LEXICAL-FEATURE REDUNDANCY RULES OF KOREAN

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Contents

1. Introductory

This paper presents part of the phonological redundancy rules of Korean in the framework of generative grammar.[1] The conception of the 'redundancy rules' is taken from Halle's original formulation of 'Morpheme Structure Rules' in 1959.[2] I understand the details of Morpheme Structure Rules are open to be discussed from a variety of theoretical and practical standpoints. The position I maintain in this paper, however, is that a section of the redundancy rules should state the phonological features which could be predicted by virtue of the feature combinations of phonological segments which make up lexical entries in a lexicon of a particular grammar. In short, the 'lexical-feature redundancy rules' presented on the following pages are formulated with an explicit aim of saving the predictable features of phonological segments in the lexicon of the Korean language.

For the theoretical justifications on which the 'generative phonology' is based, I should call our attention to the rich literature on the generative-transformational theory initiated by Chomsky's *Syntactic Structures* in 1957. More specifically, in case of generative phonology, I would refer to Halle's articles.[3]

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[1] This paper is part of the revised version of my doctoral dissertation, "Generative Phonology of Korean," submitted to the Graduate School of Ewha Womans University in November 1967.

[2] M. Halle, *The Sound Pattern of Russian*(1959).

[3] A somewhat classical forms of 'distinctive features' are presented in R. Jakobson, et al, *Prelimi-*

2. Phonological Matrix

There are a quite few questions about the number and the characters of the underlying phonological segments to set up for Korean, which deserve separate and lengthy arguments. For all these, for the present paper, I would tentatively take the twenty-nine segments of Korean as the underlying segments as they are represented in the following matrix, with ten binary distinctive features to differentiate them from each other.

Segments / Features	i	e	æ	ü	ö	ɨ	ə	u	o	a	p	p'	p^h	t	t'	t^h	č	č'	$č^h$	k	k'	k^h	s	s'	m	n	ŋ	l	h
	ㅣ	ㅔ	ㅐ	ㅟ	ㅚ/ㅞ	ㅡ	ㅓ	ㅜ	ㅗ	ㅏ	ㅂ	ㅃ	ㅍ	ㄷ	ㄸ	ㅌ	ㅈ	ㅉ	ㅊ	ㄱ	ㄲ	ㅋ	ㅅ	ㅆ	ㅁ	ㄴ	ㅇ	ㄹ	ㅎ
voc	+	+	+	+	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−
cns	−	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	−
grv	−	−	−	−	−	+	+	+	+	+	+	+	+	−	−	−	−	−	−	+	+	+	−	−	+	−	+	−	α
cmp	−	−	+	−	−	−	−	−	−	+	−	−	−	−	−	−	+	+	+	+	+	+	−	−	−	−	+	−	β
dif	+	−	−	+	−	+	−	+	−	−	+	+	+	+	+	+	−	−	−	−	−	−	+	+	+	+	−	+	γ
flt	−	−	−	+	+	−	−	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	ω
nas	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+	−	−
tns	−	−	−	−	−	−	−	−	−	−	−	+	+	−	+	+	−	+	+	−	+	+	−	+	−	−	−	−	−
asp	−	−	−	−	−	−	−	−	−	−	−	−	+	−	−	+	−	−	+	−	−	+	−	−	−	−	−	−	−
cnt	+	+	+	+	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−	+	+	−	−	−	+	+
vcd	+	+	+	+	+	+	+	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+	+	−

Matrix A

* voc:	vocalic	nas:	nasal
cns:	consonantal	tns:	tense
grv:	grave	asp:	aspirated
cmp:	compact	cnt:	continuant
dif :	diffuse	vcd:	voiced
flt :	flat		

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naries to Speech Analysis(1952), *Fundamentals of Language*(1956), and in other articles in R. Jakobson, *Selected Writings I: Phonological Studies*(1962). The original scheme of the distinctive features can be found in E. C. Cherry, et al, "Toward the Logical Description of Languages in Their Phonemic Aspect"(1953), which is reprinted in Jakobson's *Selected Writings*, pp. 449-63.

Most of Chomsky and Halle's articles elaborated the justifications for the generative theory. To mention a few among them, I would call our attention to Chomsky's "Current Issues in Linguistic Theory," Halle's "Phonology in Generative Grammar," "In Defense of The Number Two," "On the Bases of Phonology," "The Strategy of Phonemics," and "On the Role of Simplicity in Linguistic Descriptions." For the controversy over 'mentalism' in generative theory, a rather clear exposition is presented in J. J. Katz, "Mentalism in Linguistics."

For the reference of particular-language descriptions in terms of generative-phonology framework of recent publication, I recommend Schane's *French Phonology and Morphology*(1968) and Kuroda's *Yawelmani Phonology*(1967), and in particular, Chomsky and Halle's *The Sound Pattern of English*(May, 1968).

The relevent values (plus or minus) of the features are printed in large type, whereas the redundant values are printed in small type. On the 'systematic phonemic level' the phonological matrix shows only the relevant values, leaving the spaces corresponding to the redundant features blank.[4] On the basis of this phonological matrix are applied the lexical-feature redundancy rules, and they fill in the blanks with appropriate values for the segment under consideration.

3. Rules

The form of rules in this paper follows the established conventions which are in general use for generative phonology. Specifically, it takes the form,

$$A \longrightarrow B \Big/ X \left[\overline{Z}\right] Y,$$

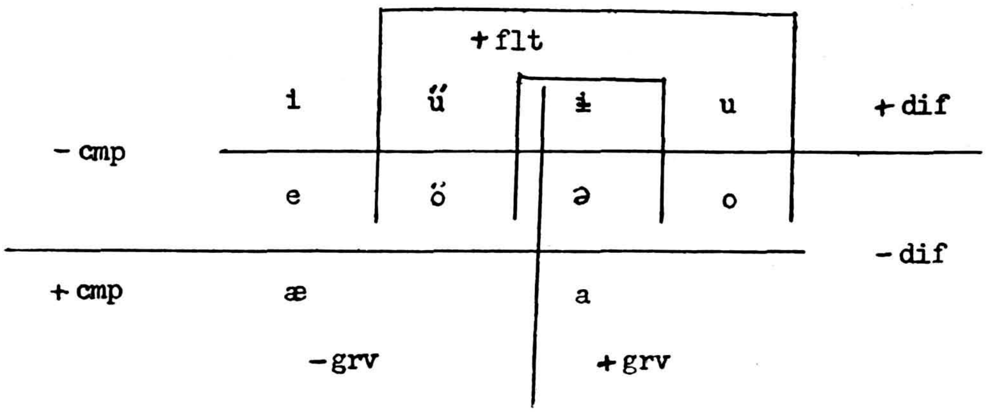
where A,B,X,Y,Z are symbols for the componential distinctive features for phonological segments, or for zero. The slash stands for the statement 'in the environment of'; and the horizontal bar above the symbol Z shows the exact position where the change A→B actually takes place. In the actual rules, the componential distinctive features are represented as a list of feature-names written in column parenthesized with brackets. The rules are numbered consecutively as R1, R2, R3, etc. These subscript numbers decide the order of rules.

$$\text{R1} \qquad \left\{ \begin{array}{l} [+\text{dif}] \longrightarrow [-\text{cmp}] \\[6pt] [+\text{cmp}] \longrightarrow \begin{bmatrix} -\text{dif} \\ -\text{flt} \end{bmatrix} \\[6pt] [\text{X}] \longrightarrow \begin{bmatrix} -\text{nas} \\ -\text{tns} \\ -\text{asp} \\ +\text{cnt} \\ +\text{vcd} \end{bmatrix} \end{array} \right\} \Big/ \overline{\begin{bmatrix} +\text{voc} \\ -\text{cns} \end{bmatrix}}$$

R1 specifies the redundancies for the 'true vowels' (the natural class of segments characterized by both [+voc] and [−cns]). It is self-explanatory that the true vowels are [−nas], [−tns], [−asp], [+cnt], and [+vcd]. And a little further attention shows that the first two sub-rules are also true. Looking at the following diagram, we find that all [+dif] segments ([i], [ü], [ɨ], and [u]) are [−cmp], and that all [+cmp] segments ([æ] and [a]) are both [−dif] and [−flt].

The second sub-rule in R1 shows further that in Korean the two [+cmp] segments are

[4] A modified model has been proposed by Stanley in which he has replaced MS-rules by 'MS-conditions'; and he has the 'systematic phonemic representation' (lexical representation) which is *fully* specified as regards both *relevant* and *redundant* features. See R. Stanley, "Redundancy Rules in Phonology," *Lg* 43.393-436(1967).



'neutralized' as regards the feature [flt]; that is, there is no segment which is in contrast to either of the [+cmp] segments by the opposition of [+flt] vs. [−flt].

R2 $$[X] \longrightarrow [-\text{flt}] \Big/ \begin{bmatrix} \overline{} \\ +\text{cns} \end{bmatrix}$$

R2 specifies that in Korean the 'secondary' articulation of lip-rounding for the 'true consonants' and the liquid is redundant at the systematic phonemic level. This rule is a combination of two separate rules, namely, one for 'true consonants' and the other for the 'liquid':

(i) $$[X] \longrightarrow [-\text{flt}] \Big/ \begin{bmatrix} \overline{} \\ -\text{voc} \\ +\text{cns} \end{bmatrix} \text{ and}$$

(ii) $$[X] \longrightarrow [-\text{flt}] \Big/ \begin{bmatrix} \overline{} \\ +\text{voc} \\ +\text{cns} \end{bmatrix}.$$

However, to incorporate (i) and (ii) in the grammar neglects the natural class which comprises 'true consonants' and the 'liquid,' because these two groups can be characterized by [+cns] feature in contrast to both $\begin{bmatrix} +\text{voc} \\ -\text{cns} \end{bmatrix}$ and $\begin{bmatrix} -\text{voc} \\ -\text{cns} \end{bmatrix}$. Consequently, R2 is more general than (i) and (ii) put together, and also simpler in terms of the number of features. Eventually, after the application of R2 all 'true consonants' and the 'liquid' are specified as [−flt].

Next, we turn to the nasal-redundancy, which can be formulated as follows:

R3 $$[X] \longrightarrow [-\text{nas}] \Big/ \left\{ \begin{matrix} \begin{bmatrix} \overline{} \\ +\text{voc} \\ +\text{cns} \end{bmatrix} \\ \begin{bmatrix} \overline{} \\ +\text{cnt} \end{bmatrix} \\ \begin{bmatrix} \overline{} \\ +\text{cns} \\ -\text{grv} \\ +\text{cmp} \end{bmatrix} \end{matrix} \right\}$$

This rule specifies that the six segments (č, č', čʰ, s, s', and l) are [−nas]. We have to note that the third sub-rule in R1 specifies that the 'true vowels' are [+cnt] and [−nas]. If R3 is applied after R1 as in the order given, we can save the [−nas] in R1, for after being specified as [+cnt] the true vowels can be specified as [−nas] by virtue of R3 which says that all [+cnt] segments are [−nas].

$$\text{R4} \qquad [X] \longrightarrow \begin{bmatrix} -\text{tns} \\ -\text{asp} \\ +\text{vcd} \end{bmatrix} \Big/ \left\{ \begin{array}{c} \begin{bmatrix} \overline{} \\ +\text{nas} \end{bmatrix} \\ \\ \begin{bmatrix} \overline{} \\ +\text{voc} \\ +\text{cns} \end{bmatrix} \end{array} \right\}$$

R4 simply specifies the three nasal consonants and the liquid are [−tns], [−asp], and [+vcd].

$$\text{R5} \qquad [X] \longrightarrow [-\text{asp}] \Big/ \left\{ \begin{array}{c} \begin{bmatrix} \overline{} \\ -\text{tns} \end{bmatrix} \\ \\ \begin{bmatrix} \overline{} \\ +\text{tns} \\ +\text{cnt} \end{bmatrix} \end{array} \right\}$$

R5 specifies that [p], [t], [č], [k], [s], and [s'] are unaspirated segments; however, a delicate adjustment has been incorporated in the rule because the first five segments (p, t, č, k, and s) form a natural class by means of [−tns] feature, from which [s'] is excluded. For this last segment the second part of R5 became necessary such that the context $\begin{bmatrix} \overline{} \\ +\text{tns} \\ +\text{cnt} \end{bmatrix}$ had to be incorporated in the rule. From a different point of view, however, R5 can be modified as follows:

$$\text{R5'} \qquad [X] \longrightarrow [-\text{asp}] \Big/ \left\{ \begin{array}{c} \begin{bmatrix} \overline{} \\ -\text{tns} \end{bmatrix} \\ \\ \begin{bmatrix} \overline{} \\ +\text{cnt} \end{bmatrix} \end{array} \right\}$$

in which we have saved one feature, [+tns], compared with R5. But in this case, [+cnt] covers not only [s'] but also [s], which forces us to *doubly* specify [s] as [−asp], for [s] is both [−tns] and [+cnt]. However, for the sake of economy, I would take R5', instead of R5, for the specification of [asp] feature.

One interesting effect of R5' in connection to R4, on the equivalent basis on which we have saved the feature [−nas] in R1, is that we can save the feature [−asp] in R4 due to the specification of [−tns] in R4 by means of which, in turn, R5 specifies [+nas] and $\begin{bmatrix} +\text{voc} \\ +\text{cns} \end{bmatrix}$ segments, in addition, as [−asp]. The same reasoning is also applicable to R1 so that the [−asp] becomes unnecessary in R1 because this can now be specified by R5 by virtue of [−tns] in R1.

$$\text{R6} \qquad [\text{X}] \longrightarrow [-\text{cnt}] \;/\; \left\{ \begin{matrix} \begin{bmatrix} \rule{1em}{0.4pt} \\ +\text{cns} \\ +\text{grv} \end{bmatrix} \\[1ex] \begin{bmatrix} \rule{1em}{0.4pt} \\ +\text{cns} \\ +\text{cmp} \end{bmatrix} \\[1ex] \begin{bmatrix} \rule{1em}{0.4pt} \\ -\text{grv} \\ -\text{cmp} \\ +\text{asp} \end{bmatrix} \\[1ex] \begin{bmatrix} \rule{1em}{0.4pt} \\ -\text{cmp} \\ +\text{nas} \end{bmatrix} \end{matrix} \right\}$$

This rule appears to be rather complicated. For the four classes represented on the right-hand side, we have to show that they are each a class of 'true consonants.' I have used [+cns] for the first two classes and [+asp] for the third class. As for the fourth class, [+nas] designates it as 'true consonant.' We know also that the 'liquid' is a [+cns] segment. But R6 does not apply to the 'liquid' because neither its [grv] nor its [cmp] feature has been specified yet. Furthermore, as we will see presently, the liquid is specified as both [−grv] and [−cmp]; however, it is exempt from R6 for the $\begin{bmatrix} -\text{grv} \\ -\text{cmp} \end{bmatrix}$ segment in R6 is also specified as [+asp], whereas the liquid has already been specified as [−asp] by R5'. Therefore, R6, even though we allow R7 to precede R6, specifies only thirteen segments (p, p', p^h, č, č', $č^h$, k, k', k^h, t^h, and m, n, ŋ) as [−cnt].

It is worth noting that R6 specifies the three [+nas] segments as [−cnt]. The first sub-rule in R6 specifies [m] and [ŋ] (both being [+grv]), and the fourth sub-rule is designed to specify specifically [n] as [−cnt]. The position of considering [+nas] segments as [−cnt] is quite characteristic of the phonological analysis in terms of generative phonology.[5]

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[5] In *Preliminaries to Speech Analysis* (pp. 21-3), the function of 'continuant vs. interrupted' for the nasal segments was not stated. In Halle's "On the Bases of Phonology"(p. 327), however, a basis on which we could classify the nasal segments as [−cnt] was given—"Continuant-Interrupted: continuant sounds are produced with a vocal tract in which the passage from the glottis to the lips contains no narrowing in excess of an *occlusion;* interrupted sounds are produced with a vocal tract in which the passage from the glottis to the lips is effectively closed by *contact.*" The nasal segments, therefore, are classified as [−cnt] because "the passage from the

R7 $$[X] \longrightarrow \begin{bmatrix} -\text{grv} \\ -\text{cmp} \end{bmatrix} / \left\{ \begin{matrix} \begin{bmatrix} \overline{} \\ +\text{voc} \\ +\text{cns} \end{bmatrix} \\ \\ \begin{bmatrix} \overline{} \\ +\text{cns} \\ +\text{cnt} \end{bmatrix} \end{matrix} \right\}$$

This rule specifies that 'liquid,' [s], and [s'] are both [−grv] and [−cmp].

Next, note the two segments, [1] and [h], are [+cnt]. In appearance it seems rather delicate to formulate a single general rule to accomodate both segments. However, the 'α-rule convention'[6] allows us a way out for this problem. Thus, we could formulate the following

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glottis to the lips" for nasal segments "is effectively closed by contact." On the other hand, [l] is a [+cnt] segment, which, I believe, does not contain an effective closure by contact.

Furthermore, to classify the nasal segments as [-cnt] effects an descriptive economy in the 'phonological rules.' In other words, if we could have a natural class comprising [m], [n], and [ŋ] by means of [−cnt], we can achieve an economy by being able to construct a general rule. For this matter, I would not go into any detail here, but I would hope to present this question in my next paper on "Korean Phonological Rules."

[6] The insights we gain by means of distinctive features can be demonstrated by a host of phonological aspects. One of them which I will present is like the following which is concerned with the "α-rule convention." Assimilation and dissimilation are phonetic processes that can be found in almost any language. In their most common form these processes determine the *value of a feature* with reference to the value of the same feature in some adjacent segment. That the change is confined to a single or two features is, of course, implicitly assumed in structuralism; however, it is only through the explicit formulation of *feature rules* that explains our intuition to the point. In appearance, in structuralism, there is no explicit clue that tells us that a single feature is the concern in the case of assimilation or dissimilation. If a voiced feature changes to a voiceless feature in the obstruents in reference to the voicing feature of an adjacent segment and vice versa, the structuralists would formulate, for instance, rules like the following.

[d] ⟶ [t] / —— {list of the voiceless sounds}, and
[t] ⟶ [d] / —— {list of the voiced sounds}.

And in these rules, there is no provision to prevent our inference that [d] in its totality changes to another completely *unrelated* sound which is represented by the symbol [t], and vice versa. By the distinctive feature framework, however, the rules can be not only simplified in terms of the number of features, but also explicitly shows us that the change is confined to a specific feature, the voicing feature in this case. More importantly, the seemingly two unrelated processes ([d] ⟶ [t] and [t] ⟶ [d]) are realized as only the two different aspects of an inherently the same process. This has become possible only by means of the "α-rule convention," as follows:

$$[-\text{cnt}] \longrightarrow [\alpha\text{vcd}] \;/\; \underline{\quad} \begin{bmatrix} -\text{cnt} \\ \alpha\text{vcd} \end{bmatrix}$$

What this rule says is that in a cluster of two 'noncontinuant' segments, the voicing feature of the first segment is determined by the voicing feature of the second segment. The α-rule convention used in this rule is possible due only to the distinctive features, which is unthinkable in the structural phonemic framework. The Greek lower-case letter or letters(α, β, γ, etc.) are *variables* ranging over the values + or −. Hence, if the right-hand α is −, the continuant in question is [−vcd]; if the right-hand α is +, the continuant is [+vcd]. In order to handle *dissimilation*, it is natural to take $-\alpha = -$, if $\alpha = +$, and $-\alpha = +$, if $\alpha = -$. Thus, for instance, rule,

R8 $$[X] \longrightarrow [+\text{cnt}] \Big/ \begin{bmatrix} \overline{\quad} \\ \alpha\text{voc} \\ \alpha\text{cns} \end{bmatrix}$$

in which $\begin{bmatrix} \alpha\text{voc} \\ \alpha\text{cns} \end{bmatrix}$ requires that the values for the two features be the same; either $\begin{bmatrix} +\text{voc} \\ +\text{cns} \end{bmatrix}$ or $\begin{bmatrix} -\text{voc} \\ -\text{cns} \end{bmatrix}$, which thus designate both [l] and [h], respectively.

The redundancy I now consider is the ones caused by the 'nonoptimal' nature of [dif]. This feature is being treated as optimal only for $\begin{bmatrix} +\text{voc} \\ -\text{cns} \end{bmatrix}$ segments in which the mid-term series ([e], [ö], [ə], and [o]) are designated as $\begin{bmatrix} -\text{cmp} \\ -\text{dif} \end{bmatrix}$. For the [+cns] segments, however, either [cmp] or [dif] should be regarded unnecessary, for not all these two features are necessary to differentiate the eighteen [+cns] segments. Either one is sufficient.

The choice between [cmp] and [dif] for a relevant feature to differentiate the eighteen segments is decided arbitrarily. For the present paper, I have decided on [cmp] as relevant, treating [dif] redundant.[7] Consequently, it becomes necessary that we set up a rule to predict the redundancies of [dif] for [+cns] segments.

We find again that a generalization should be achieved in the rule due to the fact that in the eighteen [+cns] segments are included the liquid and the true consonants. And all the eighteen segments show the opposite values between [cmp] and [dif]. The first question of generalization of designating [l] and true consonants can be easily handled by the single feature, [+cns]. As for the question of 'opposite values,' we could again utilize the α-rule. In consequence, we come to have a rule as follows:

R9 $$[X] \longrightarrow [-\alpha\text{dif}] \Big/ \begin{bmatrix} \overline{\quad} \\ +\text{cns} \\ \alpha\text{cmp} \end{bmatrix}$$

This rule states that the values of [dif] for [+cns] segments are determined by the values

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we would have a rule like the following:

$$[X] \longrightarrow [\alpha\text{vcd}] \ / \ \text{——}[-\alpha\text{vcd}],$$

where X stands for any arbitrary complex of features.

The α-rule convention also allows us, furthermore, to treat in a simple fashion many other phonological aspects of language. Another example is the case in Slavic languages "in which [e]→[æ] and [o]→[u] in the environment before nasal consonants." (M. Halle, "A Descriptive Convention for Treating Assimilation and Dissimilation,"(1962) p. 295. This can be formalized as follows:

$$\begin{bmatrix} -\text{cmp} \\ -\text{dif} \\ \alpha\ \text{grv} \end{bmatrix} \longrightarrow \begin{bmatrix} -\alpha\text{cmp} \\ \alpha\text{dif} \end{bmatrix} \ / \ \text{——}[+\text{nas}].$$

[7] Halle, on the other hand, has chosen 'diffuse-nondiffuse' as an optimal feature and restricted 'compact-noncompact' to vowels. ("On the Bases of Phonology," p. 327)

of [cmp]. In other words, R9 can be decomposed into the following two rules:

R9' $$[X] \longrightarrow [-\text{dif}] \Big/ \begin{bmatrix} \overline{\quad\quad} \\ +\text{cns} \\ +\text{cmp} \end{bmatrix} \text{ and}$$

R9" $$[X] \longrightarrow [+\text{dif}] \Big/ \begin{bmatrix} \overline{\quad\quad} \\ +\text{cns} \\ -\text{cmp} \end{bmatrix}.$$

I now consider the [−vcd] redundancies for the $\begin{bmatrix} -\text{voc} \\ -\text{nas} \end{bmatrix}$ segments in the following way:

R10 $$[X] \longrightarrow [-\text{vcd}] \Big/ \begin{bmatrix} \overline{\quad\quad} \\ -\text{voc} \\ -\text{nas} \end{bmatrix}$$

[h] and the true consonants with the exception of the three [+nas] segments are now specified as [−vcd] by R10.

Finally comes R11 which is specifically devised to specify the redundant features for [h] which is the only $\begin{bmatrix} -\text{voc} \\ -\text{cns} \end{bmatrix}$ segment represented in the phonological matrix. [h] forms a special class of its own in that its other features are determined by the features of the immediately following 'vowel' segment. There are 'seven' redundant features that have been left to be specified for the [h] segment, of which the first four are determined by the corresponding feature-values of the following 'vowel' segment. As for the other three features [−nas], [−tns], and [−asp] in R11, there is a point worth noticing in reference to the principle of simplicity. That is, we could have specified these features in other corresponding rules which have preceded R11. For example, if we had included $\begin{bmatrix} \overline{\quad\quad} \\ -\text{voc} \\ -\text{cns} \end{bmatrix}$ besides the three classes of segments represented in the braces in R3, we could have saved [−nas] in R11. However, this adjustment is not recommendable for the simple reason that by doing so we cost two features to save one feature which is not allowed on the 'simplicity' principle.

R11 $$[X] \longrightarrow \begin{bmatrix} \alpha\ \text{grv} \\ \beta\ \text{cmp} \\ \gamma\ \text{dif} \\ \omega\ \text{flt} \\ -\text{nas} \\ -\text{tns} \\ -\text{asp} \end{bmatrix} \Big/ \begin{bmatrix} \overline{\quad\quad} \\ -\text{voc} \\ -\text{cns} \end{bmatrix} \begin{bmatrix} +\text{voc} \\ -\text{cns} \\ \alpha\ \text{grv} \\ \beta\ \text{cmp} \\ \gamma\ \text{dif} \\ \omega\ \text{flt} \end{bmatrix}$$

(Where $\alpha, \beta, \gamma, \omega$ each ranging over + and −, there is no intrinsic connection between them. The value of either + or − of any of them does not depend on that of any of others.)

The ordering of R11 could have been somewhere else. But it is obvious that R11 should follow R1 and R2 because the four features ([grv], [cmp], [dif], and [flt]) of [h] depend on the same four features of the following 'vowel' segment. And R11, as it is, should follow R3 as has been pointed out, and should follow R8, for otherwise [+cnt] has to be specified in R11.

4. Diphthongization

In the preceding chapters, I have treated the redundancy rules the predictions of the redundancies of which have been possible in terms of the componential features of the segment concerned. On the other hand, the diphthongization, which I believe forms another category of redundancy rule, involves more than the features of the segment in question.

Another reason for bringing up the question of diphthongization at this separate place is to call our attention to the different treatment of the diphthongization in the generative grammar. In structuralism, the *semi-vowels* are treated as independent 'phonemes' on a par with other 'segmental phonemes.' This background of semi-vowel treatment has usually led us to list the semi-vowels along with other 'segmental phonemes.' However, in the generative grammar, the concept of 'semi-vowel' ('glide' in one sense) has changed in such a way that we no longer treat them with the 'phonemic status' on the level of systematic phonemics. Rather, the semi-vowels are treated as being derived from the corresponding 'nucleus' vowels, respectively: that is, [y] from [i] and [w] from [u], in the case of Korean. The rules which derive these semi-vowels from the corresponding nucleus are called the *diphthongization rules.*

By way of illustration, I would like to consider English which makes use of prosodic accent feature for the diphthongization rule. For example, at the systematic phonemic level is represented the word 'bee' as [bii]. After the application of the 'stress assignment rules,' we get the representation, [bíi]. To this representation, a diphthongization rule of the following form is applied:

R12. $$[+\text{voc}] \longrightarrow [-\text{voc}] \Big/ \neq X \begin{bmatrix} +\text{voc} \\ -\text{cns} \\ +\text{dif} \\ -\text{grv} \end{bmatrix} \begin{bmatrix} \underline{\qquad} \\ -\text{cns} \\ +\text{dif} \\ -\text{grv} \end{bmatrix} X' \neq$$

(Where $\neq$ stands for a *syllable boundary;* X' and X stand for other consonant or a consonant cluster, and X or X' does not contain $\neq$; the vertical stroke shows the segment where the *stress* falls.)

R12 is a diphthongization rule specifically for [i]⟶[y] in the specific context of '[i]——.'

Furthermore, we can generalize R12 to the extent that we could include the glide [w], for both 'on-glide' and 'off-glide' diphthongs. This generalized rule may be formulated as follows:

$$\text{R13} \qquad [+\text{voc}] \longrightarrow [-\text{voc}] \,/\, \neq \; X \left\{ \begin{array}{l} \begin{bmatrix} +\acute{\text{voc}} \\ -\text{cns} \end{bmatrix} \begin{bmatrix} \underline{\quad} \\ -\text{cns} \\ +\text{dif} \\ \alpha\,\text{grv} \end{bmatrix} \\ \begin{bmatrix} \underline{\quad} \\ -\text{cns} \\ +\text{dif} \\ \alpha\,\text{grv} \end{bmatrix} \begin{bmatrix} +\acute{\text{voc}} \\ -\text{cns} \end{bmatrix} \end{array} \right\} X' \neq$$

Thus formulated, R13 represents the phonological changes as shown in the examples given below:

[bíi]——→[bíy] ('bee'),

[iés]——→[yés] ('yes'),

[húu]——→[húw] ('who'),

[uén]——→[wén] ('when'),

[uóu]——→[wów] ('woe'),

[iúu]——→[yúw] ('you'), etc.

In case of Korean, however, I am in doubt what role the prosodic accent feature plays for the diphthongization. Moreover, no clear description of the phonetic nature of Korean accent is available at present. Tentatively, therefore, I have attempted a rule formulation for Korean diphthongization by means of syllable boundary. This is equivalent to the English diphthongization rule except for the absence of the stress features. Instead, I have brought in the syllable boundary into picture. That is, if two adjacent vowels, one of them being either [i] or [u], occur in a single syllable, [i] changes to [y] and [u] changes to [w].

As we have seen in the case of English, R13, there are both the on-glide and the off-glide diphthongs. The Korean diphthongs, however, are dominantly *on-glide* diphthongs except for one, that is, [ɨy][8]. Twelve diphthongs are claimed in Korean, including [ɨy]. In actual *occurrence*, eight vowels out of the ten simple vowels form the *nucleus* of the diphthongs, excluding the two front round vowels, [ü] and [ö]. But to try to exclude these two round vowels from becoming the diphthong nucleus makes the description only 'observa-

[8] It is observed that [ɨy] is very unstable in the speech of Korean speakers in that this off-glide diphthong is apt to change to an on-glide diphthong [ɨ̯i] even in the speech of a single speaker. For this observation, see Huh Woong's *Korean Phonemics* (revised edition, 1965), p. 205.

tionally' adequate in light of the excluded admissible 'diphthongs' of [wü], [wö], [yü], and [yö], the former two of which being actually in 'free variation' with [wi] and [we], respectively, in occurrence.[9] The following diphthongization rules are formulated so that they be 'descriptively' adequate, including not only the occurring but also the 'admissible' diphthongs in Korean.

$$\text{R14}\qquad [+\text{voc}] \longrightarrow [-\text{voc}] \Big/ \neq X \left\{\begin{matrix} \left(\begin{bmatrix} \_\_\_ \\ -\text{cns} \\ +\text{dif} \\ \alpha\ \text{grv} \\ \alpha\ \text{flt} \end{bmatrix} \begin{bmatrix} +\text{voc} \\ -\text{cns} \end{bmatrix}\right) \\ \left(\begin{bmatrix} +\text{voc} \\ -\text{cns} \\ +\text{grv} \\ +\text{dif} \\ -\text{flt} \end{bmatrix} \begin{bmatrix} \_\_\_ \\ -\text{cns} \\ -\text{grv} \\ +\text{dif} \\ -\text{flt} \end{bmatrix}\right) \end{matrix}\right\} X' \neq$$

R14 has two contextual specifications shown in the braces. The upper context is for the on-glide diphthongs and the lower for the particular diphthong of [iy]. In light of the generality and descriptive economy, the contextual feature specification for [ɨy] makes a typical case of inefficient feature-waste. As a matter of fact, the diphthong [ɨy] has only an unstable status in Korean, and the tendency is toward the substitution of one of the three simple vowels of [ɨ], [e], or [i] for [ɨy]. If we take this change as a *diachronic* process, we might need a rule to represent this change, namely:

$$\text{R15}\qquad \neq X \begin{bmatrix} +\text{voc} \\ -\text{cns} \\ +\text{grv} \\ +\text{dif} \\ -\text{flt} \end{bmatrix} \begin{bmatrix} -\text{voc} \\ -\text{cns} \\ -\text{grv} \\ +\text{dif} \\ -\text{flt} \end{bmatrix} X' \neq \longrightarrow \left\{\begin{matrix} \left(\begin{bmatrix} +\text{voc} \\ -\text{cns} \\ \alpha\ \text{grv} \\ +\text{dif} \\ -\text{flt} \end{bmatrix}\right) \\ \left(\begin{bmatrix} +\text{voc} \\ -\text{cns} \\ -\text{grv} \\ -\text{dif} \\ -\text{cmp} \\ -\text{flt} \end{bmatrix}\right) \end{matrix}\right\} \qquad (\text{e.g.,}\ [\text{ɨy}] \rightarrow \left\{\begin{matrix} [\text{i}] \\ [\text{ɨ}] \\ [\text{e}] \end{matrix}\right\})$$

We can see, however, that R15 is another complicated process, which is not entirely in tune with the linguistic intuition of the native speakers. Eventually, there arises a doubt about the status of the diphthong [iy] (or [i̯i] for the same reason) not only in the present-day Korean, but also in the history of the Korean language. Thus, deleting the second

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[9] I have argued for this position in my "Acoustic Transitional Cues for Korean Semi-vowels" (1966).

contextual specification in R14, we get a very simple and intuitive diphthongization rule,

$$\text{R16} \qquad [+\text{voc}] \longrightarrow [-\text{voc}] \Big/ \neq \ X \begin{bmatrix} \overline{} \\ -\text{cns} \\ +\text{dif} \\ \alpha\ \text{grv} \\ \alpha\ \text{flt} \end{bmatrix} \begin{bmatrix} +\text{voc} \\ -\text{cns} \end{bmatrix} X' \neq$$

The contextual specification of the two features, [αgrv] and [αflt], shows that the values of + and − conincide in [grv] and [flt], by which we prevent [ü] and [ɨ] from becoming the glide [y-] and [w-], respectively.

One further point to be noted in connection with R16 is that this rule generates more than the eleven (for now, [ɨy] is deleted) diphthongs which are believed to be accepted among scholars. For instance, R16 generates diphthongs such as [wu], [yi], [wo], and [yɨ], [wɨ]. This phonomenon does not seem to be absurd in my opinion in the light of the 'admissible' principle. Consequently, though tentative in nature, I claim *sixteen* 'diphthongs' in Korean at the 'systematic *phonetic*' level.

I would like to conclude the diphthongization rules with a word on the *diachronic reflections* in the ordered synchronic rules. That is, the order of the *optimally simple* rules in the synchronic description of a language reflects the diachronic order of linguistic changes in the language.[10] With the example of the diphthongization rule in Korean, we might as well argue for this point. At the systematic phonemic level, the adjacent vowels are represented as independent simple vowels; and then the syllable boundaries are imposed on them at the appropriate places as a prerequisite for the diphthongization rule to apply. To recount, this process can be shown illustratively as follows:

(I)		(II)		(III)	
[ui]	⟶	[≠ui≠]	⟶	[wi]	'위'

[10] Refer to the following articles: M. Halle's "Phonology in Generative Grammar" and "On the Role of Simplicity in Linguistic Descriptions," and N. Chomsky and M. Halle's "Some Controversial Questions in Phonological Theory." In addition, I would suggest S. Saporta's "Ordered Rules, Dialect Differences and Historical Processes," in which he has elaborated the linguistic significance of the *ordered rules* in reference to both the 'dialect differences' and the 'diachronic reflections' in the synchronic order of rules. He says, "The grammars of two speakers with different dialects will differ then, in one way of two ways: either the grammars will have different rules, or the grammars will have the same rules in a different order." (p. 218) As for the latter problem on historicity, he concludes, "thus, when a descriptive grammar is set up to account for the greatest number of facts, it reflects certain historical processes ··· synchronic facts often recapitulate historical changes." (p. 224)

[ue] ⟶ [≠ue≠] ⟶ [we] '웨'

[uæ] ⟶ [≠uæ≠] ⟶ [wæ] '왜'

[uə] ⟶ [≠uə≠] ⟶ [wə] '워'

[ua] ⟶ [≠ua≠] ⟶ [wa] '와'

[ie] ⟶ [≠ie≠] ⟶ [ye] '예'

[iæ] ⟶ [≠iæ≠] ⟶ [yæ] '얘'

[iə] ⟶ [≠iə≠] ⟶ [yə] '여'

[ia] ⟶ [≠ia≠] ⟶ [ya] '야'

[iu] ⟶ [≠iu≠] ⟶ [yu] '유'

[io] ⟶ [≠io≠] ⟶ [yo] '요' ,etc.

The representations in column I stand for the systematic phonemic shapes, whereas column III stands for the systematic phonetic shapes. Column II shows the systematic phonemic representations with the syllable boundaries imposed. The diphthongization rule R16 applies to the representations in column II to produce the diphthongs shown in column III. It is worth noting that R16 says that the two contiguous vowels [i] and [u], for example in '이웃,' remain unaffected if the sequence contained a 'syllable boundary' between [i] and [u] at the systematic phonemic level; however, if the syllable boundary is absent for either morphological or semantic reasons, this sequence changes to a diphthong [yut] '윳' through the application of R16.

The diachronic concern relates to the two part representations, befeore and after the application of R16, by which I assume that the two parts in the direction of arrows show the diachronic changes in Korean, namely, the diphthongization. In other words, I should like to set up a hypothesis that the present-day Korean diphthongs originate from combinations of two contiguous simple vowels, one of which is a segment containing the feature of [+dif].

5. Appendix

The twelve rules, including the diphthongization, that have been presented are listed below in a consecutive order. The modifications that have been suggested in the course of discussions are incorporated in the following rules. To the right are given the rule-numbers in parentheses by which the rules were first referred to in the main part of the paper.

R1

$$\left\{\begin{array}{l} [+\text{dif}] \longrightarrow [-\text{cmp}] \\ [+\text{cmp}] \longrightarrow \begin{bmatrix}-\text{dif}\\-\text{flt}\end{bmatrix} \\ [X] \longrightarrow \begin{bmatrix}-\text{tns}\\+\text{cnt}\\+\text{vcd}\end{bmatrix}\end{array}\right\} \Big/ \begin{bmatrix}\overline{\quad\quad}\\+\text{voc}\\-\text{cns}\end{bmatrix} \tag{R1}$$

R2

$$[X] \longrightarrow [-\text{flt}] \Big/ \begin{bmatrix}\overline{\quad\quad}\\+\text{cns}\end{bmatrix} \tag{R2}$$

R3

$$[X] \longrightarrow [-\text{nas}] \Big/ \left\{\begin{array}{l} \begin{bmatrix}\overline{\quad\quad}\\+\text{voc}\\+\text{cns}\end{bmatrix} \\ \begin{bmatrix}\overline{\quad\quad}\\+\text{cnt}\end{bmatrix} \\ \begin{bmatrix}\overline{\quad\quad}\\+\text{cns}\\-\text{grv}\\+\text{cmp}\end{bmatrix}\end{array}\right\} \tag{R3}$$

R4

$$[X] \longrightarrow \begin{bmatrix}-\text{tns}\\-\text{vcd}\end{bmatrix} \Big/ \left\{\begin{array}{l} \begin{bmatrix}\overline{\quad\quad}\\+\text{nas}\end{bmatrix} \\ \begin{bmatrix}\overline{\quad\quad}\\+\text{voc}\\+\text{cns}\end{bmatrix}\end{array}\right\} \tag{R4}$$

R5

$$[X] \longrightarrow [-\text{asp}] \Big/ \left\{\begin{array}{l} \begin{bmatrix}\overline{\quad\quad}\\-\text{tns}\end{bmatrix} \\ \begin{bmatrix}\overline{\quad\quad}\\+\text{cnt}\end{bmatrix}\end{array}\right\} \tag{R5'}$$

R6

$$[X] \longrightarrow [-\text{cnt}] \Big/ \left\{\begin{array}{l} \begin{bmatrix}\overline{\quad\quad}\\-\text{cns}\\+\text{grv}\end{bmatrix} \\ \begin{bmatrix}\overline{\quad\quad}\\+\text{cns}\\+\text{cmp}\end{bmatrix} \\ \begin{bmatrix}\overline{\quad\quad}\\-\text{grv}\\-\text{cmp}\\+\text{asp}\end{bmatrix} \\ \begin{bmatrix}\overline{\quad\quad}\\-\text{cmp}\\+\text{nas}\end{bmatrix}\end{array}\right\} \tag{R6}$$

R7

$$[X] \longrightarrow \begin{bmatrix}-\text{grv}\\-\text{cmp}\end{bmatrix} \Big/ \left\{\begin{array}{l} \begin{bmatrix}\overline{\quad\quad}\\+\text{voc}\\+\text{cns}\end{bmatrix} \\ \begin{bmatrix}\overline{\quad\quad}\\+\text{cns}\\+\text{cnt}\end{bmatrix}\end{array}\right\} \tag{R7}$$

R8 $$[\text{X}] \longrightarrow [+\text{cnt}] \;/\; \begin{bmatrix} \overline{} \\ \alpha\text{voc} \\ \alpha\text{cns} \end{bmatrix} \qquad \text{(R8)}$$

R9 $$[\text{X}] \longrightarrow [-\alpha\text{dif}] \;/\; \begin{bmatrix} \overline{} \\ +\text{cns} \\ \alpha\ \text{cmp} \end{bmatrix} \qquad \text{(R9)}$$

R10 $$[\text{X}] \longrightarrow [-\text{vcd}] \;/\; \begin{bmatrix} \overline{} \\ -\text{voc} \\ -\text{nas} \end{bmatrix} \qquad \text{(R10)}$$

R11 $$[\text{X}] \longrightarrow \begin{bmatrix} \alpha\ \text{grv} \\ \beta\text{cmp} \\ \gamma\ \text{dif} \\ \omega\ \text{flt} \\ -\text{nas} \\ -\text{tns} \\ -\text{asp} \end{bmatrix} \;/\; \begin{bmatrix} \overline{} \\ -\text{voc} \\ -\text{cns} \end{bmatrix} \begin{bmatrix} +\text{voc} \\ -\text{cns} \\ \alpha\ \text{grv} \\ \beta\ \text{cmp} \\ \gamma\ \text{dif} \\ \omega\ \text{flt} \end{bmatrix} \qquad \text{(R11)}$$

R12 $$[+\text{voc}] \longrightarrow [-\text{voc}] \;/\; \neq \text{X} \begin{bmatrix} \overline{} \\ -\text{cns} \\ +\text{dif} \\ \alpha\ \text{grv} \\ \alpha\ \text{flt} \end{bmatrix} \begin{bmatrix} +\text{voc} \\ -\text{cns} \end{bmatrix} \text{X'} \neq \qquad \text{(R16)}$$

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