

Prosodic size and rendaku immunity

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Abstract Research has shown there to be a strong relationship between the mora and prosody in Modern Japanese. Recently proposed, although not as yet independently evaluated, has been a prosodic size rule governing the well-known allomorphic phenomenon of rendaku, by which the initial consonants of non-initial elements in compounds may be voiced under certain conditions. It is claimed that this prosodic size rule flags a native Japanese noun as being rendaku immune, a condition for which no empirical verification has hitherto existed. In this paper the author will demonstrate that, although slight modifications are necessary, a prosodic size rule for flagging rendaku immunity is indeed a reality.

Keywords Rendaku · Sequential voicing · Prosody · Mora · Japanese · Allomorphy · Morphophonology

1 Introduction

Studies carried out over the past two decades have demonstrated a robust connection between the mora and prosody in Modern Japanese. If the prosodic unit of the foot is taken to consist of two moras, a number of phonological and morphological structures may be generalized, including compound and loanword clipping, hypocoristic formation, accentuation patterns in compounds, reduplication in mimetics, and jazz argot. The aim of this paper is to independently evaluate Rosen's (2001) claim that a prosodic size rule also governs the well-known allomorphic phenomenon of rendaku.

After reviewing rendaku and the literature thereon in Sect. 2, I examine in Sect. 3 the numerous cases where rendaku ought yet fails to be triggered (that there exists a

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small group of rendaku-immune nouns is well known). I summarize in Sect. 4 and then assess empirically in Sects. 5 and 6 Rosen's claims for a prosodic size rule which flags as rendaku immune native Japanese second elements of two-element noun compounds. The implications discussed in Sect. 7 are clear: although slight modifications are necessary to take account of certain diachronic issues of obsolescence, a prosodic size rule for flagging rendaku immunity is a reality.

2 Rendaku

In Japanese, the initial consonants of non-initial elements in compounds may be voiced under certain conditions, an allomorphy known as 'rendaku' or sequential voicing. The readily apparent irregularities exhibited by rendaku have prompted extensive research—indeed, descriptions or analyses of rendaku form some of the earliest extant research on the Japanese language in both Japanese (Motoori 1822) and English (Lyman 1894). While the volume of ink expended on the subject has been too great to allow all previous work to be reviewed here (see, however, Suzuki 2005 for a thoroughgoing bibliography), what is worthy of note is that a literature devoted to the origins of rendaku and to describing the phenomenon from a diachronic perspective (Yamada 1904; Ogura 1910; Okumura 1952; Nakagawa 1966; Vance 1982, *inter alia*) has gradually—in line with the North American academic *zeitgeist*—come to be overtaken by a literature seeking to explain the causes and apparent irregularities of rendaku within synchronic theoretical frameworks (Itô and Mester 1986; Itô, Mester and Padgett 1995; Takayama 1999; Fukuzawa and Kitahara 2001; Rosen 2001; Irwin 2005, *inter alia*).

A brief exposition of rendaku will show that in many cases what were initially considered to be irregularities have turned out not to be so at all. The basic phonological condition under which rendaku may occur is that the non-initial element in a compound begin with a voiceless obstruent (*k t s h*)¹ as in (1):

- | | | | | | | | |
|-----|----|----------------------------|---------------|---|---------------|---|---------------------------|
| (1) | a. | <i>k ~ g:</i> | <i>me</i> | + | <i>kusuri</i> | > | <i>megusuri</i> |
| | | | eye | | medicine | | 'eye drops' |
| | b. | <i>t ~ d:</i> | <i>tya</i> | + | <i>tutu</i> | > | <i>tyadutu</i> |
| | | | tea | | tube | | 'tea caddy' |
| | c. | <i>s ~ z:</i> | <i>nezumi</i> | + | <i>san</i> | > | <i>nezumizan</i> |
| | | | rat | | calculation | | 'exponential progression' |
| | d. | <i>h ~ b:</i> ² | <i>suzume</i> | + | <i>hati</i> | > | <i>suzumebati</i> |
| | | | sparrow | | bee | | 'wasp' |

¹ The one other voiceless obstruent in Modern Japanese, *p*, occurs word-initially only in foreign (e.g., *pasuta* 'pasta') and mimetic (e.g., *piqtari* 'snugly, perfectly') lexemes, neither of which typically undergo rendaku; see further below.

² As Vance (2007, p. 155) notes, "the difference between the voiced phoneme and the voiceless phoneme is more than just the presence or absence of voicing." In (1a) *g* may actually be realized as [ŋ] by some speakers; in (1b) *tu* is [ts]u while *du* is generally [z]u; and in (1d) morpheme-initial Modern Japanese *h* derives from an earlier *p*, hence the *h~b* allomorphy (cf. Kiyose 1985; Martin 1987, pp. 10–13ff; Rothaug 1991, p. 19ff; Numoto 2007).

Motoori (1822) stated that if a voiced obstruent occurs anywhere in the non-initial element, rendaku does not occur, a claim that was repeated by Lyman (1894) in English and thus unjustly became known as ‘Lyman’s Law’:³

- (2) a. $k \sim *g$: *yama* + *kuzira* > *yamakuzira*
 mountain whale ‘wild boar meat’
 b. $t \sim *d$: *hana* + *taba* > *hanataba*
 flower bunch ‘bouquet’
 c. $s \sim *z$: *se* + *suzi* > *sesuzi*
 back sinew ‘spine’
 d. $h \sim *b$: *kuroon* + *hituzi* > *kuroonhituzi*
 clone sheep ‘cloned sheep’

Subsequently, Okumura (1955) suggested that rendaku is blocked in dvandva or copulative compounds although when formed by reduplication rendaku generally does occur (Vance 1987, pp. 141–142). For example:

- (3) a. non-dvandva: *yama* + *kawa* > *yamagawa*
 mountain river ‘mountain stream’
 b. dvandva: *yama* + *kawa* > *yamakawa*
 mountain river ‘mountains and rivers’
 c. reduplication: *kuni* + *kuni* > *kuniguni*
 country country ‘countries’⁴

Japanese vocabulary is generally divided into three main strata: native vocabulary (*wago*, henceforth NJ), a Sino-Japanese stratum (*kango* or *jiongo*, henceforth SJ), and foreign vocabulary (*gairaigo* or *shakuyōgo*, henceforth FJ).⁵ Providing the non-initial element begins with a voiceless obstruent, and, bearing in mind the constraints outlined in (2–3) above, rendaku ought to occur in any of the three strata. In reality, however, the phenomenon cuts across the vocabulary strata to hugely varying degrees: it occurs with only exceptional rarity in FJ (Vance 1987, p. 141; Takayama 2005, pp. 178–181; Irwin 2010); with a frequency of approximately 10–20% in SJ (cf. (1c) where the second element is SJ), depending on whether the SJ element is a binom (Vance 1996, p. 25, App. 2) or a mononom (Irwin 2005, pp. 140–145); and at a level of around 87% in NJ (Vance 1996, pp. 30–34).

³ Variations on the ‘Lyman’s Law’ constraint, and their history, are discussed in Vance (1980b, 2007). Exceptions to the Law are discussed in detail by Martin (1987, p. 115). See also Tamura (1972, p. 143); Kindaichi (1976, p. 5); Vance (1979, App. 1).

⁴ In addition to (1–3), Ōtsu (1980) put forward a right-branching rule to account for apparent exceptions to rendaku, subsequently further refined by Itō and Mester (1986): see Vance (1980a, p. 234) and Kubozono (2005, pp. 12–15) for criticism. Haraguchi (2001) lists some 23 factors which he claims regulate rendaku while Martin (1987, pp. 115–116) lists some “unusual cases of rendaku”.

⁵ Although NJ, SJ and FJ, as well as mimetic and hybrid strata, have all been proposed, few scholars would acknowledge the existence of all five. The vast majority note three (e.g., Martin 1952; Gottlieb 2005) or four (e.g., McCawley 1968; Vance 1987; Shibatani 1990). A few scholars (Rice 1997; Ota 2004) are sceptical as to the existence of lexical stratification in Japanese at all. Further, rather than models based on lexical strata, Itō and Mester (1995, 1999), Fukuzawa, et al. (1998), Fukuzawa and Kitahara (2005) and others posit core-periphery or set-inclusion models.

Rendaku exhibits differing degrees of irregularity depending on word class: its frequency in inflected compounds (compounds which are themselves verbs or adjectives, regardless of the parts of speech to which their elements belong) is low when both elements are verbs (4a) but much higher when the initial element is a noun (4b) or one element is an adjective (4c). Differing levels of rendaku are also found in uninflected noun compounds (Vance 2005), i.e., compounds which are nouns and which may include, in any combination, deverbal noun elements, deadjectival noun elements, or ‘pure’ uninflected noun elements.

- (4) a. *ki* + *kaeru* > *kigaeru*
 wearing change ‘change clothes’
 b. *kuti* + *hasiru* > *kutibasiru*
 mouth run ‘blurt out, blab’
 c. *hara* + *kuroi* > *haraguroi*
 belly black ‘scheming, malicious’

Finally, it should be noted that in Japanese a compound string can consist of an infinite number of elements, and rendaku may operate in any or all of the non-initial elements. In this paper, however, I will restrict my definition of ‘noun’ to one which is not morphologically derived and my definition of ‘noun compound’ to a compound which is itself not morphologically derived and is composed of two such noun elements: examples (1–3) above are typical. Further, since to which vocabulary stratum the initial element in a noun compound belongs has no bearing on the triggering of rendaku (Ohno 2000, p. 155), the term ‘NJ noun compound’ shall henceforth refer to the stratal provenance of the final element. Thus, both the SJ–NJ compound (1b) and the FJ–NJ compound (2d) I label NJ noun compounds.

3 Rendaku predilection and rendaku immunity

While many NJ noun compounds not showing rendaku can be explained by the constraints described in (1–3), cases where rendaku ought yet fails to be triggered in sequentially voiceable NJ noun compounds remain numerous. This has been remarked upon since the beginning of the literature and has doubtless been a major contributory factor towards the proliferation of research into the phenomenon.

The vast majority of sequentially voiceable NJ nouns which appear as a second element in a noun compound—in numbers sufficient to make a statistical analysis significant—exhibit predilectory behaviour. In other words, although rendaku is sometimes triggered and sometimes not, a clear tendency towards or away from rendaku is apparent. Into which camp a sequentially voiceable NJ noun falls may be described by use of the terms ‘rendaku lover’ and ‘rendaku hater’. Consider examples (5–6) below, where all initial elements are bimoraic NJ nouns free of voiced obstruents, where the first element in (a) has the same accentual pattern⁶ as

⁶ Here, and elsewhere in this paper, pitch patterns are those of ‘standard’ Tokyo Japanese.

the first element in (b) and where the second element in (a) is the same morpheme as the second element in (b) used in a semantically parallel fashion:

- (5) a. *tani* + *soko* > *tanisoko*
 valley bottom 'valley floor'
 b. *kawa* + *soko* > *kawazoko*
 river bottom 'riverbed'
- (6) a. *asi* + *kuse* > *asikuse*
 leg habit 'gait'
 b. *kuti* + *kuse* > *kutiguse*
 mouth habit 'pet saying'

The second element in (5), *soko* 'bottom', is a rendaku lover, the second element in (6), *kuse* 'habit', a rendaku hater: the rendaku behaviour evinced in (5a) and (6b) is thus unusual for these two nouns.

Rosen (2001, p. 40) defines rendaku lovers as exhibiting rendaku in 66% or more of compounds where both elements are bimoraic⁷ and rendaku haters as exhibiting rendaku in fewer than 33% of such compounds, stating further that the former are considerably more frequent than the latter. Moreover, he claims there are only two nouns, *kawa* 'skin' and *hara* 'field', which appear to be neither haters nor lovers since the proportion of compounds in which they voice lies in the middle tertile. This 'apparent tendency for a noun to either strongly prefer to voice, or else to resist voicing, with almost no nouns occupying a middle ground between the two tendencies' (ibid.), if schematized, represents the logistic curve (S-curve) familiar from diffusionist hypotheses (Wolfram and Schilling-Estes 2003).

Employing the terms 'native speaker reference' and 'native speaker memorization', Ohno (2000) has argued that *rendaku* is dependent on speaker-internal references to semantically and/or phonetically parallel pre-existing compounds. Some of Ohno's (ibid., p. 160) semantically parallel examples are shown below:

- (7) a. *kuro* + *kami* *kurokami* 'black hair'
 b. *shiro* + *kami* **shirokami* 'white hair'
- (8) a. *hana* + *ti* *hanazi* 'nosebleed'
 b. *mimi* + *ti* **mimizi* 'earbleed'

The second element in (7a), *kami* 'hair', is a rendaku lover but in this particular compound does not voice while the second element in (8a), *ti* 'blood', is (it is claimed by Ohno) a rendaku hater which in this compound voices. When offered the nonce compounds in (b) and asked how to read them in an experimental situation with no reference to the forms in (a), the majority of his native speaker subjects offered pronunciations which are predilectorily contrary to expectation but semantically parallel to existing compounds. It should be noted, however, that the

⁷ Rosen's (2001) database includes a few deadjectival initial elements, but no deverbals.

compounds in (7) contain deadjectivals as their initial elements, and it may be this factor rather than semantic parallelism which accounts for Ohno's results. Similarly, while a brief perusal of any dictionary would seem to confirm Ohno's claim that *ti* 'blood' is a rendaku hater, most of the compounds of which *ti* forms the second element also have deadjectivals as initial elements: noun compounds as defined in this paper are probably too few to make a judgement as to the predilection of *ti*. That said, while problems with Ohno's theory clearly still remain, it should be borne in mind that no other convincing explanation for rendaku predilection and S-curve clustering has as yet been forthcoming.

Whether rendaku is a productive process which admits of lexical exceptions or simply the lexical property of specific words is, as Kubozono (2005, p. 5) remarks, 'difficult to assess' because of its extreme productivity (1) on the one hand and the significant number of exceptions (5–6) on the other. Ultimately, he suggests that work by Fukuda and Fukuda (1999) on Japanese native speaker children with specific language impairment (SLI) provides strong evidence for a lexical property in the case of common vocabulary but a productive process in the case of novel compounds: "what remains unclear is the boundary... between 'frequent' and 'non-frequent' compounds" (Kubozono 2005, pp. 6–7).

Predilection is not the only clearly identifiable behaviour to be exhibited by sequentially voiceable NJ nouns: some appear never to undergo rendaku, a fact which has been observed and, to varying degrees, catalogued by Vance (1979, p. 86, 1980b, p. 251), Martin (1987, pp. 114–115), and Rosen (2001, pp. 254–256) among others.⁸ Those cited as 'rendaku immune' in at least two of the aforementioned three studies are:

(9)	<i>sio</i> tide	<i>tuti</i> earth, soil	<i>himo</i> ⁹ cord, string
	<i>kase</i> shackle	<i>kasu</i> dregs, lees	<i>kemuri</i> smoke
	<i>saki</i> tip, point	<i>hime</i> princess	<i>tuyu</i> dew

It should be stressed that none of the above rendaku immune candidates has been proposed based on any empirical test or empirically verifiable criteria. While acknowledging that the overwhelming majority of the nouns in (9) do indeed appear to be rendaku immune, their inclusion is based on the fact that the compilers were unaware of any exceptions: significantly, only the first three nouns in (9), *sio*, *tuti*, and *himo*, are listed by all three. Beginning in the following section, I shall show

⁸ Other scholars have, of course, cited and commented upon NJ nouns which fail to undergo rendaku, both pre- and post-Vance (1979), including Rosen (2003). One such seminal paper is Nakagawa (1966), who coined the Japanese term *rensei* 'sequential voicelessness' to describe such behaviour. Here, however, I limit my citations to those scholars who have published lists of such nouns.

⁹ The well-documented (e.g., Martin 1987, pp. 31–32) presence of variation between the word-internal labials *-b-* and *-m-* in Old and Middle Japanese, to a lesser extent across Modern Japanese dialects, and to a lesser extent still within Modern Standard Japanese (e.g., *sabisii* ~ *samisii* 'lonely') means, as Nakagawa (1966) pointed out, that rendaku immunity may have developed due to the former presence of the voiced obstruent *b* (cf. (2)). The two nouns in (9) whose internal *-m-* is underlined have, according to Martin, earlier attestations with *-b-* and are thus highly likely to exhibit rendaku immunity due to 'Lyman's Law'.

that an empirical test is in fact possible and, in Sect. 7, revisit and revise the issue of rendaku-immune nouns.

In closing this overview of rendaku immunity, one final observation should be made. It has frequently been noted that rendaku-immune nouns possess homonyms which exhibit standard predilectory behaviour (e.g., *tuti* ‘earth’ vs. *tuti* ‘mallet’). What is more interesting is that the same circumstances exist with respect to polysemy. The immune *sio* ‘tide’ is probably polysemous with *sio* ‘salt’, but the latter is a rendaku lover; immune *saki* ‘tip, point’ is almost certainly polysemous with *saki* ‘cape, promontory’ and probably polysemous with *saki* ‘ahead’, but, once again, rendaku behaviour differs. In the grey area between polysemy and homonymy (see the discussion in Martin 1987, p. 558) we find the immune *tuyu* ‘dew’ contrasting with *tuyu* ‘rainy season’ and *tuyu* ‘broth’. It is interesting to speculate whether Japanese orthography, which unlike, say, English orthography, typically assigns different spellings not just to homonyms but also to polysemes (e.g., 潮 ‘tide’ v. 塩 ‘salt’) might historically have played a part in this behaviour in the minds of the literate.

4 Prosodic size

Although the syllable is by no means irrelevant in Japanese morphology and phonology (Vance 1987, pp. 56–76, Kubozono 1999, pp. 42–55), Japanese is held to be a moraic language (Trubetzkoy [1939]/1969, p. 8) with the mora (μ) ‘function[ing] as the unit of length... [and] the length of a phrase roughly proportional to the number of moras it contains’ (McCawley 1968, p. 131). Its role in temporal regulation and phonological length and also as a unit of segmentation and perception is indisputable (Kubozono 1999, pp. 32–42).

Of critical importance in the context of this paper, however, is the relationship between the mora and prosody in Modern Japanese. If the prosodic unit of the foot is taken to consist of two moras (Poser 1990), then, as Kubozono (1999, p. 40) points out, ‘many phonological and morphological structures [in Japanese]... can be generalized’. These include compound clipping (Shibatani 1990, pp. 254–256), the formation of hypocoristics (Mester 1990; Poser 1990, pp. 81–93), accentuation patterns in compounds (Tsuji-mura and Davis 1987; Kubozono and Mester 1995; Alderete 1999), loanword clipping (Itô 1990; Loveday 1996, pp. 138–152; Irwin 2010), reduplication in mimetics (Poser 1990, pp. 94–95; Hamano 1998, pp. 25–38) and the jazz argot *zūjago* (Tateishi 1985, cited in Poser 1990; Tateishi 1989; Itô et al. 1996; Kubozono 2002).

Related to this is the concept that the optimal word length in Modern Japanese is bimoraic (2μ) (one foot), and indeed the majority of NJ roots are of this length. By extension, we can therefore state the optimal length of two-element NJ compounds to be four moras, two feet, or one colon, and Rosen (2001) claims to have shown that this prosodic size, with one further condition (hereafter ‘PS’), plays a decisive role in marking NJ nouns for rendaku immunity. Rosen defines PS as being when “both members of the compound exceed one mora and at least one of the members of the compound exceeds two moras” (op. cit., p. 28) and restricts membership to NJ nouns. In other words, in a N_1 – N_2 compound, both N_1 and N_2 must be at least

one foot, and N_1 – N_2 must exceed one colon. Rosen maintains that *rendaku* lovers and haters exhibit their usual predilectory behaviour when this PS is not attained (in ‘PS-fail’ compounds) but that when it is (in ‘PS-pass’ compounds), these same nouns undergo *rendaku* without exception. Ergo, a noun which does not exhibit *rendaku* in a PS-pass compound must be *rendaku* immune. Rosen’s principle can be summarized below, where (10) *kasu* ‘dregs’ is *rendaku* immune, (11) *kumo* ‘cloud’ is a *rendaku* lover, and (12) *kusa* ‘grass’ is a *rendaku* hater (examples are from Rosen (2001), although English glosses are mine):

- (10) a. PS-pass: *iwasi* + *kasu* > *iwasikasu*
 sardine dregs ‘sardine meal’
 b. PS-fail: *sake* + *kasu* > *sakekasu*
 saké ‘saké lees’
- (11) a. PS-pass: *kinoko* + *kumo* > *kinokogumo*
 mushroom cloud ‘mushroom cloud’
 b. PS-fail: *yami* + *kumo* > *yamikumo*
 darkness ‘haphazardness’
 c. PS-fail: *yoko* + *kumo* > *yokogumo*
 side ‘cloud bank’
- (12) a. PS-pass: *hituzi* + *kusa* > *hituzigusa*
 sheep grass ‘water lily’
 b. PS-fail: *mizu* + *kusa* > *mizukusa*
 water ‘waterweed’
 c. PS-fail: *no* + *kusa* > *nogusa*
 field ‘wild grass’

In (10) *kasu* appears without *rendaku* as the second element in the 3μ – 2μ PS-pass compound (10a), which, if Rosen’s principle is correct, flags *kasu* as *rendaku* immune. This does indeed appear to be the case, and (10b) is an example of *kasu* appearing without *rendaku* in a PS-fail compound (note that *kasu* appears in (9) above). On the other hand, both *kumo* and *kusa* exhibit *rendaku* in the PS-pass compounds ((11a) and (12a)), flagging them as predilectory. This is indeed, once again, the case, as (11bc) and (12bc) attest. Rosen’s *rendaku* PS rule (RPS rule) has not yet been tested independently in print, the purpose of the following section. We shall see that some tweaking is required for an amended, and more accurate, version of (9) to make itself known.

5 Rosen’s RPS rule assessed: I Analysis

In this section I analyse Rosen’s RPS rule in three steps. STEP 1 compiles the set of sequentially-voiceable NJ nouns; STEP 2 identifies amongst these the *rendaku*-immune nouns flagged by the RPS Rule; finally, STEP 3 verifies whether those nouns flagged as *rendaku* immune do in fact ever undergo *rendaku*.

Japanese dictionaries do not overtly mark headwords for vocabulary stratum, and thus the most swift and effective method of creating a NJ noun database, delimiting the contents of an electronic dictionary, is denied us. For this reason, I have turned to Martin's (1987, pp. 376–599) compendium of NJ nouns, the same corpus used by Rosen (2001, p. 1). STEP 1 in assessing the validity of the RPS Rule was to excise the following nouns from Martin's compendium:

- (i) Those whose initial was not a voiceless obstruent (*k t s h*)—see (1) above.
- (ii) Those which contained a voiced obstruent anywhere in the non-initial element—see (2) above.
- (iii) Those consisting of only one mora—cf. Rosen's PS criteria.
- (iv) Those very few nouns marked by Martin as borrowings (e.g., *sata* 'tidings, news' from Chinese). However, those whose status as borrowings was indicated as questionable (e.g., *sake* 'salmon' from Ainu?) were retained.
- (v) Deadjectivals and deverbals. The latter may refer to an action (e.g., *hanasi* 'a talk, a speech' < *hanasu* 'to talk, to speak') or a concrete object (e.g., *hurui* 'sieve, strainer' < *huruu* 'to sift').
- (vi) Synchronically transparent compounds, whether the initial element be apophonic¹⁰ (e.g., *hunani* 'ship's cargo' < *hune* 'ship' + *ni* 'cargo') or not (e.g., *kusomusi* 'gold beetle' < *kuso* 'dung' + *musi* 'insect'). Those nouns whose synchronic status as a compound was indicated as questionable through having been rendered obscure by phonological change (e.g., *haraka* 'kind of trout' < *hara* 'belly' + *aka* 'red'?) were retained.¹¹

This left a residue of 498 sequentially-voiceable NJ nouns, of which 2 (0.4%) were 5 μ , 21 (4.2%) were 4 μ , 146 (29.3%) were 3 μ , and 329 (66.1%) were 2 μ .

STEP 2 in the assessment was to ascertain which of these remaining 498 nouns appeared in non-rendaku form as the second element in a PS-pass compound, thus being flagged as rendaku immune. This was done as follows. Since (1) rendaku shows some degree of variability across native speakers as well as across dictionary entries and (2) this assessment is a synchronic one seeking as much as possible to avoid interference from obsolete vocabulary, it was decided to employ three different dictionaries, all of which should reflect the modern language on as large a scale as possible. The three dictionaries selected were the well-respected *Kōjien* (Shinmura 2003), *Daijisen* (Matsumura 1995) and *Daijirin* (Matsumura 2002), whose headword counts are approximately 240,000, 220,000 and 238,000 words, respectively. Electronic versions of these dictionaries, whose software interfaces were equipped with wild-card functionality, allowed swift searching of second elements. The following criteria were applied in the STEP 2 search process:

¹⁰ A small group of nouns with variation in their final vowel: a free (or 'exposed') form and a compound (or 'covered') form. The most common variation is between final free *-e* and final compound *-a*. Though no longer productive, apophonic variation is synchronically transparent. See, *inter alia*, Frellesvig and Whitman (2004, pp. 284–285) for a more detailed description.

¹¹ Although quite a number of nouns in Martin's compendium are obsolete and do not even appear in modern dictionaries, these were not excluded—to check once for obsolescence (and, moreover, to have to define 'obsolescence') and then again for their appearance in a compound would have been inefficient.

- (a) The compound was PS-pass.
- (b) The second element had a voiceless initial and was thus not sequentially voiced.
- (c) The initial element was NJ.
- (d) The initial element was an underived noun, i.e., neither a deverbal nor a deadjectival.
- (e) The initial element was not itself a synchronically transparent compound (including compounds containing apophonic elements—see (vi) above). Where an initial element's synchronic status as a compound was questionable through having been rendered obscure by phonological change, the compound was retained.
- (f) The compound was not dvandva—see (3) above.
- (g) The compound was listed in all three dictionaries (*Kōjien*, *Daijisen* and *Daijirin*), and its second element was not listed with a rendaku allomorph in any.
- (h) The compound was neither a toponym nor an anthroponym.¹²

Of the 498 sequentially voiceable nouns remaining after STEP 1, 31 were found to appear as sequentially voiceless second elements in PS-pass compounds after the STEP 2 criteria ((a)–(h)) had been applied. These 31 were composed of four 4 μ -nouns, eighteen 3 μ -nouns, and nine 2 μ -nouns and are listed in Table 1. Where a noun appeared in five or more PS-pass compounds, I have refrained from listing them all and have instead marked the 'PS-pass compound(s)' column as '5+'. It should be noted at this juncture that some of the NJ nouns and PS-pass compounds in Table 1 are obsolete; this issue shall be dealt with further below.

STEP 3, the final step in the assessment of the RPS Rule, is a verification of the logical corollary of Rosen's claim that rendaku lovers and haters exhibit exceptionless rendaku in PS-pass compounds: that NJ nouns which do not exhibit rendaku in PS-pass compounds (the 31 nouns in Table 1 below) are rendaku immune. This was done by utilizing the same three dictionaries as in STEP 2 and employing the following criteria in the search process:

- (α) The noun appeared sequentially voiced as the second element in a compound of any prosodic size.
- (β) The initial element of such a compound was NJ.
- (γ) The initial element was an underived noun, i.e., neither a deverbal nor a deadjectival.
- (δ) The initial element was not itself a synchronically transparent compound (including compounds containing apophonic elements). Where an initial element's synchronic status as a compound was questionable through having been rendered obscure by phonological change, the compound was retained.

¹² Cross-linguistically names often exhibit aberrant behaviour, and rendaku is no exception: see, for example, Sugito (1965), Nakagawa (1978), Hirano (2000), and Zamma (2005).

- (ε) The compound was listed in all three dictionaries (*Kōjien*, *Daijisen* and *Daijirin*), and its second element was not listed with a sequentially voiceless allomorph in any.
- (ζ) The compound was neither a toponym nor an anthroponym.

Of the 31 nouns in Table 1, only 11 appeared in any compounds conforming to the criteria (α)–(ζ) above. These 11 were composed of one 4 μ -noun, five 3 μ -nouns, and five 2 μ -nouns and are listed in Table 2 below along with the compounds in which they appeared. Once again, ‘5+’ in the sequentially voiced compound(s) column indicates that a noun was found in five or more compounds. Although these 11 nouns fail Rosen’s RPS Rule in its current form, they can be clearly grouped into three types, marked I–III in the righthandmost ‘group’ column. These groupings and the implications they have for a modification of the RPS Rule will be discussed in the following section.

Table 1. NJ nouns occurring in sequentially voiceless PS-pass compounds

NJ noun	English gloss	PS-pass compound(s)
harakara	sibling	koto h arakara
hasi	edge	nisiki h asi
haya	dace	abura h aya
himo	cord	usiro h imo, sirami h imo, haori h imo
hotaru	firefly	umi h otaru
hotori	neighbourhood	kata h otori, miyako h otori
humoto	foot of mountain	oka h umoto
hutokoro	bosom	tani h utokoro, yama h utokoro
kamome	seagull	yuri h kamome
kanna	plane	mizo h kanna
kasu	dregs, lees	abura h kasu, iwasi h kasu, nisi h kasu
kata	person	omote h kata
katati	shape	5+
katura	judas tree	tama h katura
kemuri	smoke	5+
konosiro	gizzard shad	tubame h konosiro
koomori	bat	abura h koomori, iek h koomori, kanik h koomori
koori	ice	kanako h oori
koromo	gown	karako h oromo
kuina	water rail	huyuku h kuina
kusiro	bracelet	isi h kusiro, suzuku h kusiro, tama h kusiro
kususi	physician	yabu h kususi
simo	frost	hadaresimo
sita	underneath	kanmurisita, yagurasita
sitomi	latticed shutters	yokositomi
sumire	violet	ezosumire, akanesumire, tubosumire
susuki	Japanese pampas	5+
take	mushroom	5+
tosaka	cockscorb	umito h saka
tukasa	official, office	takatu h kasu
tuki	cup	yusuru h tuki

Table 2. Expected rendaku-immune nouns occurring in sequentially voiced compounds

NJ noun	English gloss	Sequentially voiceless PS-pass compound(s)	Sequentially voiced compound(s)	Group
hasi	edge	nisik h asi	hasibasi	I
sita	underneath	kanmurisita, yagurasita	sitazita	I
koromo	gown	karakoromo	5+	II
simo	frost	hadaresimo	tuyuzimo	II
tukasa	official, of- fice	takatukasa	5+	II
tuki	cup	yusurutuki	sakaduki	II
hotaru	firefly	umihotaru	tutibotaru	III
hutokoro	bosom	tanihutokoro, yamahutokoro	utibutokoro, sotobutokoro	III
kanna	plane	mizokanna	nakaganna, wakiganna, yariganna	III
kata	person	omotekata	5+	III

6 Rosen's RPS rule assessed: II Discussion

Although the 11 nouns listed in Table 2 may at first glance appear to have negative implications for the integrity of the RPS Rule, I shall show in this section that a reformulation, by way of additional conditions, is possible.

Before, however, proceeding to a description and analysis of Groups I–III, some caveats. It should be noted that Table 2 is not necessarily complete. It must be borne in mind that only three dictionaries were used, and, although the author remains confident as to his selection of dictionaries and criteria for noun and compound inclusion, different dictionaries and/or the application of laxer or more stringent criteria might have produced a slightly different outcome. Moreover, it must be remembered that Martin's NJ noun compendium was created for the purposes of historical reconstruction and contains nouns attested in Old and Middle Japanese sources.

The nouns listed in Table 2 do not appear to have anything in common that would allow us to postulate an obvious exception to or extension of the RPS Rule. There would appear to be nothing of statistical significance as far as the initial obstruents or moraic composition of the NJ nouns are concerned, nothing of statistical significance as far as the PS of the sequentially voiced compounds is concerned, and, further, nothing of statistical significance when it comes to the suprasegmental patterning of either (both the nouns and compounds in Table 2 are of varying accentual patterns). Other factors appear to hold the key.

The two nouns in Group I, *hasi* and *sita*, both appear in the reduplicative compounds *hasibasi* 'in parts, here and there' and *sitazita* 'underlings, those below one'. As noted in (3c), reduplicative compounds are technically dvandva, and dvandva compounds have always been treated as a special case in the literature. It was because dvandva compounds in general are expected not to exhibit rendaku that they were excluded from the STEP 2 dictionary search (criterion (f)) and not included as a criterion in the STEP 3 search. It is now clear that this latter decision was in error. Dvandva compounds, whether reduplicative or not, must be taken out of the equation altogether (and an additional STEP 3 criterion disallowing dvandva compounds must be added) in order for Rosen's RPS Rule to hold.

Group II is composed of four nouns: *koromo*, *simo*, *tukasa*, and *tuki*. The issue of obsolete vocabulary has already been alluded to above. Although the three dictionaries employed for the assessment in Sect. 5 were selected based on the belief that their focus on the modern language was appropriate for a synchronic analysis, there remained two problematic areas which I have delayed discussing until this juncture. The first is that none of these three dictionaries (in fact, Japanese dictionaries in general) overtly mark a headword as ‘obsolete’ or ‘archaic’. There exists no objective method of gauging a word’s defunct status in modern Japanese beyond (a) noting that the dictionary definition is brief and ends with a citation from a classical Japanese text; or (b) laboriously cross-checking against Japanese–foreign language dictionaries which tend to eschew archaisms. Neither of these methods can provide hard empirical data. The second problem is that Martin’s (1987) NJ noun compendium, due to its very *raison d’être*, includes a number of such archaic nouns. This absence of any objective criterion for obsolete status meant naturally that none was applied at either STEP 1, 2, or 3 and that a small number of archaic words and compounds have slipped into Table 2. By the two, admittedly empirically weak, objective methods just outlined, as well as after consultation with native speakers, I have judged the noun *tuki* to be obsolete, as well as its compound *yusurutuki* and the three PS-pass compounds *karakoromo*, *hadaresimo*, and *takatukasa*. Rosen’s RPS Rule must be applied in a robustly synchronic fashion and archaisms ignored in order to hold.

Group III is the problematic residue: its five members, *hotaru*, *hutokoro*, *kanna*, *kata*, and *koori* all present, to a greater or lesser extent, a challenge to Rosen’s RPS rule. Nonetheless, a number of speculative analyses are possible, the first of which is semantic. A total of five Group III compounds, *utibutokoro* ‘breast pocket, bosom of a kimono, true circumstances, true intentions’, *sotobutokoro* ‘bosom of a kimono’, *nakaganna* ‘trying up plane’, *wakiganna* ‘grooving plane’, and *omotekata* ‘theatre staff’ have locational first elements: *uti* ‘inside’, *soto* ‘outside’, *naka* ‘inside’, *waki* ‘side’, and *omote* ‘front’. While in the context of the five Group III nouns only, such locational initial elements are heavily represented, in the context of Table 2 as a whole they appear elsewhere only in *sitazita* and (arguably) in *hasibasi*. Although admittedly highly speculative, positing some kind of restraint on such locational elements would deal with both *hutokoro* and *kata*, as well as (arguably) obviating the need for a separate Group I. With *koori*, we find that, while the compound in which it appears, *kanakoori* ‘extremely cold object’ (‘icicle’ in some modern dialects), is not obsolete, it is certainly infrequent and probably non-standard.

Both *hotaru* and *kanna* still remain, however. Although *umihotaru* ‘sea firefly’ and *tutibotaru* ‘glowworm’ exhibit contradictory rendaku behaviour, neither are in fact *hotaru* ‘fireflies’. The *umihotaru* is *Vargula hilgendorffii* and an ostracode, a type of crustacean, while the *tutibotaru* is a type of gnat, *arachnocampa*, an insect of the subclass *pterygota*. Both emit luminescence, and thus their *hotaru* element may be regarded as a polyseme of *hotaru* ‘firefly’, an insect of the subclass *coleoptera*. We have already seen in Sect. 3 that polysemes often exhibit contradictory rendaku behaviour. With regard to *kanna*, although the tentative locational element hypothesis puts paid to *nakaganna* and

wakiganna, *yariganna* ‘spearhead plane’ remains problematic. Although not listed in any of the three dictionaries employed for the purposes of this assessment, the two sequentially voiceless PS-pass compounds *mizokanna* ‘base plane’ and *umihotaru* do appear online in sequentially voiced form as *mizoganna* and *umibotaru*. While the latter is outgoogled by its sequentially voiceless partner by a ratio of approximately 31 to 1, the former actually outgoogles its sequentially voiceless partner 5 to 2.¹³ Clearly, for *mizokanna*, there is a large gulf between internet usage and dictionary listings: although *mizokanna* appears in all three dictionaries and *mizoganna* in none (STEP 2(g)), *mizoganna* accounts for 72% of hits as opposed to 28% for *mizokanna*.

7 Implications and conclusions

The analysis carried out in Sect. 5 and its discussion in Sect. 6 allow me to now present a modified RPS Rule. My modifications are in italics; the remainder is condensed from Rosen (2001, 2003):

- Nouns are defined as non-deverbals and non-deadjectivals, are restricted to the native Japanese vocabulary stratum, *are not names, and must be synchronically ‘live’, i.e., not obsolete.*
- N_1 – N_2 compounds are defined as those which are composed of two such nouns, *but which are neither dvandva nor reduplicative compounds.*
- If a sequentially voiceable N_2 occurs as sequentially voiceless AND both N_1 and N_2 are each at least one foot (2 moras) in length AND N_1 – N_2 exceeds one colon (4 moras) in length, THEN N_2 is rendaku immune in all N_1 – N_2 compounds regardless of prosodic size.

A major implication of this modified rule is that an empirically robust list of rendaku-immune nouns can now be put forward. Those nouns in Table 1 which did not feature as potentially problematic cases in Table 2 number 20 in total and are listed in (13) below. Those rendaku-immune candidate nouns which I believe to be obsolete are in bold, while those which occur only in PS-compounds which I believe to be obsolete are underlined:¹⁴

- (13) *harakara* *haya* *himo* *hotori* *humoto* *kamome* *kasu*
katati *katura* *kemuri* *konosiro* *koomori* *kuina* ***kusiro***
kususi *sitomi* *sumire* *susuki* *take* *tosaka*

¹³ When the compounds were searched as both a *hiragana* and *katakana* ‘exact wording or phrase’ on 23 May, 2009. The combined *kana* voiced-voiceless ‘Google approximate hits’ were approximately 488 against 190 for *mizoganna*/*mizokanna* and 1,353 against 41,400 for *umibotaru*/*umihotaru*.

¹⁴ No rendaku-immune candidate nouns occurred in reduplicative PS-pass compounds or only in PS-pass compounds with locational initial elements. In other words, the only proposed modification to Rosen’s PS Rule, tentative or otherwise, which has any impact on rendaku-immune candidates is archaism.

If we remove these 4 NJ nouns, we are left with 16 NJ nouns demonstrably rendaku immune by the modified RPS rule:

- (14) *haya* *himo* *humoto kamome* *kasu* *katati katura* *kemuri*
*konosiro koomori*¹⁵ *kuina sitomi sumire susuki take tosaka*

Of these, we find that only three, *himo*, *kasu*, and *kemuri* (boxed in (14)), appear in the list of rendaku-immune nouns previously proposed in (9) and restated (though reordered) below:

- (9) *himo* *kasu* *kemuri* *sio tuti kase saki hime tuyu*

Of the remaining six nouns in (9), two (*sio*, *tuti*) did occur sequentially voiceless in PS-pass compounds but never across all three dictionaries, while the other four (*kase*, *saki*, *hime*, *tuyu*) did not occur in any PS-pass compounds whatsoever. While there is no empirical evidence for these six nouns' rendaku-immune status, there is equally nothing against it. As Martin (1987, p. 114) has noted in connection with rendaku immunity in general: "failure to indulge in rendaku may be accidental: some nouns have few compounds, and others offer only a single rendaku example, often obsolete or archaic." While this is not true for the remaining six nouns in (9)—the very reason why they have been cited frequently in the literature as rendaku immune—it is certainly the reason why those nouns unboxed in (14) have not been cited to any degree before. It has taken the empirical approach demonstrated here to lure them into the open.

The author acknowledges that despite the refinements to Rosen's RPS Rule stated above, five nouns, *hotaru* 'firefly', *hutokoro* 'bosom', *kanna* 'plane', *kata* 'person' and *koori* 'ice' remain problematic. The history of rendaku research has shown that an ultimate solution to its conditioning factors has proceeded in a series of small steps. Each of these has sought to further deepen our understanding of the allomorphy, but each has left a miniscule trail of apparent exceptions in its wake. Viewed in this wider historical perspective, the five exceptions just cited are merely another such miniscule trail which the author feels sure future research will resolve.

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¹⁵ Like *kemuri* and *himo*, *koomori* too may be rendaku immune due to the former presence of a voiced obstruent *b*; see footnote 9.

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