

## A Remark on Non-Linear Phonology

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## 〈Abstract〉

The existing phonology considered phonological units—phonemes or distinctive features—to be concatenated in a linear fashion. In *The Sound Pattern of English* (1968) we have also found the linear phonological system as one of the most basic assumptions. In fact, it may be safely said that phonologists have done their best to solve various problems which arose from their sticking to the assumption.

In this paper, I have showed that many problems which were not solved neatly by linear phonology can be naturally handled in the framework of non-linear phonology. And I have presented characteristics and merits of non-linear phonology, exemplifying each component of it which is divided into three parts: autosegmental phonology, function of syllables and metrical phonology.

## 復線音韻論에 관한 一考察

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## 〈요 약〉

종래의 음운론에서는 음운단위들이—음운이든 변별 자질이든—單線的으로 연결되어 있다고 가정해 왔다. *The Sound Pattern of English* (1968)에서도 이러한 單線的 음운조직은 가장 기본적인 가정이었으며, 기실 60년대의 생성음운론은 이 가정에 집착한데서 일어난 여러 문제들을 해결하는데 전력을 기울였다고도 할 수 있다.

본 논문에서는 단선음운론에서는 해결할 수 없는 문제들이 복선음운론에서는 자연스럽게 해결이 됨을 예시하여 복선음운론의 특성과 장점을 自立超分節音韻論, 音節의 기능, 그리고 韻律音韻論의 세분야로 나누어 살펴보았다.

## 1. Introduction

The existing phonology, whether generative or not, considered phonological units—phonemes or distinctive features—to be concatenated in a linear fashion. In *The Sound Pattern of*

*English* (1968) we have also found the linear phonological system as one of the most basic assumptions. In fact it may be safely said that phonologists have done their best to solve various problems which arose from their sticking to the assumption.

One typical example of linear phonology is the

assimilation occurred where a phoneme is adjacent to another one: palatalization where 'ki' is changed to 'ci'; homorganic nasalization where 'np' is changed to 'mp'; nasalization where 'tn' is changed to 'nn'. These phenomena have been represented in a formula  $X \rightarrow Y / -Z(X \text{ becomes } Y \text{ in the environment before } Z)$ . However, problems began to arise when it was known that there were phonological phenomena which could not be accounted for as the narrow assimilation: in Shona [Zimbabwe, Africa] a plosive becomes 'h' (e.g. 'mp' → 'mh', 'nt' → 'nh'... Hyman 1975: 126); in Korean an aspirated plosive becomes unaspirated before a consonant (e.g. 'nopta' → 'nobta', 'puekto' → 'puegto'). Even though these phenomena could be formulated as, for example,  $\text{stop} \rightarrow \text{h} / \text{N} \_\_\_ \text{ or } [+asp] \rightarrow [-asp] / \_\_\_ \text{C}$ , it is hard to look upon them as assimilations. Moreover it gets more complicated when the phenomenon occurs in a word final: 'puek' → 'pueg', 'nup' → 'nub'. In linear phonology they describe the phenomenon as  $[+asp] \rightarrow [-asp] / \_\_\_ \left\{ \begin{array}{c} \text{C} \\ \text{=} \end{array} \right\}$  using word boundary  $\#$ , but the authenticity is questioned, for no rational explanation has been represented as to why C and  $\#$  that are quite heterogeneous to each other go together. Nevertheless, some phonologists like Lightner (1972) tried to defend the linear phonological rules by attaching to the word boundary  $\#$  the distinctive feature [-voice] (so that word final devoicing as in German and Russian could be explained as an assimilation).

Vennemann (1972) and Hooper (1972) took one step ahead when they maintaining natural phonology pointed out the unnaturalness of the above description and claimed that the common feature shared by C and  $\#$  was that of syllable boundary. So they replaced  $\left\{ \begin{array}{c} \text{C} \\ \text{=} \end{array} \right\}$  with syllable boundary mark S which they invented, but they were still not released from the chain of linear phonology.

Another problem found in linear phonology

is that a certain phonological rule is presented not by an adjacent phoneme but by a non-adjacent one. One example is the stress-distribution rule. In languages which include stress in their systems, stress is generally affected by the syllabic structures. In many cases, the first or the last heavy syllable (CV or CVC) receives the primary stress, and the secondary stress falls on an even syllable, counting from the primary stress. For the description of the phenomenon, they not only approved the non-binarity of the distinctive features but proposed such rules as variables, parentheses, disjunctive ordering, iterative rule application. Despite such equipments, though, the existing phonology has not been able to explain why CV and CVC and behave like CVCV (for example, in 'América' the stress falls on 'me' skipping two light syllables 'ri-ca' from the word final; while in 'amálgam' the stress is on 'ma' skipping one heavy syllable), and in what circumstance a non-adjacent phonological unit can be used as an environment of the phonological rule.

The description of tone has been the most difficult tumor to deal with in the linear phonology. For one or two examples, even when a vowel is dropped in the underlying form  $\hat{V}\hat{V}$  or  $\check{V}\check{V}$  by a segmental phonological rule the tone may survive and  $\hat{V}$  or  $\check{V}$  is yielded. In other words high-low or low-high two syllables are changed to a falling or rising monosyllable. The existing phonology explained the phenomenon with the so-called 'global rule' which most phonologists accepted reluctantly, for if the tone is regarded as a distinctive feature and put down as [+high T.] or [-low T.], it cannot be explained why the tone feature alone leaves its trace behind when all the other distinctive features disappear along with the deleted segmental phoneme.

Another problem concerning tone is of the tone melody. The tone melody is said of the

phenomenon that tone gets lengthened or shortened in the melody according to the number of the syllables of the relevant morpheme. For example, the noun in Mende (Sierra Leone) has one of the five tone melodies: high, low, high-low, low-high, low-high-low. So every high-tone noun is high irrelevant to the syllable number ('kɔ' war, 'pelé' horse, 'háwámá' hip line), and the high-low tone noun becomes falling tone if monosyllabic ('mbú' owl), if two-syllabic high-low tone ('kényà' uncle), if three-syllabic high-mid-low tone ('félemà' intercession). These phenomena couldn't be described in the linear phonology which looks upon tone as a distinctive feature inseparable from a segment.

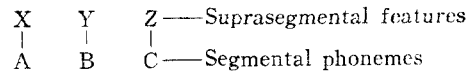
As the phenomena that could not be described in the linear phonology were repeatedly examined, the claim that the phonological units were arranged in a linear form has been discarded since the early 1970's (e.g. Leben 1971) and it has been recognized that there are certain hierarchical structures over the phonemic classes-therefrom the word 'non-linear'. This new phonology it also called hierarchical or three dimensional phonology.

In this introductory paper, I will put forward the merits of the non-linear phonology, exemplifying each component of it which is divided into three parts: 1) autosegmental phonology, 2) functions of syllables, 3) metrical phonology.

## II. Autosegmental Phonology

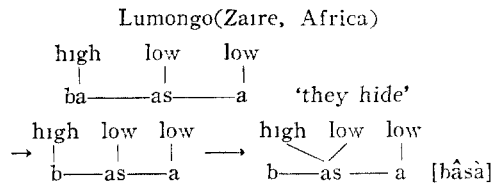
According to Goldsmith(1976), the theory which appeared in the middle of 1970's maintains that suprasegmental features have their own position independent of the segmental phonemes, freed from the old-aged opposite view. In short, it is such that segmental phonemes ABC and suprasegmental features XYZ have their own independent tiers as illustrated

below:

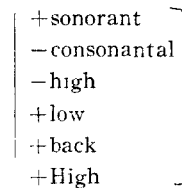


According to professor Halle, such manifestation is like a score on which the words of a song and the notes of it are written separately. It suggests that since the two tiers are independent of each other, the number of segmental phonemes does not have to be the same as that of suprasegmental features, nor must the units of the two tiers be in a one-to-one relation.

Now let us exemplify how autosegmental phonology solves the problems that are brought about in the linear phonology. First, let us consider the case where the suprasegmental features survive despite the deletion of the segmental vowel:



Though the vowel á in bá is deleted, the high-tone related to it is still kept, for the suprasegmental tier is independent of the segmental one. According to the linear phonology in which suprasegmental tones are, like distinctive features, described as [+high T.] or [-low T.], etc., the deleted á in bá above should be represented as

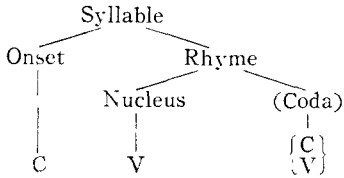


but it cannot be properly explained why the feature [+high T.] alone remains while all the others have disappeared.

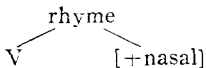
## III. Function of Syllables

Recently, as the function of syllables are

more seriously examined, it is recognized that the syllabic construction is not a linear concatenation of segmental phonemes but a hierarchical arrangement of segmental phonemes. The hierarchical (non-linear) structures of syllables can be represented, like the phrase structures in syntax, in a branching tree diagram as follows:

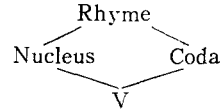


Such syllabic structures as this have made it possible to naturally explain the functional difference in the stress distribution between two kinds of syllables by clarifying that the old differentiation of a light syllable from a heavy one is that of a non-branching rhyme  $\hat{V}$  from a branching rhyme  $\hat{V}\hat{C}$  or  $\hat{V}\hat{V}$ . Moreover it can describe the morpheme structure condition by using the syllable template. For example, as for a condition that all final sounds in a language be nasal, it can be represented as

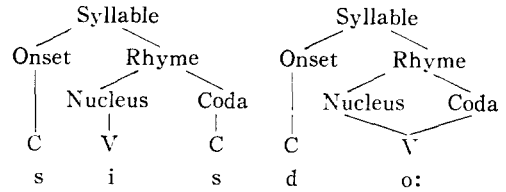


Another example showing that the hierarchical syllabic structures make neater explanations is of the phenomenon of the compensatory lengthening. (for example, Latin; *sisdo:*→*si:do:* sit, Greek; *esmi*→*e:mi*) The linear phonology has no way but to deal with the phenomenon in the two steps of rule applications—consonant deletion and vowel lengthening. However these procedures wrongly suggest that there are no dependent relations between the two phenomena except a mere diachronic relation, and that the compensatory lengthening is not a production of the organic cooperation of the two phenomena. And also it cannot explain why the preceding vowel has to be leng-

thened in a compensation for a consonant deletion. But hierarchy-based phonology is able to explain naturally the same phenomenon. First of all suppose the syllable tree diagram assumes the following form where the nucleus and coda of the rhyme are related to a vowel:



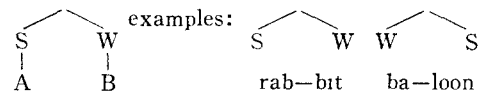
Then the example word '*sisdo:*' has the following tree diagram:



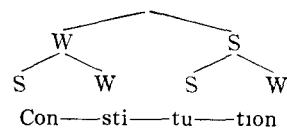
If the second 's' is deleted, the node from Coda is switched to 'i:', which is lengthened. This compensatory mechanism is naturally explained to be due to the tendency to preserve the unit (weight) of the rhyme (see Ingria 1980).

#### IV. Metrical Phonology

The theory is attributed to Liberman(1975) when he defined stress to be a relative feature. He proposed stress be defined in a fashion that syllable A is stronger than syllable B, not that syllable A has the stress of *n* degree. And he again proposed that the representation of stress be in such a tree diagram as follows [s=strong; w=week]:



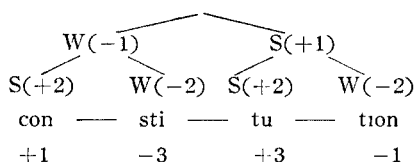
Since this strong-weak opposition permits only the binarism, multisyllabic words expand the nodes vertically and horizontally:



Here we have some points to notice. First, main stress falls on the syllable dominated solely by S nodes, the syllable which has only the W nodes gets no stress and secondary stress is on the syllable which has both S and W node.

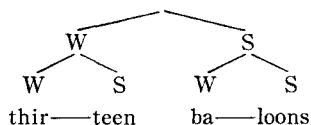
Second, the metrical phonology can treat stress as well in binarism, which the existing phonology cannot let stress features be exceptional when it has to mark the degrees of stress in number (e.g. constitution: where 1 represents the main stress).

Third, the degree of stress is naturally derived from addition of all the node values of a syllable. For example let us mark +1 on S and -1 on W of the first row, +2 on S and -2 on W of the second row. Then we get the sum of stress as follows:

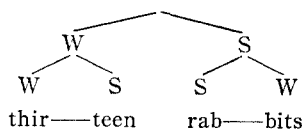


where -tu-(+3) is of primary stress, -con-(+1) of secondary stress, -sti- (-3) and -tion (-1) weak stress.

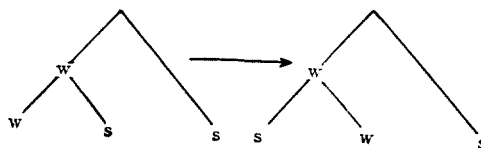
Fourth, this phonology defines the strong-weak opposition not only in the plane of syllables [which is the characteristic of linear phonology] but in that of foot, syllable class and word, foot class. For example an English numeral 'thirteen', which has the stress form of weak-strong, maintains its own stress form when it goes alone or before a word with a weak-strong stress form:



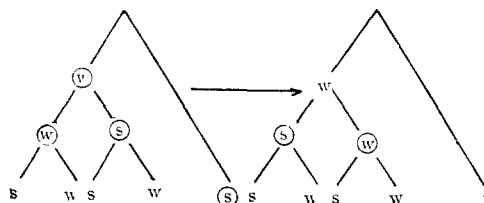
However when a noun following 'thirteen' is monosyllabic or multisyllabic which has stress on the first syllable, the rhythm sounds awkward, being weak-strong-strong...:



In this case an intonation metre is produced changing WS to SW in 'thirteen':

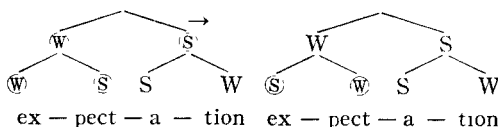


It is noticeable that the metre-inversion rule is applied not only to the terminal string but also to words and up to phrases. For example let us join 'constitution' and 'hall' together:



con-sti-tu-tion hall con-sti-tu-tion hall [The encircled parts correspondent to the structural description of the rule]

Thus the secondary stress is shifted from -tu- to con- (The primary stress is on 'hall'). Even the same phenomenon is found within a word. For example a verb 'expect' has its stress on the second syllable, and is pronounced as expect. But when a nominalizing suffix -ation is attached to it, the stress is inverted as follows:



In SPE, the stress-inversion phenomenon is explained with various rules such as cyclic rules but metrical phonology does not need much of those rules. This is the strong merit

of the new theory.

### V. Conclusion

So far I have examined the characteristics and merits of nonlinear phonology from the viewpoints of autosegmental phonology, function of syllables and metrical phonology. As mentioned above many problems which were presented, but not solved neatly by linear phonology can be naturally handled in the framework of non-linear phonology.

Non-linear phonology will be the key to many problems as well as the mentioned phenomenon of the suprasegmental feature still surviving after the segmental phoneme is deleted, or compensatory lengthening in case of consonant deletion, or metre-inversion phenomenon, etc.. Any way, it appears certain that non-linear phonology will be the must in the study of phonology from now on.

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