

Grammaticalization and Sequential Voicing in Japanese

Yoshiki Ogawa

Tohoku University

ABSTRACT. This article argues that sequential voicing (SV), which was traditionally regarded as an exclusively morphophonological phenomenon that takes place in compounds, is also available in some syntactic phrases headed by formal nouns (FNP) and that the asymmetry between the FNPs and lexical noun phrases in terms of the possibility of SV is attributed to the assumption that syntactic incorporation of V to FN through T does not violate Li's (1990) prohibition against improper head movement only if the FN is decategorized to a functional category via grammaticalization.*

Keywords: sequential voicing, formal nouns, syntactic incorporation, improper head movement, grammaticalization

1. Introduction

Sequential voicing (henceforth, SV) is defined as “the replacement of a morpheme initial voiceless obstruent with a voiced obstruent” when those sounds are the first sound of the second item in a compound (Vance (1987: 133)). Although the SV is a prevalent phonological process in Japanese, it has some intriguing semantic and/or morphological restrictions on its application, as we will see in section 2, and therefore, a lot of studies have been accumulated from the perspective of not only phonology but also morphology, lexical semantics, cognitive semantics, and psycholinguistics, among others (Martin (1952), McCawley (1968), Otsu (1980), Vance (1980, 1987, 1996, 2014, 2015), Ito and Mester (1986), Kubozono (1999), Ito and Sugioka (2001), Ohno (2001), Yamaguchi (2011), Asai and Vance (2016), Kawahara (2015), Vance et al. (2016), just to name a few).

* This work is a product of the ILCAA joint research project “Exploration into the Mechanism of Language Change and Variation through the Dialogue between Theoretical Linguistics, Linguistic Typology, and Quantitative Linguistics.” This research is financially supported by JSPS Grant-in-Aid for Scientific Research, Grant Number.20K00658. This article is based on the presentations at the Phex 12 workshop held in February 2022 and the joint forum between the 3rd workshop on the ILCAA joint research project and the 8th workshop on Language Change and Language Variation Research Unit held in September 2021, the latter being co-sponsored by ILCAA and GSIS. I thank Kunio Nishiyama and the audiences at the two conferences for their valuable comments and discussions. All remaining errors are my own.

- b. [pan-o tabe-ta {kurai/gurai}]-de-wa, manpuku-ni nara-nai.
bread-Acc eat-Past rank-at-Top full-to become-Neg
'Just eating a cake of bread, I would not become full.'
- c. Taro-to-wa [getuyoobi-ni wakare-ta] {kiri/giri}, at-tei-nai.
Taro-with-Top Monday-on say. good.by-did after meet-Asp-Neg
'We have not seen Taro since we said good-bye to him on Monday.'

FNs in Japanese are commonly understood along the following lines. First, Masuoka and Takubo (1992) provide characteristics of FNs as follows:

- (4) a. Formal nouns are semantically bleached and cannot be used without a modifying element.
b. Formal nouns are more salient in their functions as parts of a syntactic construction than their referential functions (such as referring to a notion or an object), and they are combined with a phrase/clause to form an adverbial clause/phrase or are combined with a copula to form a modal auxiliary.

Second, Hino (2001) and Miyaji (2007), among others, argue that many of the FNs in Japanese have been grammaticalized from a lexical noun or the adverbial form (the so-called *ren'yoo kei* in Japanese linguistics) of a lexical verb, which can intrinsically function as a noun in Japanese.

In Japanese, there are at least fifty types of bona-fide FNs, only some of which are illustrated below. Many of the FNs are used in much the same syntactic environments that a lexical noun can occur (that is, an argument position) even in modern Japanese, but some of them are also used as adverbial particles (the so-called *toritate-si* in Japanese linguistics) to head an adverbial clause or as modal auxiliaries in combination with the copulas *da/dearu/aru* 'be' or its negated form *N-de-nai/N-ga-nai* (Teramura (1982)):

- (5) a. koto 'fact', tokoro 'place', mono 'thing/person', kiri 'after' < 'cut',
kurai 'just after' < 'degree' < 'rank', koro 'around when' < 'approximate
time', kagiri 'as far as' < 'limit', etc.
b. uti (ni) 'while < inside', wari(ni) 'considering that < division'
c. mono (da) 'it is natural' < thing+Cop; hazu (da) 'it is probable that ...';
hazu (ga nai) 'it is impossible' < hazu (a part of an arrow that fits a bow)

The asymmetry between lexical nouns immediately preceded by a relative clause

(adnominal clause) and FNs immediately preceded by a complement clause in terms of SV is clear. Moreover, it should be pointed out that the ratio of the FNs being voiced under SV has been almost never voiced before the Meiji/Taisho Era (the late 19th century), although FNs that occur in a compound have been voiced since as early as the Nara Era (the late 8th century). Thus, we can identify three types of asymmetries on SV, as summarized as in (6a-c):

- (6) a. a formal noun preceded by a clause (optionally voiced) vs. a formal noun compounded with a single morpheme (almost always voiced)
- b. a lexical noun preceded by a clause (never voiced) vs. a formal noun preceded by a clause (optionally voiced)
- c. a historical change: a formal noun preceded by a clause was almost never voiced in the older Japanese but the ratio of its being voiced has surged up from the Meiji/Taisho Era onward.

Among these, (6a) has been traditionally recognized, but to the best of my knowledge, (6b) was out of the scope of any discussion about SV, and (6c) was not even noticed in the past research on SV.

This article is organized as follows: Section 2 will review laws and/or constraints on SV that have been previously recognized, showing that none of them is helpless in explaining the phenomena that we would like to explain here. In section 3, data collected from two historical corpora are given to show (6c). Section 4 will introduce Nishiyama's (2015) theory of incorporation in phrasal compounds and Li's (1990) theory of verb incorporation and argue that a combination of them with a theory of grammaticalization will enable us to account for why a FN that follows a clause *can* undergo SV, whereas a lexical noun that follows a clause can never undergo SV. Section 5 is a conclusion and remarks on theoretical implications.

2. Previously Observed Laws on SV and Their Deficiency

There are many laws on SV that were observed in previous studies, the most famous of which is Lyman's (1894) Law, which states that SV never occurs in a compound in which the second element already contains a voiced consonant. For example, while *sibu* 'astringent' and *kaki* 'persimmon' form a compound *sibu-gaki*, *ai* 'match' and *kagi* 'key' never form a compound *ai-gagi* 'matching key', instead of which *ai-kagi* is formed, as in (7):

- (7) a. sibu ‘astringent’ + **kaki** ‘persimmon’ → sibu-**gaki** ‘astringent persimmon’
 b. ai ‘matching’ ... **kagi** ‘key’ → ai-**kagi**/*ai-**gagi** ‘matching key’

Besides Lyman’s Law, several constraints on SV that determine the absence of SV in a potential SV environment have been proposed, such as (i) Rosen’s (2001) Law that refers to the asymmetry between *takara-bune* ‘treasure ship’ vs. *kuro-hune*/**bune* ‘black ship’, (ii) the argument/adjunct asymmetry such as *te-huki*/**te-buki* ‘hand-wipe’ vs. *kara-buki* ‘dry-wipe’ (Kubozono (1999); Ito and Sugioka 2(001); Yamaguchi (2011)), (iii) the Japanization constraint such as *umi-game* ‘sea turtle’ vs. *dezitaru kamera*/**gamera* ‘digital camera’ (Otsu (1980); cf. Ohno (2000)), (iv) the constraint that prevents dvandvas or coordinative compound from being SV-ed, such as *Tone-gawa* ‘Tone river’ vs. *yama-kawa* ‘mountains and rivers’ (Kubozono (1999), Ito and Sugioka (2001)), (v) the condition that a right-branching structure is less likely to be voiced than a left-branching structure, such as *nise-tanuki-ziru* ‘a disguised raccoon soup’ vs. *nise-danuki-ziru* ‘a soup of disguised raccoon’ (Otsu (1980)). However, all these laws and constraints of SV aim at explaining why SV does NOT occur in some compounds, under the presupposition that SV can always occur in a compound, and none of them are helpful in explaining the asymmetry between FNPs and lexical noun phrases, neither of which are compounds, as mentioned in (6b).

Another potential problem with previous studies on SV is the fact that SV can also occur in derived words, which are distinguished from compounds in traditional morphological theories. In traditional morphology, the distinction between compounding and derivation is made clear: the former is a combination of two or more free morphemes, whereas the latter is a combination of a free morpheme (either a stem or a bound root) and a bound morpheme (prefix or suffix). Thus, if SV were limited to within compounds, no derived words would be expected to trigger SV. Contrary to this prediction, however, in Japanese there are some prefixes that can form a derived word in which the first mora of the second element (root) is voiced, as in (8a-c), and there are some suffixes that can form a derived word in which initial mora the suffix is voiced, as in (9a-c):¹

- (8) prefix + stem (小人、真顔、か細い) :
 a. ko ‘small’ (diminutive prefix) + **hito** ‘person’ → ko-**bito** ‘dwarf’
 b. ma ‘serious’ (prefix) + **kao** ‘face’ → ma-**gao** ‘a serious look’

¹ In some previous studies on SV, as in Ohno (2000), the distinction between compounding and derivation is not made in the first place.

- c. ka (prefix, intensifier) + **hosoi** ‘slender’ → ka-**bosoi** ‘skinny’
 (9) stem + suffix (演者、生き様、かわいげ) :
 a. en ‘acting’ + **sya** (suffix) ‘person’ → en-**zya** ‘actor’
 b. iki ‘living’ + **sama** (suffix) ‘way’ → iki-**zama** ‘the way one lives’
 c. kawai(i) ‘charming’ + **ke** (suffix) ‘sign’ → kawai-**ge** ‘charm’

A third problem with previous theories of SV is that they cannot explain any facts about diachronic change in the possibility of SV. For example, Asai and Vance (2015) propose that a generalized Lyman’s Law was at work in Old Japanese. Recall that Lyman’s Law dictates that SV cannot occur when the *second* element already contains a voiced consonant, as in (7b). This original law does not say anything about whether the presence of a voiced consonant in the *first* element blocks SV or not. In fact, in modern Japanese, SV is generally not blocked even when the first element of a compound contains a voiced consonant in it, as shown in the right of the arrows in (10a,b):

- (10) a. **siba** ‘lawn’ + **kaki** ‘fence’ → **siba-gaki** ‘lawn-made fence’
 b. **mizu** ‘water’ + **hana** ‘edge’ → **mizu-haba/mizu-bana** ‘the moment at which water begins to gush out’

However, Asai and Vance (2015) show that in Old Japanese, such compounds were pronounced with the initial obstruent of the second element voiceless, as in (11a,b):

- (11) a. **siba-kaki** ‘lawn-made fence’
 b. **mizu-paba** ‘the moment at which water begins to gush out’²

This is because the generalized Lyman’s Law that was active in Old Japanese dictates that SV cannot occur when either the first or second element already contains a voiced consonant. The generalized Lyman’s Law in Old Japanese has been replaced by Lyman’s Law in modern Japanese. The diachronic change from Old Japanese to Modern Japanese implies that the environments in which SV occurs has been enlarged diachronically.

Similarly, Lu (2015) investigates the pronunciation of a number of compounds formed by combining two Sino-Japanese characters in traditional written texts from the Nara Era to the Meiji Era as well as in some historical corpora, demonstrating that the second element in such compounds has been becoming increasingly suffix-like and

² In Old Japanese there was no consonant /h/ and /p/ was used instead.

increasingly voiced. Thus, consider the development of *-xei/jei* (勢):

- (12) a. Gunjei 軍勢 Banjei 番勢 Mōjei 猛勢
 b. Ixei 威勢 Taixei 大勢 †Cōxei/Gōxei 強勢 Buxei 無勢 Caxei 加勢

According to Lu (2015: 111), among words listed in *Nippojisho* or *Vocabulário da Língua do Japão*, those X+勢 compound in which X is a Sino-Japanese morpheme and 勢 is voiced as *-jei* are basically limited to cases in which X contains a nasal consonant as in (12a) (which may be analyzed as ‘post-nasal voicing’), and those whose modern Japanese counterparts are voiced were pronounced with the voiceless initial obstruent, as in (12b). Also, in modern Japanese, *-jei* (勢) can only be used like an affix, combined with another Sino-Japanese morpheme,³ but Lu (2015: 108-109) shows that such an affixal usage did not appear until the Muromati/Edo periods and that from the Heian Era to Meiji Era it could be used as a free morpheme, as in (13):

- (13) サレバヨクヨクハカリ事ヲ メグラシテ、 勢ヲ モヨホシ...
 Sareba yokuyoku hakarigoto-o megurasi-te xei-o moyoosi ...
 as.such deeply plot-Acc ponder.over-and power-Acc arouse
 (*Engyo-bon Heike Monogatari*, c1419-1420)

To sum up, for 勢, the gradual change from a free morpheme to a bound one has proceeded in tandem with the gradual change from the voiceless *-xei* to the voiced *-jei*.

In the next section, we will provide a corpus-based generalization showing that the FNPs that select a complement clause has been diachronically more and more likely to be voiced along with their increase in type frequency.

3. SV in Formal Noun Phrases: Facts Obtained from Historical Corpora

3.1. Formal Nouns in Japanese

In order to uncover the nature of the asymmetry between compounds and FNP

³ Even in modern Japanese, 勢 retains the voiceless pronunciation in cases where it is used as the initial element of a compound like a prefix, as in *xei-ryoku* (勢力) ‘power, strength’. As it can be used like a prefix as well as a suffix, its morphosyntactic status does not fit into a definition of “affixes” in European linguistics. Rather, the fact that a combination of 勢 and another morpheme in either the X+勢 or 勢+X order is available shows that it is more like a neo-classical compound of the Greek origin such as {*psychology / logical*}, {*hydrophobia / phobic*}, etc.

quantitatively, I first investigated synchronic facts about FNs and SV.

First, I have identified 66 items that can only be used as formal nouns. All of them have been grammaticalized from lexical nouns or verbs and can only be used as bound morphemes. Some of them have undergone secondary grammaticalization and are currently used only as conjunctive markers, modal auxiliaries, adverbial suffixes, and so on. Among the 66 items of FN, those beginning from a non-obstruent phoneme and those containing a voiced phoneme (for which Lyman's Law would block SV in any event) are excluded as irrelevant, and 46 items were left. Among the 46 items that can potentially alternate between voiced and voiceless initial obstruents, there were 25 items that have actually allowed the voiced counterpart at least once in the history of Japanese. Among them, there were 17 items that can or could follow a clause or a VP. Among them, there were only 7 examples that can or must be voiced when they follow a clause in modern Japanese, which are illustrated as in (14a-g):⁴

- (14) a. koro/goro (ころ/ごろ/頃) 'approximate time'
 b. kurai/gurai (くらい/ぐらい/位) 'degree < rank'
 c. kiri/giri (きり/ぎり/切り) 'only/limit < cut'
 d. hakari/bakari (ばかり/計り/秤) 'just after < measure'
 e. tokoro/dokoro (ところ/どころ/処/所) 'right after / time < place'
 f. kawa/gawa (かわ/がわ/側) 'side'
 g. take/dake (たけ/だけ/丈) 'only < height'

As for these seven FNs, we compared between their uses in modern Japanese and those in old Japanese, for each of the cases in which they are immediately preceded by a clause (or a conjugated verb) and those immediately preceded by a noun, and we have obtained the following two descriptive generalizations:

- (15) a. A FN preceded by a clause was almost never voiced in the older Japanese but the ratio of its being voiced has surged up from the Meiji/Taisho Era onward.

⁴ In addition to the 7 items, I have identified *fun/bun* (分) 'minute/share' as a FN that can be combined with either a noun or a clause and can be voiced. However, I left it out from the quantitative study because in modern Japanese there are too many tokens of it to count, as it is commonly used as the temporal suffix meaning 'minute', which is voiceless, and it is hard to distinguish the voiceless uses from the voiced uses and calculate the percentage of the voiced ones just from the notations on the corpora.

- b. Some of the FNs preceded by a clause are optionally voiced, whereas the same FNs are almost always voiced when compounded with a noun.

To illustrate some of the facts of (15a), *bakari*, which means ‘only’, is grammaticalized from the noun *hakari* ‘measure’ (計り/秤), and is always voiced in modern Japanese but not in Old Japanese, as shown in (16):

(16) 秋くれと月のかつらのみやはなる光を花とちらすはかりを。

Aki kure-to tuki-no katura-no mi-yawa naru, hikari-o hana-to tirasu **hakari-o**
(*Kokin Wakasyuu*; c905)

‘I wonder if (the trees of) katura in the moon are going bear fruits when autumn comes. No, they won’t. Now they are only emitting light as if they were flowers.’

As another example, *kawa/gawa*, which means ‘side’, is always voiced in modern Japanese except when it occurs in geminated consonants as in (17b,c), but it was more often pronounced voiceless until Early Modern Japanese, as in (17a):

(17) a. Mae-ashi-o i-no **kawa-ni** nage.kake, ... (井の側)

Front-leg-Acc well-Gen side-to throw.hold

‘Throwing one’s front leg on the side of the water well, ...’

(*Amakusa-ban Isoho Monogatari*, c1593)

b. Hidari-**kkawa**-no me-ga itai. (possible in modern Japanese)

left-side-Gen eye-Nom ache

‘One’s left eye aches.’ (左側)

c. Hidari-**gawa** (possible in modern Japanese)

‘the left side’ (左側)

d. Taroo-ga tat-te-iru **gawa/*kawa**

Taroo-Nom stand-Prt-Asp-Nonast side

‘the side where Taro is standing’

As a third example, *take/dake*, which means ‘only’, is grammaticalized from the noun *take* ‘height’; it is always voiced with the same meaning in modern Japanese except when it occurs in geminated consonants as in (18b-d), but it was more often voiceless until Early Modern Japanese, as in (18a):

- (18) a. Omowu yue, te-no todok-u-**take**-wa sensaku-site, ...
 think because hand-Gen reach-Nonpast-only-Top inquiry-do, ...
 ‘As I think, I am inquiring as far as I can ...’ (*Syarebon, Satosuzume*, c1826)
- b. ari-**ttake**-no okane (possible in modern Japanese)
 be-only-Gen money (ありったけ)
 ‘as much money as one has’
- c. ringo-**dake**-o tabe-ta. (りんごだけ)
 apple-only-Acc eat-Past
- d. Kodomo-ga ayamar-u-**dake**-de-wa yurus-are-nai.
 Child-Nom apologize-Nonpast-at-Top forgive-Pass-Neg
 ‘I will not forgive you just because your child apologizes to me.’

Facts of (15b) are illustrated by the pairs of examples in (19) and (20):

- (19) a. hiru-**goro**/*hiru-**koro**
 ‘(lit.) noon-approximate.time (about noon)’
- b. **koro**-ai
 (lit.) approximate.time-fit
 ‘suitable time’
- c. [sakura-ga sak-u {**koro/goro**}-ni-wa, ... (= (3a))
 cherry.blossom-Nom bloom approximate.time-on-Top
 ‘Around when cherry blossoms bloom, ...’
- (20) a. ganbari-**dokoro**/***tokoro**
 ‘(lit.) be.full.of.energy-place
 ‘the {place where / time when} you have to be full of energy’
- b. **Tokoro** kaware-ba, sina kawaru.
 place change-COND goods change
 ‘(lit.) If places change, goods will change. (You can see different goods in different places)’
- c. Koko-wa boku-ga 5-nen-mae made sunde-i-ta **tokoro**/***dokoro** da.
 Here-Top I-Nom 5-year-before until live-Asp-Past place Cop
 ‘Here is the place where I lived until five years ago.’
- d. Boku-wa ima kaet-ta **tokoro**/***dokoro** da.
 I-Top now come-Past place Cop
 ‘I have just come home.’

- e. Isogasiku-te, hirugohan-o tabete-i-ru **dokoro/*tokoro** de-wa nai.
 Busy-and lunch-Acc eat-Asp-Nonpast place Cop-Top Neg
 ‘I am too busy to take a lunch.’

In (19a,b), the FN *koro* ‘approximate time’ is always voiced when it occurs as the second element of a compound, but voiceless when it occurs as the first element of a compound.⁵ In (19c), the same FN is optionally voiced when it occurs immediately after a clause. In (20a), the FN *tokoro* ‘place’ is always voiced when it occurs as the second element of a N-N compound or V-N compound. In (20b), *tokoro* appears to have a non-affixal voiceless use, but it is part of a proverb and there is no productivity in the occurrence of this non-affixal voiceless use, nor is there any other use of *tokoro* as a voiceless free morpheme. In (20c), the FN *tokoro* is never voiced when it immediately follows a clause and means ‘place’. In (20d,e), the same FN is used with the meaning of ‘time’, with mutually different semantics: the voiceless version in (20d) is a grammatical marker of present perfective aspect, while the voiced version in (20e) is always collocated with the negated copula to have a modal meaning of ‘incapability’ as a whole. If we assume that a modal auxiliary is more grammaticalized than an aspectual auxiliary, we can say here that the more grammaticalized FN is more likely to be voiced.

As such, we can see that FNs are by definition used as bound morphemes, but differ in the possibility of SV on them depending on whether they are part of a compound or whether they immediately follow a clause: the latter is less likely to be voiced than the former. But the important fact is that they CAN be voiced, unlike the cases in which a lexical noun is modified by a relative clause, in which case they can NEVER be voiced. Moreover, the diachronic facts show that many of the FNs have been semantically bleached and grammaticalized into focus marker, aspect marker, modality marker, adverbial particle, and so on, and accordingly they have become more likely to be voiced.

To confirm these observations quantitatively, I used two corpora to make a quantitative survey of the diachronic change in the ratio of voiced FNs in the potential SV environments. The two corpora used in this analysis are the Corpus of Historical Japanese (CHJ) and the Balanced Corpus of Contemporary Written Japanese (BCCWJ). The CHJ collects about 17 million words, mainly from literary works written in the 1200 years between the Nara Era and the Edo Era and from magazines published in the Meiji/Taisho Era (as of September 2021). The BCCWJ collects about 105 million words

⁵ Analogously to *-xei/jei* in note 4, we can assume that *koro* is like a component of a neo-classical compound, as it cannot be used as a free morpheme but it must always be a bound morpheme.

from various texts including novels, magazines, official reports, textbooks, and websites written between the years 1971 and 2008 (the Showa/Heisei Era).

From the CHJ and BCCWJ, I collected examples of both the voiced and voiceless uses of the seven items that follow either a noun or a tensed verb, and counted the number of each use in each of the following three time periods: (i) the pre-Meiji Era (before the year 1867), (ii) the Meiji/Taisho-Era (from the years 1868 to 1947),⁶ and (iii) the Showa-Heisei Era (from the year 1971 to 2008). In the investigation, I used the morpheme-based search system (短単位検索), with the lexeme of a FN put in the Key slot, with one item immediately before filled by a noun or a verb or the past-tense morpheme *ta* or the perfective auxiliary morpheme *-taru*. After the corpus search, I downloaded an Excel file of all the search results and checked if one or more of the *Kana*-realization Form, the Pronounced Form, the Original Form Written in the Text, or Furigana contains a voiced

		CHJ (pre-Meiji)		CHJ(Meiji-Taisyō)		BCCWJ (Syōwa)		
compiled words		3249276		14355250		104911460		
N+formal noun		unvoiced	voiced	unvoiced	voiced	unvoiced	voiced	
A	N+hakari/bakari	token	207	2251	11	3211	0	11142
		%	8.4	91.6	0.3	99.7	0.0	100.0
B	N+take/dake	token	6	40	47	3345	77	69138
		%	13.0	87.0	1.4	98.6	0.1	99.9
C	N+kawa/gawa	token	5	0	6	38	32	14230
		%	100.0	0.0	13.6	86.4	0.2	99.8
D	N+koro/goro	token	36	46	1076	463	8077	3753
		%	43.9	56.1	69.9	30.1	68.3	31.7
E	N+kiri/giri	token	9	26	117	52	1139	29
		%	25.7	74.3	69.2	30.8	97.5	2.5
F	N+kurai/gurai	token	48	14	1275	700	18925	9412
		%	77.4	22.6	64.6	35.4	66.8	33.2
G	N+tokoro/dokoro	token	78	20	15	145	45	2377
		%	79.6	20.4	9.4	90.6	1.9	98.1
Sum (A ~ G)		token	389	2397	2547	7954	28295	110081
		%	14.0	86.0	24.3	75.7	20.4	79.6

<Table 1: The token frequencies and ratios of the voiceless and voiced versions of each of the seven FNs following a N/NP at each of the three time periods>

form. As a result, if at least one of the four columns contains a voiced form, I classified the example as a “voiced” example. Table 1 shows to what extent each of the seven FNs

⁶ Data in the Meiji/Taisho-Era also includes those in the early Showa Era, as textbooks published in the early Showa Era are regarded as reflecting the prescriptive uses of the Taisho Era.

following a lexical N were SV-ed in each of the three time periods.

Table 1 shows the token frequencies of each of the seven items following a noun or NP in each of the three time periods. The lines of % show the ratio of voiced and voiceless uses among all the uses in each time period, and the shaded slots show the time period at which the ratio of the voiced version is at the highest among the three time periods. Among the seven items, three show the highest ratio of the voiced versions in a time period other than the Showa/Heisei Era, whereas the remaining three show the highest ratio of the voiced versions in the Showa/Heisei Era. Among others, the ratio of the voiced versions of the N+*kiri/giri* and N+*koro/goro* pairs were the highest in the pre-Meiji Era and has been gradually decreasing in the last 150 years or so. By contrast, the ratio of the voiced versions of the other five FNs are the highest in the Showa/Heisei Era and has been gradually increasing up to the modern period. In total, the ratio of the voiced versions among all the seven examples of N+FN was highest in the pre-Meiji Era at 86.0%, but the ratio of the voiced versions in the Showa/Heisei Era is also 79.6% and the average ratio of the voiced versions has been more or less stable during the history of Japanese.

		CHJ (pre-Meiji)		CHJ(Meiji-Taisyo)		BCCWJ (Syowa)		
compiled words		3249276		14355250		104911460		
V+formal noun		unvoiced	voiced	unvoiced	voiced	unvoiced	voiced	
A	V+hakari/bakari	104	65	8	445	0	4072	
	%	61.5	38.5	1.8	98.2	0.0	100.0	
B	V+take/dake	2	2	29	562	170	35186	
	%	50.0	50.0	4.9	95.1	0.5	99.5	
C	V+kawa/gawa	0	0	0	4	0	1620	
	%	0.0	0.0	0.0	100.0	0.0	100.0	
D	V+koro/goro	25	0	728	0	3329	12	
	%	100.0	0.0	100.0	0.0	99.6	0.4	
E	V+kiri/giri	0	0	82	11	1020	3	
	%	0.0	0.0	88.2	11.8	99.7	0.3	
F	V+kurai/gurai	21	2	925	29	4950	1283	
	%	91.3	8.7	97.0	3.0	79.4	20.6	
G	V+tokoro/dokoro	2595	13	18131	54	45470	878	
	%	99.5	0.5	99.7	0.3	98.1	1.9	
Sum (A ~ G)		token	2747	82	19903	1105	54939	43054
		%	97.1	2.9	94.7	5.3	56.1	43.9

<Table 2: The token frequencies and ratios of the voiceless and voiced versions of each of the seven FNs following a V/VP/clause at each of the three time periods>

The change in the ratio of the voiced FNs that follow a VP/clause shows a totally different pattern from the change in the ratio of the voiced FNs that follow a N/NP.

Table 2 shows to what extent the combination of a V in its present/past/perfective form and each of the seven FNs is SV-ed in each of the three time periods. Among the seven items, five show the highest ratio of the voiced versions in the Showa/Heisei Era, and the remaining two show the highest ratio of the voiced versions in the Meiji/Taisho Era. Except for V+*kurai/gurai*, and V+*tokoro/dokoro*, the ratio of the voiced versions has been monotonously increasing across the three time periods, and above all, the rise from the pre-Meiji Era to the Meiji/Taisho Era is sharpest for three of the seven items, and for the remaining four, the rise from the Meiji/Taisho Era to the Showa/Heisei Era is sharpest.

All in all, the result of the corpus research is summarized as below:

- (21) a. Among the examples of N/NP+FN collocation and among the examples of the VP/clause+FN collocation, the voiced version was almost always observed later than or as late as (but not earlier than) the voiceless version (the only exception was the VP/clause+FN collocation for *take/dake*).
- b. The ratio of the voiced counterparts of the N+FN collocation among all the instances of the N+FN collocation has been stable throughout the history of Japanese, between 75% and 86%.
- c. The ratio of the voiced counterparts of the VP/clause +FN collocation among all the instances of the VP/clause +FN collocation was stably low before the Meiji/Taisho Era (from 3% in the pre-Meiji period to 5% in the Meiji/Taisho Era) but surged up to 44% in the Showa/Heisei Era.

4. An Analysis: Grammaticalization and Syntactic Incorporation

As is repeatedly stated, facts to be explained are three-fold:

- (22) a. The asymmetry between the N/NP+FN combinations and the VP/clause+FN combinations in terms of the possibility of SV.
- b. The ratio of FN in the VP/clause+FN combinations being voiced has sharply increased between the Meiji/Taisho Era and the Showa/Heisei Era.
- c. While some of the FN modified by a clause can be voiced, a lexical noun modified by a relative clause can never be voiced.

We take the idea of grammaticalization to be doubly instrumental for explaining these facts because grammaticalization, by definition, involves a cline of diachronic change not only from a lexical category to a functional category, as in (23a), but also from a free morpheme to a bound morpheme, as in (23b).

FNP, in the sense that both a suffix and a FN are bound morphemes that stand in contrast to lexical nouns as free morphemes.

Another aspect of grammar that is important to know in this context is the fact that the non-head element ranges from word to phrase to clause is not limited to FNPs but is also seen in compounds: although it is not observed quite often, we can see examples of “phrasal compound,” which by definition is a compound that contains a phrase in it, as in (25) and (26):

- (25) [NP *kirei-na mati*]-*zukuri* (*zukuri* ← *tukuri*)
 beautiful town make
 ‘planning a beautiful town’
- (26) [NP *Tyuugoku-to-no kokkyoo*]-*zoi-o* *nagare-ru kawa* (*zoi* ← *soi*)
 China-with-Gen border-go.along-Acc run-Nonpast river
 ‘the river that runs along the border between China and another country’

Such instances of phrasal compounds, as they stand, could potentially involve a violation of the principle of Lexical Integrity (Lapointe (1981), Bresnan and Mchombo (1995)) and the No Phrase Constraint (Roeper and Siegel (1978); Botha (1984)), but (25) and (26) are not only acceptable but also involve SV: the heads of the compounds, *tukuri* ‘make’ and *soi* ‘go along’ are voiced as *zukuri* and *zoi*, respectively. Focusing on (25), Nishiyama (2015) also points out one more important fact that (25) as a whole contains the phrasal accent of HLLL-LHHLL, where there is a bracketing paradox such that the morphological boundary lies between *kireina* ‘beautiful’ and *mati-dukuri* ‘town making’, whereas the syntactico-semantic boundary lies between *kireina mati* ‘beautiful town’ and *tukuri* ‘make’. To solve this paradox, Nishiyama proposes that *mati*, the N head of the NP *kireina mati*, is syntactically incorporated to the head of the compound *tukuri* to form a morphological word (cf. Baker (1988)). We can apply a similar argument to (26) as well, except that *zoi* can only be used as a suffix so that *kokkyoo-zoi* is not a compound but a derived word.

Given these as presupposed, I will make the following two proposals. First, I will propose the rule of SV, as in (27):

- (27) SV is a phonological rule that can apply to the output of a “*morphosyntactic unit*” created as a result of any syntactic operation, and make the initial obstruent of the second element voiced.

Now, we go on to claim that a similar process of syntactic incorporation can occur in the complement of FNP under a certain condition. First, recall that just as a free morpheme in a compound is grammaticalized to an affix in a derived word, we are assuming that a lexical noun is grammaticalized to a FN. Note also that under a theory of diachronic constructionalization (Traugott and Trausdale (2013)), we can assume that a N+FN morphological combination can be constructionalized to a phrasal construction of the form clause+FN diachronically, by extending the host class that is available for the non-head at the complement of the FN.

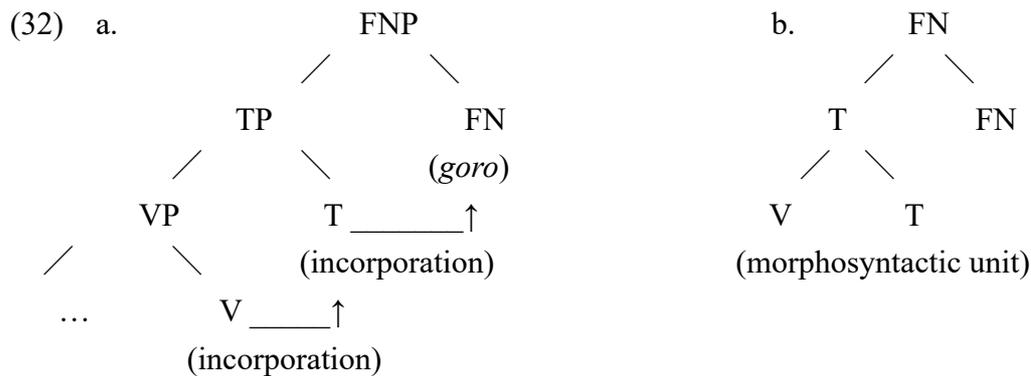
- (31) Examples of constructionalization:
- a. compound > derived word
 - b. lexical noun phrase > formal noun phrase
 - c. N/V+ FN > NP/VP+FN > Clause+FN

Given (27), (28) and (31) and an assumption on syntactic incorporation independently motivated in Nishiyama (2015), we can fully understand why we see SV not only in compounds but also in derived words and in the FNP that selects a VP/clause as well.

But before proceeding on to the explanation of (3a-c), we need to get back to the question of why it is that a combination of a clause and a lexical noun (i.e. a noun modified by a relative clause) is never SV-ed (= (2b)), whereas a combination of a clause and a FN (i.e. FNP) can sometimes be SV-ed (= (3a-c)). To explain the lexical/formal asymmetry, we should first note that when a FN takes a clause as its complement, it is TP, so the incorporation of V to FN takes the first step of incorporation of V to T followed by the second step of incorporation of the [V+T] complex to the FN, as in (32a,b). Given this, I will claim that whether the incorporation in (32a) is possible or not depends on whether the FN is a lexical or functional category, to the effect that incorporation of the [V+T] complex to the FN is possible only if the FN is a functional category:

d. kara-seki / kara-zeki ‘dry cough’ (Vance et al. (2016: 16))

We assume that the optionality of SV in (3a-c) is analogous to that in (ia-d).



Li (1990) bases his argument on Baker's (1988) observation that causativization is a case of verb incorporation (VI). VI can combine an embedded verb and the matrix verb to form a complex verbal unit, as in (33), an example from a Chichewa dialect:

- (33) Anyani a-nawa-meny-ets-a ana kwa buluzi
 baboons SP-T-OP-hit-make-A children to lizard
 'The baboons made the lizard hit the children.' (Li (1990: 411))

Li observes that such a VI is found only when the matrix causative verb takes a bare VP complement, but not when the complement clause is either TP or CP:

- (34) a. make [_{CP} C [_{TP} Subj T [... [_{VP} V (NP)]]]]
 ↑ _____ * _____ |
 b. make [_{TP} Subj T [... [_{VP} V (NP)]]]]
 ↑ _____ * _____ |

Li proposes to rule out (34a,b) as a prohibition against improper head movement, which will distinguish between legitimate and illegitimate verb incorporation: after a lexical verb (V) moves to a functional category (F), the [V+F] complex cannot be further incorporated to another lexical category V to form a more complex morphological unit of [[V+F]+V] because such a movement would violate the prohibition against improper head movement (technical details are put aside for space limitation).

Now, I will propose to apply Li's analysis of VI to SV in Japanese. In (35a), after the V-to-T incorporation, the V+T complex has to be incorporated further to the lexical noun for the entire complex to be a morphosyntactic unit. But such a successive-cyclic incorporation would violate Li's prohibition against improper head movement, for the same reason as (34a,b), as T is a functional category. This means that [*hosita-kaki*] can

never form a morphosyntactic unit. Hence, SV is blocked in (35a).

- (35) a. *[[V+T]+N] (formed by syntactic incorporation) → SV is impossible
 (This is a case of 太郎が干した柿 (**kaki**) in (2b))
- b. *[[V+T]+FN] (syntactic incorporation) → SV is impossible if FN is NOT
 decategorized by grammaticalization but remains a lexical category
 (This is a case of, for example, 太郎が花子にぶたれたこと (**koto**))
- c. [[V+T]+FN] (syntactic incorporation) → SV is possible if FN is
 decategorized and turned to a functional category, via grammaticalization
 (This is a case of, for example, 桜が咲く頃 (**koro/goro**))

Similarly, if a FN is grammaticalized (in the sense of becoming a bound morpheme) but not yet decategorized and keeps a status of the lexical noun, then the successive-cyclic incorporation would be ruled out for the same reason as (35a). This is why SV never occurs in the FNP headed by *koto* ‘fact’ in (35b).⁸ On the other hand, in (35c), we assume that the FN *koro* ‘approximate time’ is fully grammaticalized and decategorized to a functional category; in this case, the successive-cyclic incorporation would not cause any problem with improper movement, for the same reasons as a V-to-T-to-C movement as is observed in Germanic V2 languages does not. Hence, in (35c) the [[V+T]+FN] can form a legitimate morphosyntactic unit, in which SV is possible. This is our explanation of why there is a lexical/formal noun asymmetry between (35a) and (35c), as well as why not all FNs can be SV-ed, as in (35b).

Along these lines, the fact that the ratio of FNs being voiced when they take a clausal complement has been surged up from the Meiji/Taisho Era to the Showa/Heisei Era can be attributed to the fact that decategorization of FNs from a lexical noun to a functional category took place in that period.

5. Conclusion

Starting from a brief overview of the traditional approaches to Sequential Voicing (SV), we have explained the three asymmetries on SV in terms of syntactic incorporation

⁸ We assume that the primary grammaticalization involves semantic bleaching and/or metaphorical extension as well as becoming a bound morpheme but does not always involve decategorization. This assumption does not necessarily contradict Brinton and Traugott’s (2005) definition of primary and secondary grammaticalization, if becoming a bound morpheme (suffix) is part of assuming a grammatical function of taking a host and changing its grammatical category.

and grammaticalization: [A] The asymmetry between the N+FN combinations and the clause+FN combinations in terms of SV occurs because the prohibition against improper movement would prevent syntactic incorporation from V to FN in a clause-taking FNP unless FN is decategorized to a functional category; [B] While some of the FNs modified by a clause can be voiced, a lexical noun modified by a relative clause can never be voiced, because the prohibition against improper movement is always violated as the head noun modified by a relative clause is never grammaticalized; [C] The ratio of FN in the clause+FN combination being voiced has sharply increased between the Meiji/Taisho Era and the Showa/Heisei Era, because the relevant FNs began to be decategorized to a functional category in the period, which made it possible to undergo successive-cyclic syntactic incorporation of the V+T complex to the FN. It is important to note that not all FNs are functional categories and that many of them have kept their lexical status (or perhaps, they may be semi-lexical categories, in Cardinalletti and Giusti's (2001) sense), although they are bound morphemes, by definition.

Theoretical Implications of the present claims are four-fold: First, the present analysis has made the syntactic status of formal nouns clearer: some of them may remain lexical, while others are decategorized to a functional category via grammaticalization. The necessity of such a distinction will force us to conclude that Japanese has as rich a set of functional categories as English and other Germanic/Romance languages. Second, while Chomsky (2001) argues for the view that head movement is not a syntactic movement but is a matter of the PF component, this view is argued against by many authors including Kishimoto (2001, 2013), Matshantsly (2006), and Funakoshi (2012), among others. If the present analysis is on the right track, it follows that there must be syntactic head movement that results in a morphosyntactic unit in Japanese (and probably in many other languages). Third, in the field of Japanese syntax, there has been a controversy over whether there is V-raising to T or C (Otani and Whitman (1990) and Koizumi (2000) argue for it, whereas Fukui and Sakai (2003) argue against it). If our argument in this article is correct, it will provide us with an additional support for the former analysis. Last but not least, we have shown that SV, which was traditionally regarded as a phenomenon at the morphology-phonology interface and was mostly analyzed as synchronic phenomenon without any relevance to syntax or diachronic change, has to be reconsidered as a phenomenon that has strong relevance to syntax and diachronic change, in that the applicability of SV has something to do with syntactic incorporation and grammaticalization as decategorization.

We will not dare to say that the hypothesis about syntactic incorporation to FN can explain all the issues about the SV with FNs, as we have not made anything clear about

why some FNs are decategorized, while others remain lexical, nor when and under what conditions certain FNs begin to be decategorized (the Actuation Problem in the sense of Weinreich et al. (1968)). Discussing any issues about them would take us far afield from the main issue of this article, so we will have to leave them for future research, except for noting that we can assimilate the ambiguous status of FNs to that of *light verbs* in English and many other languages (Bhutt (2001)). But the claim that decategorization as a result of grammaticalization and/or constructionalization is not new at all in Japanese syntax or more broadly in Japanese linguistics (Hino (2001), Miyaji (2007), Aoki (2010), Nishiyama and Ogawa (2014), Ogawa (2014), Ogawa, Niikuni and Wada (2019), Kageyama (2020), among many others) and I believe that this proposal will have some significant contribution to the discussion of the general issue of how grammaticalization proceeds and what the relation between morphology/phonology and syntax are.

References

- Aoki, Hirofumi (2010) *Gokeisei-kara Mita Nihongo Bunpou-si [A History of Japanese Grammar Viewed from Word Formation]*, Hituzi Syobo, Tokyo.
- Asai, Atsusi and Timothy J. Vance (2016) “Kobetu Onso to Rendaku [Individual Phonemes and Sequential Voicing],” in Timothy J. Vance, Emiko Kaneko and Yasusi Watanabe (eds.), 47-68.
- Baker, Mark (1988) *Incorporation: A Theory of Grammatical Function Changing*, University of Chicago Press.
- Bhutt, Miriam and Wilhelm Geuder (2001) “On the (Semi)Lexical Status of Light Verbs,” in *Semi-Lexical Categories: On the Content of Function Words and the Function of Content Words*, ed. by Norbert Corver and Henk van Riemsdijk, 323–370, Mouton de Gruyter, Berlin.
- Botha, Rudolph (1984) *Morphological Mechanism: Lexicalist Analysis of Synthetic Compounding*, Pergamon Press, Oxford.
- Bresnan, Joan and Sam A. Mchombo (1995) “The Lexical Integrity Principle: Evidence from Bantu,” *Natural Language and Linguistic Theory* 13, 181-254.
- Cardinalletti, Anna and Giuliana Giusti (2001) “‘Semi-lexical’ Motion Verbs in Romance and Germanic,” *Semi-lexical Categories: The Functions of Content Words and the Content of Function Words*, ed. by Norbert Corver and Henk van Riemsdijk, 371-414, Mouton de Gruyter, Berlin.
- Carstairs-McCarthy, Andrew (2002) *An Introduction to English Morphology*, Edinburgh University Press, Edinburgh.
- Chomsky, Noam (2001), Derivation by phase, *Ken Hale: A Life in Language*. ed. by

- Michael Kenstowicz, 1–52, Cambridge, MA: MIT Press.
- Fukui, Naoki and Hiromu Sakai (2003) “The Visibility Guideline for Functional Category: Verb Raising in Japanese and Related Issues,” *Lingua Special Issue, Formal Japanese Syntax and Universal Grammar: The Past 20 Years*, 113, 321-375.
- Funakoshi, Kenshi (2012) “On the Headless XP-movement/Ellipsis,” *Linguistic Inquiry* 43, 519-562.
- Hino, Sukenari (2001) *Keisikigo-no Kenkyuu: Bunpooka-no Riron to Ouyou* [A Study of Formal Words: A Theory of Grammaticalization and Its Application], Kyusyu University Press, Fukuoka.
- Hopper, Paul J. and Elizabeth Closs Traugott (2003) *Grammaticalization*, Second edition, Cambridge University Press, Cambridge.
- Hüning, Matthias and Geert Booij (2013) “From Compounding to Derivation: The Rise of Derivational Affixes through ‘Constructionalization’,” *Folia Linguistica* 48, 579-604.
- Ito Junko and Ralf-Armin Mester (1986) “The Phonology of Voicing in Japanese: Theoretical Consequences for Morphological Accessibility,” *Linguistic Inquiry* 17, 49-73.
- Ito, Takane and Yoko Sugioka (2002) *Go-no Sikumi to Gokeisei* [The Internal Structure of Words and Word Formation], Kenkyuusya, Tokyo.
- Kageyama, Taro (2020) “Between Lexical Verbs and Auxiliaries: The Architecture of Japanese Verb-Verb Complexes,” *Verb-Verb Complexes in Asian Languages*, ed. by Taro Kageyama, Peter E. Hook, and Prashant Pardeshi, 15-43, Oxford University Press, Oxford.
- Kawahara, Shigeto (2015) “Can We Use Rendaku for Phonological Argumentation?” *Linguistics Vanguard* 1, 3-14.
- Kishimoto, Hideki (2001) “Binding of Indeterminate Pronouns and Clause Structure in Japanese,” *Linguistic Inquiry* 32, 598-634.
- Kishimoto, Hideki (2013) “Verb Complex Formation and Negation in Japanese,” *Lingua* 135, 132-154.
- Koizumi, Masatoshi (2000) “String vacuous over verb raising,” *Journal of East Asian Linguistics* 9, 227-285.
- Kubozono, Haruo (1999) *Nihongo-no Onsei* [The Sound of Japanese], Iwanami Syoten, Tokyo.
- Lapointe, Steven (1981) “The Representation of Inflectional Morphology Within the Lexicon,” *NELS* 11, 190-204.
- Li, Yafei (1990) “X⁰-Binding and Verb Incorporation,” *Linguistic Inquiry* 21, 399-426.

- Lu, Jianhui (2016) *Kango-no Rendaku to Imiyohou-no Siteki Hensen-nikansuru Kenkyuu* [A Study of the Diachronic Change in the Sequential Voicing and Semantic Usage of Kanji Compounds], Doctoral dissertation, Okayama University.
- Lyman, B. S. (1894) "Change from Surd to Sonant in Japanese Compounds," *Oriental Studies of the Oriental Club of Philadelphia*, 1-17.
- Martin, Samuel E. (1952) *Morphophonemics of Standard Colloquial Japanese*, supplement to *Language, Language Dissertation No.47*.
- Matushansky, Ora (2006) "Head Movement in Linguistic Theory," *Linguistic Inquiry* 37, 69-110.
- McCawley, James (1968) *The Phonological Component of a Grammar of Japanese*, Mouton, The Hague.
- Masuoka, Takashi and Yukinori Takubo (1992) *Kiso Nihongo Bunpoo* [Basic Japanese Grammar], Kurosio Publishers, Tokyo.
- Miyaji, Asako (2007) "Keisiki Meisi-no Bunpooka: Meisi-ku-tositeno Tokusei-kara Miru [Grammaticalization of Formal Nouns: A View from Their Properties as Noun Phrases]," *Nihongo-no Kouzou-Henka to Bunpouka [Structural Changes and Grammaticalization in Japanese]*, ed. by Hirofumi Aoki, 1-31, Hitsuzi Syobo, Tokyo.
- Nishiyama, Kunio (2015) "Nihongo-no Ku-Fukugoo [Phrasal Compounds in Japanese]," *Gendai-no Keitairon to Onseigaku/On'inron-no Siten to Ronten* [The Perspectives and Issues of Modern Morphology and Phonetics/Phonology], ed. by Tetsuo Nishihara and Sin'iti Tanaka, 78-95, Kaitakusya, Tokyo.
- Nishiyama, Kunio and Yoshiki Ogawa (2014) "Auxiliation, Atransitivity and Transitivity Harmony in Japanese V-V Compounds," *Interdisciplinary Information Sciences* 20, 71-101.
- Ogawa, Yoshiki (2014) "Diachronic Demorphologization and Constructionalization of Compounds from the Perspective of Distributed Morphology and Cartography," *Interdisciplinary Information Sciences* 20, 121-161.
- Ogawa, Yoshik, Keiyu Niikuni and Yuichi Wada (2019) "Keisiki Meisi Hazu-no Bunpouka to Zokkaku Syugo-no Youninsei-niokeru Sedaikan-sa [Grammaticalization of "Hazu" and the Intergenerational Difference in the Acceptability of Genitive Subject], *Koopasu-kara Wakaru Gengo-henka/Henni to Gengo Riron 2 [What Corpora Show about Language Change/Variation and Linguistic Theories 2]*, ed. by Yoshiki Ogawa, 261-288, Kaitakusya, Tokyo.
- Ohno, Kazutoshi (2000) "The Lexical Nature of *Rendaku* in Japanese," *Japanese/Korean Linguistics* 9, 151-163.
- Otani, Kazuyo and John Whitman (1991) "V-raising and VP-ellipsis," *Linguistic Inquiry*

- 22, 345-358.
- Otsu, Yukio (1980) "Some Aspects of Rendaku in Japanese and Related Problems," *Theoretical Issues in Japanese Linguistics, MIT Working Papers in Linguistics 2*, 207-228, ed. by Yukio Otsu and Ann Farmer.
- Roeper, Thomas and Muffy E. A. Siegel (1978) "A Lexical Transformation for Verbal Compounds," *Linguistic Inquiry* 9, 199-260.
- Rosen, Eric Robert (2001) *Phonological Processes Interacting with the Lexicon: Variable and Non-regular Effects in Japanese Phonology*, Doctoral dissertation, University of British Columbia.
- Stevens, Christopher M. (2005) "Revisiting the Affixoid Debate: On the Grammaticalization of the Word," *Grammatikalisierung im Deutschen*, ed. by Torsten Leuschner, Tanja Mortelmans, and Sarah De Groot, 71-83, Walter de Gruyter, Berlin/New York.
- Teramura, Hideo (1982) *Nihongo-no Sintakusu to Imi [The Syntax and Semantics of Japanese]*, Kurosio Publishers, Tokyo.
- Traugott, Elizabeth Closs and Graeme Trousdale (2013) *Constructionalization and Constructional Changes*, Oxford University Press, Oxford.
- Traugott, Elizabeth Closs and Graeme Trousdale (2014) "Contentful Constructionalization," *Journal of Historical Linguistics* 4, 256-283.
- Vance, Timothy J. (1980) "The Psychological Status of a Constraint on Japanese Consonant Alternation," *Linguistics* 18, 245-267.
- Vance, Timothy J. (1987) *An Introduction to Japanese Phonology*, State University of New York Press, Albany.
- Vance, Timothy J. (1996) "Sequential Voicing in Sino-Japanese," *Journal of the Association of Teachers of Japanese* 30, 22-43.
- Vance, Timothy J. (2014) "If Rendaku Isn't a Rule, What in the World Is It?," *Usage-based Approaches to Japanese Grammar: Towards the Understanding of Human Language*, ed. by Kaori Kabata and Tsuyoshi Ono, 137-152, John Benjamins, Amsterdam.
- Vance, Timothy J. (2015) "Rendaku-no Fukisokusei to Roozen-no Housoku [Irregularity of Sequential Voicing and Rosen's Law]," *Kokuritu Kokugo Kenkyuusyo Ronsyuu* 9, 207-214.
- Vance, Timothy J. and Mark Irwin (eds, 2016) *Sequential Voicing in Japanese: Papers from the NINJAL Rendaku Project*, John Benjamins Publishing Company.
- Vance, Timothy J., Emiko Kaneko and Yasusi Watanabe (2016, eds.) *Rendaku-no Kenkyuu: Kokuritu Kokugo Kenkyuusyo Projekuto Ronbun Sensyuu* [Studies of

Sequential Voicing: A Collection of Articles Written in the Project of National Institute for Japanese Language and Linguistics], Kaitakusya, Tokyo.

Weinreich, Uriel, William Labov, Marvin Herzog (1968) *Empirical Foundations for a Theory of Language Change*, University of Texas Press, Texas.

Yamaguchi, Kyoko (2011) "Accentedness and *Rendaku* in Japanese Deverbal Compounds," *Gengo Kenkyu* 140, 117-133.