

Rendaku in Syntax-Phonology Interface: A Corpus Study on Deverbal Noun Compounds*

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1 Introduction

In Japanese, when two words are combined to make a compound, the initial voiceless consonant of the second word sometimes becomes voiced. This phenomenon is called *rendaku*.¹ Otsu (1980) defines *rendaku* as in (1):

- (1) C(onsonant) \rightarrow [+voice] / [N X [# _ Y
where (i) X \neq null and
(ii) Y does not contain any voiced obstruent²

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¹ *Rendaku* means, and often is translated as 'sequential voicing', but in this paper I use the term *rendaku* following most of the references.

² (1ii) denotes Lyman's Law, which is discussed in Section 2.
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To expound, (1) claims that in a compound, a voiceless consonant which occurs right after the word boundary becomes voiced. Examples of *rendaku* are shown in (2a-b). In the rest of this paper, Word 1 (W1) and Word 2 (W2) refer to the first member and the second member of a compound, respectively. A hyphen indicates a boundary between the combined words.

- (2) a. W1: *hosi* ‘star’ + W2: *sora* ‘sky’ = *hosi-zora* ‘starry sky’
 b. W1: *te* ‘hand’ + W2: *tukuri* ‘making’ = *te-dukuri* ‘handmade’

However, *rendaku* does not necessarily occur when the condition in (1) is met, as observed in (3), where /t/ is not realized as /d/.

- (3) W1: *kusa* ‘weed’ + W2: *tori* ‘removing’ = *kusa-tori* ‘weeding’

Although many accounts for *rendaku* have been proposed, a number of exceptions to *rendaku* remain unexplained. One reason for that is the fact that the research on *rendaku* has been conducted mainly in the field of phonology, as voicing is involved. In this paper, I investigate *rendaku* in the contemporary Japanese from a morpho-syntactic and semantic perspective, focusing on deverbal noun (DN) compounds, such as (2b) and (3), where W2 is a noun derived from a verb.³

The aim of this research is to examine whether syntactic relations between W1 and W2 affect the occurrence of *rendaku*. For this reason, I focus on DN compounds, in which W2 is always a verb to which W1 is related to in some way. Drawing on a dictionary-based corpus that I created, I argue that more systematic and fine-grained distinctions among the role of W1 than previous studies discussed are necessary. In particular, adjunct-head relationships between W1 and W2 show high frequency of *rendaku*, whereas argument-head relationships between W1 and W2 have a lower tendency to undergo *rendaku*. Based on this finding, I propose modifications of previously proposed constraints and conditions for *rendaku*.

The organization of this paper is as follows. In Section 2, key previous studies on *rendaku* are introduced. Section 3 outlines the methodology for creating the corpus and Section 4 analyzes the result: when W1 is a subject, a direct object or an indirect object of W2, the [+*rendaku*] percentage goes down considerably, compared to other cases. This result led me to modify the previously stated conditions, which is discussed in Section 5. In Section 6, I argue that, other things being equal, *rendaku* in DN compounds is predicted based on grammatical relationship between W1 and W2, as well as the meaning of elemental words and resulting compounds.

³ Japanese DNs are generated by converting a verb into its conjunctive form with a suffix *-i* with a consonant ending verb, as in *tukur-i* in (2b) and *tor-i* in (3) or with no suffix with a vowel ending verb, as in *kae* ‘changing’ or *mi* ‘viewing’.

2 Previous Studies

Many studies have proposed conditions for when rendaku occurs or is blocked. In this section, I will discuss previous studies on rendaku with a special attention to DN compounds. I close this section by pointing out the problems of previous research.

2.1 Lyman's Law

Lyman's Law, as defined in (4) below, is perhaps the best known and most influential generalization on rendaku.

(4) Lyman's Law

In the formation of a Japanese compound, the first consonant of the second component generally gets voiced, when the consonant is voiceless. However, this rule does not apply when the second component contains a [+voice] phoneme (/b/, /d/, /g/, /dʒ/, /p/⁴ and /z/).

(Lyman 1894, Sato and Yokosawa 2018)

Lyman's Law has only a few known exceptions. Suzuki (2004) argues that the only contemporary word that violates the law is *nawa-basigo* 'rope ladder', whose W2 contains a voiced obstruent /g/.

However, Lyman's Law alone leaves a number of exceptions such as (3) unaccounted for. Hence researchers have been looking for other conditions that can account for cases where rendaku does not occur when both (1) and (4) are satisfied.⁵

2.2 Grammatical Relationship between Components of a Compound

Following Kindaichi (1976), subsequent studies such as Okumura (1984) and Sato (1989) (see Suzuki (2009) for a helpful discussion) pointed out that rendaku is less likely to occur when W1 is a subject or object of W2, while it is more likely to occur when W1 has the modifying grammatical relationship with W2.

What is not clear in Suzuki (2009) is how the alleged relationship between W1 and W2 can be defined. We can make these notions precise by considering sentences that correspond to compounds. For example, the compounds *ame-huri* 'rainfall', *ama-go* 'rain-requesting; praying for rain' and *ama-zimeri* 'rain-becoming.wet; being humid because of rain' all have

⁴ Lyman treats /p/ as voiced sound, possibly because it is considered as a "half-voiced" alternation of /h/ in Japanese.

⁵ Another well-known constraint on rendaku is that it does not change the sound in non-native words (see Otsu 1980). Because of this rule, compounds with non-native W2 were not included in the corpus. This is discussed in Section 3.

the same thematic relationship between the components as found in their phrasal/sentential counterparts (5a-c).

- (5) a. ame -ga/*-o/*-ni/*-de/*-kara huru.
rain -NOM/*-ACC/*-DAT/*-by/*-from fall
'Rain falls.'
- b. ame -o/*-ga/*-ni/*-de/*-kara kou.
rain -ACC/*-NOM/*-DAT/*-by/*-from request
'(One) prays for rain.'
- c. ame -de/*-ga/*-o/*-ni/*-kara simeru.
rain -by/*-NOM/*-ACC/*-DAT/*-from become.humid
'It gets humid because of rain.'

Ame in (5a) is the subject of the predicate/verb *huru* 'fall' and appears with a nominative case marker, while *ama* (in a different form, but has the same meaning as *ame*) in (5b) is the object of the transitive verb *kou* 'plea' and appears with an accusative case marker. Accordingly, W1 *ame* in *ame-huri* is classified as "subject", while W1 *ama* in *ama-go* is classified as "object". Followed by the postposition *-de*, *ame* in (5c) provides the reason why it gets humid. Therefore, what Suzuki means by "grammatical relationship" in compounds is the grammatical relationship of W1 and W2 in a corresponding sentence. Moreover, based on the corresponding sentences (5a-c), it is reasonable to analyze that W1 in both *ame-huri* and *ama-go* is an argument of W2, while W1 in *ama-zimeri* is an adjunct of W2. Importantly, *rendaku* fails to take place in (5a) but does take place in (5b-c). Under Suzuki's analysis, nominals in compounds have "grammatical relationship" at some abstract level of representation.

2.3 Suzuki's (2009) List of Conditions

As a wrap-up of previous studies, Suzuki (2009) summarizes the conditions where *rendaku* can be predicted, as in (6).

- (6) Specific Conditions of *Rendaku*
- a. *Rendaku* is less likely to occur when W1 is subjective or objective, yet;
- i. occurs when W1 can be followed by the case marker *-o*, but is not objective
 - ii. occurs when the compound refers to the object created by the action of W2
 - iii. occurs when speakers regard the compound as one word, rather than a combination of two words in grammatical relationship
 - iv. occurs when the DN compound has metaphorical meaning

- v. occurs when the DN compound implies continuing aspect, such that “W1 has (been) W2”
- vi. does not occur when the compound refers to a person who W2s, where W1 is an object of W2
- vii. does not occur when the compound refers to a work or play, where W1 is an object of W2
- viii. does not occur when the compound refers to a living thing
- ix. does not occur when the compound refers to a tool to do W2
- b. Rendaku is more likely to occur when W1 has the modifying grammatical relationship with W2
- c. There are rendaku forms that have different meaning of corresponding non-rendaku form

We will revisit this list after we analyze the findings from the corpus study (Section 5).

2.4 Problems

While the proposals exemplified by Suzuki (2009) suggest many reasonable conditions for rendaku, one major problem of the previous studies is that they provide neither the explanation of how the relationship between W1 and W2 are defined, nor the independent evidence for the classification of W1 categories (e.g., “objective” and “modifying” W1s). In short, how the previous studies define W1 function is ambiguous and could be different between theories.

Another problem is that, while it has been pointed out that subjective relationship, just as objective relationship, has something to do with the lack of rendaku, Suzuki (2009) and other studies focus only on compounds with an object W1 and only a few studies have analyzed the subject-type DN compounds (e.g., Arikawa 2007).

Motivated by these problems, I created a new dictionary-based corpus, which is introduced in Section 3.

3 Developing a Rendaku Corpus

With the problems pointed out above in mind, I conducted a corpus study, aiming to investigate if the grammatical relationship between W1 and W2 of a compound (as discussed above) can help us predict when compounds that obey Lyman’s Law fail to undergo rendaku. This section shows how the corpus for the study was developed.

3.1 Methodology

I collected 2,910 DN compounds in this research. Most of the examples of DN compounds came from *Kojien* (2011), one of the most popular monolingual-Japanese dictionaries. All 2,910 compounds were classified into

three types based on whether (i) rendaku is observed (ii) rendaku is not observed, and (iii) rendaku is optional (i.e. both forms can be found). I also referred to other dictionaries, such as *Daijirin* (2012) and *Digital Daijisen* (2018), only when the description of a word in *Kojien* was inconsistent with my intuition as a native speaker.

3.2 Classification of W1-W2 Relations

The first criterion used to assess the collected DN compounds is whether they follow Lyman's Law. As for the relationship between W1 and W2, I classified compounds based on the grammatical relation that W1 holds with respect to W2, by considering the case/postpositional marker that occurs with W1 in a corresponding sentence. In this way, this study operationalizes W1 classification. The types of grammatical category of W1 used in the analysis are shown in (7). All compounds in the corpus fell into at least one of these categories. Depending on its meaning and corresponding sentence, a compound could be classified into more than two categories.

(7) Types of Grammatical Relationship

- a. Subject (Case marker with W1: *-ga*)
e.g. *kami-kakusi* 'god-hiding; being spirited away'
- b. Direct Object (*-o*)
e.g. *kusa-tori* 'weed-removing; weeding'
- c. Indirect Object (*-ni*)
e.g. *hada-kake* 'skin-putting; blanket'
- d. Path (*-o*; W1 denotes a passing point)
e.g. *yama-goe* 'mountain-crossing; crossing a mountain'
- e. 'in/on/at' (Postpositional marker with W1: *-ni*; refers to time, place and direction)
e.g. *kawa-zoi* 'river-following; alongside river'
- f. 'by' (*-de*; refers to place, time period, reason, means and material)
e.g. *enpitu-gaki* 'pencil-writing; writing in pencil'
- g. 'from' (*-kara*; W1 denotes a starting point)
e.g. *oya-banare* 'parent-leaving; becoming independent from parents'
- h. Adjective/Adverb (adj/adv; no marker; W1 conjugates)
e.g. *haya-gaki* 'fast-writing; fast writing'
cf. *hayakukaku*. '(someone) writes fast.'
- i. Prefix
 1. Positional expression
e.g. *mae-gaki* 'front-writing; foreword'

2. Numeral (+ Counter suffix)
 e.g. *sen-giri* ‘thousand-cutting; shredding’
itiya-bosi ‘one.night-drying; (fish) dried overnight’
- j. V+V (i.e., both W1 and W2 are DNs)
 e.g. *kasi-kari* ‘lending-borrowing; lending and borrowing’
- k. Other (no grammatical relationship)
 e.g. *yu-zame* ‘hot.water-getting.cold; a chilly feeling after a bath’

When a compound has two different meanings that can be analyzed based on two different grammatical relationships, it was counted as two separate words. 126 compounds were recorded as having two possible interpretations and 10 compounds as having three. For example, *otoko-zuki* ‘man-prefer’ was counted twice, since it can mean both ‘something men like (usually describing a woman)’, in which *otoko* is a subject, and ‘someone who likes men’, where *otoko* is a direct object. Also, when a compound can have one meaning with two or more possible corresponding sentences, it was counted as one word, but all of the interpretations were recorded. One example for this is *ki-gumi* ‘wood-putting.together; something made by putting pieces of wood together’, which can be understood as either *ki-o kumu* with case marker *-o* or *ki-de kumu* with the marker *-de*. Both accusative and *-de* ‘by’ marker were counted in this case.

4 Results and Analysis

This section reports the result of the corpus study.

4.1 Lyman’s Law

Among all 470 compounds in which W2 has voiced obstruent(s), no compound shows rendaku. The effect of Lyman’s Law is observed with all grammatical categories of W1 listed in (7). Therefore, as previous studies show, Lyman’s Law has a strong effect over any other conditions. The data discussed below does not include those 470 compounds that meet the condition of Lyman’s Law.

4.2 Frequencies of Rendaku

[+rendaku] percentage among each category and the Pearson residuals (PR) to the lack of rendaku are summarized in Table 1. [+R] means rendaku occurs, [-R] means rendaku does not occur and [±R] means both forms are observed. Numbers below these items indicate how many compounds are found. As for PR, the positive values mean that there are positive association between the corresponding two factors (each relation-type and [-R] in this case). The negative values imply that the two factors are not associated with each other.

	[+R]	[-R]	[±R]	[+R] %	PR
1 subject	132	58	1	69.47	2.42
2 direct object	463	459	25	50.22	17.24
3 indirect object	39	15	2	72.22	0.74
4 path	30	0	0	100.00	-2.58
5 in/on/at	196	0	3	100.00	-6.63
6 ‘by’	276	6	3	97.87	-7.18
7 ‘from’	55	2	0	96.49	-2.99
8 adj/adv	153	0	3	100.00	-5.87
9 positional	104	3	4	97.20	-4.35
10 numeral	84	0	0	100.00	-4.31
11 V+V	144	22	4	86.75	-2.54
12 others	289	7	4	97.64	-7.29

Table 1: Frequencies of rendaku

Overall, rendaku was observed in 54.37% of all argument-head compounds (i.e., W1 is subject, direct object or indirect object; N = 1166) and 97.68% of all adjunct-head compounds (adjunct, numeral, particle, verb or no relationship; N = 1371). This is consistent with the findings in previous corpus studies. For example, examining the database in Amano and Kondo (1999), Yamaguchi’s (2011) corpus research found that rendaku occurs 44% of “Argument Type” (direct object + transitive verb) compounds while it occurs 96% of “Adjunct Type” (modifier + verb) compounds.⁶

The compounds with subject (henceforth Subj) (69.47%) and direct object (DO) (50.22%) as W1 are less likely to involve rendaku. Indirect object (IO) constructions also show the lower rate (72.22%). Although the number of tokens is small (N = 56), it is worth noting that, not only Subj and DO, but also IO constructions are positively associated with low [+R] ratio. To the best of my knowledge, no study has pointed out that IO is a relevant factor to the lack of rendaku.

Another novel finding of the study is that rendaku always occurs when W1 denotes (i) path, (ii) ‘in/on/at’ relationship, (iii) an adjective/adverb or (iv) a numeral (with or without a counter suffix). Since path and ‘in/on/at’ share the same morphological form as DO and IO (-o and -ni, respective-

⁶ Yamaguchi’s (2011) main focuses are on the accent of compounds and the number of morae. The study found that argument type compounds tend to be accented and resist rendaku, whereas adjunct type compounds tend to be unaccented and undergo rendaku, while these phonological differences do not tend to hold in longer compounds. See Yamaguchi (2011) for further discussion.

ly) in their corresponding sentences, this particular finding suggests that it is not the morphological form of what follows W1 (i.e., *-o* or *-ni*), but it is the nature of syntactic relation that W1 has with W2 that determines presence/absence of rendaku. Rendaku also shows at a higher probability with W1 that is ‘by’ (97.87%), ‘from’ (96.49%), or positional expression (97.20%).

Not only the grammatical relations, but also the meaning of components seems to matter. When both W1 and W2 are DN (V+V), rendaku always occurs if they express tautology or reduplication, as in *hanare-banare* ‘leaving-leaving; to get separated’ (N = 5), but rendaku never occurs if W1 and W2 are synonym or antonym, as in *ne-tomari* ‘sleeping-staying.overnight; lodging’ and *iki-kaeri* ‘going-going.back; one’s way to and from (somewhere)’ (N = 18). As for other V+V construction, rendaku occurs in 142 out of 146 compounds.⁷

To sum up, the findings from the corpus study show that when W1 is a core nominal argument of W2 (i.e., W1 is Subj, DO or IO in the sentence corresponding to the compound), DN compounds show lower rates of rendaku, and that what is important in the occurrence of rendaku is the syntactic relations between W1 and W2, but not the morphological shape of the “marker” of W1.

4.3 Lexically-Specific Cases

While most words that appear as W2 are compatible with having or not having rendaku, there are some DNs that always undergo rendaku when they occur with a Subj/DO W1, whereas others never do. The words that show this tendency are listed in Table 2 (only the words with 10 or more tokens are listed due to space limitation). Note that those [-R] in the list could be [+R] when W1 holds a different relationship with W2.

⁷ The four exceptional compounds are *kiri-kaki* ‘cutting-lacking; notching’, *nage-kai* ‘throwing-buying; purchasing stocks after a shakeout’, *okuri-taosi* ‘sending-knocking.over’ and *kime-taosi* ‘locking-knowcking.over’. They are either 1) compound in which the subject of W1 and W2 are different in corresponding sentence, as in *kiri-kaki* and *nage-kai* or 2) compound that denotes the name of winning tricks in sumo wrestling, as in *okuri-taosi* and *kime-taosi*. These are so specific that I do not regard them as rendaku conditions.

W2	Meaning	# of Examples	[±R]
<i>tome</i>	‘stopping’	35	[+R]
<i>kaesi</i>	‘returning’	28	[+R]
<i>kaki</i>	‘writing/drawing’	23	[+R]
<i>kosi</i>	‘passing’	17	[+R]
<i>tukai</i>	‘using’	16	[+R]
<i>kiri</i>	‘cutting’	33	[-R]
<i>tuki</i>	‘attaching’	27	[-R]
<i>kakusi</i>	‘hiding’	15	[-R]
<i>tataki</i>	‘hitting’	12	[-R]

Table 2: Words with particular tendencies to rendaku

Table 2 shows, for example, among all 35 compounds with Subj/DO W1 and W2 *tome* ‘stopping’ (e.g. *kuruma-dome* ‘car-stopping; buffer stop), rendaku always occurs. On the other hand, no rendaku was observed among 33 compounds with Subj/DO W1 and W2 *kiri* ‘cutting’ (e.g. *kan-kiri* ‘can-cutting; can opener’). One way to account for these lexically-specific behaviors of certain W2 is to analyze that [±R] is part of the information in our lexicon. That is, the lexical entries of these items may be specified as to whether or not they occur with rendaku.

5 Discussion

This section revisits Suzuki’s (2009) conditions for rendaku and proposes modifications of the conditions that the findings discussed in Section 4 motivate. The findings from the corpus suggest that some conditions in Suzuki (2009) should be removed from the list, and some should be revised. This section concludes with a new list of rendaku conditions that account for the cases for which Lyman’s Law are not relevant but rendaku still fails to occur.

5.1 Exceptional Conditions

In (8) I repeat Suzuki’s (2009) list of observations, which appears to be relevant to determining when Subj and DO W1s are [+R] or [-R].

(8) Specific Conditions of Rendaku

- a. Rendaku is less likely to occur when W1 is subjective or objective, yet;
- i. occurs when W1 can be followed by the case marker *-o*, but is not in objective
 - ii. occurs when the compound refers to the object created by the action of W2
 - iii. occurs when speakers regard the compound as one word, rather than a combination of two words in grammatical relationship
 - iv. occurs when the DN compound has metaphorical meaning
 - v. occurs when the DN compound implies continuing aspect, such that “W1 has (been) W2”
 - vi. does not occur when the compound refers to a person who W2s, where W1 is an object of W2
 - vii. does not occur when the compound refers to a work or play, where W1 is an object of W2
 - viii. does not occur when the compound refers to a living thing
 - ix. does not occur when the compound refers to a tool to do W2
- b. Rendaku is more likely to occur when W1 has the modifying grammatical relationship with W2
- c. There are rendaku forms that have different meaning of corresponding non-rendaku form

Based on the result of corpus study, I suggest the following modifications to this list.

First, (8a) should be modified as “rendaku is less likely to occur when W1 is a nominal argument of W2”, replacing (8a-i). The above change leads us to change (8b) as: “rendaku is more likely to occur when W1 is an adjunct of W2, or a numeral/particle that attaches to W2”.

As for (8a-ii), (8a-v) and (8a-vii), the current study found no counter example. Thus, they should remain unchanged (see Suzuki (2009) for the list of compounds in this category).

(8a-iii) and (8a-iv) should be removed for the following reasons. As for (8a-iii), while we acknowledge that defining what counts as a word in a language is difficult, there must be an objective evidence to say whether or not speakers regard a compound as one word, such as accentuation patterns. Similarly, there must be an objective definition of “metaphorical meaning” if (8-iv) is to be used as a valid condition. Even if there was an objective way of identifying metaphoric expressions, there appear to be counter examples to this generalization, such as *simo-kesi* ‘frost-erasing; drinking alcohol to get warm’.

(8a-vi) is a well-known condition that many researchers have argued for (e.g. Nakagawa (1966), Kindaichi (1976) and Sato (1989)); yet there are many counterexamples to it, such as *oomono-gui* ‘important.one-eating;

defeating a superior opponent' and *kodomo-zuki* 'child-like; being fond of children'. Therefore, (8a-vi) is clearly problematic. However, if we only look at cases in which the entire compound refers to occupations or people who engage in those occupations, there are only few counterexamples. As far as I can tell, the only exceptional compound that is used by contemporary people is *saka/sake-dukuri* 'sake-making; to make sake/sake-brewer', which usually refers to the act of making sake, rather than the occupation. Therefore, (8a-vi) should be removed, and (8a-vii) should be modified as "rendaku does not occur when the compound refers to a work, worker or play, where W1 is an object of W2".

(8a-viii) and (8a-ix) should be removed, since there are numerous counterexamples. For (8a-viii), there are words such as *ka-dayasi* 'mosquitowiping.out', referring to 'mosquitofish' and *hi-gurasi* 'day-[making.it] get.dark', referring to 'evening cicada'. For (8a-ix), there are *nezumi-gaesi* 'mouse-repelling', or 'rat guard', and *syarin-dome* 'wheel-stopping', or 'chock'.

(8c) seems to be well-motivated, as is observed in the contrast of *inu-kui* 'dog-eating; eating a dog' and *inu-gui* 'dog-eating; eating like a dog'. It seems that speakers distinguish the two meanings by the feature [$\pm R$].

The revised conditions are listed below in (9).

(9) Revised List of Exceptional Rendaku Conditions

- a. Rendaku is less likely to occur when W1 is a nominal argument of W2, yet;
 - i. occurs when the compound refers to the object created by the action of W2
 - ii. occurs when the deverbal noun compound implies continuing aspect, such that "W1 has (been) W2"
 - iii. does not occur when the compound refers to a work, worker or play, where W1 is an object of W2
- b. Rendaku is more likely to occur when W1 is an adjunct of W2, or a numeral/particle that attaches to W2
- c. There are rendaku forms that have different meaning of corresponding non-rendaku form

(9) should be a list of rendaku conditions consistent with the words that were found in a contemporary dictionary.

6 Conclusion

In this paper I have presented a corpus-based study of rendaku in DN compounds, with a new classification of W1 and W2 relationships. The result shows that whether a DN compound includes an argument or an adjunct as W1 influences the occurrence of rendaku, and suggests specific

conditions to account for when rendaku does and does not occur. I have also proposed modifications of previously proposed conditions on rendaku based on the new findings. Therefore, this study provides a partial solution to the problem of accounting for when exceptions to rendaku emerge, bringing us one step closer to a complete understanding of this complex phenomenon. The findings in this study also highlight several interesting properties of rendaku. Rendaku shows that syntactic relationship between compounded words is kept and still available when the phonological realization of a resulting compound is determined. It also shows that the phonological realization of compounds is sensitive to semantics. In a larger picture, it provides insight into how morpho-syntax, phonology and semantics work together in one phenomenon.

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