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Devoicing and the Privativity of Voicing*

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0. Introduction

One of the main issues in recent phonological theory is what phonological features are considered to be privative and what evidence is necessary for features to obtain the status of pivativity. The privative features have a monovalent, but not a binary value (Yip 1989, Selkirk 1988, Mester & Ito 1989). In the analysis of voicing phenomena in Japanese, Mester and Ito (1989) assume that a feature [voiced] is privative, and try to maintain the theory of Restrictive Underspecification which they think gives more restrictive descriptions than the Radical Underspecification Theory proposed by Achangeli and Pulleyblank (Archangeli 1986, Archangeli 1988 and Pulleyblank 1988). In this paper I will discuss the voicing and devoicing processes within the theory of Feature Geometry and Radical Underspecification (henceforth Underspecification Theory). In the model of Feature Geometry, the feature [voiced] is dominated by a Laryngeal Node which dominates both features [constricted glottis] and [spread glottis]. My discussion focuses on the question of whether or not voicing can be a privative feature universally in the theory of Feature Geometry.

1. 0 The nature of voicing and devoicing

The common environment that a voiced segment occurs in is after or before another voiced segment. Cho (1989) discusses the typology of voicing, including devoicing. In general, derived voiced segments are generated through the application of a voicing rule which spreads the feature [+ voice] to a target unspecified for the feature. Cho (1988) has discussed the typology of voicing processes in various languages and she pointed out that some of them are analysed as spreading and others are described as delinking. Many

relevant examples can be found in various languages. The most typical examples of voicing are cited in (1).

(1)

a. Dutch Voicing Assimilation (Zonneveld 1983)

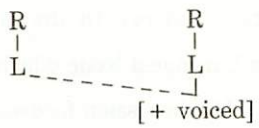
dwars-draad	[zd]	'cross-wire'
meet-band	[db]	'tape-measure'
sluit-balk	[db]	'gate'

b. Serbo-Croatian Voicing Assimilation (Patridge 1964)

topdzija	[bdz]	'gunner'
svatba	[db]	'wedding'
sbogom	[zb]	'farewell'

In these examples the pronunciation is indicated within square brackets. These data show that the voicing assimilation proceeds regressively. Within the framework of Feature Geometry and Autosegmental Theory we can explain the voicing assimilation as spreading. The feature [voiced] is dominated by the laryngeal Node in the tree model of features. We can illustrate the spreading of [voiced], as in (2) (all redundant information omitted).

(2)[1]



This rule can spread the feature [voiced] to an empty node or a segment unspecified for the feature [voiced], since assimilation is always feature filling (Poser 1982). There is no serious problem raised by voicing assimilation in our theory. As far as the spreading of the feature [+ voiced], there is no motivation for the privativity of the feature [voiced]. Next we will discuss the process of devoicing.

The devoicing process creates a voiceless segment. As Cho (1990) indicates, well-known cases of devoicing are Final Devoicing or coda devoicing which occurs in German and Dutch, and a cluster devoicing in which there is voicing agreement to voicelessness of segments in clusters. There are various kinds of devoicing in languages. We can find some interesting examples in (3).

(3)

a. German Final Devoicing (Rubach 1990)
Tag-e [g] 'days'---→Tag [k] 'day'
kindish [d] 'childish'---→Kind [t] 'child'
Smaragd-e [kd]---→Smaragd [kt] 'emerald'
Jag-d-en [kd]---→Jag-d [kt] 'hunting'
Handl-ung [d] 'act'
nebl-ig [b] 'foggy'---→glaub-lich [p] 'believable'

b. Dutch Regressive Devoicing (Zonnevelt 1983)
breed-te [t] 'width'
krab-sel [p] 'scrapings'

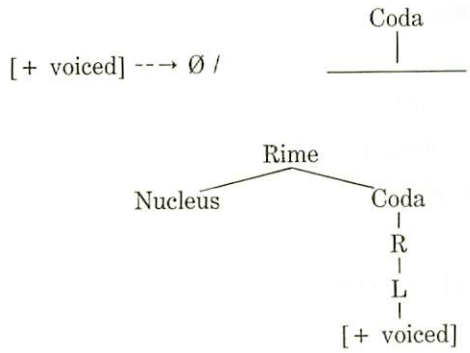
c. Dutch Progressive Devoicing (Zonnevelt 1983)
trek-vaart [kf] 'boat-canal'
pot-vis [tf] 'sperm-whale'
lach-gas [xx] 'laughing-gas'

d. Dutch Devoicing (Zonneveld 1983)
brand-zalf [ts] 'ointment'
rond-vraag [tf] 'inquiry'
maag-zuut [xs] 'heartburn'

e. Kirghiz Devoicing (Keating 1984)
abdan---→apdan 'very'
bub-ba---→kup-ba 'run after something'

As Cho (1990), Rubach (1990) and Zonnevelt (1983) pointed out, it is clear that the syllable coda is in the appropriate environment for devoicing. The example "Jag+d+en" in (3a) indicates that both obstruents must be voiced in underlying representation. Since in the case of the final devoicing there is no segment specified for [− voiced] and we cannot assume that a boundary functions as a voiceless obstruent, we cannot analyse it as the spreading of the feature [− voiced]. One of the reasonable explanations of the final devoicing is that a feature [+ voiced] is delinked from a voiced segment occurring in the coda position . We can easily see that the rule of the final devoicing can also account for the coda devoicing. The final devoicing can be stated as a rule that operates in a coda. The rule is illustrated in (4).

(4) Coda Devoicing



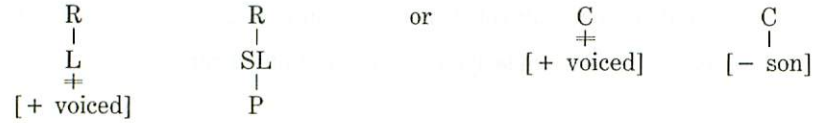
The application of the rule in (4) to internal consonant clusters exclusively depends on syllabification. Since segments in the target position are put in an onset position through syllabification, certain examples in (3a) which include such segments do not undergo the application of the rule and have voiced segments as we predicted. When the examples are checked with dictionaries, we find the pronunciation [t] for "d" of "Handlung" and "Ordnung". In addition, we find a word "nerv-ig" which is pronounced as [nerfiç] or [nerviç]. What these phenomena indicate is that the coda devoicing rule could be optional and that syllabification is posited close to a surface level[2]. It is possible to consider the voiced segments in these cases to be derived by the application of a voicing assimilation rule which is applied after a default rule fills in the feature [+ voiced] for sonorants. This means that the voicing rule could be applied after the coda devoicing rule. The implementation of the feature [+ voiced] to sonorants is given strong support by the voicing between vowels. However. this solution must be rejected, since the spread of [+ voiced] to adjacent obstruents must be blocked in "glaublich" and the coda devoicing would create a non-existent form like /ratler/ in the history of the derivation. In German the processes of devoicing in the coda position are still shaky. Moreover a detailed discussion of the process of devoicing in German is beyond the scope of this paper.

1. 1 Some Questions comcerning Devoicing

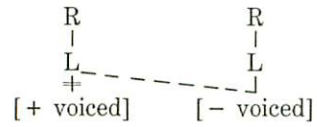
To explain the devoicing processes, two different proposals have been advocated in recent phonological research. One is to delink the feature [+ voiced] from a target segment, and the other is to spread the feature [− voiced] to a target segment from an

adjacent voiceless segment. The theory which treats voicing as a privative feature adopts the first explanation. In this paper, we shall call this theory a privative theory, while the second version is called a spread theory. In the privative theory it is necessary to formulate two kinds of delinking rule which are applied both right to left and left to right and should be applied iteratively in the case of triconsonantal devoicing. This procedure is also necessary in the spread theory. Now let us take a look at the relevant rules by which voiceless segments are derived.

(5) a. Cluster Devoicing



b. [− voiced] Spreading

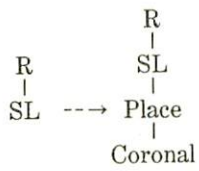


In (5a) the feature [+ voiced] is delinked before or after [− sonorant] segment if the rule has a language-specific condition concerning the direction of its application. The rule in (5b) spreads the feature [− voiced] to the adjacent segment which has already had the feature specification for [+ voiced]. This means that the rule triggers the delinking of [+ voiced] and it is a feature changing rule. The feature changing assimilation rule violates the principle stated by Poser (1982), unless the delinking of the feature must be motivated independently. The rule is not preferable when the delinking of the specified feature value is caused by the application of the rule in question, following Avery and Rice (1986). From a theoretical viewpoint, the explanation using the rule (5a) seems to be better than that using (5b). However, the situation is not so simple.

The Underspecification Theory and Feature Geometry suggest that the segment in (5a) which occurs before (or after) a derived voiceless segment is underspecified for the feature [voiced]. However, the delinking theory assumes that voicing is a privative feature. This means that the feature [voiced] does not have either a plus or a minus value, that is, it is present or absent. Therefore the principle of structure preservation applying to underlying representations like *[+ son, voiced] is necessary in order to devoice sonorants. Further, theoretically the absence of the feature [voiced] must be interpreted

differently from the underspecification for the feature [voiced]. For example, the absence of a Labial Node in a segment means that the segment could have a Coronal or a Dorsal Node. When the feature [voiced] is absent in a segment, the segment is not specified for [− voiced] in the privative theory. We do not know how such a segment can be specified concerning [voiced]. It is not possible for a segment without [voice] to be regarded as [+ son], even though [+ son] cannot be specified for the featue [voiced]. An alternative solution is that [0 voiced] is set up for the segment without [voiced] by a default rule. This solution, however, denies the privativity of the feature [voiced]. The following default rule for underspecified Place Node in (6) also shows clearly the impossibility of the introduction of [0 voiced]. This default rule is necessary in Korean phonology, since the Place Node need not be specified in underlying representation (Hirano 1990).

(6)



In Korean voiceless plain consonants between vowels become voiced consonants optinally in postlexical phonological component. The delinking theory cannot explain this phenomena, since sonorants are not permitted to have a feature [voiced] and the Underspecification Theory cannot play any role here, whether it is the restrictive or the radical one.

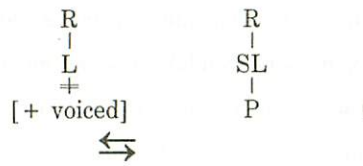
2. 0 Underspecification and Spreading

Let us now discuss the rule in (5b) further. As we have already pointed out, the explanation of devoicing using the rule in (5b) has a serious theoretical problem. From the viewpoint of the Underspecification Theory, the coda devoicing rule in (4) stipulates that the feature [− voiced] is underspecified for voiceless obstruents. In (5b) the underspecification theory shows that the feature [+ voiced] is specified underlyingly while the feature [− voiced] is inserted by a default rule before the rule in (5b) is applied. If the feature [voiced] is a binary opposition and [+ voiced] can be underspecified for the voiced segments, how can the voiced assimilation be accounted for within the spread theory? The elimination of [+ voiced] from underlying representation does not seems to be well-motivated, since the voiced segments are weakened into voiceless ones in a coda position

and regarded as more marked.

As we can easily see, the coda devoicing rule must be applied after a default rule implements the feature [+ voiced] to the segments in question. This situation may reflect the fact that the coda devoicing is a postcyclic rule and should be applied after the surface syllabification in German (Rubach 1990). However, we must face the same problem concerning rule ordering in the case of the spreading of [+ voiced]. Since the spreading is applied after the default rule inserting [− voiced], the feature [− voiced] must be delinked before the application of the spreading. The parts discussed in this section makes it clear that devoicing is better accounted for by the delinking of the feature [+ voiced] before [− son] consonants, and we should modify the rule in (5b) so that the rule can apply to segments before a default rule which meet this condition. The modified rule is illustrated in (7).

(7)



In (7) the right segment is underspecified for [− voiced] and is non-sonorant. After the application of the rule in (7), a default rule will a feature [− voiced] to each segment which remains empty for [voiced]. From a phonetic point of view, the underspecification of [− voiced] value is well-motivated and accords with the speakers' intuition. The explanation within the theory of underspecification is quite different from that in the privative theory in that we assume a model using the binary feature [voiced] and the default rule giving [− voiced].

Here we should turn our attention to the devoicing shown in the examples of Kirghiz listed in (3e). At first glance this process could be considered to be dissimilation, but perhaps it should be interpreted as the kind of coda devoicing, as we discussed in the previous section. In this case, however, the rule of coda devoicing must be applied before the spreading of voicing so that the voiced segment appears on the surface, if the language has both rules.

We find a slightly different phenomenon in Japanese (Ito and Mester 1986, 1989). According to Ito and Mester (1986), two voiced obstruents in a single morpheme are not

allowed in nouns of Japanese origin. But Sino-Japanese nouns and some adjectives do not obey this restriction. Rendaku Voicing or Layman's Law in Japanese can be applied only to nouns of Japanese origin. The examples in (8) show the restriction.

(8) a. /kodama/ ---→ *[g]odama/ 'an echo'
/kabuto/ ---→ *[g]abuto/ or *[k]abudo/ 'a helmet'
/zashiki/ ---→ *[z]ashigi/ 'a room'
/teNgu/ ---→ *[d]eNgu/ 'a long nosed goblin'
/sato/ 'a hamlet'
b. Redaku Voicing
/hito-sato/ ---→ /hitozato/ 'a village'
/ko-teNgu/ ---→ *[k]odeNgu/ 'a child long nosed goblin'
/ko-hito/ ---→ /kobito/ 'a dwarf'

From a close investigation of these examples, one can say that this kind of process should be considered as morphophonological. The second example of Rendaku Voicing must be excluded by a morpheme condition which blocks the derivation of the non-existent forms in (8a), since the initial segment of /teNgu/ has no specification for a feature [− voiced] and the rule of Rendaku Voicing can spread a feature [+ voiced] to the initial segment. Roughly a restriction of this kind is formulated as follows:

(9) $*\overset{|}{C}$ $\overset{|}{C}$
[+ voiced] [+ voiced] : in a single morpheme of Yamato nouns
: Mirror-image

The discussion of the cooccurrence restriction can give support to underlying specification of the feature [+ voiced] for voiced obstruents.

There is another interesting example of assimilation for our discussion in order to the defense of a binary opposition of voicing. Though this assimilation occurs in a very limited vocabulary, the coronal consonant /t/ assimilates to any obstruents that follows it in Sino-Japanese words. Some relevant examples are listed in (10).

(10) /hat-kyo/ ---→ /hakkyo/ 'madness'
/gat-sho/ ---→ /gassho/ 'chorus'

/sit-hai/ --→ /sippai/ 'failure'

but

/hatsu-do/ --→ *＊/hatdo/ or *＊/haddo/ 'motion'

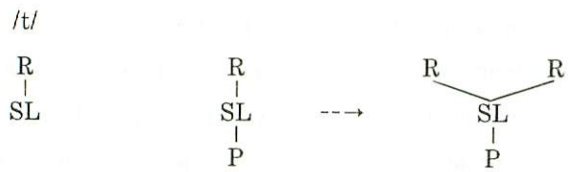
/gatsu-ten/ --→ /gaten/ or /gatten/ 'understanding'

/hatsu-mei/ --→ *＊/hammei/ 'invention'

/hatsu-aki/ --→ *＊/hataki/ 'early autumn'

The assimilation in (10) produces geminates and a sequence of affricate and vowel occurs instead of the geminates when voiced consonants or sonorants follows the coronal consonant /t/. Another possibility is that the assimilation derives the geminates from an underlying form /hatsu/ after the rule of vowel deletion.[3] In other words, the assimilation is conditioned by the voicelessness of the following consonant. It seems that some problems arise from the assimilation of /t/ to the following obstruent. First, we must refer to the unspecified feature [− voiced] to block the application of assimilation to the voiced segments. Second, the assimilation is wrongly applied to the sonorants, since they are unspecified for [voiced]. These do not pose any real problems to the Underspecification Theory, since the Feature Geometry enables us to formulate the assimilation rule which has no reference to a feature [− voiced]. The relevant redundant features are filled in by default rules later. The rule is illustrated in (11) in which /t/ has no Place Node in Japanese.

(11) /t/ Assimilation



The assimilation of /t/, on the other hand, causes some difficulties if we follow the proposal of the privativity of voicing. First, we cannt use the [− voiced] for the blocking of assimilation within the privative theory. Second, its theory must permit the feature specification [+ voiced] for the sonorants in order to avoid the application of assimilation.

Lastly let us discuss Voicing Alternation in English. I will argue that Alternation causes no problem within the model of Feature Geometry and the Underspecification Theory. Let us take a look at the English Voicing Alternation.

(12) Voicing Alternation (Halle and Mohanan 1985)

fans [z]	laps [s]
jay's [z]	Dick's [s]
he's [z]	that's [s]
tied [d]	kissed [t]
phoned [d]	talked [t]

In these examples, the voicelessness of inflectional suffixes seems to come from the stem-final voiceless consonant. The feature [− voiced] for these suffixes is given by a default rule, while the feature [+ voiced] would spread to the target segments. In the case of the voiced segments after a [+ sonorant] segment, they have a voiced quality after a default rule implements [+ voiced] to [+ son] segments. Ito and Mester (1989) argued that the non-existence of rules that insert or delete [− voiced] can be handled by the privativity of the feature [voiced]. However, the assumption of the privativity of a feature requires that we do not refer to the value, as the author and Yip (1989) discussed. The theory of Feature Geometry with underspecification never encounters the same difficulties as the delinking theory.

3. 0 Conclusion

We have argued that the treatment of voicing as a privative feature rather than as a binary feature cannot give any more insights into devoicing and voicing processes seen in given languages here. On the other hand, Feature Geometry and the Underspecification Theory can account for these phenomena in a simple way. If a feature [nasal] is underspecified for segments, they are considered as oral segments. However, the non-existence of [− voiced] value would make it impossible to distinguish a voiced from a voiceless consonant during derivation or on surface representation. In this paper we defend the status of voicing as a binary feature.

NOTES

* I am grateful to George M. Wickstead for correcting stylistic errors in this article.

1. Abbreviations used in this paper are C (consonant), R (Root), L (Laryngeal Node), SL (Supralaryngeal Node) and P (Place Node).

2. Ruback (1990) says in his note that we can find a contradiction when check the data with native speakers. They syllabify "Hundlung" 'act' as "Hand-lung" and pronounce the "d" as [t]. However, when pronouncing the whole word, they say [d]. A germanist (personal communication) suggests that the "d" in this case is pronounced close to [t], not [d].

3. Ito and Mester (1989) postulates a underlying form /hat-/ for the other possible underlying form /hatsu/. They derive the surface form [hakka] 'ignition' by /t/ assimilation, while the phonetic form [hatsudo] 'motion' is surfaced by epenthesizing the vowel /u/ and changing /t/ into the affricate [ts] before /u/. If we assume the undelying form /hatsu/, the surface form [hakka] will be derived by vowel deletion /ts/ assimilation. We cannot find the reason that the vowel epenthesis should be applied to a form /koo-hat/ to generate [koohatsu] when /hat-/ appears as the second morpheme of a word.

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