*The diachronic origins of Lyman's Law: evidence from phonetics, dialectology, and philology**

Abstract

Modern Tokyo Japanese has a set of morphophonemic alternations known collectively as *rendaku* that involve initial consonants in the second elements of compounds, as in /aki+zora/ 'autumn sky' (cf. /sora/ 'sky'). An alternating element like /sora/~/zora/ has an initial voiced obstruent in its *rendaku* allomorph and an initial voiceless obstruent in its non-*rendaku* allomorph. A nearly exceptionless constraint called Lyman's Law blocks *rendaku* in a second element that contains a medial voiced obstruent. This paper looks at three kinds of interlocking evidence to argue that Lyman's Law originated as a constraint prohibiting prenasalisation in consecutive syllables. The first kind of evidence comes from phonetics: constraints on similar consonants in close proximity generally apply not to voicing but to features with phonetic cues that are more spread out in time, such as aspiration or prenasalisation. The second kind of evidence comes from dialectology: in at least some endangered dialects of Japanese with prenasalised voiced obstruents, the *rendaku* allomorph of a morpheme cannot occur if it would result in adjacent syllables containing these marked consonants. The third kind of evidence comes from philology: compounds recorded in phonograms in Old Japanese texts are consistent with a constraint that applies to adjacent syllables.

1 Introduction

Lyman's Law was first proposed as a constraint on a well-known morphophonemic phenomenon in modern Tokyo ("standard") Japanese called *rendaku* (see §2), which yields alternations such as /k/~/g/, as in /kame/ 'turtle' and /umi+game/ 'sea turtle' (cf. /umi/ 'sea'). Lyman's Law prohibits *rendaku* from occurring in the second element of a compound if that element already contains a medial voiced obstruent. Consequently, we find compounds like /ita+kabe/ 'wooden wall' (cf. /ita/ 'board', /kabe/ 'wall'), in which the medial /b/ in the second element prevents the form with *rendaku*: */ita+gabe/.[1]

* The research reported in this paper was supported by two large-scale projects at the National Institute for Japanese Language and Linguistics in Tokyo. The first (known informally as "the Rendaku Project") ran from 2011 until 2016. It was headed by Vance, and both Kawahara and Miyashita were members. The second project, "Cross-Linguistic Studies of Japanese Prosody and Grammar" (headed by Haruo Kubozono), began in 2016 and is still running, with Vance and Kawahara as members. Support for the Kahoku-chō Survey (described in §5.1) came from the Research Institute for Humanity and Nature in Kyoto, and we are grateful to the many citizens of Kahoku-chō who helped us so generously. We would also like to Prof. Zendō Uwano for sharing his insights with us. A preliminary version of this paper was presented in 2016 at NWAV Asia-Pacific 4 in Chiayi, Taiwan. An early report on the data in §3.4 and §6.1 was presented in 2015 at the 17th Annual International Conference of the Japanese Society for Language Sciences in Beppu, Japan. We would like to express our heartfelt gratitude to three anonymous referees and a *Phonology* AE for their careful and constructive comments on the drafts of this paper. Thanks to their efforts, the final product is dramatically improved. Any remaining errors and deficiencies are entirely our responsibility.

[1] There is no consensus about how modern Tokyo Japanese should be transcribed phonemically. We adopt the "surfacy" system presented in excruciating detail by Vance (2008). Phonetic realizations of consonants that are relevant here and are not obvious to readers who do not know Japanese are (transcribed broadly): /f/[ɸ], /š/[ɕ], /c/[ts], /č/[tɕ], /z/[(d)z], /ǰ/[dʑ], /y/[j], /r/[ɾ].

We argue that Lyman's Law originated as a prohibition against prenasalisation in consecutive syllables, and that this prohibition is what held in 8th-century Old Japanese (OJ). Support for this claim comes partly from the phonetics of OJ, which we consider briefly in the following paragraph and more thoroughly in §§3–4. Additional support comes from modern dialects of Japanese that retain both prenasalisation and the original prohibition (§5). Further support comes from philological analysis of OJ compounds, which are entirely consistent with a prohibition against prenasalisation in adjacent syllables (§6.1).

The earliest substantial written documents for Japanese record varieties of OJ, and at that time, the consonants corresponding to modern Tokyo /b d z g/ were pronounced [ᵐb ⁿd ⁿz ᵑg] and, we assume, triggered salient nasalisation on an immediately preceding vowel (see §3.2).[2] The evidence for prenasalisation is overwhelming, but even a cursory review would take us far beyond the scope of this paper. We also find prenasalised voiced obstruents in some highly stigmatised modern dialects of Japanese (§5), and this prenasalisation is generally regarded as a retention from OJ times.

Rendaku was already well established in OJ, but as noted above, the OJ precursor of Lyman's Law seems to have been a straightforward ban on prenasalised voiced obstruents in adjacent syllables (§3.4). Stanton (2019) thoroughly documents a phonetically natural and typologically common restriction against /NCVNC/ sequences (where /N/ = a nasal consonant and /C/ = an obstruent), and the OJ version of Lyman's Law follows from this restriction, provided that prenasalised obstruents are like /NC/ clusters in the relevant respects (§4).

The details of the transition to the modern Tokyo version of Lyman's Law are not well understood. In OJ, *rendaku* yielded a prenasalised voiced obstruent at the beginning of the second element of a compound (§3.3), as in ^{OJ}/asi+ᵑgamo/ 'reed duck' (cf. ^{OJ}/asi/ 'reed', ^{OJ}/kamo/ 'duck'), but the constraint on adjacent syllables blocked *rendaku* when there was a prenasalised voiced obstruent in the syllable immediately preceding or immediately following a potential *rendaku* site (§3.4). In modern Tokyo Japanese, a voiced obstruent anywhere in the second element of a compound prevents *rendaku*; the inhibitor consonant need not be in the syllable immediately following a potential *rendaku* site (§2). Furthermore, a voiced obstruent preceding a potential *rendaku* site has no effect; even if it is in the immediately preceding syllable, it does not block *rendaku* (§3.4). Lyman's Law has thus undergone a metamorphosis from a phonetically natural restriction on adjacent syllables into a phonetically unnatural and cross-linguistically rare long-distance restriction on voicing.

2 *Rendaku* and Lyman's Law in modern Tokyo Japanese

Many modern Tokyo morphemes have one allomorph that begins with a voiceless obstruent and another allomorph that begins with a voiced obstruent, as in (1).

(1) a. /**t**ake/ 'bamboo'
b. /**t**ake+yabu/ 'bamboo grove' (cf. /yabu/ 'grove')
c. /sao+**d**ake/ 'pole bamboo' (cf. /sao/ 'pole')

The initial voiced obstruent in the /**d**ake/ allomorph in (1c) is an instance of *rendaku*, and the prototypical environment for *rendaku* is the beginning of the second element in a two-element

[2] Although we use [ⁿz] in our phonetic transcriptions of OJ forms, it is very likely that the actual pronunciation was [ⁿdz], given that segments described as prenasalised fricatives are usually and perhaps always realized as prenasalised affricates (Steriade 1993: 410).

compound.[3] Only the non-*rendaku* allomorph of an alternating morpheme can occur word-initially, like /**t**ake/ in (1a) and (1b).[4] Since the 1960s, *rendaku* has attracted a great deal of attention from theoretical phonologists and is now familiar to linguists all over the world (Kawahara & Zamma 2016).

Although *rendaku* always pairs a voiceless obstruent with a voiced obstruent, the phonetic difference between the two phonemes in each pair is in many cases more than just the absence vs. presence of voicing (Vance 2016: 3–4). The examples in (2) show the pairings. All the modern Tokyo obstruent phonemes except /p/ are involved in the alternations. Each voiceless obstruent phoneme other than /p/ (i.e., /t k c č s š h/) appears on the left of the tilde in at least one of the pairings, and each voiced obstruent (i.e., /b d g z ǰ/) appears on the right of the tilde in at least one of the pairings. Notice that /f/[ɸ] and /h/[ç,h] both alternate with /b/[b] (2a–c), /č/[tɕ] and /š/[ɕ] both alternate with /ǰ/[dʑ], and /c/[ts] and /s/[s] both alternate with /z/[(d)z].

(2)

a. /f/[ɸ]~/b/[b]	/asa/	‘morning’	+	/**f**uro/	‘bath’
			→	/asa+**b**uro/	‘morning bath’
b. /h/[ç]~/b/[b]	/tabi/	‘journey’	+	/**h**ito/	‘person’
			→	/tabi+**b**ito/	‘traveler’
c. /h/[h]~/b/[b]	/iši/	‘stone’	+	/**h**aši/	‘bridge’
			→	/iši+**b**aši/	‘stone bridge’
d. /t/[t]~/d/[d]	/yaku/	‘misfortune’	+	/**t**oši/	‘year’
			→	/yaku+**d**oši/	‘unlucky year’
e. /č/[tɕ]~/ǰ/[dʑ]	/soko/	‘bottom’	+	/**č**ikara/	‘strength’
			→	/soko+**ǰ**ikara/	‘latent strength’
f. /š/[ɕ]~/ǰ/[dʑ]	/tate/	‘vertical’	+	/**š**ima/	‘stripe’
			→	/tate+**ǰ**ima/	‘vertical stripe’
g. /c/[ts]~/z/[(d)z]	/hana/	‘nose’	+	/**c**una/	‘rope’
			→	/hana+**z**una/	‘nose halter’
h. /s/[s]~/z/[(d)z]	/hai/	‘ash’	+	/**s**ara/	‘dish’
			→	/hai+**z**ara/	‘ashtray’
i. /k/[k]~/g/[g]	/umi/	‘sea’	+	/**k**ame/	‘turtle’
			→	/umi+**g**ame/	‘sea turtle’

[3] Some instances of *rendaku* occur in the second elements of words that can be analyzed as prefix+base derivatives rather than as compounds. Also, many compounds have more than two elements, and some instances of *rendaku* are in third or later elements.

[4] A few words have been coined by exploiting a well-known phonaesthetic association between voiced obstruents and mostly negative attributes, particularly in initial position in native words (Suzuki 1962: 23–24; Endō 1977: 222–228; Komatsu 1981: 87–88). One example is /**z**ama/ ‘sorry state’, which is obviously related to /**s**ama/ ‘state, condition’. Since /**z**ama/ and /**s**ama/ differ both in pronunciation and in meaning, they cannot be analyzed as allomorphs of the same morpheme; they are separate lexical items, and the /z/ in /**z**ama/ is not an instance of *rendaku*. A word like /**z**ama/ can be treated as a derivative, marked by replacing a voiceless obstruent with its voiced partner (Suzuki 1962: 26–27), although this analysis is not always appropriate synchronically, since native speakers do not see the connection in every such pair. The subsegmental exponent of this derivational morpheme just happens to be homophonous with the exponent of *rendaku* in an analysis that treats *rendaku* as the manifestation of a subsegmental linking morpheme joining elements of a compound (as in §4). We should also note here that, in a few cases, a *rendaku* allomorph has ousted its non-*rendaku* counterpart diachronically. For example, the ancestor of the second element in /migi+**g**awa/ ‘right side’ was /**k**awa/, but most speakers today pronounce the independent word meaning ‘side’ as /**g**awa/ ‘side’. Once a morpheme ceases to alternate in this way, its initial voiced obstruent is no longer a synchronic instance of *rendaku*.

The historical changes that led to the pairings in (2) are well understood (Vance 2015: 397–398), and the pairings before these changes began will be described below in §3.3. For the minority of Tokyo speakers who maintain a conservative variety with word-medial, syllable-initial [ŋ] (Hibiya 1999), the pairing in (2i) is [k]~[ŋ], not [k]~[g]. This additional deviation from straightforward [±vce] will be relevant below in §4.[5]

The constraint known as Lyman's Law (Vance 2015: 402–408) prevents *rendaku* in a two-element compound if the second element (E2) contains a medial voiced obstruent. The examples in (3) illustrate.

(3) a. /me/ 'eye' + /**t**ama/ 'ball' → /me+**d**ama/ 'eyeball'
b. /hana/ 'flower' + /**t**aba/ 'bunch' → /hana+**t**aba/ 'bouquet' (*/hana+**d**aba/)

There are very few exceptions to Lyman's Law in the existing vocabulary (Kindaichi 1976: 5; Martin 1987: 115; Suzuki 2005).[6] It does not seem to matter whether the inhibiting voiced obstruent is in the syllable immediately following the potential *rendaku* site or later in E2 (Lyman 1894: 161–162; Martin 1952: 48). The examples in (4) are typical.[7]

(4) a. /umi/ 'sea' + /**s**uzume/ 'sparrow' → /umi+**s**uzume/ 'murrelet' (*/umi+**z**uzume/)
b. /ko/ 'child' + /**h**icuǰi/ 'sheep' → /ko+**h**icuǰi/ 'lamb' (*/ko+**b**icuǰi/)

The term "*rendaku*-eligible" can be used to refer to an element that begins with a voiceless obstruent as an independent word. Words that begin with a vowel, with a sonorant consonant, or with a voiced obstruent, like the examples in (5), are not *rendaku*-eligible elements because *rendaku* cannot apply.

(5) a. /aši/ 'leg' (e.g., /ato+aši/ 'hind leg')
b. /nami/ 'wave' (e.g., /yoko+nami/ 'side wave')
c. /zeni/ 'money' (e.g., /hi+zeni/ 'daily wages')

As Kawahara (2016: 33) notes, some accounts in the literature can easily be misinterpreted to mean that *rendaku* always applies to *rendaku*-eligible E2s unless Lyman's Law would be violated. In fact, however, *rendaku* is intractably irregular. Many phonological, morphological, and semantic factors are known to influence the likelihood of *rendaku*, but there is no overarching generalisation that predicts when *rendaku* occurs and when it does not.

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[5] We should point out that in most of the pairings in (2), a voiceless obstruent is paired with the voiced obstruent whose phonetic realization is the closest available to the result of simply adding voicing. Our point is just that *rendaku* cannot be characterized as straightforward phonetic voicing, but a more abstract feature can be made to work in most cases. Such a feature would add voicing to the phonetic realization of a voiceless obstruent phoneme and then change as little as possible to get to the realization of one of the voiced obstruents that the language has. This approach will not work for /h/~/b/ in (2b) and (2c), of course. Nor will it work for speakers who pair /k/ with [ŋ]. Such speakers also have [g], and whether or not [ŋ] and [g] are allophones of a single phoneme (see note 24 below in §4), [g] is not phonotactically inadmissible word medially.

[6] The compound /nawa+**b**ašigo/ 'rope ladder' (cf. /nawa/ 'rope', /**h**ašigo/ 'ladder') is probably the best-known exception to Lyman's Law.

[7] The results of some psycholinguistic experiments (Vance 1980: 258–259; Ihara & Murata 2006: 21–22) have been consistent with a small "distance effect" in responses to compounds containing nonsense E2s: the more syllables there were between the potential *rendaku* site and the inhibitor voiced obstruent, the more likely participants were to choose responses with *rendaku*. A more recent study by Kawahara (2012), however, using a different methodology, found no such effect. The apparent distance effect in the earlier studies was probably due to some other variable that was uncontrolled (Vance 2015: 403–404).

First, some *rendaku*-eligible elements are idiosyncratically immune (Irwin 2016: 104–105), including /kasu/ ‘dregs’ and /himo/ ‘string’, as shown in (6).

(6) a. /abura/ ‘oil’ + /**k**asu/ ‘dregs’ → /abura+**k**asu/ ‘oily dregs’ (*/abura+**g**asu/)
b. /kucu/ ‘shoe’ + /**h**imo/ ‘string’ → /kucu+**h**imo/ ‘shoelace’ (*/kucu+**h**imo)

The allomorphs */gasu/ and */bimo/ simply do not exist, despite the fact that neither contains a medial voiced obstruent. As these examples show, we mark all non-occurring forms with an asterisk, regardless of whether there is any principled explanation for their non-occurrence. That is, a form marked with an asterisk is not necessarily “ungrammatical” in any meaningful sense.

Second, many *rendaku*-eligible elements behave inconsistently as E2s, appearing sometimes with *rendaku* but sometimes without, even when no putative inhibiting factor is relevant. The examples in (7) illustrate.

(7) a. /**č**i/ ‘blood’ /nama/ ‘fresh’ + /**č**i/ → /nama+**č**i/ ‘fresh blood’ (*/nama+**ǰ**i/)
/hana/ ‘nose’ + /**č**i/ → /hana+**ǰ**i/ ‘nosebleed’ (*/hana+**č**i/)
b. /**h**i/ ‘sun’ /asa/ ‘morning’ + /**h**i/ → /asa+**h**i/ ‘morning sun’ (*/asa+**b**i/)
/niši/ ‘west’ + /**h**i/ → /niši+**b**i/ ‘westering sun’ (*/niši+**h**i/)

Both E2s in the compounds in (7) are polysemous (as almost all content morphemes are), but the compounds were chosen so that E2 in each pair of compounds would have the same sense. This precaution is necessary because the probability of *rendaku* in an E2 can differ dramatically depending on its sense (Vance 2015: 433; Irwin 2016a: 104–105).

Third, there are individual compounds, such as those in (8), that can be pronounced either with or without *rendaku*.

(8) a. /waru/ ‘bad’[8] + /**k**uči/ ‘mouth’ → /waru+**k**uči/~/waru+**g**uči/ ‘bad mouthing’
b. /kara/ ‘emptiness’ + /**s**eki/ ‘cough’ → /kara+**s**eki/~/kara+**z**eki/ ‘dry cough’

There are many well-known examples of compounds gaining or losing *rendaku* over time (Vance 2007a: 163), and variability like that in (8) is often symptomatic of a shift in progress.

Despite the pervasive irregularity of *rendaku*, Lyman’s Law is a very robust constraint. It is only natural that the interaction between this constraint and the *rendaku* alternations has attracted the attention of many phonologists (Kawahara & Zamma 2016: 18–26). The primary aim of this paper is to shed light on the nature of Lyman’s Law by investigating its historical origin. In §3 we look at OJ phonology, and in §4 we show that widely accepted inferences about OJ phonetics motivate an origin scenario involving a prohibition against prenasalisation in adjacent syllables. In §5 we look at non-standard modern dialects of Japanese that retain prenasalisation and the original prohibition. In §6 we show that the philological evidence is consistent with our claim that the OJ forerunner of Lyman’s Law was a constraint on adjacent syllables, although some inflectional forms and lexicalized phrases present a challenge. We offer a plausible explanation for these apparent in exceptions in §6.2.

[8] This E1 is an adjective root, and it is the stem in inflected forms such as /waru-i/ ‘is bad’ and /waru-ku/ ‘badly’. When /waru/ occurs as a word on its own, it is a noun with the lexicalized meaning ‘bad person’, but /waru/ in (8a) carries the meaning of the adjective lexeme.

3 Old Japanese and the strong version of Lyman's Law

3.1 Overview

To investigate the historical origin of Lyman's Law, we first review the basic phonological structure of OJ in §3.2, focusing on prenasalised voiced obstruents. We then present a plausible account of how *rendaku* originated in §3.3. Finally, we examine the OJ precursor of Lyman's Law (often called the "strong version" of Lyman's Law) in §3.4.

3.2 Prenasalised obstruents in Old Japanese

As noted above in §1, *rendaku* was already well established in OJ, but voiced obstruents were prenasalised. The phoneme chart in (9) displays the consonant system that most historical linguists infer for OJ (Miyake 2003: 74; Bentley 2012: 191; Frellesvig 2010: 34–36).[9]

(9)

p	t	s	k
ᵐb	ⁿd	ⁿz	ᵑg
m	n		
	r		
w		y	

The chart in (9) makes OJ look like a language in which prenasalisation could be characterised as a voicing enhancement, since there is no series of plain voiced obstruents (Riehl & Cohn 2011: 554). There are good reasons to believe, however, that the OJ "voiceless" obstruents were allophonically voiced word-medially, that is, intervocalically (Frellesvig 2010: 35). It follows that prenasalisation was the distinctive feature, not just an enhancement, for word-medial "voiced" obstruents.[10]

OJ prenasalised obstruents occurred only word-medially in the non-mimetic native vocabulary (Frellesvig 2010: 43; Takayama 2015: 627–629). The usual diachronic explanation for this phonotactic restriction attributes prenasalised obstruents to prehistoric NC clusters that originated as contracted NVC sequences (Ramsey & Unger 1972: 278; Miyake 2003: 73; Frellesvig 2010: 42–43). It appears that such contraction was not possible in word-initial NV syllables. Since OJ did not allow coda consonants, it is not really necessary to assume that the inferred contraction process produced phonological consonant clusters in prehistoric Japanese. Consider the well-known example in (10).

(10) $^{\text{pre-OJ}}$/mura+nusi/ > $^{\text{OJ}}$/muraⁿzi/ 'village headman'
cf. $^{\text{OJ}}$/mura/ 'village'; $^{\text{OJ}}$/nusi/ 'master'[11]
[muɾanusi] > [muɾãnsi] > [murãⁿzi]

Assuming that intermediate phonetic forms like [muɾãnsi] actually occurred, they could have been fast-speech variants whose phonemic forms still included the elided vowel. But once

[9] Most historical linguists (including Miyake and Frellesvig) use /b d z g/ as phonemic transcriptions for the prenasalized series, although some (including Bentley) prefer /ᵐb ⁿd ⁿz ᵑg/, indicating the phonetic realizations more explicitly. There is no disagreement about the phonetic facts. We adopt the latter transcriptions in this paper.

[10] Understandably, many historical linguists avoid describing the prenasalised obstruents of OJ as voiced and the contrasting obstruent series as voiceless. Frellesvig (2010: 34–36) adopts the terms *media* (for the prenasalised series) and *tenuis* (for the non-prenasalised series). Other scholars prefer *lax* for *media* and *tense* for *tenuis*.

[11] Martin (1987: 488) gives this etymology with a question mark, indicating that there is some room for doubt, but it is so plausible that we do not hesitate to cite it as an illustration.

voicing assimilation took place (yielding [nz] or [ⁿz]), reanalysis as a prenasalised consonant would have been compelling for later generations of speakers, assuming the prohibition against closed syllables remained active.[12]

On the other hand, the scenario in (10) depends crucially on the anticipatory nasalisation of the vowel preceding the contracted NV syllable. Cross-linguistically, such regressive assimilation is typically stronger and more likely to be marked in a phonetic transcription when the immediately following nasal consonant is in the coda of the same syllable rather than in the onset of the next syllable (Herbert 1986: 126; Stanton 2019: 658). This generalisation is what motivates the [ã] assumed in (10) for contracted [mu.ɾãn.si] but not for uncontracted [mu.ɾa.nu.si]. The transcription [ã] also appears in reanalysed [murãⁿzi] because vowel nasalisation is typical immediately preceding a prenasalised obstruent but not immediately preceding a simple nasal (Herbert 1986: 134). This difference is hard to explain if the relevant prenasalised obstruents and ordinary nasals are all simple onset consonants, and it is one reason that Herbert (1986: 134) gives for analysing prenasalised obstruents as contour segments which are "ambisyllabic" in the sense that the nasal portion affiliates with the syllable to its left, while the oral portion affiliates with the syllable to its right.[13]

3.3 The origin of *rendaku*

The scenario in §3.2 for the historical development of prenasalised obstruents dovetails with a widely accepted account of the origin of *rendaku*. In contrast to the modern Tokyo phoneme pairings shown by the examples above in (2) in §2, the OJ pairings, shown below in (11), were phonetically uniform.

(11) *–rendaku* /p/ /t/ /s/ /k/
+rendaku /ᵐb/ /ⁿd/ /ⁿz/ /ᵑg/

In a typical OJ noun+noun compound noun with *rendaku*, such as ^{OJ}/matu+ᵐbara/ 'pine grove' (cf. ^{OJ}/matu/ 'pine'; ^{OJ}/para/ 'field'), it is reasonable to suspect that prenasalised /ᵐb/ developed from a prehistoric sequence of the form $^{pre\text{-}OJ}$/NVp/. The obvious candidate for the NV syllable here is the ancestor of the OJ genitive particle ^{OJ}/no/ (cf. modern Tokyo /no/) (Murayama 1954: 107; Unger 1975: 8–9; Vance 1982: 335–338; Frellesvig 2010: 40–43), as in (12).[14]

[12] Since prenasalisation seems to be unstable in word-initial position cross-linguistically (Herbert 1986: 18), it could be that word-initial NV contraction actually was phonetically possible in prehistoric Japanese but that postnasal voicing and reanalysis were blocked.

[13] Needless to say, we cannot prove that the OJ nasalisation facts were as we describe them here in §3.2. According to a table compiled by Jeong (2012: 450), some languages seem to have strong anticipatory nasalisation immediately preceding an onset nasal consonant. If this was true in OJ, it would undermine our argument that OJ prenasalised obstruents were ambisyllabic in Herbert's sense. Jeong's table also reports that some languages seem to have relatively weak anticipatory nasalisation immediately preceding a coda nasal consonant, although stronger than immediately preceding an onset nasal consonant. If the nasalization of the first vowel was weak both in OJ ṼNV and in OJ Ṽᴺ CV and too similar to discriminate reliably, this would also undermine our argument.

[14] Non-mimetic reduplicated words strongly favor *rendaku* in modern Tokyo Japanese (Vance 2015: 417–418), and OJ examples like ^{OJ}/koto+goto/ 'various matters' (cf. ^{OJ}/koto/ 'matter') are attested. It is unlikely that a genitive would have connected the two elements in the prehistoric ancestors of such examples, and Lyman (1894: 172), like several later researchers (Martin 1987: 103–104; Frellesvig 2010:41), suggested the ancestor of dative ^{OJ}/ni/ (used to mean 'in addition to, and') as the prehistoric NV syllable.

(12) $^{\text{pre-OJ}}$/matu+no+**p**ara/ > $^{\text{OJ}}$/matu+$^{\text{m}}$**b**ara/ (cf. modern Tokyo /macu+bara/)[15]
[matunopaɾa] > [matũnpara] > [matũ$^{\text{m}}$baɾa]

Like $^{\text{pre-OJ}}$/mura+nusi/ in (10), the prehistoric form in (12) is, of course, hypothetical.[16]

There is, however, no reason to assume that every OJ noun+noun compound noun developed from an ancestor of the form noun+$^{\text{pre-OJ}}$/no/+noun. Modern Tokyo Japanese has frozen noun+/no/+noun phrases like /te+no+hira/ 'palm of the hand' (cf. /te/ 'hand'; /hira/ 'flat') as well as noun+noun compounds without *rendaku* like /te+kase/ 'hand shackles' (cf. /kase/ 'shackles'). The situation in prehistoric Japanese was probably much the same. In OJ, as expected, *rendaku* did not occur in frozen phrases (aside from one puzzling exception; Vance 2007a: 164), and there are also many compounds without *rendaku* (presumably created by simple noun+noun juxtaposition). The examples in (13) illustrate; the first element in both is $^{\text{OJ}}$/ko/(~/kwi/) 'tree; wood'.

(13) a. $^{\text{OJ}}$/ko/ 'tree' + $^{\text{OJ}}$/no/ GENITIVE + $^{\text{OJ}}$/**p**a/ 'leaf'
uncontracted frozen phrase: $^{\text{OJ}}$/ko+no+**p**a/ 'tree leaf'

b. $^{\text{OJ}}$/ko/ 'wood' + $^{\text{OJ}}$/**k**upa/ 'hoe'
simple juxtaposition: $^{\text{OJ}}$/ko+**k**upa/ 'wooden hoe'

Assuming that the prehistoric ancestors of the examples in (13), when they were first coined, were essentially identical to their OJ forms, they are entirely compatible with the account proposed above for the origin of *rendaku*: (13a) contains an NV particle that did not contract, and (13b) never had an NV particle in the first place. These examples also show why *rendaku* was intractably irregular in OJ, just as it continues to be in modern Japanese (as noted above in §2): both noun+noun combinations (as in 13b) and noun+genitive+noun combinations (as in 12) were possible.[17]

3.4 Lyman's Law in Old Japanese

The precursor of Lyman's Law in OJ was markedly different from the modern Tokyo version described above in §2. It appears that *rendaku* was blocked if there was a (prenasalised) voiced obstruent in an adjacent syllable on either side of the target segment. This stricter constraint is

[15] The phonemic transcriptions of OJ vowels in this paper follow the system proposed by Frellesvig & Whitman (2008b: 2–5). Many historical linguists reconstruct a pre-OJ vowel system in which the ancestor of $^{\text{OJ}}$/o/ in most words was pronounced something like [ə] (Frellesvig & Whitman 2008a: 16; Frellesvig 2010: 46). Some claim that this pronunciation persisted into OJ (Miyake 2003: 211–217; Bentley 2012: 191).

[16] The authoritative dictionary of OJ (Jōdaigo Jiten Henshū Iinkai 1967) lists the compound $^{\text{OJ}}$/matu+$^{\text{m}}$bara/ as well as its two elements as headwords, but not a frozen phrase in which the two elements are linked by the genitive particle. The phonographic attestations of this compound and of the those in (13) below are all unambiguous in the sense explained below in §4.

[17] The irregularities have never been leveled out, and sporadic changes continue to this day, with some vocabulary items gaining *rendaku* and others losing it, as noted above in §2. Labrune (2016) surveys irregularly occurring compound markers in several languages, and many of these markers seem to have originated historically as contracted genitive markers. As Frellesvig (2010: 40–41) points out, there are examples of *rendaku* in OJ that do not seem to be derivable from any earlier phrase with an NV syllable between the elements, and he draws the reasonable conclusion that "rendaku already in OJ was established as a morphophonemic process" that could trigger analogical extensions.

known as the "strong version" of Lyman's Law (Ramsey & Unger 1972: 287–289). The examples in (14) illustrate.[18]

(14) a. ^{OJ}/apa^{m}bi/ 'abalone' + ^{OJ}/**t**ama/ 'jewel'
→ ^{OJ}/apa^{m}bi+**t**ama/ 'abalone jewel' (*^{OJ}/apa^{m}bi+^{n}**d**ama/)

b. ^{OJ}/su^{n}zu/ 'bell' + ^{OJ}/**p**une/ 'boat'
→ ^{OJ}/su^{n}zu+**p**une/ 'belled boat' (*^{OJ}/su^{n}zu+^{m}**b**une/)

c. ^{OJ}/aka/ 'red' + ^{OJ}/**t**ama/ 'jewel'
→ ^{OJ}/aka+^{n}**d**ama/ 'red jewel'

d. ^{OJ}/opo/ 'large' + ^{OJ}/**p**une/ 'boat'
→ ^{OJ}/opo+^{m}**b**une/ 'large boat'

There was no (prenasalised) voiced obstruent in ^{OJ}/tama/ (14a) or in ^{OJ}/pune/ (14b), but there was in the last syllable of ^{OJ}/apa^{m}bi/ (14a) and in the last syllable of ^{OJ}/su^{n}zu/ (14b). Neither E2 was idiosyncratically immune to *rendaku*, as shown by (14c) and (14d).

The OJ examples cited above are all attested phonographically, which means that they appear in OJ texts represented in *man'yōgana*, that is, Chinese characters used as phonograms (mostly syllabograms). ^{OJ}/su^{n}zu+**p**une/ (14b) appears only once, written <須儒赴泥>, with each character representing a syllable.[19] ^{OJ}/apa^{m}bi+**t**ama/ (14a) appears five times in total, and while three of these occurrences are written logographically, the remaining two are written phonographically.[20] It is, of course, inappropriate to use the inferred pronunciation of a logographic attestation as evidence in phonological analysis. In particular, there is no direct evidence for the presence or absence of *rendaku* in a logographically written compound. At the same time, a phonographic representation of a compound is not necessarily an accurate reflection of that compound's actual phonemic form. No existing OJ texts are original; they are handwritten copies of handwritten copies, sometimes with discrepancies between different copies (Frellesvig 2010: 22), and it is implausible to imagine that the critical editions on which scholars rely are entirely free of transmission errors. Furthermore, some individual *man'yōgana* characters were used inconsistently, sometimes representing a syllable beginning with a "voiceless" obstruent and sometimes representing a syllable beginning with the corresponding (prenasalised) voiced obstruent. In addition, for some compounds attested phonographically more than once, it appears that a form with *rendaku* and a form without *rendaku* co-existed. Consequently, for a compound attested only once, there is no way to know for sure whether or not it was variable with respect to *rendaku*. Historical linguists working on OJ simply have to keep these philological facts of life in mind and do the best they can with the material that is

[18] Prenasalisation is transcribed phonetically throughout this paper as nasalisation on the immediately preceding vowel followed by a short nasal with oral closure (see §3.2 above), but actual realisations in the present-day Kahoku-chō dialect (see §5 below) sometimes lack a measurable oral closure (Miyashita et al. 2016: 186). Herbert (1986), Maddieson & Ladefoged (1993), and Riehl & Cohn (2011) provide cross-linguistic surveys of the phonetics and phonology of prenasalised consonants.

[19] This sole occurrence of ^{OJ}/suzu+**p**une/ is in poem 51 in *Nihon shoki* (720). The Oxford-NINJAL Corpus of Old Japanese (https://oncoj.ninjal.ac.jp) makes virtually all OJ texts publicly available in searchable electronic form. The character <儒> unambiguously represents ^{OJ}/^{n}zu/, and the character <赴> unambiguously represents ^{OJ}/pu/ (see §4 and §6.2 below for more details on ambiguous phonogram spellings).

[20] The three logographic occurrences of ^{OJ}/apa^{m}bi+**t**ama/ are written <鰒玉> or <鰒珠>, with each character representing a morpheme. The two phonographic occurrences (poems 4101 and 4103) are both in book 18 of *Man'yōshū* (ca. 760), and both are written <安波妣多麻>. The character <妣> unambiguously represents ^{OJ}/^{m}bi/, and the character <多> unambiguously represents ^{OJ}/ta/ (see §4 and §6.2 below for more details on ambiguous phonogram spellings).

available. Several other phonographically attested OJ compounds will be cited below, and these examples all need to be interpreted with caution.[21]

The strong version of Lyman's Law clearly does not hold in modern Tokyo Japanese. There are many examples like those in (15), in which *rendaku* occurs even though the last syllable in E1 contains a voiced obstruent. Since this voiced obstruent is not in the same element as the *rendaku* site, the modern version of Lyman's Law (§2) does not apply.

(15) a. /fude/ 'writing brush' + /**h**ako/ 'box'
→ /fude+**b**ako/ 'brush case' (*/fude+**h**ako/)

b. /kaze/ 'cold' + /**k**usuri/ 'medicine'
→ /kaze+**g**usuri/ 'cold medicine' (*/kaze+**k**usuri/)

The results of a psycholinguistic study (Kawahara & Sano 2014) indicate that the strong version of Lyman's Law is not psychologically real for modern speakers.

4. Lyman's Law and the OCP

We described the OJ strong version of Lyman's Law just above in §3.4 as a ban on prenasalisation in adjacent syllables. In this section, we construe this ban as an instance of a cross-linguistically common dispreference for /NCVNC/ sequences (where N is a nasal stop and C is an obstruent). As Stanton (2019) demonstrates, perceptual confusion provides a clear phonetic basis for disfavoring such sequences. The version of Lyman's Law that we see in modern Tokyo Japanese prevents multiple instances of voicing within a morph, and the relevant syllables need not be adjacent (§2). Such a constraint on voicing is cross-linguistically rare, presumably because it lacks phonetic motivation, as we will argue below.

Ever since an influential article by Itô and Mester (1986), it has been popular to interpret Lyman's Law as a manifestation of the Obligatory Contour Principle (OCP). Originally proposed as a prohibition against sequences of identical tones in underlying representations (Leben 2011: 326), the OCP was incorporated into autosegmental phonology as a constraint on the tonal tier (Goldsmith 1990: 309–318). The notion of putting non-tonal features on separate tiers made it possible to treat such features as effectively suprasegmental, and a ban on multiple occurrences of voicing could then be formulated as a subcase of the OCP: OCP-[voice] (Odden 2011: 22).

To make this approach work for Lyman's Law, voicing must be a monovalent feature applicable only to obstruents, the sole class of segments for which voicing is distinctive in Japanese.[22] If the non-distinctive voicing of vowels and sonorant consonants were specified too, any morph with two or more voiced segments in a row, such as /kizu/ 'wound' or /ame/ 'rain', would violate OCP-[voice]. If voicing were treated as a traditional binary feature that specifies voiced obstruents as [+vce] and voiceless obstruents as [−vce], the OCP would not block *rendaku* in compounds like /ko+**h**icuǰi/ 'lamb' (4b), because the [+vce] specifications in */ko+bicuǰi/ associated with /b/ and /ǰ/ would be separated by the [−vce] specification associated with /c/ ([ts]).

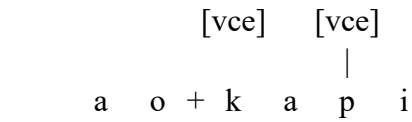
[21] We report carefully on inconsistently used phonograms below in §4 and in §6.2, where they are directly relevant to our arguments. There is no getting around the possibility that an unambiguous phonogram could simply be an error.

[22] Itô & Mester (1986), Mester & Itô (1989), and Rice (1993) offer different theoretical implementations of this idea.

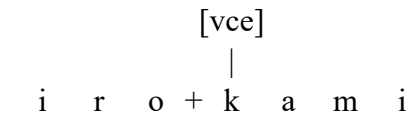
Rendaku itself can be treated as a subsegmental linking morpheme that joins the two elements of a compound (Itô and Mester 1986: 56–57; Vance 2015: 406–407; Labrune 2016). This morpheme has to be something more abstract than just the phonetic feature [voice], of course, since it converts a voiceless obstruent into its *rendaku* partner as in (2) in §1 (Vance 2018: 193–197). The linking element must also be prevented from docking onto anything other than an obstruent at the beginning of the second element of a compound (Vance 2015: 406). Otherwise, it could produce forms like */yu**g**i+yama/ instead of /yu**k**i+yama/ 'snowy mountain' (cf. /yu**k**i/ 'snow', /yama/ 'mountain') or */ura+ma**ǰ**i/ instead of /ura+ma**č**i/ 'backstreet district' (cf. /ura/ 'rear', /ma**č**i/ 'town').

Given these assumptions, Lyman's Law works as shown in (16). For the sake of illustration, the autosegmental representations are simplified to show a separate voicing tier but all other segmental information consolidated into a single tier. OCP-[voice] blocks *rendaku* in (16a) /ao+**k**abi/ 'blue-green mold' (cf. /ao/ 'blue; green', /**k**abi/ 'mold') but not in (16b) /iro+**g**ami/ 'coloured paper' (cf. /iro/ 'colour', /**k**ami/ 'paper').

(16) a.



b.



Since there are two adjacent [vce] specifications in (16a), OCP-[voice] erases the unlinked one, or at least prevents it from linking, and ensures that the compound meaning 'blue-green mold' does not surface as */ao+**g**abi/.

The domain of OCP-[voice] has to be limited, of course, so that it applies only to voicing specifications that would otherwise end up linked to segments in the same morph. Adjacency across a morpheme boundary does not count. Without this limitation, any word containing more than one voiced obstruent would be a violation, including the examples in (15) in §3.4 and even examples like /abura+cubo/ 'oil pot'.

A problem arises, however, when we consider Sino-Japanese binoms, which are written with two Chinese characters and are at least arguably bimorphemic. A minority of Sino-Japanese binoms can undergo *rendaku* as E2s, including /**k**a·ši/ 'sweets', as in /wata+**g**a·ši/ 'cotton candy' (using a dot rather than a plus to separate the morphs of a Sino-Japanese binom). However, no Sino-Japanese binom with a medial voiced obstruent ever undergoes *rendaku*, despite the fact that the medial voiced obstruent is never in the same morph as the target consonant for *rendaku* (Vance & Asai 2016: 121). There are no examples like */yama+**g**a·ǰi/, as opposed to actually occurring /yama+**k**a·ǰi/ 'mountain fire' (cf. /**k**a·ǰi/ 'fire incident'). Thus, Sino-Japanese binom elements behave like monomorphemic native elements. On the other hand, if Sino-Japanese binoms are treated as if they are monomorphemic, they can violate OCP-[voice] with impunity, as in /bo·go/ 'native language', /dai·gaku/ 'university', and many other words. Incidentally, monomorphemic recent loanwords are exempt from OCP-[voice], as in /adobaisu/ 'advice'. The usual assumption, therefore, is that OCP-[voice] applies only to native morphemes (Nasu 2015: 258–259).

Notice that the strong version of Lyman's Law in OJ (§3.4) was not just the present-day version with a larger domain (Vance 2005: 36–37). That is, the strong version was not simply a matter of limiting (prenasalised) voiced obstruents to one per word as opposed to one per

morph, because adjacency was relevant.[23] As noted below in (29) in §6.1, the two voiced obstruents in ^{OJ}/yoro^{n}du+**t**a^{m}bi/ ‘many times’ and in reduplicated ^{OJ}/tu^{ŋ}gi+**t**u^{ŋ}gi/ ‘again and again’ are non-adjacent, so neither violates the strong version of Lyman’s Law. Both would violate a word-domain version of OCP-[prenasal], however, despite the fact that neither has *rendaku*.

In conservative varieties of modern Tokyo Japanese that have word-medial [ŋ] (< OJ [^{ŋ}g]) instead of [g], [ŋ] blocks *rendaku* just as a voiced obstruent does (Kawahara & Zamma 2016: 25–26).[24] The examples in (17) illustrate.

(17) a. /koi/ ‘love’ + /**f**umi/ ‘letter’
→ /koi+**b**umi/ ‘love letter’ (*/koi+**f**umi/)

b. /curi/ ‘fishing’ + /**f**une/ ‘boat’
→ /curi+**b**une/ ‘fishing boat’ (*/curi+**f**une/)

c. /tora/ ‘tiger’ + /**f**u[ŋ]u/ ‘blowfish’
→ /tora+**f**u[ŋ]u/ ‘tiger blowfish’ (*/tora+**b**u[ŋ]u/)

E2s with medial [m] (17a) or [n] (17b) do not block *rendaku*. Along with the phonetically opaque pairings of voiceless and voiced obstruents in (2) (§2), the inhibiting power of velar nasals shows that Lyman’s Law in modern Tokyo Japanese has lost its phonetic grounding. It presumably has to be learned as a language-specific constraint.[25]

Furthermore, Kawahara (2008: 324–327) has argued that OCP-[voice] does not seem like a plausible universal constraint in the first place. Cross-linguistically, OCP constraints on consonants seem to target adjacent syllables and features with acoustic correlates that are more “spread out” in time. Such features, which include aspiration (e.g., Grassman’s Law) and prenasalisation, are susceptible to perceptual confusion (Ohala 1981: 189–196, 1993: 249–257; Gallagher 2010). That is, it is easy for a listener to perceive such a feature as linked to a segment other than its original host, and in the case of two hosts in adjacent syllables, listeners are likely to attribute the feature’s phonetic correlates to a phonological specification on a single segment. The confusion engendered by hosts in adjacent syllables can be resolved by dissimilation (Blevins 2004: 148–149; Bennett & Rose 2017: 475) or prevented from arising by the OCP. Restrictions against multiple instances of voicing are cross-linguistically rare and phonetically unnatural (Ohala 1993: 253–254). All known cases of restriction on multiple instances of voicing seem to have arisen diachronically from restrictions on other features (Kawahara 2008: 327).[26]

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[23] Thus, the strong version of Lyman’s Law in OJ, in contrast to the phenomena in Austronesian and Australian languages that Blust (2012) examines, cannot be attributed to avoidance of more than one marked segment per phonological domain. On the other hand, Itô & Mester (2003a: 101–119) propose different OCP constraints with different domains for OJ and modern Tokyo Japanese.

[24] The question of whether syllable-initial [ŋ] is an allophone of /g/ or a separate phoneme is controversial (Vance 2008: 214–222) and will not be addressed here. Native speakers of Tokyo Japanese who do not have [ŋ] tend to assume that [ŋ] and [g] must be allophones of the same phoneme.

[25] On the assumption that the relationship between [ŋ] and [g] is allophonic, the interaction with Lyman’s Law leads to an opacity problem in an OT analysis. This assumption may well be wrong (see note 24 just above), but Itô and Mester (2003b) accept it, and as a result, they have to resort to a stratal version of OT. For discussions of opacity, sound change, and phonetically unnatural patterns, see Sanders (2003), Hayes &White (2015), and Beguš (2020).

[26] The Niger-Congo language Moro disfavors voiceless consonants in adjacent syllables, and Bennett & Rose (2017) propose an OT analysis involving surface correspondence theory dissimilation, which does not limit dissimilating features to those “spread out” acoustic cues.

We now turn our attention specifically to prenasalisation. In a wide-ranging survey of the avoidance of /NCVNC/ sequences in several languages, Stanton (2019) argues that there is a universal dispreference for [NCṼ] sequences, rooted in the perceptual difficulty of assigning nasality to the underlying phonemes in such sequences. If the phonetic details inferred for OJ in §3.2 are essentially correct, prenasalised obstruents in adjacent syllables (/^{N}CV.^{N}CV/) would have produced [^{N}CṼ] sequences ([^{N}.CṼ^{N}.CV]). The strong version of Lyman's Law thus fits the cross-linguistic pattern as long as [^{N}C] can be treated as analogous to [NC]. As Stanton (2019: 657–658) notes, languages that have salient anticipatory nasalisation on a vowel preceding an onset nasal consonant will also avoid /NCVNV/ sequences, but as noted above in §3.2, such nasalisation is atypical, and we have assumed that it did not occur in OJ.

If salient nasalization had occurred in /^{N}CV.NV/ sequences in OJ, resulting in [^{N}.CṼ.NV], we would expect *rendaku* to have been avoided in compounds containing E2s such as ^{OJ}/**t**ama/ 'jewel' and ^{OJ}/**p**ana/ 'flower', but no such tendency is apparent. In the 62 relevant, phonographically attested compound nouns, there are 26 different E2s of the form /CVNV⋯/.[27] For four of these E2s, the evidence for *rendaku* is unclear. As noted in §3.4, some phonograms were used inconsistently, sometimes representing a syllable beginning with a "voiceless" obstruent and sometimes representing a syllable beginning with the corresponding prenasalised voiced obstruent. We use the label "ambiguous" to refer to these phonograms.[28] The four E2s in questions are all attested at least once with an E2-initial phonogram that is ambiguous but not with an E2-initial phonogram that unambiguously represents a prenasalised voiced obstruent. In contrast, 12 of the 26 relevant E2s have at least one token written with an E2-initial phonogram that unambiguously represents a prenasalised voiced obstruent. We can be reasonably confident that these 12 E2s were susceptible to *rendaku*. The remaining 10 E2s are attested only with E2-initial phonograms that unambiguously represent a "voiceless" obstruent. Thus, there is no evidence that any of these 10 E2s was susceptible to *rendaku*, although we can never be certain, since they might have had *rendaku* in unattested compounds. The table in (18) summarizes the numbers in this paragraph.

(18) Distinct ^{OJ}/CVNV⋯/ E2s (*N*=26)

attested unambiguously at least once as +*rendaku*:	12
attested unambiguously only as –*rendaku*:	10
attested ambiguously:	4

Of the 62 compounds described in the preceding paragraph, 17 have at least one token written with an E2-initial phonogram that unambiguously represents a prenasalised voiced obstruent (e.g., ^{OJ}/aka+^{n}**d**ama/ 'red jewel'[29]). Some of these 17 compounds almost certainly

[27] The figures reported in this paragraph and the following two paragraphs come from an exhaustive search for relevant tokens in the Oxford-NINJAL Corpus of Old Japanese (cited in note 19 above). The relevant compounds exclude those that would be expected to resist *rendaku* for some other reason. The excluded examples were: (1) those in which *rendaku* would violate the strong version of Lyman's (e.g., ^{OJ}/su^{n}ga+para/ 'sedge plain'); (2) those with coordinate meaning (e.g., ^{OJ}/tuyu+simo/ 'dew and frost'); (3) those with a numeral E1 (e.g., ^{OJ}/ya+kumo/ 'multilayer [literally '8'] clouds'); (4) those with honorific ^{OJ}/mi/ as E1 (e.g., ^{OJ}/mi+tama/ 'honorable spirit'). The number of phonographically attested tokens of each relevant compound varies widely, ranging from 1 to 51.

[28] To identify ambiguous phonograms, we relied on the character values from the table of phonogram usage in the authoritative dictionary of OJ (Jōdaigo Jiten Henshū Iinkai 1967: 891–903). Whether a phonogram was ambiguous or not can depend on the OJ text in which it occurs.

[29] This compound, used above in §3.4 as example (14c), is attested phonographically twice, once in *Kojiki* (712) with unambiguous <陀> representing ^{OJ}/^{n}da/, and once in *Nihon shoki* (720), with unambiguous <娜> representing ^{OJ}/^{n}da/.

varied between a form with *rendaku* and a form without, but there is little doubt that they had or could have *rendaku*. Another 32 of the 62 compounds are attested only with E2-initial phonograms that unambiguously represent a "voiceless" obstruent (e.g., ^{OJ}/patu+**p**ana/ 'first flower'[30]). Of course, some of these compounds might have allowed an alternative form with *rendaku*, but there is no phonogram evidence to back up such a claim. The remaining 13 compounds are all attested at least once with an E2-initial phonogram that is ambiguous but not with an E2-initial phonogram that unambiguously represents a prenasalised voiced obstruent (e.g., ^{OJ}/pito+**t**uma/~?^{OJ}/pito+^{n}**d**uma/ 'another's spouse'[31]). Philologists agree that most of these 13 had or could have *rendaku*, but the phonogram evidence is equivocal.[32] The table in (19) summarizes the numbers in this paragraph.

(19) Compounds with ^{OJ}/CVNV⋯/ E2 (*N*=62)
attested unambiguously at least once as +*rendaku*: 17
attested unambiguously only as –*rendaku*: 32
attested ambiguously: 13

In stark contrast to ^{OJ}/CVNV⋯/ E2s, there is virtually no doubt that E2s containing a prenasalised voiced obstruent in the second syllable (^{OJ}/CV^{N}C⋯/) never had *rendaku*. There are 19 different ^{OJ}/CV^{N}C⋯/ E2s phonographically attested in a total of 32 compound nouns. For 31 of these compounds, the E2-initial phonogram in every token unambiguously represents a syllable beginning with a voiceless obstruent (e.g., ^{OJ}/aki+**k**aze/ 'autumn wind'[33]). The remaining compound combines the E1 ^{OJ}/sita/ 'bottom' with the E2 ^{OJ}/kaze/ 'wind', and the sole phonographic attestation of this compound has ambiguous <賀> representing the E2-initial syllable. There is no real doubt that the compound was pronounced ^{OJ}/sita+**k**aze/, without *rendaku*, but the phonogram evidence is equivocal.[34] The table in (20) summarizes the numbers in this paragaraph.

(20) Compounds with ^{OJ}/CV^{N}C⋯/ E2 (*N*=32)
attested unambiguously at least once as +*rendaku*: 0
attested unambiguously only as –*rendaku*: 31
attested ambiguously: 1

The pattern in (20) is clear, and markedly different from the pattern in (18) and (19). We can say with a high degree of confidence that OJ compound nouns with a prenasalised voiced obstruent in the second syllable of E2 never show *rendaku*. In short, OJ was consistent with Stanton's (2019) generalisation, assuming as we have that an onset nasal did not induce salient nasalization on an immediately preceding vowel.

[30] This compound is attested phonographically four times in *Man'yōshū* (ca. 760), with <波> unambiguously representing ^{OJ}/pa/ in each token.

[31] This compound is attested phonographically five times in *Man'yōshū* (ca. 760), with unambiguous <都> representing ^{OJ}/tu/ in two cases and ambiguous <豆> representing ^{OJ}/tu/ or ^{OJ}/^{n}du/ in three cases.

[32] The headword in the authoritative dictionary of OJ (Jōdaigo Jiten Henshū Iinkai 1967) is given as ^{OJ}/pito+^{n}**d**uma/, with *rendaku*.

[33] This compound is attested phonographically four times in *Man'yōshū* (ca. 760), with unambiguous <可> representing ^{OJ}/ka/ in three cases and unambiguous <加> representing ^{OJ}/ka/ in one case.

[34] The sole phonographic attestation of this compound is in *Hitachi fudoki* (714–718). The *man'yōgana* <賀> was ambiguous between ^{OJ}/ka/ and ^{OJ}/^{ŋ}ga/ in this text, as it was in most of the OJ texts in which it was used.

5 Northern Tōhoku dialects

5.1 Northern Tōhoku *rendaku*

Japanese dialects spoken in the northern part of the Tōhoku region of northern Honshū preserve the prenasalisation of voiced obstruents, and it appears that Lyman's Law has remained a ban on prenasalisation in adjacent syllables in some of these dialects. In 2012, fieldwork on *rendaku* in one representative dialect was carried out in Kahoku-chō, a small town in northern Yamagata Prefecture (Miyashita et al. 2016: 180–183). This survey was led by Miyashita, who is a Kahoku-chō native, and the participants were 24 locally born and raised native speakers (13 male, 11 female) who ranged in age from 63 to 94 at the time of recording.

The outcome of *rendaku* in a conservative northern Tōhoku dialect is typically a prenasalised voiced obstruent. The Kahoku-chō survey participants produced many such forms (Miyashita et al. 2016: 183–192), including those in (21). Phonetic transcriptions of Kahoku-chō forms are prefixed with superscript K to avoid confusion with modern Tokyo forms or with inferred OJ forms.

(21) a. ^{K}[tẹ̥] 'hand' + ^{K}[**ɸ**ɯgɯɾo] 'bag' → ^{K}[tẽ̥^{ᵐ}**b**ɯgɯɾo] 'glove'
b. ^{K}[hɑmɑ] 'beach' + ^{K}[**k**ɯɾi] 'chestnut' → ^{K}[hɑmɑ̃^{ŋ}**g**ɯɾi] 'clam'

In most northern Tōhoku dialects, ^{OJ}[^{ŋ}g] has shifted to [ŋ], but many older Kahoku-chō speakers retain [^{ŋ}g], as in ^{K}[hɑmɑ̃^{ŋ}**g**ɯɾi] (19b).

Another salient characteristic of northern Tōhoku dialects is that, in most cases, the consonants corresponding to Tokyo "standard" voiceless stops and voiceless affricates are voiced (but not prenasalised) intervocalically in word-medial position, as shown in (22).[35]

(22) a. ^{K}[hɑdɑ] 'flag' cf. Tokyo /hata/ [hɑtɑ]
b. ^{K}[mɑdzɨ] 'town' cf. Tokyo /mači/ [mɑtɕi]
c. ^{K}[mɑdzɨ] 'pine' cf. Tokyo /macu/ [mɑtsɯ]
d. ^{K}[odʑɑ] 'tea' cf. Tokyo /oča/ [otɕɑ]
e. ^{K}[tɑgẹ̥] 'bamboo' cf. Tokyo /take/ [tɑke]

The expectation is that a counterpart to Lyman's Law in the Kahoku-chō dialect would involve prenasalised voiced obstruents, and as ^{K}[tẽ̥^{ᵐ}**b**ɯgɯɾo] in (21a) shows, a simple voiced obstruent in E2 (the [g] in this example) does not block *rendaku*.

5.2 Prenasalisation in adjacent syllables in northern Tōhoku

Modern Tokyo Japanese has the compound /nabe+**b**uta/ 'pot lid', which exhibits *rendaku* (cf. /nabe/ 'pot', /**f**uta/ 'lid'). The corresponding compound is not ordinarily used in the Kahoku-chō dialect. As a result, only 20 of the 24 Kahoku-chō survey participants were able to come up with something like the expected form in response to a picture prompt.[36] Six of these 20

[35] As noted in §3.2, it is likely that Old Japanese "voiceless" obstruents, too, were allophonically voiced in intervocalic position (Frellesvig 2010: 34–36), but the word-medial voiced consonants in the Kahoku-chō forms in (20) are probably not retentions. For one thing, Frellesvig (2010: 36) says that ^{OJ}/s/ was voiced word-medially (i.e., intervocalically), but northern Tōhoku fricatives corresponding to ^{OJ}/s/ are voiceless intervocalically, as in ^{K}[kɑsɑ] 'umbrella' (cf. Tokyo /kasa/ [kɑsɑ]). Also, vowel devoicing preempts intervocalic stop voicing in northern Tōhoku dialects, suggesting that vowel devoicing preceded stop voicing diachronically. For example, in example (23) below, we see ^{K}[ɸu̥tɑ] 'lid' (not ^{K}[ɸɯdɑ]), which corresponds to Tokyo /futa/ [ɸu̥tɑ].

[36] Kahoku-chō speakers do use a phrase corresponding to Tokyo /nabe no futa/, with the two nouns linked by a genitive particle: ^{K}[nɑ̃^{ᵐ}bẹ̥noɸu̥tɑ].

speakers produced a near-standard form with no prenasalisation and no voicing of the stop in the last syllable, as in (23a). Two other speakers had a prenasalised medial stop in E1 but a voiceless medial stop in E2, as in (23b). Another six speakers had a voiced medial stop in E2 but no prenasalisation, as in (23c).

(23) E1: ^{K}[nãᵐbe̤] ‘pot’ E2: ^{K}[ɸɯ̤tɑ] ‘lid’
a. ^{K}[nɑbe̤bɯtɑ] 6 speakers
b. ^{K}[nãᵐbe̤bɯtɑ] 2 speakers
c. ^{K}[nɑbe̤bɯdɑ] 6 speakers

The 14 productions in (23) all display a lack of full integration into the traditional Kahoku-chō dialect’s phonological system, indicating non-nativeness. Even the oldest of the Kahoku-chō participants were born too late not to be impacted by the relentless standardisation policy of the Japanese national government, which began in the Meiji period (1868–1912). Like most northern Tōhoku speakers, Kahoku-chō speakers are acutely aware that voiced obstruents corresponding to Tokyo voiceless obstruents and prenasalised obstruents corresponding to Tokyo voiced obstruents are salient and highly stigmatised. Most Kahoku-chō speakers, especially those who are educated, have a tacit understanding of the correspondences between the local dialect and the Tokyo standard.[37] Consequently, they are capable to some degree of converting local forms to standard forms and vice versa, and the almost fully standardised form in (23a) and the partially standardised forms in (23b) and (23c) are all natural outcomes under these circumstances.

The remaining six survey participants who produced a form corresponding to modern Tokyo /nabe+buta/ all had prenasalised [ᵐb] for the medial consonant in E1 and voiced [d] for the medial consonant in E2, but only one had prenasalisation on the initial consonant of E2, as shown in (24). Furthermore, this sole instance of E2-initial prenasalisation is not entirely unambiguous phonetically, as indicated by the question mark in (24b).

(24) a. ^{K}[nãᵐbe̤bɯdɑ] 5 speakers
b. ^{K}[nãᵐbẽ̤ᵐbɯdɑ] 1 speaker (?)

What is hard to understand about the form ^{K}[nãᵐbe̤bɯdɑ] in (24a) is that it unabashedly contains both stigmatised features (prenasalisation and stop voicing) but deviates from the correspondence pattern at the *rendaku* site.

The key to understanding (24a) was provided in a presentation about another northern Tōhoku dialect, spoken in the town of Shizukuishi-chō in Iwate Prefecture (Uwano 2015). In the Shizukuishi-chō dialect, prenasalised obstruents in consecutive syllables are phonotactically prohibited. For example, consider the Shizukuishi-chō compound in (25), which corresponds to Tokyo /hana+bi/ ‘fireworks’ (cf. /hana/ ‘flower’, /hi/ ‘fire’) and shows the expected prenasalisation at the *rendaku* site. (Phonetic transcriptions of Shizukuishi-chō forms are prefixed with superscript Sh.)

[37] This complex diglossic situation, which we find even in the most traditional northern Tōhoku communities, is the reason we have refrained from offering a consonant phoneme chart like the one for OJ in (9) in §3.2. There is such a chart in one of the published reports of the 2012 Kahoku-chō survey (Miyashita et al. 2016: 175), but that chart assumes that present-day speakers identify a word-initial voiced obstruent and a word-medial prenasalised voiced obstruent with the same place of articulation as allophones of the same phoneme. This analysis leads to a variety of thorny problems (Vance, Miyashita & Irwin 2014: 36–38) because ordinary natives of the northern Tōhoku who are senior citizens today are bidialectal and literate (in “standard” Tokyo Japanese). There is no point in trying to grapple with these sociolinguistic issues in this paper.

(25) ^{Sh}[hanɑ] ‘flower’ + ^{Sh}[**h**ɨ] ‘fire’ → ^{Sh}[hanɑ̃^{m}**b**ɨ] ‘fireworks’

Now consider the Shizukuishi-chō compound corresponding to Tokyo /kaba+bi/ ‘ceremonial fire’ (cf. /kaba/ ‘birch’, /hi/ ‘fire’), shown in (26). The prenasalisation in the preceding syllable blocks prenasalisation at the *rendaku* site, although *rendaku* does occur.

(26) ^{Sh}[kɑ̃^{m}bɑ] ‘birch’ + ^{Sh}[**h**ɨ] ‘fire’ → ^{Sh}[kɑ̃^{m}bɑ**b**ɨ] ‘ceremonial fire’

Although the Shizukuishi-chō dialect preserves prenasalised [^{m}b ^{n}d ^{n}dz], ^{OJ}/g/ [^{ŋ}g] has become [ŋ], just as in (conservative) Tokyo pronunciation. This [ŋ] does not block prenasalisation in an adjacent syllable, that is, the constraint has maintained its phonetic grounding. For example, compare two compound verbs corresponding to Tokyo /nige+das-u/ ‘run away’ (27a) and /tobi+das-u/ ‘fly away’ (27b).[38]

(27) a. ^{Sh}[niŋe] ‘flee’ + ^{Sh}[**d**ɑsɯ] ‘move away’ → ^{Sh}[niŋẽ^{n}**d**ɑsɯ] (*^{Sh}[niŋe**d**ɑsɯ])
b. ^{Sh}[tõ^{m}bɨ] ‘fly’ + ^{Sh}[**d**ɑsɯ] ‘move away’ → ^{Sh}[tõ^{m}bɨ**d**ɑsɯ] (*^{Sh}[tõ^{m}bɨ̃^{n}**d**ɑsɯ])

In (27b), prenasalisation following E1 would produce the disfavored phonetic sequence [^{N}CṼ], as the form in parentheses shows, and the constraint against prenasalisation in adjacent syllables prevents this sequence from arising, as explained in §4 in connection with the strong version of Lyman’s Law in OJ. In (27a), on the other hand, prenasalisation following E1 does not produce the disfavored [^{N}CṼ] sequence. We saw in §2 and §4 that, for modern Tokyo speakers who have onset [ŋ], a medial [ŋ] in an E2 blocks *rendaku*, that is, [ŋ] behaves like a voiced obstruent with respect to the modern Tokyo version of Lyman’s Law. In contrast, onset [ŋ] in the Shizukuishi-chō dialect does not behave like a prenasalised obstruent with respect to the constraint against prenasalisation in adjacent syllables, despite the fact that it derives historically from prenasalised [^{ŋ}g]. Notice that if the same constraint holds in the closely related Kahoku-chō dialect, then ^{K}[nɑ̃^{m}bę**b**ɯdɑ] (24a) is actually the fully nativised form corresponding to Tokyo /nabe+**b**uta/ ‘pot lid’.

When we look beyond compounds, however, there are examples that pose a serious challenge to our hypothesis that there is a straightforward ban on prenasalisation in adjacent syllables in the northern Tōhoku dialects we have considered. In the Shizukuishi-chō dialect, the conditional form of a verb ends with a suffix that is ordinarily pronounced /^{m}ba/, and some verb stems end in a syllable that has a prenasalised onset consonant. The question that arises, of course, is whether these forms are pronounced with prenasalisation in adjacent syllables. The answer is that these forms are variable, as the examples in (28) show.[39]

(28) a. ^{Sh}[kagũ-^{m}ba] (*^{Sh}[kagɯ-ba]) ‘write’-CONDITIONAL
cf. Tokyo /kake-ba/
b. ^{Sh}[jõ^{m}bũ-^{m}ba]~^{Sh}[jõ^{m}bũ-ba] (*^{Sh}[jobũ-^{m}ba]) ‘call’-CONDITIONAL
cf. Tokyo /yobe-ba/

[38] The E1s in these examples are sometimes called (simplex) verb stems. The E1 in a verb+verb compound verb must appear in this stem form. The E2 in both examples carries a figurative meaning, and the compounds are intransitive. As a verb on its own, this E2 is transitive and means ‘put/take out’.

[39] The data reported in this paragraph comes from Zendō Uwano (personal communication), a native speaker of the Shizukuishi-chō dialect and the author of the paper cited above in this section (Uwano 2015). Uwano informs us that his grandparents had the stem-final vowel [ẽ] preceding the conditional suffix (matching the vowel in the corresponding Tokyo forms) but that speakers of his own generation have [ũ].

We propose that the variability in examples like (28b) can be understood as a conflict between faithfulness (in this case, the desire to avoid allomorphy by maintaining the "basic" form of the suffix) and the constraint prohibiting prenasalisation in adjacent syllables. Since speakers cannot have it both ways, they vacillate as to whether or not to apply dissimilation. In an OT analysis, neither of the two constraints would outrank the other. As the asterisked form in (28b) shows, dissimilation can alter only the initial consonant of the suffix, not the last consonant of the stem, which an OT analysis might handle by ranking root/stem faithfulness higher than affix faithfulness (McCarthy & Prince 1995: 364–365).

As for the Kahoku-chō dialect, although Miyashita is a proficient speaker (thanks to spending a lot of time with her grandparents as a child), she does not have the secure native intuitions of Kahoku-chō speakers a generation older. As noted in §5.1, many older Kahoku-chō natives retain prenasalised ^{K}[ᵑg]. Does the Kahoku-chō dialect in fact have a phonotactic constraint prohibiting prenasalisation in consecutive syllables? If so, does ^{K}[ᵑg] block prenasalisation just like other prenasalised voiced obstruents? And do Kahoku-chō inflectional forms show the kind of variability that we see in Shizukuishi-chō? Unfortunately, these are questions that the 2012 Kahoku-chō survey did not address. Our fragmentary knowledge at the time did not give us any reason to probe in these directions. Since all northern Tōhoku dialects are endangered, we feel extremely fortunate to have learned what we have about the phonotactics of the closely related Shizukuishi-chō dialect, and there is still hope that the necessary follow-up fieldwork in Kahoku-chō can be carried out in the near future.

6 The Domain of OJ Lyman's Law

6.1 Compounds

We have argued in this paper that Lyman's Law in OJ (the so-called strong version of Lyman's Law) was a constraint that blocked prenasalised obstruents in adjacent syllables (§3.4), but we have not considered whether there is any evidence that might cast doubt on the claim that adjacency was crucial. In this section, we report an earnest search for examples that could be construed as instances of a nonadjacent prenasalised voiced obstruent inhibiting *rendaku*. As noted in §3.4, the extant OJ materials have serious limitations, but the results of our search give us no reason to doubt that adjacency was in fact crucial.

As explained in §2, Lyman's Law in modern Tokyo Japanese blocks *rendaku* when there is a voiced obstruent anywhere in E2. Adjacency is not relevant; a voiced obstruent in E2 blocks *rendaku* even if it is not in the immediately following syllable. Furthermore, a voiced obstruent in the last syllable of E1 does not block *rendaku*, even though it is adjacent to the syllable containing the *rendaku* site.

In northern Tōhoku dialects, on the other hand, the evidence cited in §5.2 from Shizukuishi-chō indicates that what is prohibited is prenasalised voiced obstruents in adjacent syllables. The strong version of Lyman's Law in OJ (§3.4) was also a constraint involving prenasalised voiced obstruents, and the examples cited in §4, repeated below in (29), are consistent with the claim that adjacency was relevant.

(29) a. ^{OJ}/yoroⁿdu/ 'myriad' + ^{OJ}/**t**aᵐbi/ 'time'
→ ^{OJ}/yoroⁿdu+**t**aᵐbi/ 'many times' (*^{OJ}/yoroⁿdu+**ⁿd**aᵐbi/)

b. ^{OJ}/**t**uᵑgi/ 'next' + ^{OJ}/**t**uᵑgi/ (reduplicated)
→ ^{OJ}/tuᵑgi+**t**uᵑgi/ 'again and again' (*^{OJ}/tuᵑgi+**ⁿd**uᵑgi/)

Each of the examples in (29) contained two prenasalised voiced obstruents, but not in adjacent syllables.

The question that remains to be addressed, of course, is whether the strong version of Lyman's Law prevented *rendaku* only when *rendaku* would have resulted in prenasalised voiced obstruents in adjacent syllables. The situation in OJ is hard to assess for two reasons. First, the number of phonographically attested compounds is limited. Second, very few OJ morphemes were longer than two syllables.

One important example is given in (30).

(30) ^{OJ}/swo^{n}de/ 'sleeve' + ^{OJ}/tuke/ 'attaching' → ^{OJ}/swo^{n}de+tuke/ 'sleeved'
^{OJ}/swo^{n}de+tuke/ 'sleeved' + ^{OJ}/**k**oromo/ 'garment'
→ ^{OJ}/swo^{n}de+tuke+^{ŋ}**g**oromo/[40] 'sleeved garment' (*^{OJ}/swo^{n}de+tuke+**k**oromo/)

(30) shows that a prenasalised voiced obstruent not in the morph immediately preceding the *rendaku* site did not block *rendaku*. It is not clear from (30), however, whether the domain of the inhibiting effect in E1 was the entire preceding morph or just the preceding syllable. Distinguishing these two possibilities requires examples with a monomorphemic E1 that contains a prenasalised voiced obstruent somewhere other than in its final syllable. As noted in §3.2, word-initial prenasalised voiced obstruents did not occur in the non-mimetic native OJ vocabulary. Consequently, the compounds of interest must have an E1 that was one of the few OJ morphs longer than two syllables. The sole relevant example is shown in (31).

(31) ^{OJ}/ma^{n}dara/ 'multicolour'+ ^{OJ}/**p**usuma/ 'bedding'
→ ^{OJ}/ma^{n}dara+^{m}**b**usuma/[41] 'multicoloured bedding' (*^{OJ}/ma^{n}dara+**p**usuma/)

The *rendaku* in (31) indicates that a prenasalised voiced obstruent preceding the *rendaku* site had to be in the immediately preceding syllable to block *rendaku*.

As for E2, unfortunately there are no convincing diagnostic examples involving a prenasalised voiced obstruent that is not in the syllable immediately following the *rendaku* site. The absence of *rendaku* in the examples in (32) is suggestive but by no means conclusive.

(32) a. ^{OJ}/moto/ 'origin' + ^{OJ}/**p**ototo^{ŋ}gisu/ 'cuckoo'
→ ^{OJ}/moto+**p**ototo^{ŋ}gisu/[42] 'returned cuckoo' (*^{OJ}/moto+^{m}**b**ototo^{ŋ}gisu/)

b. ^{OJ}/yama/ 'mountain' + ^{OJ}/**t**ati^{m}bana/ 'tangerine'
→^{OJ}/yama+**t**ati^{m}bana/[43] 'mountain tangerine' (*^{OJ}/yama+^{n}**d**ati^{m}bana/)

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[40] In the sole phonographic attestation of this compound, each of the five obstruent-initial syllables is written with an unambiguous phonogram (see §4).

[41] In the sole phonographic attestation of this compound, the phonograms for the two obstruent-initial syllables in E2 are unambiguous (see §4), but the phonogram for the second syllable in E1 is ambiguous, sometimes representing ^{OJ}/ta/ and sometimes represented ^{OJ}/^{n}da/. The headword in the authoritative dictionary of OJ (Jōdaigo Jiten Henshū Iinkai 1967) for E1 as an independent word is given as ^{OJ}/ma^{n}**d**ara/, but it is not attested phonographically. Later phonographic attestations (from Middle Japanese) all have a voiced obstruent in the second syllable, matching modern Tokyo /madara/. It is thus very unlikely that example (31) was pronounced ^{OJ}/matara+^{m}**b**usuma/. If it was, it is irrelevant here.

[42] In the sole phonographic attestation of this compound, E2-initial ^{OJ}/po/ and E2-medial ^{OJ}/gi/ are both written with unambiguous phonograms (see §4).

[43] In the sole phonographic attestation of this compound, the phonogram representing E2-initial ^{OJ}/ta/ is unambiguous (see §4), but the phonogram representing E2-medial $^{OJ/m}$ba/ is ambiguous, sometimes representing $^{OJ/m}$ba/ but sometimes representing ^{OJ}/pa/. Furthermore, of the 13 phonographic attestations of this E2 as an independent word, this penultimate syllable is written with an ambiguous phonogram in nine cases

Both E2s in (32) are etymologically composite, although OJ speakers may not have analyzed them.

For ^{OJ}/pototoᵑgisu/ ‘cuckoo’ in (32a), Martin (1987: 416) gives the etymology in (33).

(33) $^{pre\text{-}OJ}$/poto/ onomatopoetic + $^{pre\text{-}OJ}$/to/ quotative + $^{pre\text{-}OJ}$/naki/ ‘crying’ + $^{pre\text{-}OJ}$/su/ ‘bird’
[pototonakisu] > [pototõᵑgisu]

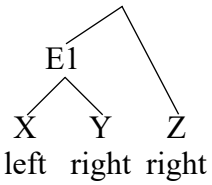
Mimetic morphemes are usually characterised as consistently *rendaku*-immune in modern Tokyo Japanese (Vance 2015: 416–417). The immunity may not have been quite so consistent in OJ, but distinction between mimetic and non-mimetic is difficult to draw because the boundary between these two sectors of the vocabulary has always been fuzzy and porous (Hamano 1998:6–7).[44] In any case, if the first two syllables of ^{OJ}/pototoᵑgisu/ derive from a *rendaku*-immune morpheme, there is no reason to attribute the absence of *rendaku* in (32a) to the non-adjacent prenasalised voiced obstruent ^{OJ}/ᵑg/.

For ^{OJ}/tatiᵐbana/ ‘tangerine’ in (32b), Martin (1987: 543) gives the etymology in (34).

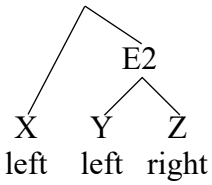
(34) $^{pre\text{-}OJ}$/ta/ ‘paddy’ + $^{pre\text{-}OJ}$/ti/ ‘path’ + $^{pre\text{-}OJ}$/no/ genitive + $^{pre\text{-}OJ}$/pana/ ‘flower’
[tatinopana] > [tatĩᵐbana]

It seems likely that speakers would have seen the morpheme for ‘flower’ in ^{OJ}/tatiᵐbana/, and as long as the entire word was felt to be compound of some sort, its resistance to *rendaku* could have developed because of the right-branch condition, which restricts *rendaku* to a right-side branch in constituent structure (Otsu 1980: 217–222; Vance 2007b; Kumagai 2014). The diagrams in (35) illustrate.

(35) a.



b.



In most three-element compounds X+Y+Z, the middle element Y combines with X to form a complex E1, as in (35a), or with Z to form a complex E2, as in (35b). Assuming that neither Y nor Z is immune to *rendaku*, the right-branch condition predicts that *rendaku* is possible in both Y and Z in (35a) but is possible only in Z in (35b). If the pre-OJ ancestor of the word for ‘mountain tangerine’ had the structure $^{pre\text{-}OJ}$/yama/+{$^{pre\text{-}OJ}$/tati+ᵐbana/}, the middle element $^{pre\text{-}OJ}$/tati/ was on a left branch, like Y in (35b). If the right-branch condition was active in pre-OJ, it would have made any Y+Z combination immune to rendaku as an E2, regardless of whether or not there was a prenasalised voiced obstruent anywhere in that Y+Z. The upshot is that, originally, the absence of *rendaku* in ^{OJ}/yama+**t**atiᵐbana/ (32b) may have had nothing to do with the ^{OJ}/ᵐb/ in ^{OJ}/tatiᵐbana/.

The claim that adjacency was crucial for the strong version of Lyman’s Law would be greatly strengthened if there were an example of *rendaku* in a two-element OJ compound with an E2

and with a phonogram that unambiguously represents ^{OJ}/pa/ in the other four cases. If the E2 in (32b) was actually pronounced ^{OJ}/tatipana/, then the absence of *rendaku* is irrelevant here.

[44] The entry in *Nihon kokugo daijiten* (Nihon Kokugo Dai-jiten Dainihan Henshū Iin-kai 2000–02), the Japanese counterpart of the *Oxford English Dictionary*, says that /kira+gira+ši/, with *rendaku*, is attested in the late 11th century, although not in OJ. This is an example of *rendaku* in a base that is mimetic, at least etymologically (cf. modern /kira+kira/ ‘sparkle-sparkle’).

that (1) was unambiguously monomorphemic, (2) had more than two syllables, and (3) contained a prenasalised voiced obstruent in the third syllable or later. Unfortunately, there simply are no such examples. Nevertheless, the available evidence from compounds is consistent with the idea that Lyman's Law in OJ reflected a phonetically motivated prohibition against prenasalised voiced obstruents in adjacent syllables, as proposed in §3.4.

6.2. Inflectional forms and frozen phrases

Just as we saw above in §5.2 in connection with northern Tōhoku dialects, when we look beyond compounds in OJ, there are examples that pose serious problems for our hypothesis that OJ had a straightforward ban on prenasalisation in adjacent syllables. First, there were inflectional suffixes that began with a prenasalised voiced obstruent and attached to verb stems. Since some OJ verb stems ended in a syllable with a prenasalised onset, such inflectional forms were a potential source for prenasalisation in adjacent syllables. Second, the genitive particle ^{OJ}/ŋga/ linked nouns, just like ^{OJ}/no/ (see §3.3). Many noun+^{OJ}/ŋga/+noun phrases were lexicalized and thus appear as headwords in the authoritative dictionary of OJ (Jōdaigo Jiten Henshū Iinkai 1967). Since many OJ nouns ended in a syllable with a prenasalised onset, these frozen phrases are another potential source for prenasalisation in adjacent syllables within a phonological word.

The examples in (36) are inflectional forms of verbs that are phonographically attested and appear to have had prenasalised obstruents in consecutive syllables.[45]

(36) a. ^{OJ}/yo^{m}ba-^{n}zu/ 'call'-NEGATIVE
b. ^{OJ}/i^{n}de-^{n}zu/ 'emerge'-NEGATIVE
c. ^{OJ}/aswo^{m}be-^{n}domo/ 'play'-CONCESSIVE
d. ^{OJ}/me^{n}de-^{m}ba/ 'appreciate'-CONDITIONAL

The phonemic transcriptions in (36) obviously violate the proposed ban on prenasalisation in adjacent syllables, but there is room for doubt about whether these transcriptions accurately reflect OJ pronunciation. As noted above in §3.4, some *man'yōgana* characters were used inconsistently, sometimes representing a syllable beginning with a "voiceless" obstruent and sometimes representing a syllable beginning with the corresponding prenasalised voiced obstruent. In the single phonographic attestation of (36a) ^{OJ}/yo^{m}ba-^{n}zu/, the character that represents the second syllable (<婆>) was used sometimes for ^{OJ}/^{m}ba/ but sometimes for ^{OJ}/pa/. In the single phonographic attestation of (36b) ^{OJ}/i^{n}de-^{n}zu/, the character that represents the second syllable (<弖>) was normally used for ^{OJ}/te/ and not for ^{OJ}/^{n}de/. There are three phonographic attestations of (36c) ^{OJ}/aswo^{m}be-^{n}domo/, and in two of them the character that represents the fourth syllable (<等>) was normally used for ^{OJ}/to/ and not for ^{OJ}/^{n}do/.[46]

Turning next to frozen noun+^{OJ}/ŋga/+noun phrases, (37) shows the only two phonographically attested examples we have found.[47]

[45] The forms in (36) are four of the six relevant examples we found in a systematic search of the Oxford-NINJAL Corpus of Old Japanese (cited above in note 19). The other two are both negative forms like (36a) and (36b) and thus add little information, and one of them contains a compound stem with E1 written logographically.

[46] All the attestations cited in this paragraph are from *Man'yōshū* (ca. 760), and the character values are from the table of phonogram usage in the authoritative dictionary of OJ (Jōdaigo Jiten Henshū Iinkai 1967: 891–903).

[47] Like the examples in (36), we found the examples in (37) in a systematic search of the Oxford-NINJAL Corpus of Old Japanese.

(37) a. ^{OJ}/su^{n}zu/ ‘bell’ + /^{ŋ}ga/ GENITIVE + /ne/ ‘sound’
→ ^{OJ}/su^{n}zu+^{ŋ}ga+ne/ ‘tone of a bell’

b. ^{OJ}/ta^{n}du/ ‘crane’ + /^{ŋ}ga/ GENITIVE + /ne/ ‘sound’
→ ^{OJ}/ta^{n}du+^{ŋ}ga+ne/ ‘cry of a crane’

The phonemic transcriptions in (37), like those in (36), clearly violate the proposed ban on prenasalisation in adjacent syllables, but here again there is room for doubt whether the transcriptions accurately reflect OJ pronunciation. There is only one phonographic attestation of (37a) ^{OJ}/su^{n}zu+^{ŋ}ga+ne/, and the phonograms for ^{OJ}/^{n}zu/ and ^{OJ}/^{ŋ}ga/ are unambiguous. There are four phonographic attestations of (37b) ^{OJ}/ta^{n}du+^{ŋ}ga+ne/. Three of them have an unambiguous phonogram for ^{OJ}/^{ŋ}ga/, but two of these three have <頭> for the second syllable, and this character was used to represent ^{OJ}/^{n}du/ in some texts and ^{OJ}/tu/ in others. In the fourth phonographic attestation, the character for the second syllable (<豆>) was used sometimes for ^{OJ}/^{n}du/ and sometimes for ^{OJ}/tu/, and the character for the genitive particle (<賀>) was used sometimes for ^{OJ}/^{ŋ}ga/ and sometimes for ^{OJ}/ka/.[48]

We suggest that the phonogram spellings described in the preceding two paragraphs can be construed as evidence that dissimilation may have applied to OJ inflectional forms and frozen phrases that would have violated our proposed constraint against prenasalisation in adjacent syllables. We can also surmise that such instances of dissimilation would have been especially susceptible to “correction” by copyists working in later centuries, although we have no evidence to offer. (As noted in §3.4, there are undoubtedly transmission errors in the earliest extant manuscripts of OJ texts, which are handwritten copies of handwritten copies.) It is quite possible, of course, that OJ forms like those in (36) and (37) showed variability of the kind we saw in §5.2 for Shizukuishi-chō inflectional forms like (28b) (^{Sh}[jõ^{m}bũ-^{m}ba]~^{Sh}[jõ^{m}bũ-ba]). That is, faced with the dilemma of avoiding prenasalisation in adjacent syllables but also avoiding allomorphy, OJ speakers may have wavered, as in (38).

(38) ?? ^{OJ}/aswo^{m}be-^{n}domo/~^{OJ}/aswo^{m}be-tomo/ ‘play’-CONCESSIVE = (34c)

Some of the phonogram spellings noted suggest that, in contrast to the Shizukuishi-chō dialect, even altering a root/stem may have been an option in OJ, as in (39).

(39) ?? ^{OJ}/ta^{n}du+^{ŋ}ga+ne/~^{OJ}/ta^{n}du+ka+ne/~^{OJ}/tatu+^{ŋ}ga+ne/ ‘cry of a crane’ = (35b)

We acknowledge that we are speculating here on the basis of very little evidence, but we would rather not simply stipulate that our proposed constraint against prenasalisation in adjacent syllables applied to compounds but not to inflectional forms and frozen phrases in OJ. Inflectional forms like those in (36) and frozen phrases like those in (37) created a conflict between this phonetically motivated constraint and the equally natural desire to avoid allomorphy. The suggestion we have just outlined is that the hypothesized constraint was overridden in such circumstances but perhaps only variably.

If we compare compounds in which *rendaku* would have violated the strong version of Lyman’s Law, the same conflict would not have arisen. As we noted in §4, *rendaku* in modern Tokyo Japanese can be treated as a subsegmental linking morpheme that joins the two elements of a compound. Diachronically, this linking morpheme is the descendant of a prehistoric

[48] The first three attestations of ^{OJ}/ta^{n}du+^{ŋ}ga+ne/ are from *Man’yōshū* (ca. 760), while the fourth is from *Kojiki* (712). The character values, which differ for these two texts, are from the table of phonogram usage in the authoritative dictionary of OJ (Jōdaigo Jiten Henshū Iinkai 1967: 891–903).

genitive particle $^{\text{pre-OJ}}$/no/, as explained in §3.3, and its OJ counterpart was prenasalisation that docked onto the first segment in the second element of a compound, as in (40).[49]

(40) $^{\text{OJ}}$/satwo/ ‘village’ + /$^{\text{N}}$/ + $^{\text{OJ}}$/pito/ ‘person’ → $^{\text{OJ}}$/satwo+$^{\text{m}}$**b**ito/ ‘village person’

The presence or absence of the OJ linking morpheme was unpredictable, just as the presence or absence of its diachronic source (the genitive particle) was unpredictable in prehistoric Japanese (see §3.3). In an example like (41) below, the linking morpheme was absent.

(41) $^{\text{OJ}}$/miya/ ‘palace’ + $^{\text{OJ}}$/pito/ ‘person’ → $^{\text{OJ}}$/miya+**p**ito/ ‘palace retainer’

In the examples in (42), *rendaku* would have resulted in prenasalisation in adjacent syllables, and we assume that the linking morpheme was predictably absent in such cases.

(42) a. $^{\text{OJ}}$/aki/ ‘autumn’ + $^{\text{OJ}}$/ka$^{\text{n}}$ze/ ‘wind’ → $^{\text{OJ}}$/aki+**k**a$^{\text{n}}$ze/ ‘autumn wind’
(*$^{\text{OJ}}$/aki+$^{\text{ŋ}}$**g**a$^{\text{n}}$ze/)

b. $^{\text{OJ}}$/u$^{\text{n}}$du/ ‘whirlpool’ + $^{\text{OJ}}$/sipo/ ‘field’ → $^{\text{OJ}}$/u$^{\text{n}}$du+**s**ipo/ ‘whirlpool tide’
(*$^{\text{OJ}}$/u$^{\text{n}}$du+$^{\text{n}}$**z**ipo/)

Just as there is no exponent of the linking morpheme in (41), there is none in (42): (42a) has $^{\text{OJ}}$/k/, not $^{\text{OJ}}$/$^{\text{ŋ}}$g /, and (42b) has $^{\text{OJ}}$/s/, not $^{\text{OJ}}$/$^{\text{n}}$z/. An OJ speaker had no reason to infer underlying forms that contained a morpheme that never surfaced. *Rendaku* in the examples in (42) would have created both prenasalisation in adjacent syllables and E2 allomorphy; the actual forms had neither. The proposed constraint against prenasalisation in adjacent syllables affected OJ compounds in the sense that it prevented an optional linking morpheme from occurring when its realisation would have produced a violation. Prehistorically, the constraint presumably prevented contraction of genitive $^{\text{pre-OJ}}$/no/ (see §3.3) from leading to the same undesirable outcome. If such a noun+$^{\text{pre-OJ}}$/no/+noun phrase became conventional, speakers could have either maintained it uncontracted or replaced it with a compound involving the simple juxtaposition of the two nouns.

To summarise our discussion of the proposed prohibition against prenasalised voiced obstruents in adjacent syllables, we saw in §6.1 that compounds are consistent with this statement of the constraint. Specifically, the strong version of Lyman’s Law that held in OJ (§3.4) prevented *rendaku* in any compound in which a prenasalised voiced obstruent appeared in the syllable immediately preceding or immediately following a potential *rendaku* site. We saw here in §6.2, however, that there are inflectional forms of verbs and frozen phrases that presumably were phonological words and yet appear to have contained prenasalised voiced obstruents in adjacent syllables. We cited peculiarities of phonogram usage that cast doubt on whether such sequences were actually permissible, but this evidence is less than compelling. It could be that strong version of Lyman’s Law that we see in OJ reflected a purely phonetic constraint that held in prehistoric Japanese, and that the original constraint had already begun to weaken by OJ times.

[49] The E2-initial syllables in the phonographically attested tokens of the examples (40)–(42) are all represented by unambiguous phonograms (in the sense explained above in §4).

7 Conclusion

This paper has looked at three kinds of evidence to argue that Lyman's Law originated as a constraint prohibiting prenasalisation in consecutive syllables. First, in §3 and §4, we considered phonetic motivation. Constraints on similar consonants in close proximity generally involve features with phonetic cues that are spread out in time. Prenasalisation is one such feature, and our account of Lyman's Law in OJ is compatible with the results of cross-linguistic research on nasality and perceptual confusion. Second, in §5, we looked at Lyman's Law in some endangered dialects of modern Japanese that, unlike Tokyo "standard" Japanese, still retain prenasalised voiced obstruents. The dialects we examined appear to prohibit these prenasalised consonants from occurring in adjacent syllables. Third, in §6.1, we looked carefully at the compounds recorded in phonograms in OJ texts. None of the relevant examples conflicts with our interpretation of Lyman's Law in OJ as a constraint that applies to adjacent syllables. On the other hand, as we saw in §6.2, some inflectional forms and lexicalized phrases challenge the claim that this constraint held across the board without regard to morphological structure. Nonetheless, the phonogram spellings of the few phonographically attested examples contain enough oddities to cast doubt on whether these forms were truly counterexamples to our hypothesis.

Needless to say, this account of the strong version of Lyman's Law in Old Japanese does not explain how it morphed into the constraint that we find in modern Tokyo Japanese. Modern Lyman's Law applies not to words but to compound elements (morphemes in the case of native elements), and adjacency does not seem to be relevant (§2). Recent studies on the diachronic development of consonant cooccurrence constraints by Coetzee (2014) and Gallagher (2016) offer some tantalizing hints, but we leave this problem for future research.

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