Rendaku and Morphological Correspondence*

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ABSTRACT. In Japanese compounding, *rendaku* (sequential voicing) is not equally applicable to every Yamato morpheme; there are several morphemes that are lexically immune to this operation even if phonological context allows it. Interestingly enough, such morphemes undergo *rendaku* in reduplication. In this article, I argue for morphological correspondences that are crucial in the investigation of the applicability of *rendaku* within the framework of Optimality Theory. I point out that Output-Output faithfulness constraints that require phonological identity between morphologically related words give a plausible account for the problem. The difference in the application of *rendaku* between normal compounds and reduplicated forms arises from the two distinct morphological structures and the Base-Reduplicant faithfulness constraint that is ranked relatively low in constraint ranking.

Keywords: *rendaku*, compounding, reduplication, Optimality Theory, Correspondence Theory

1. Facts: The Application of Rendaku in Yamato Japanese

*Rendaku* is one of the most well-known phonological phenomena in Japanese. Many theoretical developments in Japanese phonology have been achieved through studying this topic (Ito and Mester (1986, 1998, 2003), Rosen (2003), among many others). In this article, I analyze (non)application of *rendaku* in several types of compounds and point out that morphological correspondences (McCarthy and Prince (1995), Benua (1997), Ito and Mester (1997)) play a crucial role in this morpho-phonological operation.

It has been argued that the Japanese vocabulary can be classified into several strata, each of which is independently governed by stratum-specific phonology (McCawley (1968), Ito and Mester (1995ab, 1999), among others). *Rendaku*, one of such stratum-specific operations, is basically found in the Yamato (native Japanese) vocabulary. The following are examples of morphemes that undergo *rendaku*:

\[
\begin{align*}
\text{tana} & \; \text{‘shelf’} & \text{kami-dana} & \; \text{‘god’s shelf, altar’} \\
\text{kokoro} & \; \text{‘mind’} & \text{sita-gokoro} & \; \text{‘secret desire’} \\
\text{sao} & \; \text{‘pole’} & \text{hata-zao} & \; \text{‘flag pole’}
\end{align*}
\]

The initial segment of the second member in a compound that is originally a voiceless obstruent becomes voiced as a result of *rendaku*. I call such morphemes *rendaku*-undergoers.\(^1\)

It is well known that this operation is obstructed by the OCP effect on voicing (also known as Lyman’s Law: Ito and Mester (1986, 1998, 2003) among others). Consider the following examples:

(2) hada ‘skin’  same-hada, *same-bada ‘sharkskin’
sode ‘sleeve’  naga-sode, *naga-zode ‘long sleeve’
kotoba ‘word’  onna-kotoba, *onna-gotoba ‘women’s language’

If the second member in a compound already contains a voiced obstruent, *rendaku* is impossible.

Not every member of this lexical class is subject to *rendaku* even if it meets the phonological condition illustrated above. It is reported that there is a group of morphemes that never undergo *rendaku* in normal compounds although they are regarded as Yamato morphemes (Martin (1987), Vance (1987), Rosen (2003)). Examples are shown below.

(3) hasi ‘edge’  kire-hasi, *kire-basi ‘cutting piece’
saki ‘destination’  tabi-saki, *tabi-zaki ‘travel destination’
simo ‘lower’  kawa-simo, *kawa-zimo ‘downstream’
sumi ‘corner’  kata-sumi, *kata-zumi ‘obscure corner’
kemuri ‘smoke’  tuti-kemuri, *tuti-gemuri ‘cloud of dust’

Although these examples satisfy the phonological condition of *rendaku*, it does not occur through compounding. I call such morphemes *rendaku*-immunes. Note that there is no overt phonological or morphological reason that obstructs the application of *rendaku* in these compounds; that is, they are lexically immune to *rendaku*.

A puzzling fact is that such *rendaku*-immunes undergo *rendaku* in reduplication (Nishimura (2004), Vance (2006)). Many Yamato morphemes reduplicate themselves to emphasize their meaning or enhance their quantity. As shown in (4), the second part of reduplicated forms undergoes *rendaku* if it meets the phonological condition, that is, its initial segment is voiceless and it does not originally contain any voiced obstruent.

(4) hanare ‘separation’  hanare-banare ‘separated from each other’
tuki ‘month’  tuki-duki ‘monthly’
kuro ‘black’  kuro-guro ‘pitch-black’

As with normal compounds, *rendaku* is blocked by the OCP effect on obstruent voicing as shown below.

(5) hodo ‘limit’  hodo-hodo, *hodo-bodo ‘moderate’
tugi ‘next’  tugi-tugi, *tugi-dugi ‘in succession’
kazu ‘number’  kazu-kazu, *kazu-gazu ‘various, many’

Interestingly enough, the *rendaku* immunity of particular morphemes shown in (3) is overridden in this morphological operation in contrast to normal compounding. Consider the following:

(6) hasi ‘edge’  hasi-basi ‘every edge’
saki ‘destination’  saki-zaki ‘every destination’
simo ‘lower’  simo-zimo ‘the lower classes’
sumi ‘corner’  sumi-zumi ‘every corner’

The morphemes shown above resist *rendaku* in normal compounding as shown in (3), but they are voiced in reduplication as in (6). It should be concluded that the force of *rendaku*
voicing in reduplication is stronger than that in normal compounding.\textsuperscript{2, 3}

Now, we have to answer two questions: (i) What causes the contrast between \textit{rendaku}-undergoers in (1) and \textit{rendaku}-immunes in (3)? (ii) Why do \textit{rendaku}-immunes undergo \textit{rendaku} in reduplication as in (6)? In the following sections, it is claimed that the theory of morphological correspondences (McCarthy and Prince (1995), Benua (1997), Ito and Mester (1997)) convincingly answers these questions.

2. Theoretical Analysis

2.1. \textit{Rendaku} and Output-Output Correspondence

In this section, I illustrate the (non)applicability of \textit{rendaku} in Yamato morphemes illustrated in the previous section under the framework of Optimality Theory (OT: Prince and Smolensky (1993)). I propose that the difference between the two classes is due to the effect of Output-Output (OO) faithfulness constraints (Benua (1997), Ito and Mester (1997)), which require phonological identity between two morphologically related words.

2.1.1. Rejecting the Input-Output Faithfulness Approach

Before discussing on the OO faithfulness theory, let us consider one alternative proposal to this problem, that is, the relativized Input-Output (IO) faithfulness approach (Fukazawa, Kitahara, and Ota (1998), Ito and Mester (1999)). Relativization of IO faithfulness constraints is one of the established ways to explain phonological diversity within a grammar. For example, suppose the two groups in the Yamato vocabulary, \textit{rendaku}-immunes and \textit{rendaku}-undergoers, possess an IO faithfulness constraints, namely \textsc{Ident-IO-YAMATO}\textsubscript{I} and \textsc{Ident-IO-YAMATO}\textsubscript{II}. When they sandwich a constraint that causes \textit{rendaku} realization in the constraint ranking of Japanese, the diversity in the application of \textit{rendaku} shown above is formally described.

It is true that this approach is at least descriptively adequate to the problem we are tackling. I claim, however, that this approach is too strong to investigate the entire lexical structure of Japanese accurately. The striking fact is that there is no phonological and morphological difference between the two groups except for the application of \textit{rendaku}. Normally, lexical strata that are assumed to possess distinct sets of stratum-specific IO faithfulness constraints behave differently from each other in several respects, such as phonological inventories, accentuation, morpheme sizes, the selection of epenthetic segments, and word formations (McCawley (1968), Ito and Mester (1995ab, 1999), among others). If \textit{rendaku}-immunes and \textit{rendaku}-undergoers compose different sub-strata of the Japanese vocabulary, it naturally follows that they behave differently in various respects as well as in the application of \textit{rendaku}. However, there is no evidence that shows such differences in their phonological behaviors. Why do the two groups in the Yamato vocabulary lack any diversity except for the application of \textit{rendaku}? I believe it is impossible to solve this question in an explanatorily explicit way under the relativized IO faithfulness approach.

In the relativized OO faithfulness approach, which we will argue for in detail in the
following subsections, while the two Yamato morpheme groups shown in (1) and (3) share the same set of IO faithfulness constraints, each of them independently belongs to different categories for OO correspondence. In contrast to categorization in the relativized IO faithfulness theory, this categorization for OO correspondence does not yield any systematic diversity in the simple words because it works only when some morphological operations take place. Therefore, the absence of diversity in simple forms between the two Yamato groups is theoretically predicted.

2.1.2. Simple Compounds

As the source of voicing in *rendaku*, I assume that a voicing feature ‘\( \nu \)’ is automatically inserted in compounding, following Rosen (2003). Phonological realization of this feature is guaranteed by a faithfulness constraint $\text{MAX}(\text{voice})$; when this constraint is satisfied, *rendaku* takes place in the compound, and when it is violated, this operation is blocked.

$\text{IDENT}$ is a faithfulness constraint that requires identical feature specification in segments between two entities in some correspondence. An OO correspondence version of this constraint guarantees the phonological identity between two morphologically related words. In this article, it is claimed that there is an OO correspondence between the component of a compound and an independently existing word that consists of the same morphemes. For example, the simple word *saki* ‘destination’ and the second morpheme of the compound *tabi-saki* ‘travel destination’ are theoretically connected in this sense.

As mentioned above, each of the two Yamato groups, *rendaku*-immunes and *rendaku*-undergoers, belongs to a different category of OO correspondence. The former is a component of Category I and the latter of Category II. The OO voicing faithfulness constraint for Category I ($\text{IDENT-OOI}(\text{voice})$) outranks $\text{MAX}(\text{voice})$, and that for Category II ($\text{IDENT-OOII}(\text{voice})$) is dominated by this constraint. $\text{IDENT-IO}(\text{voice})$, which bans any changes of voicing in underlying specification at the output level, is also dominated by $\text{MAX}(\text{voice})$. Overall ranking is shown in (7).

\[
\text{IDENT-OOI}(\text{voice}) \gg \text{MAX}(\text{voice}) \gg \text{IDENT-IO}(\text{voice}), \text{IDENT-OOII}(\text{voice})
\]

Tableaux (8) and (9) below show how this constraint ranking works in the (non)application of *rendaku*. The Yamato morpheme *saki* ‘destination’ is a *rendaku*-immune morpheme, therefore it is a member of Category I. As the OO faithfulness constraint for this category dominates $\text{MAX}(\text{voice})$, which requires realization of *rendaku*, this operation is blocked as shown in (8).

\[
\begin{array}{|c|c|c|c|}
\hline
/\text{tabi+}\nu+\text{saki}_{\text{category I}}/ & \text{IDENT-OOI} & \text{MAX}(\text{voice}) & \text{IDENT-IO} & \text{IDENT-OOII} \\
\hline
\text{Base: [saki]} & & & & \\
\hline
\text{a. } \rightarrow \text{tabi-saki} & * & & NA & \\
\hline
\text{b. } \text{tabi-zaki} & *! & * & & NA \\
\hline
\end{array}
\]

On the other hand, a *rendaku*-undergoer *tana* ‘shelf’ belongs to Category II and its OO faithfulness constraint is dominated by $\text{MAX}(\text{voice})$. Therefore, in spite of a violation of the
OO constraint, *rendaku* takes place when it is the second member of a compound, as shown in (9).

<table>
<thead>
<tr>
<th></th>
<th>IDENT-OOI</th>
<th>MAX(voice)</th>
<th>IDENT-IO</th>
<th>IDENT-OOII</th>
</tr>
</thead>
<tbody>
<tr>
<td>/kami+v+ta<em>na</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base: [tana]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. kami-tana</td>
<td>NA</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. kami-dana</td>
<td>NA</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

In this way, the difference in the application of *rendaku* between *rendaku*-immunes and *rendaku*-undergoers illustrated in the first section is theoretically explained.

2.1.3. Complex Compounds

The idea that *rendaku* is blocked by an OO correspondence constraint in some morphological contexts has already been proposed by Ito and Mester (2003). They tentatively suggest a similar proposal to explain the branching condition of *rendaku* in complex compounds. As Otsu (1980) points out, *rendaku* applicability in complex compounds depends on the morphological structure of the word. More concretely, while *rendaku* is possible in the morpheme in a left-branching structure, it is blocked in a right-branching structure. Two complex compounds, *nise*-{*kami-dana*} ‘fake altar’ in (10a) and {*nise-gami*}-*dana* ‘altar of the fake god’ in (10b) clearly show this contrast. The applicability of *rendaku* in the second morpheme *kami/gami* depends on the morphological structures of the compounds.

In Ito and Mester’s account, this difference is theoretically explained by the (non)existence of OO correspondence between each of the complex compounds and the simple compound that is a component of one of the two complex compounds. Schema (10) illustrates the relationship among the three.

(10)  

An OO correspondence is established between (10a) and (10c), the latter of which is an independently existing compound and shares morphemes with the head compound of (10a). At the same time, there is no such relationship between (10b) and (10c) because the former does not contain the latter as a morphological component.

I claim that unlike the simple words in (8) and (9), compounds do not contain any lexical specification of OO categorization since they are derived words, not lexical entries. In such cases, specification of Category I is automatically given by the grammar as the default specification. Consider the following tableau:
Rendaku in the second morpheme kami, which is in the left branch, is blocked by IDENT-OOI(voice). On the other hand, because there is no such OO correspondence between compounds such as (10b) and (10c), rendaku is not obstructed in the morpheme in the right branch.

2.2. Rendaku in Reduplication and BR Correspondence

Finally, I analyze rendaku in reduplication. As illustrated above, the application of rendaku in reduplication is not the same as that in normal compounding. In this type of reduplication, the second member always undergoes rendaku if it meets the phonological conditions ignoring the lexical immunity to rendaku in rendaku-immunes as shown in (7). To explain this difference, we must draw attention to two factors. One is Base-Reduplicant (BR) correspondence, which is specific to reduplication (McCarthy and Prince (1995)), and the other is the morphological structure of the reduplicated forms.

BR correspondence is a phonological relationship between the morphological head (base) and the reduplicant in a reduplicated form. The BR faithfulness constraints require phonological identity between these two components. I suggest that the BR faithfulness constraint for voicing is dominated by MAX(voice) in constraint ranking of Japanese so that it cannot obstruct voicing in reduplication.

The difference in morphological structure is also crucial. With a head morpheme and a reduplicant (RED), two structures are possible: the head-final structure in (12a) and the head-initial structure in (12b).

(12) a. head-final structure  b. head-initial structure

\[
\begin{array}{c}
\text{RED} \quad \text{saki} \\
\text{saki} \quad \text{RED}
\end{array}
\]

In normal Japanese compounding, the morphological head occupies the final position except for special cases. I claim, however, that the head-initial structure (12b) is correct for this type of reduplication.8,9

These two differences correctly accounts for the application of rendaku in reduplication. Consider the following tableau: 10
(13)

<table>
<thead>
<tr>
<th>/saki\textsubscript{category} + v + RED/</th>
<th>IDENT-OO\textsubscript{t}</th>
<th>MAX(voice)</th>
<th>IDENT-IO</th>
<th>IDENT-BR</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. saki-saki</td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. \textasciitilde saki-zaki</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>c. zaki-zaki</td>
<td>*!</td>
<td></td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

It should be noted that the OO correspondence we have discussed above is not violated in this case. What is subject to \textit{rendaku} is not the morpheme that corresponds to the base but the reduplicant. Then, let us put the head-final structure in (12a) to the test. Consider the following tableau:

(14)

<table>
<thead>
<tr>
<th>/RED + v + saki\textsubscript{category} l/</th>
<th>IDENT-OO\textsubscript{t}</th>
<th>MAX(voice)</th>
<th>IDENT-IO</th>
<th>IDENT-BR</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. saki-saki</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. saki-zaki</td>
<td>*!</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c. zaki-zaki</td>
<td>*!</td>
<td></td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

Although candidate (b) is the correct output, candidate (a), in which voicing does not occur, would be incorrectly singled out as optimal. Note that permutation of these constraints is useless for picking out the correct output as candidate (b) is harmonically bound by candidate (c). Accordingly, with any hierarchy of these constraints, candidate (b) is defeated by candidate (c). The correct form would never come to the surface if one assumed the head-final structure as input forms.\textsuperscript{11}

3. Summary

This article has shown that morphological correspondence is crucial in investigating the (non)application of \textit{rendaku} in Yamato morphemes within the framework of OT. The applicability of \textit{rendaku} is plausibly explained by the constraint ranking with OO faithfulness constraints, which require phonological identity between the component of compounds and simple words. In this approach, morpho-phonological phenomena are clearly distinguished from phonological characteristics in simple words because this type of correspondence is established only when some morphological operations occur. As argued in 2.1.1., relativization of IO faithfulness constraints is problematic for this issue. The difference between \textit{rendaku} in normal compounding and that in reduplication arises from their morphological structures and the BR faithfulness constraint, which ranks relatively low in constraint ranking of Japanese.

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Notes
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1 Rosen (2003) further classifies members of this group into two subgroups, namely rendaku-resisting morphemes and nonresistant morphemes. While nonresistant morphemes always undergo rendaku in compounds, rendaku-resisters block it in short (shorter than $2\mu+2\mu$) compounds, but are voiced in long compounds. In this article, I ignore this difference as space is limited.

2 It should be noted that Rosen’s (2003) classification within rendaku-undergoers is also overridden in this respect. For example, kusa ‘grass’ normally resists rendaku in $2\mu+2\mu$ compounds as in ao-kusa ‘green grass,’ but are voiced in reduplication as in kusa-gusa ‘all kinds of grasses.’

3 I have found three exceptions to this generalization: kore-kore ‘such and such,’ kaku-kaku in kaku-kaku sika-zika ‘such and such,’ and tu-tu ‘every port’ in tu-tu ura-ura ‘all over the country.’ The last example has a voiced variant tu-zu ura-ura.

4 I suppose that these two categories of OO correspondence are not specific to Yamato but general to the entire Japanese vocabulary. The application of rendaku in several Sino-Japanese words (e.g., kabusiki-gaisha ‘stock company’ < kaisha) is accounted for if such words are members of Category II. It should be noted that in such cases, they are treated as lexical items although they are originally compounds.

5 In their final analysis, Ito and Mester reject their OO correspondence approach for the branching condition of rendaku for two reasons. The first reason is that this approach would incorrectly block rendaku on rendaku-undergoers in simple compounds. In my proposal, the relativization of OO faithfulness under discussion solves this problem. As the second reason, they suggest that it is unclear how the existence of bases in speakers’ knowledge is guaranteed. I claim, however, that native speakers’ intuition about the morphological relationship between the base and the compound at issue is firmly reliable even though they do not know the meaning of the base. I believe information about the base is provided by such native speakers’ strong productivity of compounds.

6 It seems reasonable to suppose that a category for the highest-ranked faithfulness constraint serves as the default in Correspondence Theory. Consider nonsense words, for example: they lack any specifications about lexical category and often behave similarly to loanwords, which
form the most faithful class in Japanese.

Haruo Kubozono and an anonymous reviewer have pointed out the branching condition also plays an important role in accentuation and it is debatable whether this approach is consistent with accentuation of complex compounds in Japanese. This issue remains open to future investigation.

Contrary to this view, Kurafuji (2002) assumes that input of Yamato reduplication is head-final.

Note that in this section, I limit the focus of my analysis to the reduplication pattern in Yamato. The proposal here does not imply that other types of reduplication in Japanese (such as mimetic words) are also head-initial. Their morphological structures should be discussed separately according to their behaviors. It is possible that phonological and morphological variations among reduplication patterns in this language are due to differences in their morphological structures.

Note that “Base” in the following two tableaux does not mean the head of the reduplicated forms but the independently existing simple word. The OO faithfulness constraint bans phonological disparities between the simple word and the head of the reduplicated form.

Changing the definition of BR correspondence can be an alternative solution to this problem (Spaelti (1997), Struijke (1998)). I leave the investigation in this line open to further study.

References


