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Voicing in Japanese and the Theory of Underspecification*

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0. Introduction.

Although underspecified segments have been strongly motivated within autosegmental theory, the issue of which values of which features may be underspecified is not settled. Previous proposals in this respect can be divided into two theories, Contrastive Specification (Steriade (1987)), and Radical Underspecification (Kiprarsky (1982), Archangeli (1984, 1988), Pulleyblank (1986), Archangeli & Pulleyblank (1986, 1989)). The former theory claims that only the non-distinctive (redundant) values can be excluded from the underlying representation, while the latter claims that all the predictable values of phonological features must be excluded.

A Voicing rule in Japanese phonology to be discussed in this paper poses a problem to both theories. Unlike the other sonorants (/r/, /w/, /y/ and vowels), nasals do appear to trigger the Voicing rule, in spite of the fact that [+voice] for nasals is generally assumed to be missing from underlying representation in both theories. The Contrastive Specification theory excludes [+voice] for nasals from underlying representation, because it is non-distinctive, while the Radical Underspecification theory bans it, because it is predictable. I will solve this problem by proposing a constraint on consonant cluster in Japanese. This constraint requires that the value for [nasal] of the consonant in the coda must agree with the value for [voice] of the consonant in the onset of the next syllable.

This paper is organized as follows. In section 1,

theoretical background will be discussed. The Contrastive Specification theory and the Radical Underspecification theory will be introduced and compared. In section 2, some facts from Japanese phonology will be discussed. I will establish the fact that the value for [voice] of nasals as well as the one of the other sonorants must be considered to be missing, based on the Rendaku phenomena to be discussed in section 2.1. I will also argue that the interaction between Rendaku and Lyman's Law observed in this section is compatible with the Radical Underspecification theory but is not compatible with the Contrastive Specificatoin. In section 2.2., Voicing phenomena which can be observed in verbal morphology of Japanese will be discussed. The problem is that nasals appear to be trigger Voicing, although nasals are considered not to be specified for [voice]. I will solve this problem along the line mentioned above. In section 3, some concluding remarks will be given.

1. Theoretical Background.

1.1. Contrastive Specification

Proponents of Contrastive Specification (Steriade (1987) and others) assume that feature values are missing from underlying representation only when the values are redundant (non-contrastive), while feature values (+ or -) are represented in underlying representation only if the feature in question is used to distinguish (at least) two segments in underlying representation.

For example, the five-vowel system (like the ones of Spanish or Japanese) has the following underlying representation within the theory of Contrastive Specification.[1]

(1) Contrastive Specification

	full specification					contrasts	contrastive specification				
	i	e	a	o	u		i	e	a	o	u
high	+	-	-	-	+	{i,e};{o,u}	+	-		-	+
low	-	-	+	-	-	{a,o}			+	-	
back	-	-	+	+	+	{i,u};{e,o}	-	-		+	+
voice	+	+	+	+	+	___					

The values for [high] and [back] in the low vowel /a/ is missing from underlying representation, since these values are not contrastive in the context of [+low]. Values for [low] must be specified for both /a/ and /o/, since this feature is the only one which distinguishes these segments. Both values for [high] are represented in the [-back] segments (/i/ and /e/), given that these segments are distinctive in this feature. The same is true for the back vowels /o/ and /u/. /i/ and /u/ as well as /e/ and /o/ have contrast in backness, so these segments have the values for [back]. The other values are missing from the table in (1), since they are not contrastive.

1.2. Radical Underspecification

The theory of Radical Underspecifcation assumes that in every context C, only one value α (α = + or -) for any feature F can be specified in the underlying representation, where α is considered to be 'unpredictable'. Predictable value $-\alpha$ will be inserted either by a context-free rule or by a context-dependent rule during the course of derivation. (See Kiparsky (1982), Archangeli (1984, 1985), Pulleyblank (1983, 1988), Archangeli and Pulleyblank (1986, 1989) among others.)

The five-vowel system discussed in (1) will be represented as in (2) among other options.

(2) Some Radical Underspecification Options

	a. i	e	a	o	u	b. i	e	a	o	u	c. i	e	a	o	u
high	-		-			-		-			+				+
low		+					+						+		
back			+	+		-	-							+	+
voice															

Missing values in (2a)-(2c) are inserted by rules in (3a)-(3c), respectively.

(3) Redundancy Rules

a. [+low]->[-high]
[+low]->[+back]
[ ] ->[-low]
[ ] ->[+high]
[ ] ->[-back]
[ ] ->[+voice]

b. [+low]->[-high]
[ ] ->[+high]
[ ] ->[-low]
[ ] ->[+back]
[ ] ->[+voice]

c. [+low]->[+back]
[ ] ->[-low]
[ ] ->[-high]
[ ] ->[-back]
[ ] ->[+voice]

For example, the option (2a) chooses /i/ ([+high,

-back, -low]) as unmarked for vowels, while (2b) and (2c) choose /u/ and /e/ as unmarked, respectively.

2. Voicing Phenomena in Japanese

As the basis of discussion, the consonant inventory of Japanese is shown. Japanese has the consonant inventory for native ([+Yamato]) vocabulary as follows[2]:

(4) Japanese Consonant Inventory

(p)	t	k	s
b	d	g	z
m	n		
	r		
w	y		

In this system, sonorants /m, n, r, w, y/ are redundantly [+voice], while obstruents have distinction with respect to [voice].

In the following sections, we will make a close look at two sets of facts; *Rendaku* and Voicing of the initial consonants of verbal suffixes.

2.1. Rendaku

In this section, we will examine *Rendaku* (sequential voicing) based on the discussion presented in Ito and Mester (1986). Japanese phonology includes a rule of sequential voicing, which is called *Rendaku*. Rendaku voices word-initial obstruents in the second elements of compounds. In (5), examples of this process are listed:

(5) a. iro + kami -> irogami
'color' 'paper' 'colored paper'
b. yama + tera -> yamadera
'mountain' 'temple' 'mountain temple'
c. suna + hokori -> sunabokori
'sand' 'dust' 'storm dust'
d. maki + suši -> makizusi
'rolled' 'sushi' 'rolled sushi'

In (5), /k, t, h, s/ become the voiced counterparts [g, d, b, z], respectively.[3]

It is well known that this rule is subject to Lyman's Law:[4]

(6) Lyman's Law
If the second member of compound contains a voiced obstruent, Rendaku does not apply.

Given Lyman's Law, the initial obstruents of the second member of the compounds in (7) cannot be changed into [+voice] counterparts:

(7) a. kami+kaze *kami+gaze 'divine wind'
b. mono+šizuka *mono+zizuka 'tranquil'
c. širo+tabi *širo+dabi 'white tabi'
d. maru+hadaka *maru+badaka 'completely naked'

In (7), application of Rendaku is blocked because the second members of the compounds contain voiced obstruents in non-initial position.

Of great interest is the fact that the redundant voicing of [+sonorant] segments (e.g. vowels and sonorants) is irrelevant to Lyman's Law. Examples are given in (8):

(8) a. onna+kokoro -> onna+gokoro
'woman + heart' "feminine feelings"

b. garasu+tana -> garasu+dana
'glass + shelf'

c. iro+kami -> iro+gami
'color + paper' "colored paper"

d. hana+tayori -> hana+dayori
'flower + tidings'

e. migi+kawa -> migi+gawa
'right + side'

In (8), the second elements of the compounds have sonorants /r, n, m, y, w/ in non-initial position. However, these sonorants do not trigger Lyman's Law, so Rendaku applies to these forms. Ito and Mester (1986) suggest that this fact be attributed to the fact that the value for feature [voice] is missing in sonorants. The missing value will be filled in by redundancy rule (9):

(9) [ ] -> [+voice]

Rule (9) redundantly fills in [+voice] for [+sonorant] segments. It is not necessary to specify [+son] in the structural description of (9), since (9) is ordered after (11a) by Elsewhere Condition[5] (Kiparsky (1982, 8)), then (9) does not fill [+voice] for obstruents.

Rendaku facts also suggest that [-voice] for obstruents be missing. Lyman's Law appears to have 'nonlocal' influence on Rendaku. Consider (10):

(10) a. onna + kotoba -> *onna + gotoba
'woman + word' "feminine speech"
b. oo + tokage -> *oo + dokage
'big + lizard'
c. de + kasegi -> *de + gasegi
'go out + work' "migratory work"

In (10), the voiced obstruents in the third syllable of the second elements trigger Lyman's Law and block Rendaku, in spite of the existence of the voiceless obstruents in the second syllable. In other words, the voiceless obstruents in the second syllable appear to be 'transparent' to Lyman's Law.

Given the facts above, we can conclude that only the [+voice] for obstruents is represented in underlying representation and that [-voice] for obstruents and [+voice] elsewhere (that is, for sonorants) are missing from underlying representation. The [+voice] for obstruents is represented, since it triggers Lyman's Law, as in (7). [-voice] for obstruents is missing, since it is 'transparent' to Lyman's Law. (See (10) above.) [+voice] is missing elsewhere (namely, for sonorants), since it neither triggers nor blocks Lyman's Law. (See (8) above.)

The missing values will be filled by rules (11):

(11) a. [-sonorant] -> [-voice]
b. [ ] -> [+voice] (9)

If the conclusion above is correct, Lyman's Law can be restated as a restriction on the voicing tier[6] as follows:

(12) Lyman's Law (Revised) cf. Ito and Mester (1986)
*[μ [+voice][+voice]]
(μ =morpheme)

(12) states that two [+voice] autosegments cannot be adjacent in a ([+Yamato][7]) morpheme. In other words, it restricts the specification of [+voice] to only one per morpheme.[8]

To sum up, Rendaku facts are compatible with the Radical Underspecification theory but are not compatible with the Contrastive Specification theory. Compatible with the former, since this theory requires that only one value for any feature F can be specified in underlying representaion, where the feature is used as distinctive (in the Rendaku case, '+' for the feature [voice] in the obstruent segments). Incompatible with the latter, since this theory claims that only non-distinctive value for some feature can be unspecified but the facts laid out above require that one of the 'distinctive' values, namely '-', for the feature [voice] be unspecified. Note also that nasals as well as other sonorants are not specified for [voice].

2.2. Verbal Morphology

In this section, we will examine Voicing phenomena which can be observed in verbal morphology of Japanese. The Voicing rule to be discussed in this section poses a problem to both theories. Unlike the other sonorants (/r/, /w/, and vowels), nasals do appear to trigger the Voicing rule, in spite of the fact that [+voice] for nasals is generally assumed to be missing from underlying representation in both theories. The Contrastive Specification theory excludes [+voice] for nasals from underlying representation, because it is non-distinctive, while the Radical Underspecification theory bans it, because it is predictable. I will solve this problem by proposing a constraint on consonant cluster in Japanese. This constraint requires that the value for

[nasal] of the consonant in the coda must agree with the value for [voice] of the consonant in the onset of the next syllable.

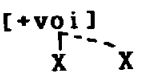
A Japanese verb stem ends with one of the following segments /e, i, r, w, t, s, k, g, b, m, n/ as in (13):

(13)	stem		Negative	Past
a.	/tabe/	'eat'	[tabenai]	[tabeta]
b.	/mi/	'look'	[minai]	[mita]
c.	/tor/	'take'	[toranai]	[totta]
d.	/kaw/	'buy'	[kawanai]	[katta]
e.	/tat/	'stand'	[tatanai]	[tatta]
f.	/kas/	'lend'	[kasanai]	[kašita]
g.	/kak/	'write'	[kakanai]	[kaita]
h.	/kag/	'smell'	[kaganai]	[kaida]
i.	/yob/	'call'	[yobanai]	[yonda]
j.	/yom/	'read'	[yomanai]	[yonda]
k.	/šin/	'die'	[šinanai]	[šinda]

The examples in (13) can be divided into two classes, namely Voicing-Class (henceforth VC) and Non-Voicing-Class (henceforth NVC). The stems in (13h-k) are VC-verbs, which voice the first segment of the past suffix /ta/ and make it [da]. (Ignore other irrelevant changes.) The stems in (13a-g) belong to NVC. They does not affect the suffix /ta/, and leave it as it is. Any description of Japanese verbal morphology must make proper distinction between VC and NVC.

Following Ito and Mester (1986), I assume that Voicing Spread (14) is (partly) responsible for the Voicing phenomena discussed here:

(14) Voicing Spread



Given Voicing Spread (14), what we have to do is to establish the assumption that only the stem-final segments of the VC-stems are specified as [+voice].

Consider first the NVC-stems (13a-g). Both the Contrastive Specification theory and the Radical Underspecification theory predict that the stem-final segments are not associated with [+voice] in (13a-g). The stem-final segments in (13a-d) is missing [+voice], since this value is non-contrastive and thus predictable. The stem-final voiceless obstruents are not specified as [+voice]. Within the Contrastive Specification theory, these consonants are specified as [-voice]. In the Radical Underspecification, they are underspecified for the value of the feature [voice]. Assuming either theory, the stem-final seegments in (13a-g) are not specified as [+voice].

Consider next the VC-stems (13h-k). As for (13h-i), there is no problem. They have [+voice] for their stem-final segments. This [+voice] is spread onto /t/ of the Past-suffix. However, the examples in (13j-k) pose a problem. Their stem-final segments are nasals. As we have observed in the previous section, nasals (in Japanese at least) are considered not to be specified for the value of [voice]. Therefore, it might be predicted that these stems should behave like NVC-stems. In fact, the contrary is true. Some mechanism is needed in order to voice /t/ after nasals.

Ito and Mester (1986) propose that (15) is such a mechanism:

(15) Postnasal Voicing

C -> [+voi]/[+nas] ____

They claim that this rule reflects a general constraint on native (or nativized) morpheme structure requiring voicing agreement in NC clusters. In Japanese native morpheme, we find NC cluster /mb, nd, nz, ŋg/ as in *tombo* 'dragonfly', *kambasii* 'fragrant', *sindoi* 'tired', *unzari* 'disgusted', *kaŋgae* 'thought', but not /*mp, *nt, *ns, *ŋk/. (15) is restricted to apply to [+Yamato] morpheme and applies morpheme-internally and to some suffixes. This rule operates neither in Sino-Japanese compounds (e.g. *sam+po* **sam+bo* 'stroll', *han+tai* **han+dai* 'opposition')[9] nor in Yamato compounds postlexically (e.g. *hyootan+kago* **hyootan+gago* 'gourd basket').

They think, however, that it would be desirable if the Postnasal Voicing could be subsumed under Voicing Spread (14). They discuss four alternative approaches but deny them, since they are not compatible with the analysis of Rendaku phenomena. I will not reduplicate their discussion here. See Ito and Mester (1986, 69-71) for detail.

True, their discussion is correct, but it does not exhaust all possibilities. One alternative approach comes to mind that utilizes Marking Condition in the sense proposed in Kiparsky (1985). Before examining this possibility, I will discuss Coda Nasalization. This process has been reported in the literature on Japanese Phonology such as Kuroda (1965), McCawley (1968) and Ito and Mester (1986) among others. I tentatively formulate this rule as follows:

(16) Coda Nasalization

[ ] -> [+nas]/ ___ [+voi]

Coda Nasalization is a process responsible for the sur-

face absence of voiced consonant clusters. I will discuss two cases where this process can be observed. First, I discuss the case where /b/-ending verb stems are involved. Consider (17):

(17) (14) (16)

a. /yob+ta/ -> /yob+da/ -> [yonda]
'call+Past'

b. /tob+ta/ -> /tob+da/ -> [tonda]
'fly+Past'

In (17), the underlying cluster /bt/ is changed into /bd/ by Voicing Spread (14), and then changed into [nd] by Coda Nasalization (16).

Second, I discuss Intensive Infixation. Examples are given in (18):

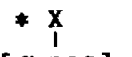
(18) a. karakaze -> karakkaze
'dry wind' 'dry wind (intensified)'

b. togaru -> toŋgaru
'be pointed' 'be pointed (intensified)'

I agree with Ito and Mester (1986) that Intensive Infixation is a insertion of a empty slot, followed by assimilation (spreading) of the adjacent consonantal melody. If the adjacent consonant is a voiced one, then a voiced geminate will occur. Coda nasalization must be apply when a voiced geminate is derived.

At this point, we can observe that Postnasal Voicing (15) and Coda Nasalization (17) are similar in effect. They reflect a general constraint on Yamato morpheme structure requiring agreement between the value of [nasal] and that of [voice] in cluster. This constraint can be easily formulated as Marking Condition (19):

(19) [nas]-[voi] agreement

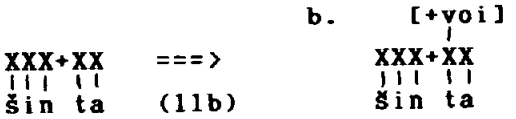


The Marking Condition (19) prohibits any rule (in Lexicon) to create the structure in (19).

Introducing the Marking Condition (19), we can dispense with both Postnasal Voicing (14) and Coda Nasalization (16).

We can derive [sinda] from /sin+ta/ without applying Postnasal Voicing (14) as shown in (20):

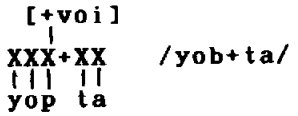
(20) a. b.



The Marking Condition (19) prevents redundancy rule (11a) from applying to (20a). Therefore, redundancy rule (11b) applies to (11a) confirming the Marking Condition (19).

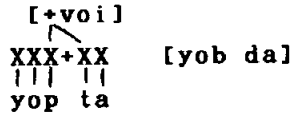
Next, consider the derivation of [yonda] from /yob+ta/. The underlying representation is roughly as (21):

(21)



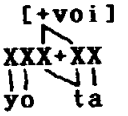
Voicing Spread (14) applies to (21) yeilding (22):

(22)



Then, the stem-final consonant /b/ assimilates to the suffix-initial consonant /t/, then (22) becomes (23):

(23)



[yod da]

At this point, we have no rule which supplies any value for [nasal] to stem-final segment, if we abandon Coda Nasalization (16). Archangeli (1984) proposes (24) as the Default Rule for [nasal]:

(24) [ ] -> [-nas]

(24) is, however, prevented from applying to (23) by the Marking Condition (19). Then, the coda consonant might be left unspecified.

I suggest one tentative solution to this problem utilizing Full Interpretation (FI) proposed in Chomsky (1986). I assume that at the end of the lexical phonology, a general principle of Full Interpretation is invoked. FI requires that every element of PF(=phonology) and LF(=sementics) must receive an appropriate interpretation. In (23), the segment in coda cannot be interpreted appropriately, because it lacks the specification for [nasal].[10] Therefore, the value for [nasal] for the segment is fixed to '+' confirming the Marking Condition (19). Now, we can derive [yonda] from /yob+ta/ without using Coda Nasalization.

3. Concluding Remarks

In this paper, I observed Voicing penomena in Japanese phonology. Rendaku (Sequential Voicing) suggests that only [+voice] for obsturent can be represented in underlying representation. Voicing phenomena observed in the verbal mor-

phology of Japanese appears to pose a problem. The problem is that nasals appear to have [+voice] specification underlyingly. This problem is solved by proposing the Marking Condition (19), which requires that the value for [nasal] of the consonant in the coda must agree with the value for [voice] of the consonant in the onset of the next syllable.

NOTES

* I would like to express the deepest gratitude to Masao Okazaki and Shin-ichi Tanaka for their useful comments and discussions. Of course, sole responsibility for errors is my own.

[1] I maily follow the presentation of the discussion in Archangeli (1988). See Archangeli (1988) and Steriade (1987) for detail.

[2] I will restrict the discussion here to the native or nativized vocabulary. In fact, the native vocabulary does not have underlying /p/ phoneme. /h/ is considered to be the 'voiceless' counterpart of /b/.

[3] In Japanese, /h/ is considered to be the 'voiceless' counterpart of /b/. This position can be supported by the fact that /h/ sometimes has [p] as surface realization; *otya + ha -> otyappa* 'tea + leaf'.

[4] Besides Lyman's Law, three morphological facts must be taken into consideration. See Ito and Mester (1986) for detail. First, the compound must be endcentric. In other words, the elements of compound stand in a modifier-head relation as shown in (i). Second, the second member of compound may not be compound. See (ii) below. Finally, the second member of compound must be the native (or nativized) word of Japanese, which is traditionally disignated as [+Yamato] as in (iii).

(i) a. morai+ko -> morai+go 'adopted+child'
"adopted child"

b. oya+ko x> *oya+go 'parent+child'
"parent and child"

(ii) a. [[nuri+kasa]+ire] -> nuri+gasa+ire
'[[lacquered umbrella] case]'

b. [nuri+[kasa+ire]] x> *nuri+gasa+ire
'[lacquered [umbrella case]]'

(iii) a. nise + kane -> nise + gane
[+Yamato]
'counterfeit money'

b. nise + kin x> *nise + gin
[-Yamato]
'counterfeit money'

[5] Kiparsky's definition of the Elsewhere condition is given below:

Elsewhere Condition
Rules A, B in the same component apply disjunctively to a form Φ if and only if
(i) The structural description of A (the special rule) properly includes the structural description of B (the general rule)
(ii) The result of applying A to Φ is distinct from the result of applying B to Φ .
In that case, A is applied first, and if it takes effect, then B is not applied.

[6] I assume the general theory of phonological tiers. Crucial to the discussion here is the assumption that fea-

ture [voice] constitutes a tier.

[7] This restriction is irrelevant to [-Yamato] morphemes (e.g. *adobaisu* 'advice', *baggu* 'bag'). Some 'native' words also violate this restriction. Examples are as follows; *debu* 'fatty', *doǰi* 'blunder', *ǰiǰii* 'old man', *babaa* 'old woman', *obebe* 'clothes (infantile)'. The last example is childish word, while the others, as Ito and Mester (1986) suggest, have pejorative connotations. Some of the examples above are pointed out by Shin-ichi Tanaka (personal communication.) He also points out *domburi* 'porcelain bowl', which I think is a real exception.

[8] (12) can be considered as a specific realization of Obligatory Contour Principle.

[9] Shin-ichi Tanaka points out that some 'Sino-Japanese' compounds do undergo (15); /an+san/ -> [anzan] 'easy birth', /čin+kin/ -> [čiŋ+gin] 'wage money', /gun+hai/ -> [gum+bai] '*sumo* (Japanese wrestling) umpire's fan', /šin+čuu/ -> [šin+ǰuu] 'double suicide'. I suggest that these examples are nativized. The latter two have meanings which are not compositional. The compositional meaning of /gun+hai/ is 'troops positioning' and that of /šin+čuu/ is 'mind inside'. *gum+bai* means 'fan (which is used in order to position the troops)', while *šin+ǰuu* means 'killing of oneself with someone (who he/she has in mind)'.

[10] I have a hidden assumption here to the effect that the values for all features in a segment must be specified in order to be interpreted properly. However, some phonologists admit the unspecified elements after 'phonology,' that is, in phonetics. See Pulleyblank (1986) among others.

REFERENCES

Archangeli, D. (1984) *Underspecification in Yawelmani Phonology*, Ph. D. Dissertation, MIT.

Archangeli, D. (1985) "Yokuts Harmony: Evidence for Coplanar Representation in Autosegmental Phonology," *LI 16*, 335-372.

Archangeli, D. (1988) "Aspects of Underspecification Theory," *Phonology 5*, 183-207.

Archangeli, D. and D. Pulleyblank (1986) *The Content and Structure of Phonological Representations*, ms., University of Arizona and University of Southern California.

Archangeli, D. and D. Pulleyblank (1987) "Maximal and Minimal Rules: Effects of Tier Scansion," *NELS 17*, 16-35.

Archangeli, D. and D. Pulleyblank (1989) "Yoruba Vowel Harmony," *LI 20*, 173-217.

Borowsky, T. (1986) *Topics in the Lexical Phonology of English*, Ph. D. Diss. University of Massachusetts, Massachusetts.

Borowsky, T. "Syllable Codas in English and Syllabification," *NELS 17*, 36-45.

Chomsky, N. (1986) *Knowledge of Language*, Praeger Publishers, New York.

Chomsky, N. and M. Halle (1968) *The Sound Pattern of English*, Harper and Row, New York.

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

Ewen, C. and Harry van der Hulst (1987) "Single-valued Features and the Distinction between [-F] and [ØF]," *Linguistics in the Netherlands (1987)*, 51-60.

Halle, M. and K. P. Mohanan (1985) "Segmental Phonology of Modern English," *LI 16*, 57-116.

Hulst, H. van der and N. Smith (eds.) (1982a) *The Structure of Phonological Representation (Part I)*, Foris,

Dordrecht.

Hulst, H. van der and N. Smith (eds.) (1982b) *The Structure of Phonological Representation (Part II)*, Foris, Dordrecht.

Hulst, H. van der and N. Smith (1987) "Vowel Harmony in Khalkha and Buiat (East Mongolian)," in *Linguistics in the Netherlands (1987)*, 81-89.

Ito, J. and R.-A. Mester (1986) "The Phonology of Voicing in Japanese: Theoretical Consequences for Morphological Accessibility," *LI 17*, 49-73.

Kiparsky, P. (1982a) "Lexical Morphology and Phonology," *Linguistics in the Morning Calm*, Hansin, Seoul.

Kiparsky (1985) "Some consequences of Lexical Phonology," *Phonology Yearbook 2*, 85-138.

McCarthy, J. (1981) "A Prosodic Theory of Nonconcatenative Morphology," *LI 12*, 373-418.

McCarthy, J. (1986) "OCP Effect: Gemination and Antigemination," LI 17, 207-264.

Mohanan, K. P. (1982) *Lexical Phonology*, Indiana University Linguistics Club, Bloomington.

Pulleyblank, D. (1988) "Vocalic Underspecification in Yoruba," *LI 19*, 233-270.

Sagey, E. C. (1986) *The Represantation of Features and Relations in Non-linear Phonology*, Ph. D. Diss., MIT.

Schein, B. and D. Steriade (1986) "On Geminates," *LI 17*, 691-744.

Steriade, D. (1982) *Greek Prosodies and the Nature of Syllabification*, Ph. D. Diss., MIT.

Steriade, D. (1987) "Redundant Values," *CLS 23*.

Yip, M. (1987) "English Vowel Epenthesis," *NLLT 5*, 463-484.

Yip, M. (1988) "The Obligatory Contour Principle and Phonological Rules: A Loss of Identity," *LI 19*, 65-100.

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