

MARK IRWIN

## RENDAKU-BASED LEXICAL HIERARCHIES IN JAPANESE: THE BEHAVIOUR OF SINO-JAPANESE MONONOMS IN HYBRID NOUN COMPOUNDS

Takayama (1999) recently proposed a new rendaku-based vocabulary stratum hierarchy for Japanese, in which what he terms a “vulgarized Sino-Japanese” stratum is treated separately from, and occupies a more core position than, the traditional Sino-Japanese (SJ) stratum. However, Takayama deliberately excludes from his analysis one particular subset of the SJ vocabulary layer, monomorphemic SJ lexemes (SJ mononoms), and focuses exclusively on bimorphemic SJ lexemes (SJ binoms), claiming that analytical difficulties caused by another voicing phenomenon known as *shindaku* (Okumura (1952)), which occurs only in the SJ stratum, hampers any attempt to ascertain the frequency of rendaku amongst SJ mononoms. As it has been established that the stratum to which the initial element in a dual element noun compound belongs is not a factor conditioning rendaku in the second element (Ohno (2000)), examining comparatively under-researched hybrid noun compounds whose second element is a SJ mononom allows us to bypass any interference caused by *shindaku* and establish the frequency of rendaku occurrence amongst SJ mononoms. Such a corpus of hybrid noun compounds whose second element is a SJ mononom is presented here, to the author’s knowledge the first time any such corpus has appeared in print, an analysis of which shows that rendaku is in fact more than twice as likely to occur amongst SJ mononoms as amongst SJ binoms. When a further dynamic, the faithfulness of SJ mononoms to a prosodic size factor proposed by Rosen (2001) for native Japanese lexemes, is taken into consideration, it is clear that not only, at the very least, must Takayama’s vulgarized SJ stratum be amended to incorporate SJ mononoms, but that there is also a strong case for proposing an independent vulgarized SJ mononom stratum occupying an even more central position than the vulgarized SJ binom stratum.

### 1. PRELIMINARIES

Rendaku, or sequential voicing, is a well-documented allomorphic phenomenon in Japanese whereby the non-initial morpheme in a compound may undergo voicing under certain conditions. Recently, a number of scholars have sought to explain the phenomenon’s causes and its apparent irregularity within a theoretical framework (Itō and Mester (1986), Itō et al. (1995), Fukuzawa and Kitahara (2001), Rosen (2001), etc.). Prior to this more recent body of theorizing, there was already a sizeable literature devoted to the origins of rendaku and to discussing the phenomenon from a

diachronic perspective (Hashimoto (1932), Okumura (1952), Nakagawa (1966), Vance (1982), Unger (1993), *inter alia*). In this paper, I will seek to clarify the relative position, within a *rendaku*-based vocabulary stratum hierarchy most recently proposed by Takayama (1999) and itself built on work by Itō and Mester (1995), of lexemes belonging to one particular subset (the single-morpheme subset) of one Japanese vocabulary stratum (the Sino-Japanese stratum).

*Rendaku* exhibits differing degrees of irregularity depending on the part of speech (Vance (1987, 142–146, and forthcoming), Rosen (2001), Rice (forthcoming)), and different researchers have worked within different criteria when carrying out statistical analyses of the phenomenon's occurrence (Vance (1996), Rosen (2001)). Additionally, in Japanese a compound noun string can in theory consist of an infinite number of elements and, providing certain conditions are met (see Section 3), *rendaku* may operate in any or all of these elements, bar the initial. It is therefore necessary at the outset to define the criteria to be worked to here. Since the two major statistical analyses of the frequency of occurrence of *rendaku* carried out by Vance (1996) employ only dual element<sup>1</sup> compound nouns, further discussion will be limited in this paper also to dual element compound nouns only. Vance (1996) includes both deverbal nouns (e.g. /kimari/, 'decision', </kimaru/, 'decide'), which he treats as monomorphemic, and deadjectival nouns (e.g. /aka/, 'being red, redness,' < /aka.i/, 'be red'), although he limits both these morphologically derived nouns to one element per compound, i.e., does not include deverbal–deverbal compound nouns such as /uti-awase/, 'hitting-joining > (prearranged) meeting'. However, Rosen (2001, 21–23), who argues for a 'prosodic size factor' which blocks *rendaku* irregularity (cf. Section 3.1), excludes morphologically derived nouns altogether. For ease of comparison I will follow Vance (1996) and, in addition, use the term "noun compound" to refer to a compound which must include at least one noun that is not morphologically derived.

This paper has two main aims: first, to present and analyse a corpus of Japanese noun compounds whose second and final element is a member of the single-morpheme Sino-Japanese vocabulary stratum—the first time, to my knowledge, such a complete corpus has appeared in print. This I do in Section 5. The second aim is to show that the results obtained from analysis of this corpus are sufficiently solid to warrant a redefinition of the *rendaku*-based Japanese vocabulary hierarchy. This I demonstrate in Section 6. Before introducing and analysing the corpus, it is necessary first to discuss Japanese vocabulary strata and noun compounding (Section 2) as well as the phenomenon of *rendaku* (Section 3) and the concept of vocabulary hierarchies (Section 4) in greater detail.

## 2. JAPANESE VOCABULARY STRATA AND NOUN COMPOUNDING

Although the vocabulary strata of modern Japanese may be categorized and sub-categorized in various ways (Martin (1952), Miller (1967, 235–267), McCawley (1968, 62–75), Shibatani (1990, 140–157), Nishio (2002), etc.), the four strata I employ for the purposes of this paper, despite differing in some slight respects from some of the frameworks just referenced, are, I believe, uncontroversial. These are shown in (1) below, the Japanese names for the each stratum being given in italics, along with the abbreviations to be used henceforth in brackets:

- |     |   |      |
|-----|---|------|
| (1) | native Japanese/ <i>wago/yamatokotoba</i>                         | (NJ) |
|     | mimetic or sound-symbolic Japanese/ <i>gitaigo/giseigo/giongo</i> | (MJ) |
|     | Sino-Japanese/ <i>kango/jiongo</i>                                | (SJ) |
|     | foreign Japanese/ <i>gairaigo/yōgo</i>                            | (FJ) |

Here, I do not subsume MJ under the NJ stratum as is sometimes the case but rather consider it as a separate lexical stratum for the simple reason that here rendaku does not occur. The MJ stratum will therefore not be considered further in this paper.

The three remaining vocabulary strata cited in (1) yield nine possible two-element compound noun permutations: six types of hybrid compound or *konshugo* (2) and three types of non-hybrid compound (3).

- |     |                                     |
|-----|-------------------------------------|
| (2) | NJ-SJ NJ-FJ SJ-NJ SJ-FJ FJ-NJ FJ-SJ |
| (3) | NJ-NJ SJ-SJ FJ-FJ <sup>2</sup>      |

It is fair to say that the hybrid compounds shown in (2) have received far less study than non-hybrid compounds in (3). Exactly what proportion of Japanese compounds are hybrid depends greatly on sampling techniques and the media to which they are applied, but Nishio (2002, 101–107), summarizing previous research, cites figures ranging from 1% to 5% of total vocabulary. This proportion would be greater if we were to consider only compounds, and there would be few who would dispute that cross-stratum hybrid compounding is highly productive in the modern language. We shall also see later (Section 5) that limiting an analysis of rendaku frequency to hybrid compounds only is an effective way of bypassing other non-rendaku allophonic alterations that might interfere with the overall statistical picture.

The six hybrid compound types shown in (2) do not make up the whole picture, however. As will be discussed in more detail in Section 3 below, two different kinds of SJ lexeme have also to be distinguished:

(a) those composed of two or more morphemes (although nearly always two)<sup>3</sup> together forming one lexeme and thus one element in a noun compound (e.g. the initial element /ki.kai/ in compound (6) below);

(b) those composed of only one morpheme (e.g. the initial element /ki/ in compound (5) below).

The former (when composed of two morphemes) are generally termed SJ binoms (to be abbreviated here to SJ<sub>2</sub>) and are by a large margin the more frequent, while the latter I will here term SJ mononoms (to be abbreviated to SJ<sub>1</sub>).

Noting that neither SJ<sub>2</sub>-SJ<sub>1</sub> nor SJ<sub>1</sub>-SJ<sub>2</sub> compounds are to be considered hybrid compounds since both elements are drawn from the same vocabulary stratum, taking this further SJ<sub>1</sub>/SJ<sub>2</sub> split of the SJ stratum into consideration ultimately yields the 16 unique dual element compound noun pennutations (10 hybrid, 6 non-hybrid) listed below in (4–19). As stated earlier, *rendaku* in the non-initial morpheme may only occur under certain phonological conditions (cf. Section 3): in all the examples below the second element in the compound does not fulfil these.

(4)	NJ-NJ:	suzi nerve, sinew	+	miti road, path	>	suzi-miti 'thread (of an argument)'
(5)	SJ <sub>1</sub> -NJ:	ki spirit, <i>ki</i>	+	magure fluke	>	ki-magure 'whim'
(6)	SJ <sub>2</sub> -NJ:	ki.kai machine	+	abura oil	>	ki.kai-abura 'machine oil'
(7)	FJ-NJ:	koohii coffee	+	mame bean	>	koohii-mame 'coffee bean'
(8)	SJ <sub>1</sub> -SJ <sub>1</sub> :	zeN everything	+	iN member	>	zeN-iN 'everyone'
(9)	NJ-SJ <sub>1</sub> :	sakura cherry blossom	+	niku meat	>	sakura-niku 'horse meat'
(10)	SJ <sub>2</sub> -SJ <sub>1</sub> :	siN.ka evolution	+	roN discussion, opinion	>	siN.ka-roN 'theory of evolution'
(11)	FJ-SJ <sub>1</sub> :	biiru beer	+	eN garden	>	biiru-eN 'beer garden'

(12)	SJ <sub>2</sub> -SJ <sub>2</sub> :	hiQ.su essential	+	zyoo.keN condition	>	hiQ.su- zyoo.keN 'prerequisite'
(13)	NJ-SJ <sub>2</sub> :	he fart	+	ri.kuttu argument, reason	>	he-ri.kutu 'quibble'
(14)	SJ <sub>1</sub> -SJ <sub>2</sub> :	eki station	+	ba.sya (horse-drawn) carriage	>	eki-ba.sya 'stage coach'
(15)	FJ-SJ <sub>2</sub> :	igirisu UK	+	ei.go English language	>	igirisu-ei.go 'British English'
(16)	FJ-FJ:	tieri cherry	+	booi boy	>	tieri-booi 'male virgin'
(17)	NJ-FJ:	wa hoop, ring	+	gomu rubber	>	wa-gomu 'elastic band'
(18)	SJ <sub>1</sub> -FJ:	dai big size	+	zyoQki beer mug	>	dai-zyoQki 'large beer'
(19)	SJ <sub>2</sub> -FJ:	mei.waku bother	+	meeru e-mail	>	mei.waku- meeru 'spam'

To borrow an iconography from computing, the wild card \*, the 16 compound noun types listed above can be subdivided by second element into (4–7) \*-NJ, (8–11) \*-SJ<sub>1</sub>, (12–15) \*-SJ<sub>2</sub> and (16–19) \*-FJ types.

In the case of compounds containing a SJ<sub>1</sub> element (5, 8–11, 14, 18), the single morpheme of which the SJ<sub>1</sub> element is comprised rarely occurs unbound as an independent lexeme. SJ<sub>1</sub> morphemes viewed as a whole appear most frequently bound, as monomorphemic elements in non-hybrid SJ<sub>1</sub>-SJ<sub>2</sub> (14), SJ<sub>2</sub>-SJ<sub>1</sub> (10), or SJ<sub>1</sub>-SJ<sub>1</sub> (8) noun compounds. SJ<sub>1</sub> morphemes may also appear bound in hybrid noun compounds (5, 9, 11, 18), although with considerably less frequency. However, SJ<sub>1</sub> morphemes appear unbound, as independent SJ<sub>1</sub> lexemes, only infrequently. For example, the final monomorphemic SJ<sub>1</sub> element /roN/ of noun compound (10) is somewhat atypical in that, while it occurs with greatest frequency in other non-hybrid SJ<sub>1</sub>-SJ<sub>2</sub>, SJ<sub>2</sub>-SJ<sub>1</sub> or SJ<sub>1</sub>-SJ<sub>1</sub> compounds, it can also occur as both a bound monomorphemic SJ<sub>1</sub> element in a hybrid noun compound (20a), and even as an independent lexeme (20b).<sup>4</sup>

- (20) a. NJ-SJ<sub>1</sub>: yo + roN > yo-roN  
           world opinion 'public opinion'  
       b. SJ<sub>1</sub>: roN  
           'discussion, opinion'

The final monomorphemic SJ<sub>1</sub> element /eN/ of noun compound (11) is less atypical, although still not typical, in that, while it too occurs with greatest frequency in other non-hybrid SJ<sub>1</sub>-SJ<sub>2</sub>, SJ<sub>2</sub>-SJ<sub>1</sub> or SJ<sub>1</sub>-SJ<sub>1</sub> compounds and can also occur as a bound SJ<sub>1</sub> element in hybrid noun compounds, it cannot occur as an independent lexeme. The bound SJ<sub>1</sub> morpheme /siN/ of the initial SJ<sub>2</sub> /siN.ka/ element of noun compound (10) is most typical: while it does occur in other non-hybrid compounds, it appears neither as a bound SJ<sub>1</sub> element in a hybrid noun compound, nor unbound as an independent lexeme. The degree of boundness of SJ mononoms can be summarized in (21) below.

	-----	-----
(21) UNBOUND	BOUND-	
	IN HYBRID	IN NON-HYBRID
	COMPOUND	COMPOUND
/roN/	/roN/	/roN/
	/eN/	/eN/
		/siN/
	<i>least frequent</i> .....	<i>most frequent</i>

As stated in Section 1, this paper's goal is to clarify the relative position of the SJ<sub>1</sub> vocabulary stratum within Takayama's (1999) rendaku vocabulary stratum hierarchy (cf. Section 4). This will be done by analysing hybrid noun compound rendaku candidates whose second and final element is a SJ mononom, i.e., examples such as (9) and (11) above. Before considering such hybrid \*-SJ<sub>1</sub> compounds however, a discussion of the frequency of occurrence of rendaku within hybrid and non-hybrid \*-NJ, \*-FJ and \*SJ<sub>2</sub> two-element noun compounds, as well as in non-hybrid \*-SJ<sub>1</sub> two-element noun compounds, will be necessary for purposes of comparison.

### 3. RENDAKU IN NOUN COMPOUNDS OTHER THAN HYBRID \*-SJ<sub>1</sub>

Rendaku occurs when the non-initial element in a compound begins with a voiceless obstruent (of the various phonological possibilities, only /k/, /t/ (and its allophones [ts] and [cç]), /s/ (along with its allophone [ç]), and /h/ (and allophones [ϕ] and [ç] exist in Modern Japanese).<sup>5</sup> Providing this non-initial element is a voiceless obstruent, rendaku may occur, in theory, in any of the three Japanese vocabulary strata, whether the compounds in

question are hybrid or not. In reality, however, the phenomenon of rendaku cuts across the vocabulary strata to hugely varying degrees. Moreover, there are further phonological, morphological, and prosodic constraints which block the process, and these are summarized in Sections 3.1 (\*-NJ compounds), 3.2 (\*-FJ compounds), 3.3 (non-hybrid \*-SJ<sub>1</sub> compounds) and 3.4 (\*-SJ<sub>2</sub> compounds) below. Discussion of hybrid \*-SJ<sub>1</sub> two-element noun compounds will be postponed until Section 5.

### 3.1. \*-NJ noun compounds

Treating first non-hybrid NJ-NJ two-element noun compounds, examples of rendaku for each of the four voiceless obstruents are shown in (22):

- (22) a. *k* ~ *g*: saru + kutuwa > saru-gutuwa  
           monkey (horse's) bit 'gag'
- b. *t* ~ *d*: hi + tane > hi-dane  
           fire seed 'spark, cause'
- c. *s* ~ *z*: mukae + sake > mukae-zake  
           meeting, welcoming alcohol 'hair-of-the-dog'
- d. *h* ~ *b*:<sup>6</sup> sukasi + he > sukasi-be  
           transparency fart 'silent fart'

As a constraint on the above, Motoori Norinaga (1730–1801) stated (according to Miyake (1932, 136)) that the existence of a voiced obstruent as the second consonant of a non-initial element in a compound blocks rendaku.<sup>7</sup> This was taken up by Lyman (1894) in English (and thus unfairly came to be known as 'Lyman's Law'), with Martin (1952, 48) subsequently proposing that the occurrence of a voiced obstruent anywhere in the non-initial element (see (23b), where it occurs as the third consonant) blocks rendaku. This constraint is illustrated below for each of the four voiceless obstruents:

- (23) a. *k* ~ *g*: ito + kuzu > ito-kuzu  
           thread, yarn rubbish, waste 'link'
- b. *t* ~ *d*: tuno + tokage > tuno-tokage  
           horn lizard 'horned lizard'
- c. *s* ~ *z*: zaru + soba > zaru-soba  
           bamboo buckwheat 'cold buckwheat  
           colander noodles noodles'

- d. *h~b*: tori + hada > tori-**h**ada  
 bird skin 'goose pimples'

Several exceptions to Martin's (1952) version of Lyman's Law, where *rendaku* occurs in spite of the existence of a voiced obstruent in the second element, have been found, including (24) from Tamura (1972, 143):

- (24) nawa + hasigo > nawa-**b**asigo  
 rope ladder 'rope ladder',

but essentially the Law holds for the overwhelming majority of cases.<sup>8</sup>

Ōtsu (1980, 211–217) has shown that *rendaku* is blocked in *dvandva* or copulative compounds, illustrated in (25) below (adapted from Ōtsu (*ibid.*, 213)):

- (25) a. yama + kawa > yama-**g**awa  
 mountain river 'mountain stream'  
 b. yama + kawa > yama-**k**awa  
 mountain river 'mountain and rivers'

It should be noted, however, that such compounds, when formed by reduplication (26), generally do undergo *rendaku*, due probably to analogical extension (Vance (1987, 141–142)).

- (26) tokoro + tokoro > tokoro-**d**okoro  
 place place 'places'

Ōtsu (1980, 217–221) also put forward a right-branching rule, subsequently further refined by Itō and Mester (1986), to account for apparent exceptions to *rendaku* as in the second morpheme /tanuki/ of (27a):

- (27) a. nise + [tanuki + siru] > nise-tanuki-ziru  
 fake [raccoon dog soup] 'fake [raccoon dog soup]'  
 b. [nise + tanuki] + siru > nise-**d**anuki-ziru  
 [fake raccoon dog] soup '[fake raccoon dog] soup'

adapted from Ōtsu (1980, 218)

Here, *rendaku* can only be triggered when a morpheme is on the right branch of a constituent tree and, in addition, *rendaku* is blocked by Lyman's Law for the /tanuki/ morpheme of (27a). However, as Vance (1980a, 234) points out, examples such as (27) are "not ordinary words in common use[,] ...they strike native speakers as artificial, and judgments about *rendaku* in them are not easy to get."



It has not escaped anyone's attention that rendaku fails to be triggered with certain NJ elements in spite of the absence of any of the above constraints.<sup>9</sup> Certain NJ morphemes appear never to undergo rendaku (28), despite the fact they do not contain a voiced obstruent, and despite appearing as the second element in a non-dvandva compound. Others appear to have a certain seemingly irregular predilection towards (29) or aversion to (30) rendaku. Rosen (2001) claims to have shown that what he terms a "prosodic size factor" (hereafter "PS factor"), which operates only within noun compounds, plays a decisive role in marking a given NJ morpheme as either being "rendaku immune" or exhibiting apparent irregularity. Those latter he places in two groups, termed "rendaku lovers" and "rendaku haters,"<sup>10</sup> and claims any irregularity is blocked when a given PS factor is attained. Rosen defines this PS factor as being when "both members of the compound exceeds one mora and at least one of the members of the compound exceeds two moras" (ibid., 28). Thus, morphemes which are rendaku lovers or rendaku haters exhibit predilectory irregularity in  $2\mu-2\mu$ ,  $2\mu-1\mu$ ,  $1\mu-2\mu$  and  $1\mu-1\mu$  "PS-fail" noun compounds, while in "PS-pass" noun compounds (whether  $3\mu-2\mu$ ,  $2\mu-3\mu$ ,  $4\mu-2\mu$ ,  $3\mu-4\mu$ , etc.), both rendaku lovers and rendaku haters undergo rendaku without exception.<sup>11</sup> NJ morphemes which do not trigger rendaku in PS-pass compounds never do so either in PS-fail compounds and are thus rendaku immune. Rosen's "law" can be summarized below, where (28) /kasu/, 'dregs', is a rendaku immune morpheme, (29) /kumo/, 'cloud', is a rendaku lover, and (30) /kusa/, 'grass', is a rendaku hater (examples are from Rosen (2001), although English glosses are mine).<sup>12</sup>

- |      |    |          |          |       |       |                 |                  |
|------|----|----------|----------|-------|-------|-----------------|------------------|
| (28) | a. | PS-pass: | iwasi    | +     | kasu  | >               | iwasi-kasu       |
|      |    |          | sardine  |       | dregs |                 | 'sardine meal'   |
|      | b. | PS-fail: | sake     | +     | kasu  | >               | sake-kasu        |
|      |    |          | saké     |       | dregs |                 | 'saké lees'      |
| (29) | a. | PS-pass: | kinoko   | +     | kumo  | >               | kinoko-gumo      |
|      |    |          | mushroom |       | cloud |                 | 'mushroom cloud' |
|      | b. | PS-fail: | yami     | +     | kumo  | >               | yami-kumo        |
|      |    | darkness |          | cloud |       | 'haphazardness' |                  |
|      | c. | PS-fail: | yoko     | +     | kumo  | >               | yoko-gumo        |
|      |    |          | side     |       | cloud |                 | 'cloud bank'     |
| (30) | a. | PS-pass: | hituzi   | +     | kusa  | >               | hituzi-gusa      |
|      |    |          | sheep    |       | grass |                 | 'water lily'     |
|      | b. | PS-fail: | mizu     | +     | kusa  | >               | mizu-kusa        |
|      |    | water    |          | grass |       | 'waterweed'     |                  |
|      | c. | PS-fail: | no       | +     | kusa  | >               | no-gusa          |
|      |    |          | field    |       | grass |                 | 'wild grass'     |



and morphological (dvandva compounding) constraints identical to those in non-hybrid NJ-NJ compounds hold.<sup>13</sup>

- (34) SJ<sub>1</sub>-NJ: zi + hara > zi-**bara**  
 self stomach '(out of) one's own  
 pocket'
- SJ<sub>2</sub>-NJ: koo.si + sima > koo.si-**zima**  
 lattice, grid stripe 'tartan, check'
- FJ-NJ: biniiru + hukuro > biniiru-**bukuro**  
 vinyl, plastic sack, bag 'plastic bag'

There are, again, some exceptions (35) where rendaku fails to be triggered, as is the case with non-hybrid NJ-NJ compounds:

- (35) a. SJ<sub>1</sub>-NJ kiN + tama > kiN-**tama**  
 gold ball 'testicle' (coll.)
- b. SJ<sub>2</sub>-NJ dai.ri + haha > dai.ri-**haha**  
 proxy mother 'surrogate mother'
- c. FJ-NJ: peN + saki > peN-**saki**  
 pen end, tip 'nib'

I therefore concur with Ohno (2000, 155) when he states with reference to the fact that the majority of \*-NJ compounds undergo rendaku that "there are no ... restrictions [as to vocabulary stratum] on the first item of a compound" (square brackets mine). The fact that the stratum to which the initial element belongs is not a factor conditioning rendaku is critical in that hybrid compounds can be used to measure rendaku frequency in the corpus presented in Section 5.

In an effort to set an approximate figure to the proportion of NJ nouns affected by rendaku in \*-NJ compounds (hybrid or non), Vance (1996, 30–34) carried out a statistical study across a 100-item sample of monomorphemic NJ candidate nouns and concluded that 87% of them underwent rendaku. It should be noted, however, that Vance counts a NJ noun as undergoing rendaku even if voicing does not occur in all possible compounds. For example, /hi/, 'day, sun', is counted as 'yes' in his Appendix 1 (Vance (ibid., 30–34)) in spite of the fact that it not infrequently resists rendaku (36), and this thus adds a full 1% onto his final figure.

- (36) a. asa + hi > asa-**hi**  
 morning sun 'rising sun'

- b. yuu + hi > yuu-**hi**  
 evening sun 'setting sun'

Given the difficulties inherent in how one would assign a figure to the lexeme /hi/ in this sense, coupled with the relatively small sample size as a whole, I have no quibble with his methodology and would agree that his final figure of 87% would appear to be a satisfactory estimate.

### 3.2. \*-FJ noun compounds

Non-hybrid FJ-FJ compounds can be divided into two categories: those borrowed wholesale as compounds already existing in the language in question (37a) and those “made in Japan” (so-called *waseieigo* since the elements are almost invariably English) (37b). In neither type of FJ-FJ compound does rendaku ever occur, despite the second element fulfilling the necessary phonological conditions:

- (37) a. FJ-FJ miruku + tyokoreeto > miruku-tyokoreeto  
 milk chocolate 'milk chocolate'
- b. FJ-FJ nyuu + haahu > nyuu-**haahu**  
 new half 'male transsexual'

With hybrid NJ-FJ compounds, however, there is a very small number of FJ lexemes, borrowed into Japanese centuries ago, which do exhibit rendaku in a very few, extremely low-frequency compounds, including (38a), from English '(blan)ket' (Takayama (forthcoming)), and (38b), from Khmer *khsier* (Vance (1987, 141)):

- (38) a. NJ-FJ: aka + keQto > aka-**geQto**  
 red blanket 'red blanket' = 'country bumpkin'
- b. NJ-FJ: mizu + kiseru > mizu-**giseru**  
 water pipe 'hookah'

The overwhelming majority of NJ-FJ compounds (39), however, do not exhibit rendaku:

- (39) NJ-FJ: ebi + hurai > ebi-**hurai**  
 prawn breaded deep-fried food 'scampi'

As is the case with NJ-FJ compounds, the overwhelming majority of SJ-FJ hybrid compounds also resist rendaku (40a). However, (40b), a SJ<sub>2</sub>-FJ

hybrid compound whose FJ element was borrowed into Japanese in the 16th century (Umegaki (1963)), attracts rendaku. Like NJ-FJ compounds (38), such occurrences of rendaku are highly marked.<sup>14</sup>

- (40) a. SJ<sub>1</sub>-FJ: maN + taN > maN-taN  
           full            tank            ‘full tank of petrol’
- b. SJ<sub>2</sub>-FJ: saN.mai + karuta > saN.mai-garuta  
           three            karuta            ‘three-card karuta’  
           (cards etc.)    (a card game)

### 3.3. Non-hybrid \*-SJ<sub>1</sub> noun compounds

From a diachronic perspective, the occurrence of rendaku in non-hybrid SJ<sub>1</sub>-SJ<sub>1</sub> compounds is complex. Viewed, however, from a synchronic perspective, it is possible to summarize the situation. Historically, SJ<sub>1</sub>-SJ<sub>1</sub> bimorphemic compounds were either borrowed as SJ binoms, ‘ready-made’ as it were, from Chinese as in (41a), or created in Japan as calques of English or other foreign terms (41b), especially in technical and academic fields, and even subsequently borrowed back into Chinese (Shibatani (1990, 145)). These latter are known as *waseikango*, ‘made-in-Japan SJ compounds’ (see Satō (1982) for a thorough treatment).

- (41) a. 行脚 aN.gya ‘pilgrimage’  
       b. 科学 ka.gaku ‘science’

The historical waters have been muddied, however, by the fact that SJ lexemes and the sinographs used to represent them were borrowed into Japanese (the phonology frequently substantially altered to fit the Japanese phonetic system) in successive waves and from differing Chinese regionalects. Most scholars (Hayashi and Yuzawa (1980, 676–677), Vance (1987, 167–169), Yamada (1992, 2047–2050), Takeuchi (1999, 6–12), Miyake (2003, 100–109) inter alia) describe three different waves of SJ borrowing, in many cases the same lexemes being reborrowed with a new pronunciation each time. These are, in chronological order: the *go-on* from c. 5th century CE; the *kan-on*, officially adopted by the Japanese imperial court in the 8th century CE; and the least important (in terms of frequency) *tō-on* (or *sō-on*), in the 14th century.<sup>15</sup> Since the same sinographs were and are employed to write the differing pronunciations of such lexemes, many Japanese sinographs are said to have more than one SJ ‘reading’ (or *on*) and what may thus appear on the surface as an instance of sequential voicing in a SJ<sub>1</sub>-SJ<sub>1</sub> compound may in fact be simply due to the use of a particular reading.

For example, the sinograph 地, ‘ground, land’, may be read as either (42a) /ti/ (the *kan-on*), or as (42b) /zi/ (the *go-on*):

- (42) a. 台地 dai.ti ‘plateau’  
 b. 路地 ro.zi ‘lane, alley’

In contrast, the sinographs 国 and 者, representing /koku/, ‘country’, and /sya/, ‘person’, respectively, each have only one prescribed reading, but these may undergo sequential voicing when the second element in a SJ binom, as in (43).

- (43) a. 東国 too.goku ‘the east country, eastern provinces’  
 b. 患者 kaN.zya ‘patient’

The example in (42b), where the voicing of the initial voiced obstruent in the second SJ monom stems from a different reading of the sinograph 地, is known in Japanese as *hondaku*, ‘original voicing’, while the examples in (43), where the voicing is in fact sequential, are known as *shindaku*, ‘new voicing’. The most plausible theory proposed for the origin of sequential voicing in SJ binoms such as (43) above (and such examples are in the minority) is that of Okumura (1952), who hypothesized that the phenomenon was triggered by the existence of a final nasal in the initial morpheme. In some cases (43a), this later disappeared (the modern *kan-on* reading /too/ has developed from reconstructed Early Middle Chinese and Late Middle Chinese forms \*/təwŋ/ (Pulleyblank (1991)) ending in a velar nasal), in other cases (43b) the final nasal of the initial morpheme still exists.

As a general rule of thumb, therefore, we can state that when the second morpheme in a SJ<sub>1</sub>-SJ<sub>1</sub> compound undergoes voicing but appears only in its voiceless form when the initial morpheme in a SJ<sub>1</sub>-SJ<sub>1</sub> compound, then it will be listed in a sinograph dictionary as having only the voiceless reading, and any voicing is thus sequential. This is the case for (43), neither sinograph being read as /goku/ or /zya/ when the initial morpheme in a SJ<sub>1</sub>-SJ<sub>1</sub> compound, and both being listed as only /koku/ and /sya/ respectively in sino-graph dictionaries. A problem arises, however, in cases like (42), where the reading of 地 as /zi/ may be due to sequential voicing of the *kan-on* reading /ti/ (i.e. *shindaku*), or may simply be the *go-on* reading /zi/ (i.e. *hondaku*). Both /ti/ and /zi/ occur as initial morphemes in SJ<sub>1</sub>-SJ<sub>1</sub> compounds, both readings are listed in sinograph dictionaries, and the question would only be answerable after recourse to a specialized dictionary, if at all. For this reason, problematic morphemes such as /ti~/ /zi/ in (42) will not be considered as \*-SJ<sub>1</sub> hybrid compound corpus candidates (see Section 5 below).



noun compounds (45–46) testify. Given the fact that SJ binoms are made up overwhelmingly of four morae (Nishio (2002, 85)) and that the vast majority of \*-SJ<sub>2</sub> compounds will thus be PS-pass, the fact that Rosen’s PS factor does not hold for the SJ stratum is hardly surprising.

- |      |    |                                    |                    |   |            |   |                                |
|------|----|------------------------------------|--------------------|---|------------|---|--------------------------------|
| (45) | a. | FJ-SJ <sub>2</sub> :               | karaa              | + | sya.siN    | > | karaa-sya.siN                  |
|      |    |                                    | colour             |   | photograph |   | “colour photo”                 |
|      | b. | SJ <sub>2</sub> -SJ <sub>2</sub> : | deN.si             | + | sya.siN    | > | deN.si-sya.siN                 |
|      |    |                                    | electron           |   | photograph |   | “xerography”                   |
| (46) | a. | NJ-SJ <sub>2</sub> :               | tako               | + | kai.sya    | > | tako-kai.sya                   |
|      |    |                                    | octopus            |   | company    |   | “bogus company”                |
|      | b. | SJ <sub>2</sub> -SJ <sub>2</sub> : | taN.si             | + | kai.sya    | > | taN.si-kai.sya                 |
|      |    |                                    | short-term<br>loan |   | company    |   | “call-loan company/<br>dealer” |

Finally, as with the NJ layer, it should be noted that the stratum to which the initial element in a compound belongs is not a factor in conditioning *rendaku* within the SJ<sub>2</sub> layer either.

#### 4. VOCABULARY STRATUM HIERARCHIES IN JAPANESE

Although, viewed as whole, the process of *rendaku* may be “completely bewildering” (Miller (1967, 195)) or a phenomenon whose “fundamental irregularity . . . remains a fact of modern standard Japanese” (Vance (1987, 148)), there exists, as we have just seen, an indisputable vocabulary stratum hierarchy within the framework of which examining the phenomenon as a whole can prove productive. Before discussing such a *rendaku*-based vocabulary stratum hierarchy, it is worth examining Itō and Mester’s vocabulary hierarchy model for Japanese based on phonological constraints.

The concept of lexical hierarchies was first put forward by Kiparsky (1968) and expanded on by Saciuk (1969), who also stressed the gradual nature of such stratifications, and this hypothesis has been employed by Itō and Mester (1995, 1999) and Itō et al. (1995) in their examination of the Japanese lexicon. Their most recent work (Itō and Mester (1999, 64ff)) puts forward a core-periphery model (reproduced in abbreviated form in (47) below), whose structure is organized in terms of set inclusion, so that members of the innermost core (NJ lexemes) “fulfill lexical constraints in the maximal way,” while lexical items in outlying strata “fulfill only a small subset of . . . constraints” (Itō and Mester (*ibid.*, 65)). This set inclusion



structure is, according to them, the lexicon's fundamental characteristic, the "existence of large, homogenous and well-defined strata" being a "secondary phenomenon" (ibid., 70).

(47)	$Lex^{\max}$		$\leftarrow Lex^{\max}-Lex^2$	=	unassimilated foreign [unassimilated FJ]
	$Lex^2$		$\leftarrow Lex^2-Lex^1$	=	assimilated foreign [assimilated FJ]
	$Lex^1$		$\leftarrow Lex^1-Lex^0$	=	established loans [SJ]
	$Lex^0$		$\leftarrow Lex^0$	=	native [NJ]

after Itō and Mester (1999, 69)

Their four sets,  $Lex^0$ – $Lex^{\max}$ , are based on four constraints and their systematic violations within the phonological lexicon as a whole: NO-NT (compulsory voicing of post-nasal obstruents), NO-P (no [p] exclusively linked to onset position), NO-DD (no voiced obstruent geminates), and SYLLSTRUC (the basic syllable constraints of Japanese, including no complex onsets and codas, etc.), respectively. It is also stressed that "the demarcation lines for the different constraints characterizing, for example, the native stratum do not always exactly coincide, resulting in the occurrence of items with mixed behaviour" (ibid., 70).

Prior to Itō and Mester's set-inclusion vocabulary model just outlined, and before even the concept of lexical hierarchies were proposed, Nakagawa stated of rendaku in the FJ stratum in general, and referring to compounds such as (38) and (40b) in particular:

In the same way as the chances of sequential voicing in a SJ lexical item which has been nativized increase, sequential voicing in the FJ vocabulary stratum is also a barometer of nativization. For example, those FJ words that were borrowed during or before the Edo Era [1603–1867] are considerably more likely to have become nativized.

Nakagawa (1966, 306–307), trans. mine, square brackets mine

In a similar vein to Nakagawa, Ōtsu (1980, 209) stated that "...*kango* [SJ] and *gairaigo* [FJ] can be affected by rendaku to the extent that the words become Japanized" (square brackets mine), and thus those few (10% according to Vance (1996)) \*-SJ<sub>2</sub> dual element compound nouns that do exhibit rendaku would do so because the final SJ<sub>2</sub> element has become "nativized," in other words reanalysed by native speakers as a NJ morpheme. However, this issue of "Japanization" or "nativization" is a thorny problem. Vance counters Ōtsu's (1980, 209) proposal above:



scores this caveat by drawing attention to the fact that, while many of his VSJ<sub>2</sub> lexemes attract the NJ honorific prefix /o/-, a substantial number conform to the standard SJ honorific prefix /go/-. In a more recent paper, Takayama (forthcoming) restates his vocabulary hierarchy with one subtle but important addition. Pointing out that differences in register or varieties in style exist not only inter- but also intra-stratally, he would assign (49a) to his VSJ<sub>2</sub> stratum on the basis that it is “preferred in everyday colloquial contexts,” while assigning (49b) to the SJ stratum by virtue of its being “used only in formal or official contexts.” What is important here is that (49a) begins with a vowel and thus cannot undergo rendaku: assignment to the VSJ<sub>2</sub> stratum is being made solely on the basis of native speaker intuition.

- (49) a. /i.sya/ ‘doctor, physician, etc.’ (everyday, colloquial)  
 b. /i.si/ ‘doctor, physician, etc.’ (stiff, formal, official)

The more NJ-ward position of Takayama’s VSJ<sub>2</sub> stratum suggests that such lexemes should also tend towards obeying Rosen’s PS factor, since we have just seen (Section 3.4) that SJ lexemes in general do not and, with few exceptions, NJ lexemes do. Faithfulness to the PS factor may be swiftly and very roughly tested via Takayama’s (1999, 379) listing of ten lexemes for inclusion in the VSJ<sub>2</sub> stratum.<sup>19</sup> We have already seen (45–46) that of these ten, neither /kai.sya/ nor /sya.siN/ hold up, and of the remainder, three others also fail while five are faithful to the PS factor.<sup>20</sup> In addition, of the ten SJ binoms listed by Vance (1996) as undergoing rendaku, three are also listed by Takayama, and of the remaining seven, four are faithful to Rosen’s PS factor while three are not.<sup>21</sup> Clearly the picture is very muddled, with an apparent approximate fifty-fifty split.

Finally, but critically, Takayama (ibid., 382–384) deliberately excludes SJ<sub>1</sub> morphemes from his vulgarized Sino-Japanese layer (hence my careful use of VSJ<sub>2</sub>, rather than VSJ) primarily on the grounds of the difficulties involved in discriminating between *hondaku* and *shindaku* (see Section 3.3). Despite going on to point out that some SJ<sub>1</sub> morphemes, such as /haN/~ /baN/ (see (51b) below), do exhibit rendaku in \*- SJ<sub>1</sub> noun compounds where the initial element does not end in a nasal, he dismisses such examples as “sporadic” (trans. mine). Crucially, he fails to pick up on the fact that analysing SJ<sub>1</sub> morphemes as the second elements in hybrid compounds, where the question of *hondaku* versus *shindaku* cannot possibly arise (recall we have established in Section 3 that the frequency of rendaku in hybrid compounds is no different from in non-hybrids), would be an efficacious method of determining whether SJ<sub>1</sub> morphemes should be

admitted into his vulgarized Sino-Japanese stratum. The hybrid \*-SJ<sub>1</sub> noun corpus introduced in the next section is designed to do just this.

5. THE HYBRID \*-SJ<sub>1</sub> NOUN COMPOUND CORPUS & RENDAKU IN HYBRID \*-SJ<sub>1</sub> NOUN COMPOUNDS

Rendaku in hybrid \*-SJ<sub>1</sub> compounds is a subject that has generally been given short shrift in the literature (Martin, (1952, 52–57), Vance (1980a, 229–230), Ōtsu (1980, 208–209), Takayama (1999, 382–384)) and, to my knowledge, there has been no statistical study, similar to those for \*-NJ or \*-SJ<sub>2</sub> compounds carried out by Vance (1996), conducted to determine the frequency of rendaku occurrence within even non-hybrid \*-SJ<sub>1</sub> compounds. As noted above, this is in all probability due to the philological and phonological difficulties inherent in distinguishing between *hondaku* and *shindaku*. An additional difficulty is, as Vance states:

... the equivocal morphological status of such words [ie., SJ<sub>1</sub>-SJ<sub>1</sub> compounds]: many Sino-Japanese words written with two kanji probably should not be analysed as consisting of two morphemes.

Vance (1996, 23), square brackets mine

While, as Vance (1996, 25) also says, “it seems fair to say that binoms are the prototypical free forms of Sino-Japanese,” there does exist a large number of SJ monoms that exist as independent lexemes. If, however, one consults a large Japanese dictionary such as Shinmura (1996), one finds virtually every single regularly used sinograph listed as an unbound morpheme followed by its set pronunciation and a definition. This parallels the situation in modern Chinese dictionaries, where, according to DeFrancis (1984, 185), who classifies Chinese morphosyllables<sup>22</sup> into “free,” “semi-bound/meaningful” and “completely bound/meaningless,” the first two types together comprise around 90% of the total. In theory, then, the vast majority of Japanese SJ morphosyllables can also be unbound or semi-bound and have an associated meaning. In (21), /roN/ is unbound and both /eN/ and /siN/ semi-bound—all three morphemes occur in many other compounds, and all three are meaningful. Both the /bu/ (written 葡) and the /doo/(葡) of /bu.doo/ (葡萄), ‘grape’, however, occur in no other compounds and are meaningless as individual morphemes. A complete hybrid \*-SJ corpus would seek to include all but the completely bound SJ monoms such as /bu/ (葡) and /doo/ (葡), but here I will restrict the corpus to “free” SJ monoms only. In order to ascertain which and how many of these SJ monoms are free, in other words function as independent unbound (for the most part ‘speakable’)<sup>23</sup> SJ monoms for native Japanese speakers, it was decided to use one of the largest Japanese-

English dictionaries, Masuda (1989),<sup>24</sup> where SJ<sub>1</sub> entries are restricted to words which have an associated English meaning. For example, Shinmura (1996) lists 80 SJ<sub>1</sub> entries for /koo/, while Masuda (1989) lists only 29. While a figure of 29 free SJ mononoms all pronounced /koo/ and all “speakable” still appears too high, the fact that many of these (viewed overall, statistically somewhat over half—see (50) below) do not appear at all as the second element in hybrid \* -SJ<sub>1</sub> noun compounds weakens their case still further as free “speakable” SJ mononoms and removes them from the core corpus.

The first step in the corpus compilation was to list every SJ mononom beginning with a voiceless obstruent (i.e. rendaku candidates) listed in Masuda (1989): this formed the corpus BASE. The next step was to weed out two types of problematic SJ mononom:

(a) ON-DOUBLETS,<sup>25</sup> such as 地 /ti/~zi/ noted in (42) above, which, according to a representative Japanese sinograph dictionary (Ozaki (1992)), have two or more SJ readings that form a morpheme-initial voiceless/voiced doublet. Here it would be unclear (often even impossible to ascertain) whether an instance of such a voiced obstruent initial morpheme, occurring as the second element in a \*-SJ<sub>1</sub> compound noun, was caused by rendaku. Such ON-DOUBLETS made up approximately 5% of the corpus BASE (see (50) below).

(b) KUN-DOUBLETS, such as, for example, 州 /su/, where, according to Ozaki (1992), one of the SJ readings is identical to the NJ *kun* reading, and where it would be unclear whether, as the second morpheme in a \*-SJ<sub>1</sub> compound noun, it was a NJ or a SJ<sub>1</sub>, reading. Such KUN-DOUBLETS accounted for 0.4% of the corpus BASE (see (50) below).

To avoid the laborious process of going through Japanese reverse dictionaries, the CD-ROM version of Shinmura (1996), which allows easy wild card searches, was used in the final step: the elimination of SJ mononoms on which NO DATA was available, i.e. those remaining corpus CORE SJ<sub>1</sub> candidates that did not appear at all as the second element in a hybrid \*-SJ<sub>1</sub> noun compound. NO DATA SJ mononoms accounted for somewhat over half, 59%, of the BASE.

When the ON-DOUBLET, KUN-DOUBLET and NO DATA SJ mononoms are subtracted from the BASE figure we are left with the corpus CORE of rendaku candidates, statistically some 36% of the initial BASE. This corpus CORE is listed in Appendices A (rendaku lovers and haters) and B (rendaku immune), and those SJ<sub>1</sub> mononoms rejected from the corpus CORE (ON-DOUBLET, KUN-DOUBLET and NO DATA SJ mononoms) in Appendices C, D

and E, respectively. The actual number of SJ mononoms in question is shown in (50).

(50)	BASE:	543
	<i>minus</i> ON-DOUBLETS:	29
	<i>minus</i> KUN-DOUBLETS:	2
	<i>minus</i> NO DATA:	318
	= CORE:	194

As can be seen from Appendix A, of the 194 corpus CORE SJ mononoms, 42 (22%) undergo rendaku in at least one hybrid \*-SJ<sub>1</sub> noun compound, a figure more than twice that of Vance's (1996) \*-SJ<sub>2</sub> noun compound study. Examples of SJ mononoms where rendaku does occur are shown in (51), examples where the SJ monom is rendaku immune in (52) below.

(51)	a. NJ-SJ <sub>1</sub> :	hito	+	siti	>	hito-ziti
		person		pledge		'hostage'
	b. FJ-SJ <sub>1</sub> :	hairaito	+	haN	>	hairaito-baN
		highlight		version, print		'highlight plate'
(52)	a. NJ-SJ <sub>1</sub> :	zaru	+	hoo	>	zaru-hoo
		bamboo		law		'law full of
		colander				loopholes'
	b. FJ-SJ <sub>1</sub> :	eQkusu	+	seN	>	eQkusu-seN
		X		line		'X-ray'

Rosen's (2001) PS factor appears to hold in 38 of the 42 mononoms (or 90%) which undergo rendaku, a level of faithfulness far more in line with the NJ stratum than with Takayama's VSJ<sub>2</sub>. The four exceptions are Appendix A items [12] /kaku/ (/aNmoN-kaku/ but /no-gaku/, [18] /kyaku/(/omote-kyaku/ but /uti-gyaku/), [24] /saN/ (/ararato-saN/ but /osore-zaN/), and [37] /syoo/ (/abura-syoo/ but /umare-zyoo/).

As to why over twice as many SJ mononoms as binoms should undergo rendaku at least once when the second element in hybrid noun compounds, there are, perhaps, two possible explanations. Firstly, and most obviously, the size of the corpus CORE employed in this study is nearly twice as large (194 items as against 100) as Vance's (1996) study, and this larger size may have led to greater statistical accuracy. Secondly, the phonotactics, generally speaking, of SJ mononoms are closer to the NJ stratum than those of SJ binoms. While both SJ mononoms and binoms admit long vowels, glides and the mora nasal /N/, none of which are particularly frequent in the NJ stratum, SJ mononoms are

most commonly bimoraic (and otherwise always monomoraic, since a Japanese SJ monomorpheme cannot exceed two morae), as are NJ morphemes. In contrast, SJ binoms can be up to four morae in length—and most frequently are this length (Nishio (2002, 85)). Additionally, the /p/ phoneme never surfaces in SJ monomorphemes, while in SJ binoms it may surface directly after the morpheme boundary. Against this claim for phonotactic similarity with the NJ stratum it can be argued, as already pointed out by Takayama (1999, 381), that although the phonotactics of FJ morphemes are even more similar to those of NJ morphemes than those of SJ monomorphemes and binoms (cf. Section 4), rendaku is restricted to a very few extremely isolated cases in this layer.

#### 6. TOWARDS A MORE COMPLETE RENDAKU-BASED VOCABULARY HIERARCHY

Taking stock of what I have shown so far, we find that:

(a) Statistical studies carried out by Vance (1996) and in Section 5 above, show that the proportion of lexemes (rounded to the nearest 10%) which exhibit rendaku in noun compounds is approximately 90% for the NJ, 20% for the SJ<sub>1</sub>, 10% for the SJ<sub>2</sub>, and negligible for the FJ stratum.

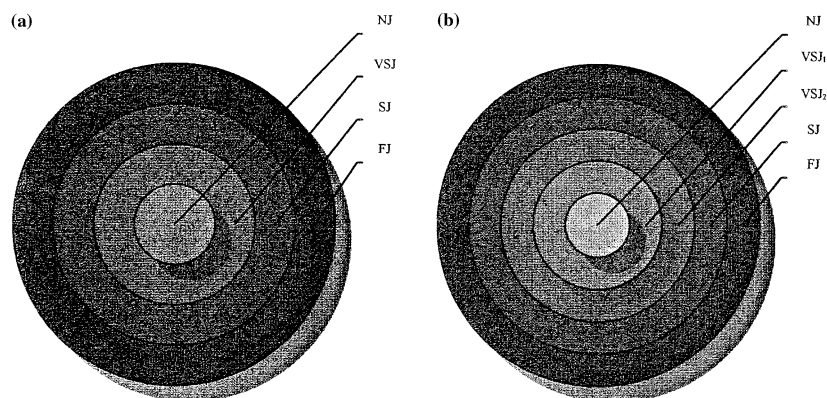
(b) Rosen's PS factor operates with a high level of accuracy in the NJ stratum (perhaps higher than 99% if a noun is defined as excluding deverbals and deadjectivals), with 90% accuracy in the SJ<sub>1</sub> stratum, and with perhaps 50% accuracy in the VSJ<sub>2</sub> stratum (although the sample here is very small, being limited only to those VSJ<sub>2</sub> lexemes cited by Vance (1996) and Takayama (1999)). The level of accuracy with the SJ<sub>2</sub> stratum in general is unknown, but is apparently lower than in the VSJ<sub>2</sub>.

Based on the summary of the statistical frequency of rendaku in (a), Takayama's (1999) decision to exclude SJ<sub>1</sub> morphemes from the schema in (48) is untenable: not only is rendaku more frequent amongst SJ monomorphemes than binoms, the fact that Rosen's PS factor as summarized in (b) is greatly more accurate among monomorphemes adds even more weight to their inclusion. According to Shibatani (1990, 142–143), SJ vocabulary makes up approximately 40% to 65% of the modern Japanese written lexicon, depending on measurement criteria and media. This would mean that, at the most conservative estimate, in the relatively large, well-respected, 230,000-headword Japanese dictionary edited by Shinmura (1996), approximately 90,000 headwords are SJ lexemes. Taking SJ binoms to make up half of all SJ lexemes (again, I believe, an extremely conservative estimate) and, since Vance (1996) estimates rendaku frequency in SJ binoms at 10%, there are probably at the very least 4,500 SJ binoms which undergo rendaku: over 100 times more than

SJ mononoms. In Takayama's defence, therefore, it may be argued that, compared to the much larger number of SJ binoms that exhibit rendaku, the actual number of SJ mononoms that undergo the phenomenon is very few (only 42 lexemes from what was a wide corpus) and that the situation appeared to him much like searching for the proverbial needle in the haystack.

The larger question that arises from what has been demonstrated in this paper is, however, not whether Takayama's (1999) VSJ<sub>2</sub> layer should be modified to a VSJ layer (53a). That much is, I hope, readily apparent. What must be considered is whether one can assert the existence of a separate VSJ<sub>1</sub> layer that lies closer to the core than that of VSJ<sub>2</sub> (53b).

(53)



As both Takayama (1999) in his rendaku-based model and Itō and Mester (1999) in their phonological model stress, clear lines of demarcation cannot be drawn between vocabulary strata. I stress the same for (53) above. As to which model in (53) is the more realistic, the higher rendaku frequency in the SJ<sub>1</sub> layer lends weight to (53b), as does the fact that Rosen's PS factor operates at a level of 90% among rendaku-affected SJ mononoms. Against this (53a), however, it might be argued that (i) while 20% is a large enough proportion of VSJ<sub>1</sub> lexemes to go beyond mere blurring at lines of demarcation, the actual figure of 42 is perhaps too low to warrant an independent stratum; (ii) that Rosen's PS factor remains somewhat questionable outside his strict definition of noun; and (iii) that the lack of any large-scale statistical study to ascertain a more accurate level of PS factor faithfulness for rendaku-affected SJ binoms makes any claim for an independent, more NJ-ward, VSJ<sub>1</sub> stratum too premature.

In apparent opposition to both the models in (53) is the fact that, since the proportion of rendaku immune NJ lexemes and rendaku-affected VSJ<sub>2</sub> lexemes are approximately the same (10%), it would appear difficult to justify the existence of an independent VSJ<sub>2</sub> stratum while denying that of a



“de-Japanized” (“de-nativized”, “Sinoized”, or whatever epithet one chooses) stratum. However, as Ohno (2000, 157) points out, there is no independent evidence of “de-Japanization” other than rendaku immunity itself, while in the VSJ<sub>1</sub> and VSJ<sub>2</sub> layers we find additionally that the occurrence of NJ honorifics (see Section 4) is more frequent. Furthermore, while assimilation of borrowed lexemes resulting in their gradual movement towards a language’s core vocabulary stratum has been frequently documented, the opposite phenomenon, that of core vocabulary being de-assimilated and moving outwards to peripheral strata, has, I believe, yet to be so noted.

Whichever model in (53) may be the more accurate, it is clear that Takayama’s model shown in (48) must be refined to at least (53a). Further research on Rosen’s PS factor, in particular its faithfulness within the VSJ<sub>2</sub> stratum and a possible redefinition to account for the greater prosodic length of SJ binoms, will go a long way to revealing whether further modification to (53b) is more appropriate. It is therefore hoped research in the near future will focus on the creation of a sizeable SJ binom corpus in order to ascertain not just a more precise figure for the proportion of SJ binoms undergoing rendaku but also their level of faithfulness to the PS factor.

#### APPENDICES

The appendices are divided into five sections as follows (with the number of SJ monoms in question following in parentheses):

A: CORE SJ <sub>1</sub> monoms which undergo rendaku	(42)
B: CORE SJ <sub>1</sub> monoms which resist rendaku	(152)
C: ON-DOUBLET SJ monoms	(29)
D: KUN-DOUBLET SJ monoms	(2)
E: NO DATA SJ monoms	(318)

It should be noted that when the same sinograph can be used to write two or more different SJ monoms (or, put another way, when a given sinograph has two or more different SJ readings), all those SJ monoms beginning with a voiceless obstruent have been included as corpus candidates. Thus, with 気, read as either /ki/ or /ke/, both SJ readings exhibit rendaku in hybrid \*-SJ<sub>1</sub> noun compounds (Appendix A items [13] and [14]); while with 質, rendaku surfaces when read as /siti/ (Appendix A item [30]), but not when read as /situ/ (Appendix B). In Appendices B–E such sinographs are immediately followed by the reading in question.

Furthermore, hybrid \*-SJ<sub>1</sub> noun compounds whose initial element is either the NJ honorific prefix /o/- or the NJ quantifier /naN/- (e.g. /naN. byaku/ ‘hundreds’) do not constitute valid compounds for the purposes of this corpus. Any corpus candidates whose only hybrid \*-SJ<sub>1</sub> compound falls

into one of these two categories (of which the number is in any case extremely small) have been considered as NO DATA.

*Appendix A: CORE SJ<sub>1</sub> Mononoms which Undergo Rendaku*

The following 42 SJ mononoms are listed in Masuda (1989), appear as the second element in a hybrid -\*SJ<sub>1</sub> noun compound in Shinmura (1996), and exhibit rendaku at least once. Columns show in order: (1) the reference number; (2) the SJ monom; (3) the sinograph used to write the SJ monom; and one example of rendaku written in (4) Japanese orthography and (5) Yale transcription. Toponyms are indicated by an asterisk following the Yale transcription.

1	haN	半	播り半	suri-baN
2	haN	版	ハイライト版	hairaito-baN
3	hati	鉢	火鉢	hi-bati
4	hei	塀	練塀	neri-bei
5	hi	碑	板碑	ita-bi
6	hoN	本	種本	tane-boN
7	hu	賦	日賦	hi-bu
8	hu	府	大府	oo-bu*
9	huku	福	子福	ko-buku
10	hyoo	俵	小俵	ko-byoo
11	kai	会	立会	tate-gai
12	kaku	角	野角	no-gaku
13	ke	気	湯気	yu-ge
14	ki	気	男気	otoko-gi
15	kiku	菊	野菊	no-giku
16	koo	香	腕香	ude-goo
17	koo	甲	裏甲	uta-goo
18	kyaku	客	内容	uti-gyaku
19	kyoo	経	門経	kado-gyoo
20	kyoo	京	下京	simo-gyoo*
21	kyuu	灸	傘灸	karakasa-gyuu
22	sai	菜	引菜	hiki-zai
23	saku	作	鰻作	u-zaku
24	saN	山	恐山	osore-zaN*
25	saN	産	初産	hatu-zaN
26	saN	算	割り算	wari-zaN
27	saN	棧	襷棧	tasuki-zaN
28	sei	精	堪え精	korae-zei

29	si	師	小師	ko-zi
30	siti	質	人質	hito-ziti
31	soN	損	丸損	maru-zoN
32	soo	僧	車僧	kuruma-zoo
33	soo	相	寢相	ne-zoo
34	syaku	尺	巻き尺	maki-zyaku
35	syaku	酌	仲酌	naka-zyaku
36	syoku	食	小食	ko-zyoku
37	syoo	性	生れ性	umare-zyoo
38	syuku	宿	原宿	hara-zyuku*
39	toku	得	買 <sub>レ</sub> 得	kai-doku
40	toku	徳	賭徳	kake-doku
41	tya	茶	口茶	kuti-dya
42	tyuu	中	町中	mati-zyuu

*Appendix B: CORE SJ Mononoms which are Rendaku Immune*

The following 152 sinographs represent SJ mononoms which are listed in Masuda (1989), appear as the second element in a hybrid -\*SJ<sub>1</sub> noun compound in Shinmura (1996), but do not exhibit rendaku: 化科華海格核冠勘官棺環管缶艦器期機紀記吉脚宮級橋局曲筋菌金句区系罍計欠券権鼎湖公坑工校行講鉦鋼項骨紺差札三酸市式質(/siti/)紗車杓主朱州(/syuu/)衆書抄章証賞燭職心新真芯数寸制姓性(/sei/)生(/syoo/)製席石(/koku/)石(/seki/)積節説先千戦栓線腺船錢層多体(/tai/)体(/tei/)対(/tai/)帶隊宅短注丁(/tyoo/)帳朝町蝶超亭(/tei/)敵の鉄天点堵斗党唐塔灯等糖頭派肺伯箔八斑秘票表豹符封(/huu/)風兵幣偏辺遍方法砲癩窩腱.

*Appendix C: ON-DOUBLET SJ mononoms*

The following 29 sinographs represent SJ mononoms listed in Masuda (1989), but were rejected as corpus candidates due to the fact that they have a second SJ reading listed in Ozaki (1992) which forms a morpheme-initial voiced/voiceless doublet: 着拳見賢胡劫才慘士治集旬神臣地調長賃藤博判貧服仏分吻歩(/hu/)妍隗.

*Appendix D: KUN-DOUBLET SJ Mononoms*

The following 2 sinographs represent SJ mononoms listed in Masuda (1989), but were rejected as corpus candidates due to the fact that they have a *kun*-reading identical to an *on*-reading in Ozaki (1992): 洲(/su/)麩.

*Appendix E: NO DATA SJ Mononoms*

The following 318 sinographs represent SJ mononoms which are listed in Masuda (1989), but do not appear as the second element in a hybrid \*-SJ<sub>1</sub> two-element compound in Shinmura (1996): 佳加可寡架荷課画解回塊快怪戒界開階各殼郭闊活渴寒刊卷完寬感款歛汗漢簡貫間(/kaN/)間(/keN/)閑閑韓館基奇忌季軌騎客(/kaku/)丘急球笈旧居拳虛距京(/kei/)凶卿(/kyoo/)卿(/kei/)境峽強狂興鄉極斤禁九(/ku/)九(/kyuu/)矩苦空黝君訓卦刑兄徑景經(/kei/)決件兼劍圈軒鍵險個弧戶交侯候功効孝幸更港甲(/kaN/)稿紅考腔膏貢香(/kyoo/)刻国穀酷坤根左妻歲犀祭際朔柵策索冊刷燦贊刺史四死糸詩資七失室濕斜社勺寂種首囚周宗臭週暑緒(/syo/)緒(/tyo/)署勝升商妾將小少省祥称衝鉦囑觸信寢審粹世正生(/sei/)聖声静籍切拙選疎祖粗素双叢壯宋想相(/syo/)則束足卒他堆对(/tui/)態胎卓鐸丹歎端胆知智宙忠柱著丁(/tei/)兆寵斤徵腸勅直朕珍通亭(/tiN/)貞帝底弟挺艇邱滴哲轍典徒途都刀当筒統凸霸敗杯拍泊發反(/haN/)反(/taN/)犯班繁藩範煩否比緋費非百標瓢評品譜負封(/hoo/)副複糞丙弊壁癖變篇編步(/ho/)補報苞鋒鵬咄奸婢柁棹楷湍疇疇瘵瘵瘵瘵箴箴箴胚脾腑臄裴詠詠豺駁鑿頌頌頌

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## NOTES

<sup>1</sup> I do not take the less wordy option of referring to these compound nouns composed of two elements as “bimorphemic compound nouns”, since in one very important instance (see Section 3.4) an element itself may be bimorphemic.

<sup>2</sup> In this paper, I will indicate element boundaries within compounds by use of a hyphen (-), and use a period (.) to indicate morpheme boundaries within elements. For phonemic transcriptions, I use the Yale system of phonemic transcription (cf. Martin (1975), Takeuchi (1999), Miyake (2003)).

<sup>3</sup> Those SJ lexemes composed of more than two morphemes are almost without exception composed of either a two-morpheme lexeme plus a prefix or suffix (or both) (i), or are compounds of two or more two-morpheme lexemes (plus prefixes, suffixes, or both) (ii).

- |      |               |   |             |   |                      |
|------|---------------|---|-------------|---|----------------------|
| (i)  | ki.kai        | + | ka          | > | ki.kai.ka            |
|      | machine       |   | -ization    |   | ‘mechanization’      |
| (ii) | ki.kai.ka     | + | noo.gyoo    | > | ki.kai.ka-noo.gyoo   |
|      | mechanization |   | agriculture |   | ‘mechanized farming’ |

<sup>4</sup> I am grateful to an anonymous reviewer for pointing out that the use of the word “bound” to describe the monomorphemic SJ<sub>1</sub> element /roN/ here runs counter to a textbook definition, in that a bound morpheme cannot also occur elsewhere as unbound. In the absence of any other suitable term, I ask for the reader’s indulgence.

<sup>5</sup> The voiceless obstruent /p/ does not occur as the initial phoneme in unbound SJ or NJ morphemes and no examples for this voiceless obstruent will therefore be cited with regard to these two strata.

<sup>6</sup> It is generally accepted that Modern Japanese /h/ derives from a posited earlier [P] via an intermediate [ϕ], hence the Modern Japanese /h/-/b/ pair (see Wenck (1959, 86ff), Mabuchi (1971, 77ff), Okumura (1972, 129), Komatsu (1981, 264ff), Kiyose (1985), Frellesvig (1995, 39), Miyake (2003, 66–77 and 164–166) *inter alia* for a more detailed discussion).

<sup>7</sup> According to Takeuchi (1999, 12), the 11th century Saishōōkyō-ongi, a glossary to the Buddhist text *Suvar aprabhāsa uttamarāja sūtra*, “contains the earliest statement of the constraint on the morphophonological rule usually termed *rendaku*..., which only received its second (partial) formulation in Lyman’s Law (1894)”. Additionally, variations on the Lyman’s Law constraint, and their history, are discussed in Vance (1980b).

<sup>8</sup> Exceptions to Lyman’s Law are discussed in more detail by Martin (1987, 115). Vance (1979, Appendix 1) lists a total of nine compounds with sequentially voiced /-basigo/ as the second element. Kindaichi (1976, 5) cites the male given name /syoo-zabu.roo/ as another exception to Lyman’s Law, but as Martin (1987, 115) points out, this is not a NJ-NJ compound.

<sup>9</sup> Haraguchi (2001) lists some 23 factors which he claims ‘regulate’ *rendaku*. As well as factors already reviewed in (22–27) and others relevant only to non-noun compounds which need not concern us within the scope of this paper, these include acronyms or “clipped words,” a semantic factor whereby sequential voicing is blocked in elements with a “fugulative (sic) meaning,” and pragmatic and regional variation. See also Martin (1987, 115–116) for some other “unusual cases of *rendaku*.”

<sup>10</sup> The terms “*rendaku* haters” and “*rendaku* lovers” appear, according to Rosen, to have been first coined by Kubozono (no publication or date given).

<sup>11</sup> Additionally, Rosen (2001, 40) claims there are far more *rendaku* lovers than *rendaku* haters (he defines the former as voicing in 66% or more of PS-fail compounds in which they appear, the latter as voicing in fewer than 33% of PS-fail compounds in which they appear). Further, he claims there are only two morphemes, /kawa/ ‘skin’, and /hara/, ‘field’, which appear to be neither haters nor lovers, since the proportion of compounds in which they voice as a second element in Rosen’s corpus lies between the two extremes. Thus, “there is an 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.*).

<sup>12</sup> Rosen’s (2001) glosses tend to be overwhelmingly element-for-element literal and frequently mask a compound’s real meaning.

<sup>13</sup> In order to leave no doubt as to whether voicing on the initial obstruent of the second element of a hybrid \*-NI compound whose initial element ends in a nasal (i.e., /N/) is caused by *rendaku* or post-nasal obstruent voicing, I avoid using any such compounds as *rendaku* examples.

<sup>14</sup> For a recent and thoroughgoing treatment of these few instances of *rendaku* in the FJ stratum, see Takayama (forthcoming).

<sup>15</sup> Some scholars (e.g. Hayashi and Yuzawa (1980, 676–677)) also add a layer of very ancient borrowings predating the *go-on* and known as the *ko-on*, and/or a layer of modern borrowings (e.g. Vance (1987, 167–169)), although others (e.g. Tanaka (2002, 15)) would subsume the latter ultra-modern layer into FJ. There are also the so-called *kan’yō-on*, (lit. ‘customary readings’), sinograph readings not borrowed directly from Chinese pronunciation but of Japanese origin. Such *kan’yō-on* readings include “mistaken pronunciations” that have become standardized in the language, as well as “pronunciations of obscure origin” (Vance (1987, 168)) and readings “invented for reading characters devised in Japan” (Unger (1993, 5)).

<sup>16</sup> Ohno (2000, 157) also points out that one of the oldest SJ lexemes, /hakase/, ‘specialist’, which occurs in the *Man’yōshū* (8th century CE), never exhibits *rendaku*.

<sup>17</sup> Itō and Meister (1999, 70) also note such SJ<sub>2</sub> lexemes as “historically borrowed items with core behaviour.” They do not, however, comment in any greater detail on these particular cases, other than to point out that “non-homogeneity is not restricted to the foreign stratum” (recall Itō and Mester propose a two-set FJ stratum, cf. (47).

<sup>18</sup> In Takayama's original schema (Takayama (1999, 380)), the space between NJ and VSJ<sub>2</sub> and also between SJ and FJ, is indicated by means of a dash or hyphen. The space between VSJ<sub>2</sub> and SJ is however indicated by use of an aligned-centre dot, which in Japanese script frequently corresponds in usage to a slash in English. Although Takayama offers no explanation for his choice of punctuation, one can only presume the choice of a dot is designed to indicate that VSJ<sub>2</sub> lies closer to SJ than it does to NJ, hence the narrower gap between VSJ<sub>2</sub> and SJ in (48). Note, however, that in Itō and Mester's (1999) set-inclusive model, the idea of distance between strata would be meaningless.

<sup>19</sup> The ten lexemes in question are /kai.sya/, 'company', /hu.soku/, 'insufficiency', /sya.siN/, 'photograph', /ke.syoo/, 'make-up', /sui.ryoo/, 'guess', /kiN.tyaku/, 'purse, pouch', /ka.si/, 'cake', /too.roo/, 'lantern', /keN.ka/, 'quarrel', and /tai.kai/, '(large) meeting.'

<sup>20</sup> Those which fail are /kiN.tyaku/, /too.roo/ and /tai.kai/, while /hu.soku/, /ke.syoo/, /sui.ryoo/, /ka.si/ and /keN.ka/ hold up in PS-pass noun compounds. I regard the one \*SJ<sub>2</sub> /ke.syoo/ compound I can find that does not undergo rendaku, /kami-ke.syoo/, 'hairstyling and make-up', to be a dvandva compound. Furthermore, while showing that some 'unfamiliar' SJ<sub>2</sub> lexemes such as /hoo.koo/, 'service', in /deQ.ti-boo.koo/, 'apprenticeship', and /too.roo/, 'lantern', in /isi-doo.roo/, 'stone lantern', also undergo rendaku, Ohno (2000, 157) casts doubt on whether the latter SJ<sub>2</sub> lexeme can really be described as "familiar."

<sup>21</sup> The four that obey Rosen's PS factor are /hu.toN/, 'futon' (see (44d)), /koo.yaku/, 'salve', /syaku.si/, 'ladle', and /si.taku/, 'preparation', while the three that do not are /tya.waN/, 'bowl', /ke.siki/, 'scene(ry)' and /sa.too/, 'sugar.'

<sup>22</sup> DeFrancis's (1984) concept of "morphosyllable" in Chinese corresponds to my definition of "mononom" in this paper.

<sup>23</sup> I use the term "speakable" in the same sense that DeFrancis (1984, 193ff) does for Chinese:

Can the Chinese you have in mind be understood if spoken aloud? If the answer is yes, then this Chinese can be pinyinized. If the answer is no, then it cannot. We can test this approach, which consists of what might be called the Speakability Test, by applying it to various kinds of Chinese.

DeFrancis (1984, 193)

<sup>24</sup> The latest and long awaited 5th edition of *Kenkyūsha's New Japanese-English Dictionary* (Watanabe et al. (2003)) came too late for use in the Corpus.

<sup>25</sup> The *on* reading of a sinograph is the SJ reading (see Section 3.3 for subcategories). The NJ reading is known in Japanese as the *kun* reading.

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Faculty of Literature and Social Sciences  
Yamagata University  
Yamagata-shi, Kojirakawa-machi 1-4-12  
990-8560 Japan  
E-mail: irwin@human.kj.yamagata-u.ac.jp