Grammaticalization and Sequential Voicing in Japanese

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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).

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Typical examples of SV are illustrated in (1a-c). For example, in (1a), the noun *ao* ‘blue’ is merged with another noun *sora* ‘sky’ to form a N-N compound, in which the first sound of the second item is voiced to *zora*. (1b,c) are similar examples with a V-N compound and a N-V compound, respectively:

(1)  
(a)  N-N compound: *ao* ‘blue’ + *sora* ‘sky’ → *ao-zora* ‘blue sky’  
(b)  V-N compound: *hosi* ‘dry’ + *kaki* ‘persimmon’  
    → *hosi-gaki* ‘dried persimmon’  
(c)  N-V compound: *ume* ‘Japanese apricot’ + *hosi* ‘dry’  
    → *ume-bosi* ‘dried Japanese apricot’

To the best of my knowledge, however, no relevance to syntax has been argued for about the phonological process of SV, except for a common recognition that SV does not take place in a syntactically composed phrase, as shown in (2). In (2a), *kaki* ‘persimmon’ is voiced to *gaki* by SV in a V-N compound, which is as expected. But in (2b-d), where NP is modified by a relative clause, a NP, and an AP, respectively, *kaki* is never voiced:

(2)  
(a)  *hosi-gaki/*kaki* (= V-N compound; = (1b))  
    ‘dried persimmon’  
(b)  *Taro-ga* hosi-*ta* {kaki/*gaki} (= NP modified by a relative clause)  
    Taro-Nom dry-Past persimmon  
    ‘the persimmon that Taro dried’  
(c)  *Taro-no* {kaki/*gaki} (= NP modified by a NP)  
    ‘Taro’s persimmon’  
(d)  *akai* {kaki/*gaki} (= NP modified by an AP)  
    ‘red persimmon’

Unlike in (2b-d), however, in (3a-c), we can see optional SV in a Formal Noun Phrase (henceforth, FNP) in which a FN such as *koro* ‘approximate time,’ *kurai* ‘rank’, *kiri* ‘(lit) cut’, selects a clausal complement.

(3)  
(a)  *[sakura-ga* sak-*u* {koro/goro}]-ni-wa, …  
    cherry.blossom-Nom bloom-Nonpast approximate.time-on-Top  
    ‘Around when cherry blossoms bloom, …’
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.’

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 adverbal 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’you 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 itsnegated form N-de-nai/N-ga-nai (Teramura (1982)):

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)
(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-bune/*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-hosoi ‘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. si-ba ‘lawn’ + kaki ‘fence’ → si-ba-gaki ‘lawn-made fence’

b. mi-zu ‘water’ + ha-na ‘edge’ → mi-zu-haba/mi-zu-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. si-ba-kaki ‘lawn-made fence’

b. mi-zu-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 Mŏjei 猛勢
    b. Ixei 威勢 Taixei 大勢 ↑Cŏxei/Gŏxei 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 -jej 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, -jej (勢) can only be used like an affix, combined with another Sino-Japanese morpheme, 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 -jej.

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...

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3 Even in modern Japanese, 势 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 势 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 (切り/切り/切り) ‘only/limit < cut’
   d. hakari/bakari (ばかり/計り/枠) ‘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-\textit{k}kawa\textit{-}no me-ga itai. (possible in modern Japanese)
   left-side-Gen eye-Nom ache
   ‘One’s left eye aches.’
   (左の側)

c. Hidari-gawa (possible in modern Japanese)
   ‘the left side’
   (左側)

d. Taroo-ga tat-te-iru \textit{gawa/\textit{k}}awa
   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-take-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.’
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), 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 \textit{ta} or the perfective auxiliary morpheme \textit{-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 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

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline
compiled words & CHJ (pre-Meiji) & CHJ(Meiji-Taisyo) & BCCWJ (Syowa) \\
\hline
N+formal noun & 3249276 & 14355250 & 104911460 \\
\hline
A N+hakari/bakari & 207 & 2251 & 11 & 3211 & 0 & 11142 \\
    token & & & & & & 8.4 & 91.6 & 0.3 & 99.7 & 0.0 & 100.0 \\
    & & & & & & 11.6 & 88.4 & 0.3 & 99.7 & 0.0 & 100.0 \\
B N+take/dake & 6 & 40 & 47 & 3345 & 77 & 69138 \\
    token & & & & & & 13.0 & 87.0 & 1.4 & 98.6 & 0.1 & 99.9 \\
    & & & & & & 11.6 & 88.4 & 1.4 & 98.6 & 0.1 & 99.9 \\
C N+kawa/gawa & 5 & 0 & 6 & 38 & 32 & 14230 \\
    token & & & & & & 100.0 & 0.0 & 13.6 & 86.4 & 0.2 & 99.8 \\
    & & & & & & 100.0 & 0.0 & 13.6 & 86.4 & 0.2 & 99.8 \\
D N+koro/goro & 36 & 46 & 1076 & 463 & 8077 & 3753 \\
    token & & & & & & 43.9 & 56.1 & 69.2 & 30.8 & 97.5 & 2.5 \\
    & & & & & & 68.3 & 31.7 & 69.2 & 30.8 & 97.5 & 2.5 \\
E N+kiri/giri & 9 & 26 & 117 & 52 & 1139 & 29 \\
    token & & & & & & 25.7 & 74.3 & 69.2 & 30.8 & 97.5 & 2.5 \\
    & & & & & & 29 & 71.1 & 69.2 & 30.8 & 97.5 & 2.5 \\
F N+kurai/gurai & 48 & 14 & 1275 & 700 & 18925 & 9412 \\
    token & & & & & & 77.4 & 22.6 & 64.6 & 35.4 & 66.8 & 33.2 \\
    & & & & & & 66.8 & 33.2 & 64.6 & 35.4 & 66.8 & 33.2 \\
G N+tokoro/dokoro & 78 & 20 & 15 & 145 & 45 & 2377 \\
    token & & & & & & 79.6 & 20.4 & 9.4 & 90.6 & 1.9 & 98.1 \\
    & & & & & & 90.6 & 1.9 & 90.6 & 1.9 & 98.1 & 1.9 \\
\hline
Sum (A ~ G) & 389 & 2397 & 2547 & 7954 & 28295 & 110081 \\
    token & & & & & & 14.0 & 86.0 & 24.3 & 75.7 & 20.4 & 79.6 \\
    & & & & & & 86.0 & 14.0 & 75.7 & 20.4 & 79.6 & 14.0 \\
\hline
\end{tabular}
\caption{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}
\end{table}

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.

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<td>100.0 0.0 100.0 0.0 99.6 0.4</td>
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<td>91.3 8.7 97.0 3.0 79.4 20.6</td>
<td>99.5 0.5 99.7 0.3 98.1 1.9</td>
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<td>%</td>
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<td>104911460</td>
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<td></td>
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<tr>
<td>Sum (A ~ G)</td>
<td>token</td>
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<td>97.1 2.9 94.7 5.3 56.1 43.9</td>
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<td>97.1 2.9 94.7 5.3 56.1 43.9</td>
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<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).
We pointed out in section 2 that not only compounds but also derived words are environments in which SV can occur. This is naturally understood in a theory of grammaticalization (or more recently, a theory of “constructionalization”). Brinton and Traugott (2005) define “grammaticalization” as the “change whereby in certain linguistic contexts speakers use parts of a construction with a grammatical function. Over time the resulting grammatical item may become more grammatical by acquiring more grammatical functions and expanding its host-classes” (ibid.: 99). More recently, proponents of a theory of diachronic construction grammar such as Hüning and Booij (2013) and Traugott and Trousdale (2013) propose that grammaticalization takes place in a construction, and refer to such a process as “constructionalization.” Constructionalization from a free morpheme to a derivational suffix goes as in (24):

(24) the constructionalization of “full/-ful”
   a. I’m full. (lexical item) >
   b. a basket full of eggs (syntactic construct) >
   c. a cupful of water (compounding form) >
   d. hopeful (derivation)

Whether we assume grammaticalization or constructionalization, it is important to view compounding and derivation as gradient stages of language change along a single cline. Hence, once SV occurs in a compound, it is not surprising to see the environments for SV to be diachronically extended to a derived word. We have also seen that lexical N-N compound and N-FN combination differ only in whether the second is a free morpheme that is part of a compound or a bound morpheme that is part of a derived word, and that the FN that is takes a VP or a clause as its complement differs from lexical NP that takes a clausal complement differ only in whether the head noun is a bound morpheme (FN) or a free morpheme (lexical N). Moreover, the only essential difference between a FN that is part of a word and a FN that is combined with a VP/clause to form a FNP is the syntactic size of the non-head element and accordingly of the entire constituent. Given these considerations, it is reasonable to assume that the SV that occurs in a derived word is arguably a bridge between the SV that occurs in a compound and the one that occurs in
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) \[ NP \text{kirei-na mati-}zukuri\] (zukuri \(\leftrightarrow\) tukuri)
    beautiful town make
    ‘planning a beautiful town’

(26) \[ NP \text{Tyuugoku-to-no kokkyoo-}zoi-o\] nagare-ru kawa (zoi \(\leftrightarrow\) 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.
Second, I will propose two ways to form a morphosyntactic unit:

(28) A morphosyntactic unit can be formed either by direct syntactic merger of two morphemes (such as compounding and derivation), or by syntactic incorporation of a head from within the complement domain (such as phrasal compounding and FNP), but not by morphological merger.

The two ways to form a morphosyntactic unit can be schematized as below. (29) is a direct syntactic merger, while (30a,b) involves syntactic incorporation:

(29) $[Y^0 X^0 Y^0]$

(29) applies to lexical compounds with SV, as illustrated in (1a-c), and derived words with SV, as in (8) and (9). In these cases, triggering SV is the default, so that some phonological, semantic, or morphological auxiliary assumption is necessary to explain cases in which SV does not occur. On the other hand, Z in (30a) does not form “a morphosyntactic unit” with anything else: even if they could form a morphophonological word by virtue of the fact that they are morphologically adjacent to X, they are syntactically separate. (30a) as a ZP is licit as a syntactic phrase, but illicit as a compound that contains a phrase, by virtue of the No Phrase Constraint. But if Nishiyama (2015) is correct in arguing that the head X of the non-head XP syntactically incorporates to the head Z, the resulting X+Z will form a morphosyntactic unit:

(30)  a. $[ZP^*Z^0 [XP YP \ldots X] Z] \quad (X+Z \text{ does not form a morphosyntactic unit})$
    b. $[ZP [XP YP \ldots X] X+Z] \quad (X+Z \text{ forms a morphosyntactic unit via incorporation})$

Hence, we can explain not only why the X+Z form a phonological word that excludes YP but also why SV can occur in (25).\(^7\)

\(^7\) The obligatoriness of SV is another issue. While in many cases where SV can occur, SV is obligatory, as in (1a-c). But Asai and Vance (2016), Kubozono (1999), Ohno (2000), and Vance et al. (2016) illustrate a few cases of optional SV, as below:

(i)  a. hue-taiko / hue-daiko ‘flute-and-drum’ \quad (Kubozono (1999: 134))
    b. waru-kuti / waru-guti ‘bad-mouthing’ \quad (Ohno (2000: 152))
    c. mizu-hana / mizu-bana ‘beside water’ \quad (Asai and Vance (2016: 56))
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-meney-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 $[_{CP}C[_{TP}SubjT[…[_{VP}V(NP)]]]]$
    ↑________*________

b. make $[_{TP}SubjT[…[_{VP}V(NP)]]]$
    ↑________*________

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) \(\rightarrow\) SV is impossible
   (This is a case of 太郎が干した柿 (kaki) in (2b))

b. *[V+T]+FN] (syntactic incorporation) \(\rightarrow\) 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) \(\rightarrow\) 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). 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

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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 the discussion of the general issue of how grammaticalization proceeds and what the relation between morphology/phonology and syntax are.

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