Visibility of Covert Voicing Feature in Serialism

Kazutaka Kurisu
Kobe College

1. Introduction

Rendaku or sequential voicing has attracted considerable previous attention in Japanese phonology. This is a morphophonological phenomenon where the initial voiceless consonant of a compound head is voiced. One lingering issue is how to explain facts of sequential voicing in complex compounds. Left-branching and right-branching compounds exhibit a sharp contrast. Although descriptive generalization is straightforward, no satisfactory analysis exists, especially in OT (Prince and Smolensky 2004).

In this paper, I develop an analysis with the Lexical Phonology-Morphology version of Optimality Theory (LPM-OT; Kiparsky 2000). The basic idea is that compounds are built up cyclically outward, and phonology occurs at every stage of compounding. My analysis will be similar to Ito and Mester's (1986) rule-based one, but there is a good reason for favoring a constraint-based approach. My analysis implies serialism, but transderivational OO-correspondence (Benua 1997) and derivational frameworks called Harmonic Serialism (McCarthy 2007b, 2008a, b) and OT-CC (McCarthy 2007a; Wolf 2008) fail.

The rest of this work is organized as follows. In section 2, I provide data, descriptive generalization, and an OT analysis of simple compounds. Section 3 provides examples of complex compounds, and I critically review Ito and Mester's (2003) OT analysis. In section 4, I develop an LPM-OT analysis and discuss why the serial OT analysis is superior to Ito and Mester's (1986) ruled-based account. In section 5, I argue against a parallel alternative. In section 6, I show that other conceivable derivational theories cannot explain sequential voicing in complex compounds. This paper is concluded in section 7.

2. Sequential voicing in simple compounds

Sequential voicing is a voicing phenomenon observed primarily in native nominal compounds. As exemplified in (1a), the initial consonant of the head member of a compound undergoes voicing. But this voicing process is prevented when the head contains a lexical voiced obstruent, as demonstrated in (1b) (McCawley 1968; Ito and Mester 1986, 2003; Vance 1987).

(1)		*First*	*Second*	*Compounds*	*Gloss*
	a.	imo	hatake	imo-batake	potato field
		yama	tera	yama-dera	mountain temple
		iro	kami	iro-gami	colored paper
		ao	sora	ao-zora	blue sky
	b.	ʃima	hebi	ʃima-hebi	garter snake
		ɸuna	tabi	ɸuna-tabi	trip by ship
		kami	kuzu	kami-kuzu	paper waste
		aka	sabi	aka-sabi	red rust

In the subsequent discussion, I assume that only contrastive features are specified in the surface representation (Ito et al. 1995). As a corollary, voiced obstruents have a voicing feature, but sonorants do not. Moreover, I assume that the source of sequential voicing is a linking voicing morpheme inserted between compounded words (Ito and Mester 1986, 2003). This morpheme is indicated by π.

* For invaluable comments and stimulating questions on this paper, I am grateful to Michael Hammond, Brett Hyde, Paul Smolensky, and Adam Ussishkin. All errors and infelicities are mine.

The examples in (1) are analyzed with the four constraints in (2). The self-conjoined constraint in (2a) is an OCP constraint that militates against multiple voicing features in a morpheme (Lyman's Law). Given the first assumption above, $[+\text{voi}]^2_M$ prohibits multiple tautomorphemic voiced obstruents. (2b) militates against deletion of the π feature, and (2c) requires π to be associated with a segment.

(2)
a. $[+\text{voi}]^2_M$: No morpheme may contain multiple [+voi] features.
b. MAX-π: The π morpheme must not be deleted.
c. *FLOAT-π: π not affiliated with any segment is prohibited.
d. IDENT-IO[voi]: Input-output correspondents must agree in voicing.

The examples in (1a) are analyzed in (3). Because MAX-π and *FLOAT-π outrank IDENT-IO[voi], it is most harmonic to apply sequential voicing. MAX-π and *FLOAT-π together have the effect of REALIZE MORPHEME in the sense of Kurisu (2001). By contrast, in (1b), application of sequential voicing results in violation of $*[+\text{voi}]^2_M$. As shown in (4), the best candidate does not apply voicing but leaves π in the surface representation to respect MAX-π even though this floating π remains unpronounced.

(3)

/imo-π-hatake/	$*[+\text{voi}]^2_M$	MAX-π	*FLOAT-π	IDENT-IO[voi]
a. imo-π-hatake			*!	
b. imo-hatake		*!		
c. ☞ imo-batake				*

(4)

/ʃima-π-hebi/	$*[+\text{voi}]^2_M$	MAX-π	*FLOAT-π	IDENT-IO[voi]
a. ☞ ʃima-π-hebi			*	
b. ʃima-hebi		*!		
c. ʃima-bebi	*!			*

3. Sequential voicing in complex compounds

Sequential voicing behaves differently in complex compounds, depending on the internal structure of the compound. In left-branching compounds with the [[X-Y]-Z] structure, Y undergoes voicing, as in (5a). On the other hand, in right-branching compounds with the [X-[Y-Z]] structure, Y does not undergo voicing, as illustrated in (5b) (Otsu 1980; Ito and Mester 1986, 2003).

(5)

	Underlying	*Surface*	*Gloss*
a.	[nuri-kasa]-ire	nuri-gasa-ire	case for lacquered umbrellas
	[nise-hana]-matsuri	nise-bana-matsuri	festival with fake flowers
	[hoʃi-kusa]-motʃi	hoʃi-gusa-motʃi	rice-cake with hay
b.	nuri-[kasa-ire]	nuri-kasa-ire	lacquered umbrella case
	nise-[hana-matsuri]	nise-hana-matsuri	fake flower festival
	hoʃi-[kusa-motʃi]	hoʃi-kusa-motʃi	dried grass rice-cake

Ito and Mester (2003) develop a parallel OT analysis. Their key argument is that left-branching and right-branching compounds have different prosodic structures and that this difference is responsible for the contrast in (5). The left-branching compounds in (6a) have one accent, so they consist of a single prosodic word, as in (7a). As shown in (7b), on the other hand, the right-branching compounds in (6b) comprise two prosodic words since two accents are assigned.

(6)

	Complex compounds	*Gloss*
a.	[nihoN-zakura]-mátsuri	festival for Japanese cherry blossoms
	[nihoN-bujoo]-k^jóokai	association of Japanese dance
b.	nihóN-[sakura-mátsuri]	cherry blossom festival in Japan
	nihóN-[bujoo-k^jóokai]	dance association of Japan

(7) a. Left-branching compound b. Right-branching compound

Ito and Mester declare that the initial consonant of /sakura/ 'cherry blossoms' does not undergo sequential voicing in (7b), assuming that initial voiced obstruents are disallowed in native nouns. This analysis encounters two problems. First, not all right-branching compounds have two accents. All the forms in (5b) have only one accent. Second, native nouns may begin with a voiced obstruent.

4. LPM-OT analysis

In this section, I give an LPM-OT analysis. In LPM-OT, morphological processes and phonology are interleaved such that phonology is rendered sensitive to internal morphological structure. For the case at hand, the morphological operation of interest is compounding. Let us assume that compounds are constructed cyclically and that phonology enters the picture after each step of compounding. It is usually assumed in Lexical Phonology that a derivation starts out with a bare root. I assume below that the head in the most deeply embedded compound is inserted first. Subsequently, phonology (sequential voicing) and compounding alternate until the optimal form for the whole compound is determined.

The OCP constraint in (2a) prohibits multiple voicing features within a morpheme. Obviously, this morpheme structure constraint does not explain the contrast between (5a) and (5b). The OCP constraint operative in complex compounds is given in (8).

(8) $*\pi^2_{Hd}$: No head word may contain multiple (exponents of) π.

$*\pi^2_{Hd}$ is not sensitive to voicing features in general. Rather, it is sensitive only to (exponents of) the π morpheme. As shown in (9a), two words with a lexical voiced obstruent may be compounded. The examples in (9b) suggest that a voiced obstruent in a left non-head member does not prevent sequential voicing. Two lexical obstruents or a combination of a lexical voiced obstruent and an exponent of π can appear in a compound if the two voiced obstruents belong to distinct morphemes. $*\pi^2_{Hd}$ does not rule out complex compounds in which compounds as in (9) occupy a head position.

(9)		*First*	*Second*	*Compounds*	*Gloss*
	a.	kuzu	kago	kuzu-kago	waste basket
		ɸuʒi	tsubo	ɸuʒi-tsubo	acorn shell
		tabi	sugata	tabi-sugata	traveling attire
		kagi	taba	kagi-taba	key bundle
	b.	suʒi	hone	suʒi-bone	sinew bone
		sabi	take	sabi-dake	rusty bamboo
		tsubo	sara	tsubo-zara	small, deep dish
		tabi	karasu	tabi-garasu	wanderer

My analysis of the compounds in (5) goes as follows, taking /[nuri-kasa]-ire/ and /nuri-[kasa-ire]/ as representative examples. In the left-branching compound, /kasa/ is inserted on the first cycle. Voicing is irrelevant here. On cycle 2, /nuri/ is attached before [kasa], and the π morpheme is inserted. As (10) shows, the optimal candidate applies sequential voicing. On cycle 3, /ire/ is attached, producing /[nuri-gasa]-π-ire/. No phonological change occurs as the initial segment of /ire/ is underlyingly voiced.

(10)

/nuri-π-kasa/	$*\pi^2_{Hd}$	MAX-π	*FLOAT-π	IDENT-IO[voi]
a. nuri-π-kasa			*!	
b. nuri-kasa		*!		
c. ☞ nuri-gasa				*

In the right-branching compound /nuri-[kasa-ire]/, on the other hand, the derivation starts with /ire/. This input surfaces faithfully on the first cycle. On the second cycle, this output is combined with /kasa/, producing /kasa-π-ire/. The potential docking site of π is occupied by a sonorant, so sequential voicing takes no effect. The π morpheme nevertheless remains on the second cycle, as illustrated in (11). On the third cycle, [kasa-π-ire] is preceded by non-head /nuri/. Initial /k/ of the head compound is the potential locus of sequential voicing. However, its application leads to violation of undominated $*\pi^2_{Hd}$. Unlike in the left-branching counterpart, sequential voicing fails to apply to the first consonant of /kasa/ in the right-branching compound, as shown in (12).

(11)

/kasa-π-ire/	$*\pi^2_{Hd}$	MAX-π	*FLOAT-π	IDENT-IO[voi]
a. ☞ kasa-π-ire			*	
b. kasa-ire		*!		

(12)

/nuri-π-[kasa-π-ire]/	$*\pi^2_{Hd}$	MAX-π	*FLOAT-π	IDENT-IO[voi]
a. ☞ nuri-π-[kasa-π-ire]			**	
b. nuri-[gasa-π-ire]	*!		*	*
c. nuri-[gasa-ire]		*!		*

The analysis above presupposes the absence of covert voicing on sonorants. This presupposition is supported by data from Japanese mimetic voicing. Mimetic voicing is largely associated with negative connotations like heaviness, dullness, and coarseness. This voicing phenomenon usually targets a root-initial consonant (e.g., [baku-baku] 'devouring' from [paku-paku]) (Nasu 1999; Kurisu 2006). However, a root-medial obstruent is voiced when the root is sonorant-initial ([mozo-mozo] 'creeping about' from [moso-moso]). This observation lends support to the assumption that covert voicing does not take place.

The proposed LPM-OT analysis is quite analogous to Ito and Mester's (1986) rule-based analysis. There are three key rules in their account. They are provided in (13) in simplified forms.

(13)
a. Rendaku: Insert π between compounded words.
b. Lyman's Law: Delete π if the following phonological string contains [+voi].
c. Voicing spread: Spread π to the closest right-hand segment.

The three rules are ordered as provided in (13). Ito and Mester's cyclic account is demonstrated in (14). On the second cycle of the right-branching compound, π is added when the complex compound is constructed. This π morpheme is immediately erased by Lyman's Law since the head compound has a π morpheme. Consequently, sequential voicing fails to apply to /kasa/ in the right-branching compound.

(14)

		Left-branching compound	*Right-branching compound*
Cycle 1	Compounding	nuri-kasa	kasa-ire
	Rendaku	nuri-π-kasa	kasa-π-ire
	Lyman's Law	N/A	N/A
	Voicing spread	nuri-gasa	N/A
Cycle 2	Compounding	[nuri-gasa]-ire	nuri-[kasa-π-ire]
	Rendaku	[nuri-gasa]-π-ire	nuri-π-[kasa-π-ire]
	Lyman's Law	N/A	nuri-Ø-[kasa-π-ire]
	Voicing spread	N/A	N/A
	Output	[nuri-gasa-ire]	[nuri-kasa-ire]

My analysis is essentially identical to Ito and Mester's (1986) except for one important difference. Mine is framed in constraint-based OT, but their analysis is couched in a rule-based framework. There is a point in favor of the constraint-based approach.

Ito and Mester (1986) claim that morpheme-level Lyman's Law should also be viewed as a rule and that the first voiced obstruent is devoiced if a morpheme contains two voiced obstruents. Given this argument, the rule-based formalization of morpheme-level Lyman's Law predicts the total absence of initial voiced obstruents in native nouns since nothing in principle prevents the possibility that all native nouns contain morpheme-initial and morpheme-medial voiced obstruents in their lexical representations. This prediction is not borne out. As illustrated in (15b) and (15c), a voiced obstruent may be positioned morpheme-initially or medially in native nouns. The constraint-based formalization of Lyman's Law in (2a) merely prohibits multiple tautomorphemic voiced obstruents. It does not decide the position where devoicing applies, so nouns as in (15b) are ruled in. It is superior to view Lyman's Law as a constraint.

(15)		*Native nouns*	*Gloss*		*Native nouns*	*Gloss*
	a.	kake	bet	b.	gake	cliff
		ɸuta	lid		buta	pig
	c.	kage	shade	d.	*gage	
		ɸuda	card		*buda	

5. Against parallel alternative

The LPM-OT analysis proposed in the previous section assumes successive alternate application of morphology and phonology. In this section, I defend the necessity of this assumption.

If we assume complete parallelism, the input representation of a complex compound should consist of all compounded words and a π morpheme inserted at each word juncture. The underlying structures of the complex compounds in (5) should look like (16).

(16)	a.	*Left-branching compounds*	b.	*Right-branching compounds*
		[nuri-π-kasa]-π-ire		nuri-π-[kasa-π-ire]
		[nise-π-hana]-π-matsuri		nise-π-[hana-π-matsuri]
		[hoʃi-π-kusa]-π-motʃi		hoʃi-π-[kusa-π-motʃi]

The tableaux given in (17) and (18) show that the asymmetry of left-branching and right-branching compounds in (5) is captured with the parallel analysis.

(17)

	/[nuri-π-kasa]-π-ire/	$*\pi^2_{Hd}$	MAX-π	*FLOAT-π	IDENT-IO[voi]
a.	[nuri-π-kasa]-π-ire			**!	
b. ☞	[nuri-gasa]-π-ire			*	*

(18)

	/nuri-π-[kasa-π-ire]/	$*\pi^2_{Hd}$	MAX-π	*FLOAT-π	IDENT-IO[voi]
a. ☞	nuri-π-[kasa-π-ire]			**	
b.	nuri-[gasa-π-ire]	*!		*	*
c.	nuri-[gasa-ire]		*!		*

A problem arises when larger complex compounds are considered. The examples in (19) are right-branching compounds consisting of four words. As a consequence, a complex compound occupies the head position of a whole compound. Sequential voicing targets only the most deeply embedded head.

(19)	*Underlying*	*Surface*	*Gloss*
	naga-π-[kuro-π-[hako-π-ɸuta]]	naga-kuro-hako-buta	long black lids for boxes
	k^{j}uu-π-[ʃiro-π-[saka-π-kura]]	k^{j}uu-ʃiro-saka-gura	old white alcohol cellar
	nise-π-[kami-π-[tana-π-tsukuri]]	nise-kami-tana-zukuri	fake shelf making by god

As demonstrated in (20), the parallel analysis erroneously predicts optionality. The head of a whole compound is occupied by a complex compound, and the head contains two π morphemes. Simultaneous realization of both morphemes results in violation of π^2_{Hd}. Well-formedness is the same whichever π is realized in the surface representation, so two possible surface forms are obtained, contrary to fact.

(20)

		/naga-π-[kuro-π-hako-π-ɸuta]/	$*\pi^2_{Hd}$	MAX-π	*FLOAT-π	IDENT-IO[voi]
a.		naga-π-[kuro-bako-buta]	*!		*	**
b.		naga-π-[kuro-hako-π-ɸuta]		*	**!	
c.		naga-π-[kuro-π-hako-ɸuta]		*	**!	
d.		naga-π-[kuro-bako-π-ɸuta]	*!		**	*
e.		naga-π-[kuro-π-hako-buta]	*!		**	*
f.	☞	naga-π-[kuro-bako-ɸuta]		*	*	*
g.	☞	naga-π-[kuro-hako-buta]		*	*	*

The analysis presented in (20) ignores the internal morphological structure of the head. In order to distinguish (20f) and (20g), one may assume that the whole morphological structure is visible and that there is some constraint that favors realization of the most deeply embedded π. Wolf (2008) makes this line of suggestion. However, it is no more than a stipulation that the deeper a morpheme is embedded, the more likely it is to be realized in the surface representation. It is likely that there is no principled connection between morpheme realization and the degree of embeddedness. The constraint that makes such a connection will be a restatement of Otsu's (1980: 219) Right Branch Condition that sequential voicing applies when the potential target is placed in a head position at the lowest level of a compound. The Right Branch Condition follows from Ito and Mester's (1986) and my cyclic accounts.

The LPM-OT analysis avoids optionality. The tableaux presented in (21)-(23) illustrate cycles 2-4. On the second cycle, the deepest head (i.e., /ɸuta/) undergoes sequential voicing. In the later cycles, no more sequential voicing is tolerated because it leads to violation of undominated $*\pi^2_{Hd}$. The locus of sequential voicing is fixed on the second cycle, so no optionality arises.

(21)

		/hako-π-ɸuta/	$*\pi^2_{Hd}$	MAX-π	*FLOAT-π	IDENT-IO[voi]
a.		hako-π-ɸuta			*!	
b.		hako-ɸuta		*!		
c.	☞	hako-buta				*

(22)

		/kuro-π-[hako-buta]/	$*\pi^2_{Hd}$	MAX-π	*FLOAT-π	IDENT-IO[voi]
a.	☞	kuro-π-[hako-buta]			*	
b.		kuro-[bako-buta]	*!			*
c.		kuro-[bako-ɸuta]		*!		**

(23)

		/naga-π-[kuro-π-hako-buta]/	$*\pi^2_{Hd}$	MAX-π	*FLOAT-π	IDENT-IO[voi]
a.		naga-π-[kuro-π-hako-buta]	*!		**	
b.	☞	naga-π-[kuro-hako-buta]		*	*	
c.		naga-[guro-hako-buta]	*!	*		*

6. Against other serial approaches

Besides LPM-OT, there are other serial models proposed in earlier studies. One is transderivational OO-correspondence (Benua 1997). In (5b), the heads are compounds with independent word status. The intuition is that the output forms of the head compounds are inherited by the complex compounds.

Suppose that the head compounds in (5b) serve as the bases that IDENT-OO[voi] makes reference to. As illustrated in (24), this alternative analysis succeeds in (5b).

(24)

		/nuri-π-[kasa-π-ire]/ *Base*: [kasa-π-ire]	IDENT-OO[voi]	MAX-π	*FLOAT-π	IDENT-IO[voi]
a.	☞	nuri-π-[kasa-π-ire]			**	
b.		nuri-[gasa-π-ire]	*!		*	*
c.		nuri-[gasa-ire]	*!	*		*

As pointed out by Ito and Mester (2003), however, this analysis has a fundamental difficulty. Bases referred to by Ident-OO[voi] are in principle not restricted to compounds. Lexical items also qualify as bases. Given that simple compounds consist of two lexical items, the OO-faithfulness approach predicts the absence of sequential voicing in Japanese, contrary to fact.

There are two recent serial OT models called Harmonic Serialism (McCarthy 2007b, 2008a, b) and OT-CC (McCarthy 2007a; Wolf 2008). Gradualness and harmonic ascent are two hallmarks of the two theories. Gradualness dictates that *Gen* can apply only one change at a time (i.e., only one faithfulness violation is tolerated), and harmonic ascent requires that each derivational step increase phonological harmony against a given constraint hierarchy. LPM-OT does not assume these requirements, so LPM-OT and the other two serial models are significantly different. I argue below that Harmonic Serialism and OT-CC are not able to explain the data in (19).

Wolf (2008) argues that a morphological operation counts as one gradual step. Compounding is at issue here, so let us assume X as the constraint that favors compounding. If *Float-π outranks X, no compound is expected because compounding is accompanied by insertion of not-yet-realized π. Then, it follows that X must be ranked over *Float-π. There are three ranking ramifications in this case. They are summarized in (25).

(25) a. X » $*\pi^2_{Hd}$ » Max-π » *Float-π » Ident-IO[voi]
b. $*\pi^2_{Hd}$ » X » Max-π » *Float-π » Ident-IO[voi]
c. $*\pi^2_{Hd}$ » Max-π » X » *Float-π » Ident-IO[voi]

Let us consider Harmonic Serialism first. The compounds in (19) are triple-layered. I assume that a violation of X is assigned for each missing layer. (26)-(28) demonstrate passes 2-4 under (25a). The input of pass 4 contains two π morphemes, so there are two ways for satisfying $*\pi^2_{Hd}$. If (28b) is opted, [naga-π-kuro-hako-buta] emerges on pass 5, realizing π before /ɸuta/. This output is selected again on pass 6, reaching convergence. If (28c) is picked, [naga-π-kuro-bako-ɸuta] wins on pass 5, realizing π before /hako/. No more harmonic improvement can be accomplished, so the derivation converges on pass 6. Thus, optionality is expected, contrary to fact. The same problem as the parallel approach arises.

(26)

	/hako-π-ɸuta/	X	$*\pi^2_{Hd}$	Max-π	*Float-π	Ident
a.	hako-π-ɸuta	**!			*	
b.	hako-buta	**!				*
c. ☞	kuro-π-[hako-π-ɸuta]	*			**	

(27)

	/kuro-π-[hako-π-ɸuta]/	X	$*\pi^2_{Hd}$	Max-π	*Float-π	Ident
a.	kuro-π-[hako-π-ɸuta]	*!			**	
b.	kuro-π-[hako-buta]	*!			*	*
c.	kuro-[bako-π-ɸuta]	*!	*		*	*
d. ☞	naga-π-[kuro-π-hako-π-ɸuta]		*		***	

(28)

	/naga-π-[kuro-π-hako-π-ɸuta]/	X	$*\pi^2_{Hd}$	Max-π	*Float-π	Ident
a.	naga-π-[kuro-π-hako-π-ɸuta]		*!		***	
b. ☞	naga-π-[kuro-hako-π-ɸuta]			*	**	
c. ☞	naga-π-[kuro-π-hako-ɸuta]			*	**	

The optionality problem does not emerge with the ranking in (25b), but a new problem comes out with this constraint hierarchy. The tableaux in (29)-(31) illustrate passes 2-4. A problem arises on pass 4. Given that $*\pi^2_{Hd}$ is undominated, multiple (exponents of) π morphemes are not allowed in the head. The optimal status of (31a) means convergence of the derivation since (31a) does not add any change to its input. The crucial observation here is that the ranking in (25b) does not generate complex compounds headed by a complex compound. The same observation holds of (25c) since obedience to $*\pi^2_{Hd}$ is more important than constructing a whole compound. (25b) and (25c) do not lead to optionality, but complex compounds comprising four or more lexical words are not produced.

(29)

	/hako-π-ϕuta/	$*\pi^2_{Hd}$	X	MAX-π	*FLOAT-π	IDENT
a.	hako-π-ϕuta		**!		*	
b.	hako-buta		**!			*
c. ☞	kuro-π-[hako-π-ϕuta]		*		**	

(30)

	/kuro-π-[hako-π-ϕuta]/	$*\pi^2_{Hd}$	X	MAX-π	*FLOAT-π	IDENT
a.	kuro-π-[hako-π-ϕuta]		*		**!	
b.	kuro-[hako-π-ϕuta]		*	*!	*	
c. ☞	kuro-π-[hako-buta]		*		*	*
d.	kuro-[bako-π-ϕuta]	*!	*		*	*
e.	naga-π-[kuro-π-hako-π-ϕuta]	*!			***	

(31)

	/kuro-π-[hako-buta]/	$*\pi^2_{Hd}$	X	MAX-π	*FLOAT-π	IDENT
a. ☞	kuro-π-[hako-buta]		*		*	
b.	kuro-[hako-buta]		*	*!		
c.	naga-π-[kuro-π-hako-buta]	*!			**	

OT-CC fails too. The tableau in (32) shows violations of relevant forms, not a competition.

(32)

	/ϕuta/	X	$*\pi^2_{Hd}$	MAX-π	*FLOAT-π	IDENT
a.	ϕuta	***				
b.	hako-π-ϕuta	**			*	
c.	hako-buta	**				*
d.	kuro-π-[hako-π-ϕuta]	*			**	
e.	kuro-π-[hako-buta]	*			*	*
f.	naga-π-[kuro-π-hako-π-ϕuta]		*		***	
g.	naga-π-[kuro-hako-π-ϕuta]			*	**	
h.	naga-π-[kuro-π-hako-ϕuta]			*	**	
i.	naga-π-[kuro-π-hako-buta]		*		**	*
j.	naga-π-[kuro-bako-π-ϕuta]		*		**	*
k.	naga-π-[kuro-hako-buta]			*	*	*
l.	naga-π-[kuro-bako-ϕuta]			*	*	*

In OT-CC, each chain begins with a fully faithful candidate. In addition, gradualness and harmonic ascent must be respected within a chain. Then, valid chains are limited. They are encapsulated in (33). Under the ranking in (25a), two different outputs are yielded out of the six legitimate chains (i.e., (32k) and (32l)). OT-CC encounters the same problem as parallelism and Harmonic Serialism.

(33)

Valid chains	*Outputs*
(32a) → (32b) → (32c) → (32e) → (32i) → (32k)	naga-π-[kuro-hako-buta]
(32a) → (32b) → (32d) → (32e) → (32i) → (32k)	naga-π-[kuro-hako-buta]
(32a) → (32b) → (32d) → (32f) → (32g) → (32k)	naga-π-[kuro-hako-buta]
(32a) → (32b) → (32d) → (32f) → (32h) → (32l)	naga-π-[kuro-bako-ϕuta]
(32a) → (32b) → (32d) → (32f) → (32i) → (32k)	naga-π-[kuro-hako-buta]
(32a) → (32b) → (32d) → (32f) → (32j) → (32l)	naga-π-[kuro-bako-ϕuta]

Like Harmonic Serialism, OT-CC cannot produce a complex compound with a complex compound as its head under the ranking in (25b). (35) shows that there is no valid chain that reaches the actual output (i.e., (34k)). The problem here is the same as Harmonic Serialism. Once a fourth lexical word is compounded, the head contains two π morphemes. But the cooccurrence of multiple π morphemes is disallowed by undominated $*\pi^2_{Hd}$. The same observation holds of (25c) because $*\pi^2_{Hd}$ outranks X.

(34)

	/ɸuta/	$*\pi^2_{Hd}$	X	MAX-π	*FLOAT-π	IDENT
a.	ɸuta		***			
b.	hako-π-ɸuta		**		*	
c.	hako-buta		**			*
d.	kuro-π-[hako-π-ɸuta]		*		**	
e.	kuro-π-[hako-buta]		*		*	*
f.	naga-π-[kuro-π-hako-π-ɸuta]	*			***	
g.	naga-π-[kuro-hako-π-ɸuta]			*	**	
h.	naga-π-[kuro-π-hako-ɸuta]			*	**	
i.	naga-π-[kuro-π-hako-buta]	*			**	*
j.	naga-π-[kuro-bako-π-ɸuta]	*			**	*
k.	naga-π-[kuro-hako-buta]			*	*	*
l.	naga-π-[kuro-bako-ɸuta]			*	*	*

(35)

Invalid chains	*Remarks*
(34a) → (34b) → (34c) → (34e) → *(34i)	(34i) does not improve harmony.
(34a) → (34b) → (34d) → (34e) → *(34i)	(34i) does not improve harmony.
(34a) → (34b) → (34d) → *(34f)	(34f) does not improve harmony.

In summary, Harmonic Serialism and OT-CC expect optionality with (25a), and they do not create complex compounds consisting of four or more lexical words with the rankings in (25b) and (25c).

7. Conclusion

The contrastive behavior of left-branching and right-branching compounds is successfully analyzed with LPM-OT. Covert voicing features are crucial in the cyclic analysis. Other analyses, either serial or parallel, are not able to provide a satisfactory account of sequential voicing.

References

Benua, Laura (1997) *Transderivational identity: phonological relations between words*. Doctoral dissertation. University of Massachusetts, Amherst.

Ito, Junko and Armin Mester (1986) The phonology of voicing in Japanese: theoretical consequences for morphological accessibility. *Linguistic Inquiry* 17. 49-73.

Ito, Junko and Armin Mester (2003) *Japanese morphophonemics: markedness and word structure*. Cambridge, Massachusetts: The MIT Press.

Ito, Junko, Armin Mester, and Jaye Padgett (1995) Licensing and underspecification in Optimality Theory. *Linguistic Inquiry* 26. 571-614.

Kiparsky, Paul (2000) Opacity and cyclicity. *The Linguistic Review* 17. 351-365.

Kurisu, Kazutaka (2001) *The phonology of morpheme realization*. Doctoral dissertation. University of California, Santa Cruz.

Kurisu, Kazutaka (2006) Theoretical implications of mimetic voicing in Japanese. In Timothy Vance and Kimbery Jones (eds.). *Japanese/Korean Linguistics* 14. 51-62.

McCarthy, John (2007a) *Hidden generalizations: phonological opacity in Optimality Theory*. London: Equinox.

McCarthy, John (2007b) Restraint of analysis. In Sylvia Blaho, Patrik Bye, and Martin Krämer (eds.) *Freedom of Analysis*. Berlin and New York: Mouton de Gruyter. 203-231.

McCarthy, John (2008a) The gradual path to cluster simplification. *Phonology* 25. 271-319.

McCarthy, John (2008b) The serial interaction of stress and syncope. *Natural Language and Linguistic Theory* 26. 499-549.

McCawley, James (1968) *The phonological component of a grammar of Japanese*. The Hague: Mouton.

Nasu, Akio (1999) Voicing in onomatopoeia and the markedness of [p]. *Journal of the Phonetic Society of Japan* 3. 52-66.

Otsu, Yukio (1980) Some aspects of Rendaku in Japanese and related problems. In Yukio Otsu and Ann Farmer (eds.). *Theoretical Issues in Japanese Linguistics* [*MIT Working Papers in Linguistics* 2]. 207-228.

Prince, Alan and Paul Smolensky (2004) *Optimality Theory: constraint interaction in generative grammar*. Malden, Massachusetts: Blackwell Publishing.

Vance, Timothy (1987) *An introduction to Japanese phonology*. Albany, New York: State University of New York Press.

Wolf, Matthew (2008) *Optimal interleaving: serial phonology-morphology interaction in a constraint-based model*. Doctoral dissertation. University of Massachusetts, Amherst.

Proceedings of the 29th West Coast Conference on Formal Linguistics

edited by Jaehoon Choi, E. Alan Hogue, Jeffrey Punske, Deniz Tat, Jessamyn Schertz, and Alex Trueman

Cascadilla Proceedings Project Somerville, MA 2012

Copyright information

ISBN 978-1-57473-451-5 library binding

Ordering information

Orders for the library binding edition are handled by Cascadilla Press.
To place an order, go to www.lingref.com or contact:

Cascadilla Press, P.O. Box 440355, Somerville, MA 02144, USA
phone: 1-617-776-2370, fax: 1-617-776-2271, sales@cascadilla.com

Web access and citation information

This entire proceedings can also be viewed on the web at www.lingref.com. Each paper has a unique document # which can be added to citations to facilitate access. The document # should not replace the full citation.

This paper can be cited as:

Kurisu, Kazutaka. 2012. Visibility of Covert Voicing Feature in Serialism. In *Proceedings of the 29th West Coast Conference on Formal Linguistics*, ed. Jaehoon Choi et al., 134-142. Somerville, MA: Cascadilla Proceedings Project. www.lingref.com, document #2696.