl

             x   x   x   x   x   x
             | | | | | |
         kwe s   s   y Vn   be s   s   y Vl

             x   x   x   x   x   x
             | | | | | |
       * kwe s   š   y Vn   * be s   š   y Vl

    again through the application of the palatalization rule, /s, z/ will become /š, ž/. But these produce unexpected results because a correct output will require the two slots of segments not to be *s-š, but to be s-č as (7) above.

    Therefore we need to explain (7) above in another way. This paper will consider now Borowsky & Yip's way as its alternative.
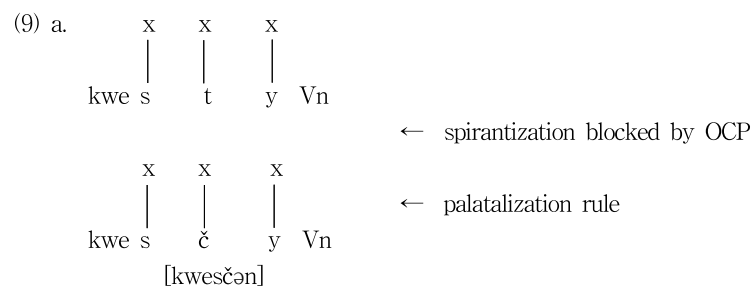
3. Borowsky & Yip's analysis

Borowsky & Yip's analysis is different from other explanations in two respects. One is that they view the relevant segments of the preceding examples as a total identity; and the other that they explain these examples using OCP. Before considering their analysis, it is necessary to introduce what OCP is.
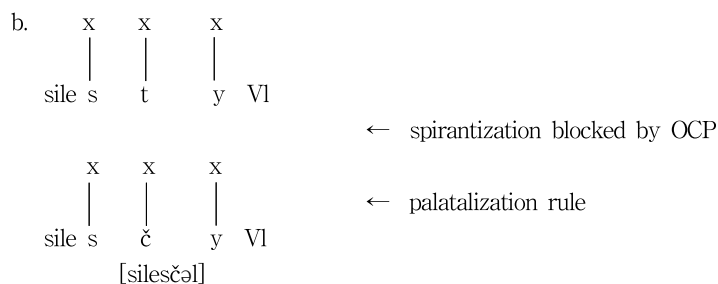
The main concept of OCP originated from Leben (1973), who explained tone melody of Mende language in morphology. After this, Goldsmith (1976) described the *concept* as a principle, which prohibits two identical elements from occurring on a metrical tier, like HHL or LLH. Thus OCP works both as a rule trigger and a rule blocker, according to the situation. The definition of OCP is as follows:

(8)   Obligatory Contour Principle
      At the melodic level, adjacent identical elements are prohibited.

This principle will prohibit two identical segments from occurring adjacently, and the same features of two segments from occurring beside each other. According to the way of Borowsky & Yip, when the spirantization rule is applied to (4a, b) above, the segments -st- will become *-ss-, and therefore the examples of (4a, b) will be a violation of OCP. For this reason, the application of rules all result in the ill formed outputs *quession, digession, bassion, congession, exhaussion, combussion, chrissian, indigession, suggession, celessial, bessia*. Thus, OCP has to block the rule of spirantization from applying to *question*, while it also has to trigger a rule of palatalization. If we apply the rule to *question*, it is not *quession* [kwesʃən], but *question* [kwesčən]. In other words, we can say that if a continuant comes after -s-, due to the OCP, the rule of spirantization can't apply to the word,

(9) a.   x   x   x
               | | |
          kwe s   t   y Vn
                                        ← spirantization blocked by OCP

               x   x   x
               | | | ← palatalization rule
          kwe s   č   y Vn
               [kwesčən]

b.
```
      x    x    x
      |    |    |
sile s    t    y   Vl
```
                              ← spirantization blocked by OCP
```
      x    x    x
      |    |    |
sile s    č    y   Vl
```
                              ← palatalization rule
```
      [silesčəl]
```

and instead palatalization applies, and /t/ becomes /č/ like [kwesčən]. The representation of the rule application such as *question* and *celestial* of (4a, b) above can appear like (9) below.

But there is a problem in the approach of Borowsky & Yip. In the explanation of examples like (9a, b) above, Borowsky didn't know whether the OCP application was viewed as a total assimilation or a feature assimilation (Oh, 1991).

With regard to his problem, this paper will insist that, when we see examples like *question, celestial,* we can say that the OCP application is performed in the total assimilation aspect. Because if we regard the OCP application as the feature assimilation aspect, when we apply the OCP to the palatalized words, *[kwesʃən] and *[silesʃəl], we would need a special rule to change [ʃ] into [č] in order to avoid the OCP violation.

Until now we have considered Dissimilation as the linear approach of SPE and the nonlinear approach, according to Clements' and Borowsky & Yip's analyses. However, none of them are satisfied because, when we pronounce a word, these methods can't show all the processes that produce a correct phonetic form. They also cannot show the proper position of the rule application in those processes. Beyond this, we can't see where the OCP applies in whole levels and the motivation of the principle application. For these cases, we can consider another theoretical analysis, Harmonic approach.

Ⅲ. ALTERNATIVE APPROACH

1. Harmonic Theory

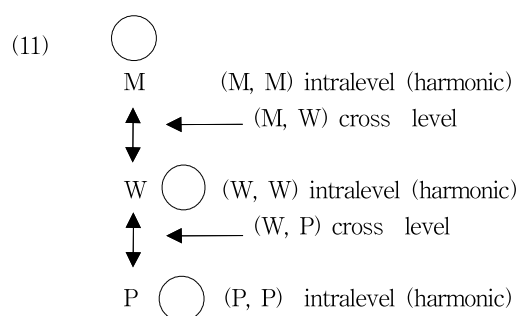When we consider the development of language analysis, existing language

analyses have regarded certain rules and derivations as the important units. In fact, the focus of analyses was to establish a non existing intermediate representation, that is, derivation, and applying to serial rules to the representation sequentially. But within recent years, there is some doubt about the intermediate form, and thus rather than analyzing to establish derivation, there is an attempt to establish a few levels and apply some phonological rules on these levels (Lakoff, 1989). Is there a proper way to deal with the analysis of language? This is the nature of the Harmonic Theory. This theory has advocated by Wiltshire (1988), Brentari (1990), Bosch (1991), Goldsmith (1993), etc. Among them, especially Goldsmith, defined the theory as follows: The theoretical framework disposes of the problematic intermediate process, which Generative Phonology handled importantly, and instead, the theory establishes three levels that are applied by phonotactic constraint, thus leading to a phonological generalization. Therefore the main point of the theory is in the naturalness and complexity of explanation by using its levels of information. Goldsmith suggests three levels in the Harmonic theory: the M-level, W-level, and P-level. The levels referred to in the theory are different from the levels in Lexical Phonology, and the definition about each level is as follows:

(10) **M-level** (a morphophonemic level) – the level at which morphemes are phonologically specified, giving information about the structure of the phoneme;

    W-level – the level of most importance, relating to prosodic structure, well-formed syllables, feet, words, and phonological words being structured;

    P-level – the level of broad phonetic aspects that are associated with the peripheral articulatory and acoustic devices, making it possible to represent a complete phonetic form.

As we see from the above, the M-level is a level in which morphemes are specified phonologically, which includes the information of phonemes within the morphemes. The W-level is closely associated with prosodic structure, as well as building up the syllable, foot, phonological word, and phonological phrase. Compared to other levels, this level is the most important because it includes the well-formedness conditions such as a well-formedness syllable and a well-formedness foot structure. The P-level is related to a wide phonetic aspect that is connected with the articulatory and phonetic devices, and therefore at this

level it is possible to represent the complete phonetic form of a word.

In this theory there are six types of phonological rules, in principle: three intralevel rule types: (M, M) rules, (W, W) rules, (P, P) rules, and two cross level rule types: (M, W) rules and (W, P) rules. Now we can refer to a model in (11) above which is based on the definition of (10), and which represents a correlation among three levels.

(11)

M   (M, M) intralevel (harmonic)
                      (M, W) cross level

W   (W, W) intralevel (harmonic)
                      (W, P) cross level

P   (P, P) intralevel (harmonic)

According to the model (11) above, we can understand that most rule applications are performed between levels. For example, a rule like epenthesis is applied at the (M, W) level, and the Lowering rule is applied at the (W, P) level. The rules like Stress Shift, Trisyllabic Laxing, and Prestress Destressing are also performed at the (W, P) level.

2. Harmonic analysis

The merits of Harmonic theory, compared to others, are that it can bring morphological information to a phonetic level and show a few phonological processes, such as Stress Shift or Vowel Laxing, compositely. That is, we can see both morphological information and its phonological process wholly between levels.

Now let's consider the Dissimilation that has been dealt with in this paper. If a suffix is added to a root, a phonological changes occurs between consonants. Then, by using the harmonic approach, how can we sufficiently explain the examples that SPE, Clements, and Borowsky & Yip couldn't explain. On the other hand, how can we regard the OCP as applying to any level?

From the previous explanation about model (11) above, we know that, in the W-level, the phonotactics, the well formedness of the prosodic, the syllable, the foot, the phonological word can properly be handled. Based on this fact, the OCP

will be like a kind of well formedness condition in the W-level. Because of this, we should regard the OCP in the rule application as not only having an effect on the process, but also as serving to produce a correct surface representation.

The next thing to consider is where the Dissimilation occurs in the three levels, and also at which level the spirantization or the palatalization applies to the segment of the related words. This paper maintain that the Dissimilation may occur in the cross level (W, P), and the two rules for explaining the phenomenon are also applied in the same level.

If so, let's consider how we can explain the example of (4a, b) above using the harmonic approach. For example, *question* of (4a) and *celestial* of (4b) will be represented at the M-level, where the bases, *quest, celeste* and the suffixes, *ion, ial* are represented. Afterward, at the W-level the base and suffix are combined, and at the cross level, (W, P) a sequential rules are applied to the word. The OCP will first apply at this level, and by a proper rule application it will produce each correct surface phonetic form. If we analyze one example of (4a) above, it will be as follows:

(12)   M-level: quest, ion

      W-level: question

            X   X

            | | Spirantization application

         *s   š   OCP violation

            X   X

            | | Palatalization application

          s   č

      P-level: [kwesčən]

As we see in (12) above, the suffix, *ion* is added to *quest* [kwest] at the W-level, and afterward – st will undergo a segmental change. But in the (W, P) level, the spirantization rule to be considered is blocked by the OCP, and instead, the palatalization is applied to segment /t/, and /t/ becomes /č/ as we see at a correct phonetic form in the P-level. Thus we can represent a whole phonological process synthetically using the harmonic approach.

Now how can we analyze *celestial* of (4b)? If it is analyzed under the harmonic

approach, it will be a similar structure to (12) above as we see in (13) below. In the M-level, *celeste* [silest] combines with a suffix, *ial* and then -st of *celeste* will undergo a segmental change because of adding *ial*. The OCP blocks the application of the spirantization rule in (W, P) level, and instead, the palatalization rule should apply to the segment /t/ in the same level, and thus become /č/. All these processes will be represented by the harmonic approach synthetically.

(13)   M-level: celeste, ial
         W-level: celestial

```
        X      X
        |      |          Spirantization application
       *s      š          OCP violation


        X      X
        |      |          Palatalization application
        s      č
```

         P-level: [silesčəl]

From these results we can show that the examples of the Dissimilation, which is hard to explain by Borowsky & Yip's method, can easily be explained synthetically within the harmonic approach.

IV. CONCLUSION

This paper considered Dissimilation through two approaches, linear and nonlinear. The linear approach, SPE, analyzes the phenomenon by a sequence of rule applications. But this approach has a problem in that it cannot explain cases where if a sound is preceded by a continuant sound like /s/ sound. Although SPE attempts to solve the problem by rule modification, there are still examples that are unsolved.

On the other hand, under Clements' nonlinear approach, we tried to explain the phenomenon using feature geometry. But this method had a limit because the

examples that were hard to deal with in SPE, also left ill-formed representations even under Clements' nonlinear approach. We tried to explain these results by Borowsky & Yip's method. Their approach analyzes the phenomenon on a segmental tier by using the OCP as a rule blocker. Although their explanations are more satisfactory, Borowsky & Yip can't explain whether the OCP application was viewed as a total assimilation or feature assimilation. And this method doesn't show the relationship between the OCP and rule application on a whole structure synthetically. Therefore we have adopted the Harmonic approach to resolve the raised problems clearly.

Using the harmonic approach, we can explain the referred examples using level information. Performing the analysis using the three levels makes dependence on derivation unnecessary. Thus we can represent the whole phonological process synthetically by using the harmonic approach. In addition to this, we may say that this explanation can give us easy understanding in perceiving the phonological phenomenon as Dissimilation. Because we can regard the harmonic approach as a method to show us a series of phonological processes simply in levels, and thus students may easily perceive real phonetic forms occurred in sentences.

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