Ann. Rep. Asahikawa Med. Coll.
1993. Vol.14, 7～27

Underspecification and Mispronunciations in tongue twisters*

Hideyuki HIRANO

Introduction

In underspecification theory some redundant features are eliminated from underlying representations. They are filled in at some point in derivations or postlexically by default rules. This idea is based on the assumption that all predictable information should be underspecified in underlying form (Kiparsky 1982, Archangeli 1984, 1988).

The theory has two versions concerning phonological predictability: one version is called Radical Underspecification, the other is called Contrastive Underspecification. The palatalized /š/ occurring before /i/ is predictable in Japanese and from the assumption of binary of a phonological feature one value of the feature is predictable if the other value is specified in underlying representation. Both predictabilities are assumed in the radical version of underspecification (Archangeli 1988, Pulleyblank 1988, and others). However, in the theory of contrastive underspecification the contrastive value of features need to be specified in underlying form, such as [Coronal] of /t/, but [+voiced] is underspecified for a sonorant (Steriade 1986, Mester and Ito 1989).

Stemberger (1991) presents the argument that errors in speech production provide support to radical underspecification. This study has been based on unintentional mispronunciation of words by native speakers of a language that are indentified as incorrect by all native speakers of the language, even by the speaker him-or herself. These mispronunciations are caused by contextual conditions; one sound is replaced by the other sound under influence of a sound in a neighboring word.

The similar but somewhat different kinds of mispronunciation occur in fast speech production especially when native speakers of a language try to say or repeat difficult words to pronounce, i.e. tongue twisters. These are regarded as a different type of errors from those discussed by Stemberger (1991) in that the tongue twisters are formed, intending to induce speakers' mispronunciations. Our investigation into these errors shows that there are some interesting theoretical implications to the theories of feature geometry and underspecification.

In this paper we examine mispronunciations produced by native speakers of Japanese who try to pronounce tongue twisters within the theories of underspecification and feature geometry. We argue that the more marked segments are prone to be involved in the errors and the mispronunciations are produced by a segmental harmony. In section 1 we set out our assumptions conderning phonological representations and present a chart of radically specified consonants in the Japanese language and some typical data classified by phonological processes. Section 2 shows that the phonological changes caused by errors can be accounted for if a floating geature node is introduced. In section 3 we will show that Stemberger's discussion is supported by our data. Section 4 will give our concluding remarks.

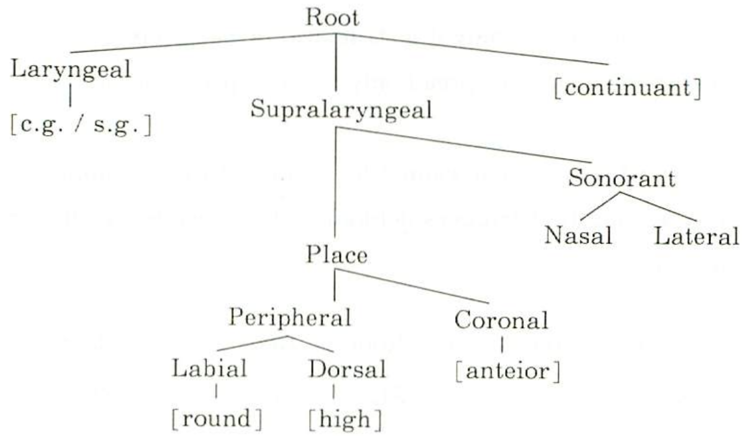
1. 0 Assumptions

In this section we will present a theoretical framework which we adopt in this paper and some typical examples will be illustrated. We will mainly concern with phonological processes of Japanese consonants which occur in fast speech.

1. 1 Feature Geometry

The arrangement of features that we assume grows out of the proposal advocated by Clements (1985), Sagey (1986), McCarthy (1988), and others, that distinctive features are hierarchically organized. We think that the arrangement of features, which is discussed by Aery and Rice (1989), and Rice and Avery (1991), is fundamentally correct. The relevant model of segment structure we adopt is shown below.

(1)



The model in (1) is called Feature Geometry (Clements 1985). In Feature Geometry, Lateral, Lateral (La), Nasal (N), labial (Lab), Coronal (C) and Dorsal (D) are called articulator nodes, and nodes such as Supralaryngeal (SL), Laryngeal (L), Place (PL) and Sonorant (S) are called organizing nodes that define sets of features which function together as units with respect to phonological processes such as spreading and delinking. They are dominated by Root (R). In the Feature Geometry model, segments are not simply unordered feature bundles; the articulator nodes should define natural classes of segments. We assume that Laryngeal, Dorsal, Labial and Coronal dominate binary features, and that a binary feature [continuant](cont), which organizes a stricture feature, is a direct dependent of Root. The binary features dominated by Labial, Coronal and Dorsal are called secondary articulator nodes. The Organaizing nodes and the articulator nodes are monovalent or privative nodes. These nodes are present or absent: [−Coronal] does not exist (Yip 1988). We cannot discuss the binarity or the monovalency of each feature, because it is beyond the scope of this paper.

1.2 Rules

We assume that the rule component involves at most three operations, spreading, fusion and delinking, as proposed by Avery and Rice (1989). We adopt their assumption that spreading is a language−particular process which may include trigger and target conditions as well as a directionality parameter. The principles of spreading are stated as follows:

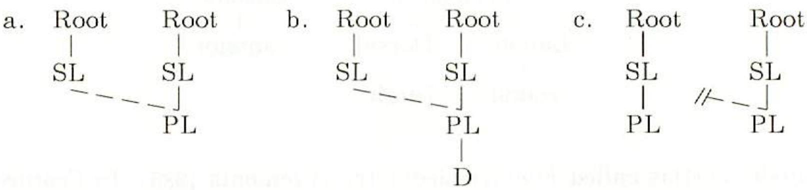
(2)

a. Spreading can occur only if a structural target is present

b. A feature or node can spread only to an empty position

According to (2a), a new node cannot be generated by spreading and (2b), prohibits any spreading that triggers delinking. The workings of the principles are illustrated in (3):

(3)



In (3a) speading of PL to SL can occur, since SLdominates PL in Feature Geometry. In (3b) speading of PL to SL can occur for the same reason as in (3a), but spreading of D to SL is nao allowed because SL cannot directly dominate D. In (3c) PL cannot spread to SL both right to left and left to right because SL has the dependent PL, but the spreading can occur only if one PL is delinked by an independently motivated delinking rule.

We assume that fusion is an operation which creates a true geminate and obeys the Obligatory Contour Principle proposed by McCarthy (1986). Avery and Rice (1989) suggest that fusion cannot apply to Organizing nodes, such as Supralaryngeal, Sonorant and Place. They assume that fusion fuses identical articulator nodes if the nodes are non-distinct;i.e. both nodes do not dominate different secondary articulator nodes. We cannot find any processes to test the validity of their assumption in Japanese.

We assume that delinking is an operation which eliminates nodes by co-occurrence restrictions and in neutralization positions, for example, syllable-final in German where devoicing of obstruents occurs.

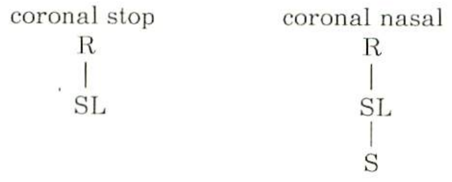
1. 3 Underspecification

As we have discussed in 1.1, the articulator nodes and the organizing nodes in this geometry are present or absent. The absence of plus and minus values on these nodes is an important feature and stems from an assumption that all features are privative.

We assume that phonological underspecification is preferable in phonological theory. Underspecification plays an important role in the phonology. Some features are left blank in underlying representations. Following Pulleyblank (1988), we hold the position that nodes also are subject to underspecification; if they do not dominate any feature or node, they are underspecified, up to and including the Root node. They are filled in at some point in the derivation, if they are referred to by phonological rules. They are filled in by default rules. We assume that there are two kinds of default rule; a context-free default rule and a context-sensitive default rule.

We assume that the Place node is underspecified for coronal consonants and the Nasal node is not specified for nasal consonants. The Lateral node is underlyingly specified. Thus a typical coronal stop and a coronal nasal have the phonological representations in (4), where the irrelevant structure is omitted.

(4)



The Coronal node is present only if two segments are distinguished by a feature that is a Coronal dependent.

The claim that the organizing node as well as the articulator nodes are underspecified for certain segments is supported by the asymmetric patterning of the unmarked feature at a node with respect to phonological processes such as assimilation, nasalisation and harmony. Coronals undergo rules of assimilation, but do not trigger rules of assimilation (see Paradis and Prunet 1991 and Hirano 1992). They can be transparent to rules of harmony (Piggot 1992).

We will focus on the consonant system of Japanese. We assume that under the theory of feature geometry the node or feature matrix in (5) for underspecified consonants in Japanese ('+' indicates that the relevant node or feature is present, segments in brakets are not present in underlying forms and [consonantal] ([cons]) is a feature in the Root node) :

(5)

	p	t	k	b	d	g	s	z	m	n	r	h	w	y	(š	ž	č)
[cons]												−	−	−			
Place	+		+	+		+			+		+						
Son									+	+	+						
[cont]							+	+			+				+	+	±
Labial	+			+					+				+				
Dorsal			+			+											
Coronal														+			
[s.g.]												+					
[voiced]				+	+	+										+	
[anterior]															−	−	−

In (5) the features enclosed in the square bracket are binary. In the case that a feature is binary, one value of the feature can be left blank in underlying representations; as the egment /t/ is not specified as [+cont], it must be [−cont] by default. We assume that any node is omitted from underlying representations if no articulator nodes are specified. Articulator nodes are underspecified unless they dominate a specified secondary articulator feature. We also assume that the nodes are not distinctive or are predictable for a segment in a language; they need not be present in underlying representation for that segment. The Coronal node is specified if it dominates a specified feature [anterior]. This assumption makes it possible that the nasals are underspecified for Nasal and the Labial node is underlyingly absent in the labials in Japanese. We postulate that /h/ is underspecified for Supralaryngeal node and [+continuant]. The underspecification of [+cont] for /h/ stems from the fact that it is specified [−continuant]. We assume that /š/, /č/ and /ž/ are derived by an early rule of fusion (palatalization) when /s/, /t/ and /z/ occur before a coronal vowel or a coronal glide, respectively.

1. 5 Data

We would like to take a look at the typical examples of mispronunciations. We use the errors caused by tongue twisters, since we can easily find the mispronunciations and predict what kinds of error will happen. Of course, we can confirm our discussion by the addition of the data picked up from everyday utterances. Among the mispronunciations occurring in Japanese tongue twisters we can find at least four kinds of phonological processes. They are grouped under the following headings: metathesis, assimilation, palatalization and epenthesis. To look at some of the data, we list them in (6), where the mispronounced parts are indicated by brackets. We shall use the brackets to display mispronunciations in the rest of this paper.

In the Japanese language we have allophone [ts] and [f]. The segments can occur only before a vowel [u] and surface as [t] and [h] in other contexts.

(6)[1]

(a) Metathesis

1. namagome ---> nama(moge) 'a raw rice'

2. amagappa higappa ---> amagappa hi(makka) 'a rain coat, a coat'

(b) Assimilation

1. take tatekaketa ---> take ta(ke)kaketa '(I) lean a bamboo against'

2. naga matsuge ---> na(ma)matsuge 'a long eyebrow'

(c) Palatalization

1. ryokyaku ---> ryokya(kyu) 'a passenger'

2. šošasan ---> šoša(š)an 'a name of noutain'

(d) Epenthesis

1. uga oi au ---> uga oi(y)au 'cormorants chase each other'

2. no aoi ---> no(w)aoi 'a wild hollyhock'

It is possible to argue against the discussion of this sort on the basis of two reasons. One is that these mispronunciations are all reduced to the difficulty of pronunciation. So we cannot rely on underspecification to account for the phenomena. However, we would like to clarify why such difficulty occurs among native speakers of the language and what it stems from. We should throw light on deeper mechanisms of these kinds of phonological alternations, and we should not adhere to a speakers' superficial impressions when we investigate phonological processes.

The other reason is that these kinds of error are caused only by physical factors at the time of pronouncing the phrases or words which are made into tongue twisters. We can apply the same discussion as we have just presented above to this argument. We consider that they can be used as a source of data on speakers' internal representations (Fromkin 1971). It is difficult for non–native speakers of the language to made errors in tongue twisters, on the one hand, and even though native speakers feel no difficulties in producing them after several practices, they tend to mispronounce in their trial after a while, on the other. These indicate that any non–linguistic factors cannot account for the data properly.

We can often find various kinds of mispronunciations which are unintentionally made by annoucers, lecturers, our friends, and so on, everyday life. The errors in tongue twisters show the types that occur most frequently. In this sense, we can claim that they form genuine data of speakers' internal sound forms.

2. 0 Analysis of Mispronunciation

In this section we will discuss the relationship between the less marked segments and the most marked segments in the production of mispronunciations. We suggest that some errors in fast speech is caused before all underspecified features or nodes are filled in. We also discuss that the Laryngeal node stays under the Root node and gives the laryngeal features to a segment which has derived by spreading. This is an interesting factor in fast speech. We will show that harmony which is created by spreading of nodes causes the production of errors.

2. 1 Metathesis

We begin by discussing metathesis illustrated in (6a). In this sort of error a labial and a velar are involved. For discussion we give relevant examples in (7).

(7)

a. namamugi namagome ---> namamugi nama(moge) 'a raw wheat and a raw rice'

b. akamakigami kimakigami ---> akamakigami kimaki(magi) 'a roll of red paper, a roll of yellow paper'

c. tsugomori zarusoba --->tsu(mogo)ri zarusoba 'the end of year, a soba noodle'

d. amagappa higappa ---> amagappa hi(makka) 'a rain coat, a sun coat'

e. širogama akagama ---> širogama aka(maga) 'a white pan, a red pan'

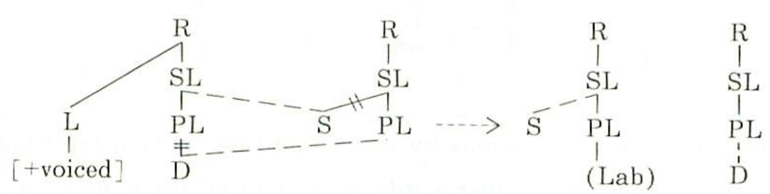
f. ušigobo kegobo ---> ušigobo ke(bogo) 'a large burdock, a hairy burdock'

All these errrors display the interchange of a velar with a labial segment. The velar segment is specified for the Dorsal node and the labial segment has the Place node underlyingly. Under the theory of feature geometry we can account for these metatheses by formulating two rules; speading and delinking.

All the errors except for two examples in (7d) and (7f) involve the interchange of /m/ with /g/. The metathesis in (7a) and (7c) cannot be accounted for by saying that these mispronunciations are produced simply by the attraction of /m/ to the adjacent segments /u/ or /m/ owing to the affinity of their nasality. If we follow this reasoning, the parallel discussion has to be able to apply to the data in (7b) and (7e). But we cannot find any reason that a velar stop /k/ attracts /m/ beyond a velar stop /g/, and we must explain why /m/ does not attract the final /m/ beyond the two segments /k/ and /g/ in (7b). We return to this problem later in this section.

The best way to account for the metathesis of /m/ and /g/ is to rely on the operation of spreading and delinking. The metathesis shown in (7a), (7b), (7c) a nd (7e) is illustrated in (8).

(8)

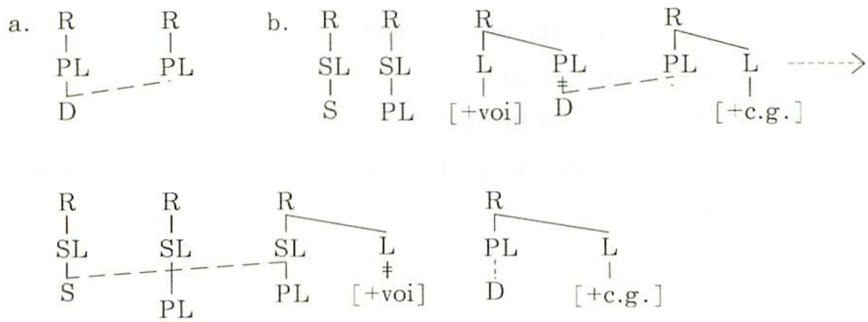


(A broken line indicates spreading or reassociation)

The Laryngeal node is redundant in a nasal consonant and is delinked after spreading of the S node to the PL node of the velar. The Labial node in a bracket is supplied by default rule. Note that this metathesis involves the Place node and the Dorsal node. We never find the mispronunciations such as /tsugoromi/ or /baso/ in (7c).

In (7f) the metathesis again involves the Place node and the Dorsal node. As we have noted, these segments are two of the more marked segments. In (7d) the metathesis presents a theoretically quite interesting problem to the explanation by the rules in (8). In this case a voiced velar stop /g/ changes into a glottal stop /pp/, and /pp/ in turn changes into a nasal /m/ which receives the Snode from a distant nasal consonant. To account for this change we assume that a feature dominated by the L node is not deleted, and that the feature associated with the L node is specified in the structure of a new segment. This status of feature is quite similar to that of tone (Goldsmith 1990). Under this explanation the Dorsal node of /g/ spreads to the Place node of /pp/, its feature[+c.g.]docks to the empty L node of /g/, and then the glottal velar stop is generated, on the one hand. On the other hand, the glottal /pp/ too loses its[+c.g.], and the S node of a neighboring segment spreads to the SL node, which produces a labial nasal /m/. The redundant feature [+voiced] cannot be dominated by the L node of /m/ and is deleted. The derivations of the mispronunciations in (7f) and in (7d) are illustrated in (9a) and (9b), respectively.

(9)



Observing the mispronunciations we notice that they make a repetition of the same pattern of segments. In other words, a constant rhythmic movement seems to control the speech production throughout the fast speech events. In (7b), the voiced velar stop /g/ is avoided after /k/ and a sequence of segments like velar–nasal–velar–nasal–velar is created. In the other examples, an intervening /g/ among nasals is pushed away to the end of the word, and a sequence of nasals is produced. All the examples in (7) indicate that the Sonorant node tends to get close to each other in their positions in the words. This tendency of the Sonorant node is considered to be governed by so–called sonorant harmony. The sonorant harmony is reinforced by the avoidance of the sequence of the more marked segments. This is the main reason for the mispronunciations shown in (7). We will see the effects of the S node on errors in 2. 2. We can see here that such a rhythmic consistency governs fast speech. We postulate the rhythmic consistency governing the speech errors and call it a Pattern Congruity. These mispronunciations result in the easiness of pronunciation by violating some general conditions. For example, the spreading of the S node in (9b) is not permitted, since its effect is to create an association line that will cross at least an existing association line. The pattern congruity is stated as follows:

(10)

a. The S nodes tend to attract each other.

b. The most marked segment is not prone to be repeated.

Here we postulate that two rules such as across-the-board spreading and delinking operate to create the errors in fast speech. We have to ask why the spreading that violates the association convention can apply and forces to delink nodes. Our answer is that the pattern congruity forces the spread of the Dorsal node to a target to generate a mispronunciation.

The pattern congruity has another effect in phonological theory. The pattern congruity in (10) provides evidence that the OCP proposed by McCarthy (1986), by which a sequence of segments which are specified for the same articulatory node is prohibited, is working only in segments specified for the Dorsal node, since the Dorsal node sequence is broken by intervening of the PL node, which is filled in for the Labial node by default rule. However, the Labial node sequence is permitted. We can claim that sonorant harmony overrides the OCP concerning the Labial node and causes mispronunciations.

Ther pattern congruity forces the spread of the Dorsal node from left to right. This is the first cause of the errors. The spreading from left to right violates a spreading parameter set for Japanese (Cho 1989). The delinking caused by spreading is the second reason that the errors occur. In autosegmental theory of phonology, independent delinking has to be well-motivated, but the delinking in (9) is prohibited by a principle of delinking, since the delinking is motivated only by spreading. This principle is proposed by Avery and Rice (1989), and we assume that the principle correctly limits the operation of delinking. Without this principle, delinking generates a lot of wrong forms.

The S node may spread rather freely so that it tends to produce harmony as is known from (7a). This behavior of the S node too is one of the reasons that the mispronunciations are easily produced in tongue twisters.

2. 2 Assimilation

In this section we examine the function of the more marked segments in mispronunciations which are created by assimilation. We will show how the pattern congruity conditions the production of errors. Consider the following examples.

(11)

a. namagome namatamago ---> namagome namatama(m)o 'a raw rice, a raw egg'

b. take tatekaketa ---> take ta(k)oka...or take ta(ketake)kaketa '(I)lean a bamboo against'

c. onama kabe ---> onama ka(n)e or o(m)ama ka(m)e 'a still-wetted wall'

d. naga matsuge ---> na(m)a matsuge 'a long eyebrow'

e. konama baši ---> konama (m)aši 'a small chopstick'

f. nerigìnu ni hiraginu ---> nerigi(r)u ni hiragi(r)u 'a glossed silk and a plain silk'

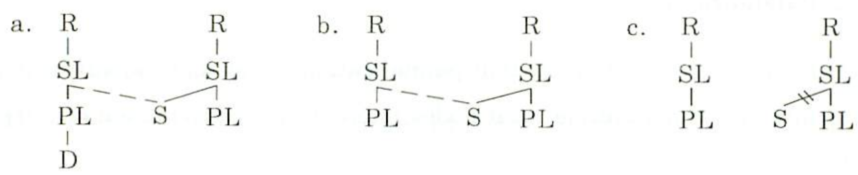
g. mame bugi kašu ---> ma(b)e bugi kašu or mame bu(m)i kasu 'a little bugie-woogie singer'

h. yoru tobu tori ---> yoru tobu to(b)i 'a bird which flies at night'

i. kikukuri mikikukiri ---> kikukuri mikikuk(u)ri 'a small chestnut, three small trees'

The directionality in assimilation is not fixed in the examples in (11). The assimilation in (11c), (11d) and (11g) occurs from right to left, and the assimilation in the other examples occurs from left to right. This means that the mispronunciations are caused by both progressive and regressive processes here. This indicates that a feature or node spreads to a target segment bidirectionally. As we can see in (11g), assimilation occurs in both direction. The most characteristic is that features can spread beyond a segment or a syllable, or even cross a word boundary.

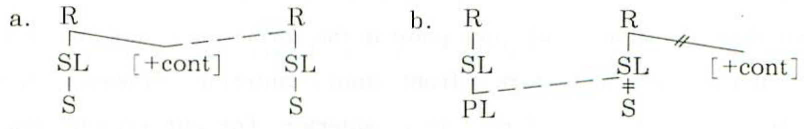
Three examples in (11a, d, g) involve the Dorsal node and the Place node and in all these examples the Sonorant node spreads to the SL node of the velar. The velar consonant /g/ totally assimilates to a nasal consonant /m/. The spreading of the S node to the target SL node triggers the delinking of the Dorsal node of /g/. Labial consonants are involved in three cases of assimilation in (11c, e, g). The processes of assimilation of /g/ to /m/ and of /b/ to /m/ are illustrated in (12a) and (12b), respectively. The change of /m/ to /b/ in (11g) is accounted for by delinking of the S node and the derivation is given in (12c).

(12)


The phenomenon shown in (6b) is quite interesting. Speakers are forced to stop to continue to say after they mispronounce /ke/ in place of /te/. This may be why it is impossible for them to make a sequence of segments which is consistent with the pattern congruity, since only a sequence of velar stops occurs in the rest of the phrase. Most of the assimilation in (11) occurs so that the resulting sequence of syllables follows the pattern congruity. The S node spreads to the velar stop or the labial stop.

In (11b) a coronal consonant and a velar are involved in this error. However, the coronal does not function as a trigger and is a target to which the Dorsal node dominated by the Place node spreads. The Coronal node is underlyingly underspecified and plays little role in phonological speech errors.

In (11f) coronal consonants are involved in the mispronunciation. In this case the feature [+cont] spreads to the Root node of /n/. The feature [+cont] is specified for fricatives and /r/ in underlying representation. This is why the feature [+cont] plays a role in determining the similarity of segments and in errors. In (11h) /r/ is involved in the error, but it serves as a target. /r/ assimilates to the labial stop by spreading the Place node of /b/ to the SL node, and the delinking of [+cont] and the S node from /r/ have to be taken place. The derivations of

(13)


(11f) and (11h) are given in (13a) and (13b) respectively.

In the case of (11i) the vowel /i/ is replaced by /u/. This example is concerned with a vowel, which we will not discuss here in detail. However, we can see that the mispronunciation regarding the vowel are influenced by the pattern congruity in fast speech. The error in (11i) is caused by spreading of the Labial node of /u/ which is underlyingly specified.

2. 3 Palatalization

In this section we will show that palatalization forces us to modify our pattern congruity. We can examine what nodes interact in the production of mispronunciations.

Palatalization shown in the pronunciation of tongue twisters is mainly caused by a neighboring palatalized segment, but is rarely caused by a vowel following or preceding a target of the process. The relevant examples are given in (14).

(14)

a. kyaku wa yoku kaki kuu ---> kyaku wa yoku (kya)ki(kyu)u 'a guest eats many persimmons'

b. kin byobu ni kin bozu no e o kaku --->... ni kin (byo)zu no... 'to draw a golden bonze on fa golden fence'

c. ryokyaku ---> ryokya(kyu) 'a passenger'

d. žazu šanson kayokyoku ---> žazu šan(š)on kayokyoku 'a jazz, a chanson, a popular song'

e. šošasan ---> šoša(š)an 'a name of a mountain'[2]

f. Tokyo tokkyo kyoka kyoku ---> Tokyo tokkyo kyo(kya) kyoku 'Tokyo paternt office'

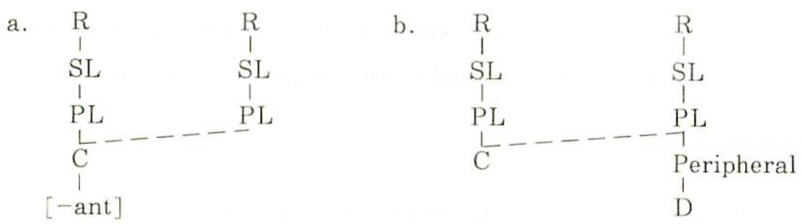
g. oaya ya oayamarinasai ---> o(ya)ya ya o(ya)yamarinasai 'Oaya! Apologize, please.'

For our present purpose, we assume that a palatalized segment has specified for [−anterior] ([−ant]) dominated by the Coronal node in the structure of a segment whether it is filled in at some point in the derivation or not. We feel a little more sympathy with the feature [+front] than [−anterior]. However, there is no reason that [+front] is preferred to [−anterior] for our present discussion.

Palatalization is caused by spreading the feature [−ant] to the Coronal node of a target coronal segment of by the Coronal node to a target segment. This implies that a coronal consonant, which is underspecified for the PL node in underlying representation, has to have been filled in for the Coronal node dominated by the PL node. This means that some default rules have to apply to a segment structure during derivation. We will discuss this problem in relation to underspecification later in section 3.

In these mispronunciations, we also find that a velar and a labial are closely related to the production of the errors. Most speakers feel the most difficulty in (14f). All the errors can be accounted for by the spreading the Coronal node or the feature [−ant]. The derivations are given in (15).

(15)



Now we try to explain these mispronunciations in terms of the pattern congruity. All of these errors listed in (14) cannot be accounted for by the pattern congruity in (10). A velar consonant can occur immediately after or before the same velar consonant, which is considered to be the most marked segment. This violates our pattern congruity. We can predict that most of the segments are subject to the process of palatalization, if they occur close to a palatalized segment. In (14) there is no sound replacement by which the adjacent most marked segments are avoided. However, we easily notice that palatalized consonants have affinity with palatal or palatalized segments. We can claim that in fast speech we avoid the difficulty of pronunciation by creating palatal harmony. As we have discussed in (10), hamony is one of the main causes of mispronunciation. Now we modify the pattern congruity in (10) as follows;

(16)

a. The S nodes and the specified Coronal node tend to create consonant harmony.

b. The most marked segment is not prone to be repeated.

The pattern congruity conditions can account for the occurrence of mispronunciation. The mispronunciations caused by fast speech or tongue twisters are produced under influence of the pattern congruity in (16). In the case of palatalization, the Coronal node which is involved in the errors is specified for a glide or /i/ in underlying representation. The errors generated by palatalization involve the interaction only of underlyingly specified nodes.

The secondary articulator feature may freely spread to a target in fast speech. We would like to point out that the same sort of harmony can be found in child phonology. Spencer (1986) argues that a feature [+lateral] spreads rather freely in child phonology and the spreading of the feature causes lateral harmony in the course of the acquisition of a native language. We may expect that the pattern congruity in (16a) play a role in child phonology of Japanese. But fast speech phenomena seem to be different from processes in child phonology in that the nodes are not permitted to spread to every segment to create harmony.

2. 4 Epenthesis

Let us take a look at errors by inserting glides /y/ or /w/ between vowels. Epenthesis usually occurs for avoidance of hiatus. We will see that mispronunciations happen in order to break down a sequence of vowels and in a sense to optimize a syllable structures according to Onset Principle proposed by Ito (1989).

We can find only two examples of epenthesis. Consider the following examples;

(17)

a. ...ayu o oiau ---> ...ayu o oi(ya)u 'to chase a smelt together'

b. noaoi ieaoi ---> no(wa)oi ie(ya)oi 'a wild hollyhock, a house hollyhock'

These mispronunciations can be accounted for by the pattern congruity. A slot is associated to onset, and the Coronal or the Labial node of a glide then spreads to the onset position. This spreading realizes a segment as /y/ or /w/. Epenthesis seems to be against minimal effort, since it makes syllable structures complicated. But this complexity is compromised by palatalization. The errors caused by epenthesis can be accounted for by spreading of the Coronal node or the Labial node to an empty onset.

We assume that /ya/, /yu/ and /yo/ are underlying segments in Japanese and are specified for the Coronal node, and that /wa/ is also present in underlying representatin with specification of the Labial node. The occurrence of a palatalized vowel adjacent to another palatalized vowel or /i/ can be accounted for by spreading of the Coronal node to /a/ in (17a). In (17b) the Labial node spreads to /a/ and the low vowel /a/ surfaces as /wa/.

In these mispronunciations the Coronal node and the Labial node are involved. The Coronal node and the Labial node are underlyingly specified for vowels and are responsible for the production of mispronunciation. In vowels the secondary articulator features such as [high], [round] and [back] are underspecified in underlying representatin. In vowels and glides the articulator nodes have effects on mispronunciation.

3. 0 Errors and Specified Nodes

In this section we will duscuss underspecification related to fast speech mispronunciation shown in tongue twisters which we have discussed in section 2. Stemberger (1991) presents the argument that gives support to radical underspecification by providing evidence from rates of speech errors. This work has been developed on the basis of unintentional mispronunciation of words by native speakers of a language. Our data of speech errors in tongue twisters will give a slightly different picture of underspecification. It is important for our discussion to prove the validity of radical underspecification on which the pattern congruity and the assumption of segment structure are based.

The mispronunciation in the tongue twisters is an interesting case for underspecification. To see whether the underspecification of nodes is a possible way to account for the difference between underspecified and specified nodes in speech errors, we should discuss the following three points concerning behavior of each feature or node in the processes of various mispronunciations.

(18)

a. Nodes which are underlyingly specified are apt to induce errors.

b. Underlyingly underspecified nodes tend to be replaced or serve as a target segment of spreading.

c. A node which is unspecified plays little or no role in determining qualities of segments which make a sequence.

As we have seen, a segment specified for the Dorsal node interchages with a segment specified for the Place node in most cases of metathesis. Both of these nodes are specified in underlying representation. We can see that coronal consonants in the mispronounced words play no role in inducing the errors. These coronals are underlyingly underspecified for the Place node. In addition, the pattern congruity is accomplished by the Dorsal node and the Place node in the process of metathesis, as it was shown in 2.1. It is clear that there is no effect of redundant nodes on the mispronunciation by metathesis. Since there are no counterexamples to the above three points, we conclude that radical underspecification in the theory of feature geometry can offer the best explanation at least to the case of metathesis.

The same line of discussion can apply to the other three cases which we have discussed. In the process of assimilation, the Dorsal node interacts with the Place node, and both of the nodes possibly give a dominant effects on segments which are underspecified for nodes. In (11b) /t/ assimilates to /k/ in place of articulation, in which case the Place node of /k/ spreads to the SL node of /t/, In (11f) /r/ which is specified for the feature [+cont] interacts with the coronal nasal /n/ which is underspecified for [cont], and the feature [+cont] spreads to the Root node of /n/. In (11h) /r/ in turn is replaced by a more marked segment /b/. These observations clearly show that underlyingly specified nodes have a strong effect on the mispronunciations in tongue twisters.

In the errors by palatalization and epenthesis, we would like to examine the three points in (18). Before we discuss this problem, we have to give some words to a segment /š/ and a glide /y/. We assume that /š/ is a derived segment, that is, not in underlying representation. This means that /š/ is derived by applying a rule of palatalization in Japanese is one of the very early rules. Accepting their findings, the segment /š/ has been specified for a feature [−ant] when it has effects on mispronunciations. The segment /y/ is believed to be underlyingly specified for the Coronal node and to be filled in for [−ant].

The three points in (18) indicates that the Coronal node and [−ant] are involved in mispronunciations, since the Coronal node is present in /y/ underlyingly. The feature [−ant] is filled in at the early stage of derivation. We argue that it is natural that palatalized segments cause mispronunciations by spreading the Coronal node or the feature [−ant]. Note that the Coronal node which is underspecified for consonants plays no role in producing mispronunciation, but that the Coronal node which is specified for glides and vowels have an effect on errors. We can claim that the three points in (18) control the production of mispronunciations in tongue twister. Our discussion should confirm that the specified nodes are involved in mispronunciations in fast speech which occur in various contexts.

Finally we will point out the stage where errors may occur. The replacement of /t/ by /k/ suggests that the mispronunciations in the tongue twisters occur before all underspecified nodes are filled in. There is no consensus about the time when default rules fill in all underspecified nodes or features for segments. However, our discussion shows that all underspecified nodes play little or no role in creating errors.

4. 0 Conclusion

In this paper we discussed the mispronunciations shown in the words which are made into tongue twisters. These errors are considered to reflect speakers' internal representation of speech sounds. We argued for radical underspecification in the analysis of fast speech errors. Using the theory of feature geometry and underspecification, we can account for the occurrence of mispronunciation in fast speech by assuming the pattern congruity. The pattern congruity forces the specified nodes to spread across−the−board and create a harmonized sequence of segments. Though our discussion can cleary account for speech errors, it is necessary to investigate more date for our discussion to be conclusive.

NOTES

* I am grateful to Iggy Roca, Andrew Spencer and Martin Atkinson for their assistance during my stay at University of Essex where I finished the first draft of this paper. I also thank Simon Bayley for helpful comments and correcting my English phrasing. All errors are exclusively mine.

1. Meaningful sentences and phrases are generally used as tongue twisters,

aside from the simple concatenation of words. In this paper most of the examples of such words are expressed only in relevant parts for our purpose of discussion.

2. This kind of phrases is not consederred to be difficult and can be quite easily said correctly, especially if you place an accent on the syllable preceding /s/, you will rarely mispronounce them.

REFERENCES

Archangeli, D. (1984) Underspecification in Yawelmani phonology and morphology. PhD dissertation, MIT. Published 1986, New York: Garland.

Archangeli, D. (1988). Aspects of Underspecification Theory. Phonology 5. 183–207.

Avery, P. & K. Rice (1989). Segment Structure and Coronal Underspecification. Phonology 6. 179–200.

Cho, Y.-Y. (1988). Korean assimilation. Proceedings of the West Coast Conference on Formal Linguistics 7. 41–52.

Clements, G. N. (1985). The Geometry of Phonological Features. Phonology Yearbook 2. 225–252.

Fromkin, V. A. (1971). The non-anomalous nature of anomalous utterances. Language 47. 27–52.

Goldsmith, J. A. (1990). Autosegmental and metrical phonology. Oxford: Blackwell.

Hirano, H. (1992). Underspecification, Sonority Hierarchy and Feature Geometry in Korean. Journal of the Linguistic Society of Japan (Gengo Kenkyu). 102. 88–120.

Ito, J. (1989). A prosodic theory of epenthesis. Natural Language and Linguistic Theory 7. 217–260.

Kiparsky, P. (1982). Lexical morphology and phonology. In I.-S. Young (ed.) Linguistics in the morning calm. 3–91. Seoul: Hanshin.

McCarthy, J. (1986). OCP Effects: Gemination and Anti-gemination. Linguistic Inquiry 17. 207–263.

McCarthy, J. (1988). Feature Geometry and Dependency. Phonetica 43. 84–108.

Mester, R. A. and J. Ito (1989). Feature predictability and underspecification:

palatal prosody in Japanese mimetics. Language 65. 575−602.

Paradis, Co. $ J. −R. Prunet (1991). Asymmetry and visibility in consonant articulation. In C. Paradis, J. −R. Prunet(eds.) The special status of coronals: internal and external evidence. New York: Academic Press.

Piggot, G. (1992). Variability in feature dependency: the case of nasal harmony. Natural Language and Linguistic theory 10.

Pulleyblank, D. (1988). Vocalic Underspecification in Yoruba. Linguistic Inquiry 19. 233−270.

Rice, K. & P. Avery (1991). On the Relationship between Laterality and Coronality. In C. Paradis, J. −F. Prunet (eds.) Phonetics and Phonology. Vol. 2, 101−124. San Diego: Academic Press.

Sagey, E. (1986). The representation of feature and relations in non−linear phonolgy. Ph.D. dissertation, MIT. Published 1990, New York: Garland.

Stemberger, J. P. (1991). Radical underspecification in language production. Phonology 8. 73−112.

Steriade, D. (1987). Locality Conditions and Feature Geometry. NELS 17. 595−617.

Yip, M. (1988). The OCP and phonological rules: a loss of identity. Linguistic Inquiry 19. 65−100.