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A new consonant-vowel architecture: Japanese borrowings from European languages from the viewpoint of Complexity Scales and Licensing

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Japanese has borrowed lexical items from European languages for centuries, mostly for historical and cultural reasons. Phonological analyses concerning the process of importing words from various languages are numerous. Syllabic structures of Western languages usually differ from those in Japanese and this difference manifests itself mainly in the lack of many consonant groups in the latter. In this paper, a number of examples will be provided so as to show how consonant clusters from donor languages undergo decomposition in Japanese loanwords from European languages, also referred to as *gairaigo*. The phonological model of Complexity Scales and Licensing is employed here with a view to demonstrating precisely why the process of cluster disintegration usually happens, which enforces epenthetic vowels, and why it is at times inhibited.

Keywords: borrowings, consonant clusters, empty nuclei, decomposition, government and licensing, epenthesis

1. Introduction

Borrowing from language to language is common in the contemporary world of sound systems. The literature on how, when, where and why languages borrow words from other tongues is very rich. What deserves attention is the details, which may be cultural, semantic, syntactic, orthographic, morphological or phonological. The phonotactics of what can be possible regarding consonant clusters is described by e.g. Algeo (1978). What is aimed at now is to demonstrate and discuss how consonant clusters from European languages[1] behave in a language where such groups are most unwelcome.

[1] A word of explanation seems in place here. We are not considering Indo-European languages as such, since these embrace also many languages of India and the Middle East. Those are not included here.

Loanword adaptation is a complicated matter. It is even more complex when two languages, the donor/source (L1) and the borrower/target (L2) are very different. Barring loans from Chinese and other oriental tongues, the phonological system of Japanese has incorporated a great number of lexical items from Western languages over the past few centuries. These loanwords have come mainly from English,[2] but quite a few other European tongues need not be neglected as donors.

The medium to facilitate the ensuing analysis will be the model of Complexity Scales and Licensing (Cyran 2010; Jaskuła 2006, 2014, 2016). It is a theory of representations based on Government Phonology (Kaye & Lowenstamm & Vergnaud 1990).

The organization of this article is as follows. Firstly, a presentation of the basic assumptions of Complexity Scales and Licensing (CSL) will be offered, along with repair strategies which it offers in word adaptation. Secondly, the phonotactics of Japanese and adaptation methods will be briefly described. Thirdly, a body of data including borrowings from European languages will be presented. Fourthly, a CSL analysis of changes which Western words undergo once entering the lexicon of Japanese will be proposed.[3] Finally, conclusions will be drawn.

2. The theoretical model of CSL

2.1. Basic assumptions and mechanisms

The model employed in this paper is that of Complexity Scales and Licensing (Cyran 2010), a development of Government Phonology (Kaye 1990; Kaye & Lowenstamm & Vergnaud 1990; Charette 1991; Harris 1990; etc.). Similarly to the original framework, CSL adopts the stance that lateral governing relations are present in phonology. It is postulated, in principle, that two mechanisms, that is government and licensing, are cross-linguistically responsible for the shape of words as well as for phonological processes that can be observed in the world's languages. Moreover, the assumed universal structure is that every word begins with an onset and ends with a nucleus. Both onsets and nuclei can be empty. Finally, parameters are language-specific (ON or OFF), while government and licensing relations are universal.

However, it must be mentioned that CSL is derived more closely from the Strict CV model proposed by Lowenstamm (1996). Another major theory that also stems from Strict CV is the Lateral Theory of Phonology by Scheer (2004). Unlike Scheer, who claims that government 'spoils' the health of a segment, while licensing 'supports' the melodic material and both these mechanisms operate from right to left, Cyran (2010) assumes that government

[2] Tomoda (1999: 232) mentions about 80%. The first loanwords probably came from Portuguese (Kono 2001) and Dutch (Zhang 2019).

[3] In this paper, only the decompositions of Western consonant clusters are going to be discussed. Many other issues which also concern Japanese word adaptation, e.g. replacements of foreign consonants or vowels, are discussed elsewhere, e.g. Kay (1995), Vance (2008), Daulton (2008), Irwin (2011), Labrune (2012), Þórdísarson (2016), Zhang (2019).

depicts asymmetric relations only between consonantal segments in both directions. No government holds between nuclei whereas licensing is a force that is provided to onsets by the following nuclei in order to make government possible. Both these devices are responsible for the architecture of words, in whatever language they happen to occur. In any event, all the post GP models save the spirit of government and licensing, at the same time postulating modifications in the ways that these mechanisms work and being faithful to the CVCV structure.

The CSL model of phonology has been chosen in this analysis for a reason. The reason is that it can precisely predict the structures of words using the simplest assumptions concerning complexity, government and licensing.

Let us now focus on those assumptions of CSL which will have a bearing on the analytic part of this paper. Above all, every onset is licensed by the following nucleus. Moreover, when consonants which stand side by side enter into inter-onset (IO) governing relations, these relations are sanctioned by the nuclei that follow such consonant clusters via the so-called government-licensing, i.e. a licence to govern (Charette 1991).

Consider the following diagrams in which IO governing relations are depicted (R[4] = resonant/sonorant, T = obstruent/ ‘true consonant’, C = any consonant, V = vowel/schwa, ∅ = empty nucleus). (T) always governs (R) but not vice versa:

(1) a.	b.	c.	
(RIO) *rightward*	(LIO) *leftward*	no IO	
$O_1\ N_1\ O_2N_2$	$O_1\ N_1\ O_2N_2$	$O_1\ N_1\ O_2N_2$	government
| | |	| | |	| | |	
T R V/∅	R T V/∅	C ∅ C V	licensing
t r e nd	me l t	mɒ t l ɪ	

These diagrams should be read in the following fashion. (1a) represents an obstruent-sonorant cluster (where the resonant is usually a liquid or a glide, rarely a nasal). This structure is traditionally referred to as a ‘branching onset’, represented by the English word *trend*. Here, the obstruent (T) governs the resonant (R) via a rightward inter-onset relation (RIO). In (1b) we can see a reverse situation, a leftward inter-onset relation (LIO), as illustrated by English *melt*, where a sonorant is followed and governed by an obstruent, which may be called a ‘coda-onset’ group in other phonological models.[5] What requires special attention is that in both (1a) and (1b) the nucleus (N_1) is allowed by IO relations to remain empty. In other words, it is invisible to phonology (‘locked’) and plays only a formal role in the ONON sequence, unlike the empty nuclei represented by ∅.[6]

The third representation (1c) shows two consonants which establish no governing

[4] In geminates, the symbol (R) also represents the ‘coda’, the first part of a double consonant, while the ‘onset’ is the part symbolized by (T).

[5] Let us note that [s]+stop clusters are perceived by Standard GP as ‘coda-onset’ groups (Kaye 1990), while by CSL as LIO relations, even word-initially.

[6] In another approach, namely VC, such nuclei are called ‘buried’ (Szigetvári 1999).

relation, e.g. English *motley*. The reason why there is no RIO here is that [tl] never form a branching onset word-initially in English (Gussmann 2002). What follows from this is that IO relations are geared to the language in which they appear. [tl] is a well-formed branching onset in Polish, e.g. *tlen* – 'oxygen'. Thus, apart from the type of consonants, also language-specific parameters are of importance. In English there is a constraint on homorganic 'branching onsets', e.g. *[tl, dl, pw, bw], while in Polish there is no such restriction.[7]

Another word should also be said about empty nuclei. A word-final empty nucleus (FEN) is allowed to stay silent by parameter. Many languages (e.g. English, Polish, German, Irish, etc.) 'switch' this parameter ON and words may end in consonants in these systems. In other languages (e.g. Italian, Japanese, Hawaiian, etc.) this parameter is OFF and all words must end in vowels. As for word-internal empty nuclei (IEN), these may remain mute inside an IO relation, e.g. (N_1) in both (1a) and (1b). In CSL there are no lateral governing relations between nuclei. When an empty nucleus is outside such a relationship, as (N_1) in (1c), the universal No Lapse constraint, borrowed from Rowicka (1999) and represented as *∅_∅, is at work. This constraint ensures that no two empty nuclei can occur in a row.

Now let us turn to licensing. In (1a) the RIO relation is government-licensed by the nucleus (N_2). This government-licensing (GL) is indirect (difficult), which means that the GL nucleus is distant from the governor. In (1b) the LIO is also government-licensed by (N_2), the difference being in that the GL nucleus is close to the governor and this type of GL is direct (easy). Finally, in (1c) there is no GL but a simple type of licensing provided by any nucleus to the preceding onset. Which type of licensing nuclei can deliver is parametric/language--specific.

What needs to be mentioned now is the role of vocalic material attached to the nuclei. The nucleus (N_2), which provides government-licensing to both RIO (1a) and LIO (1b), may either be filled by a vowel or remain empty (with no melody), depending on the phonological system. Generally, full vowels are better licensers than empty nuclei. In other words, the government-licensing potential of nuclei is scalar. In a number of languages, such a nucleus may be empty word-medially, e.g. [tr∅fat͡ɕ] in ***trw**ać* – 'to last' (Polish) and word-finally [bəʊlt∅] *bo**lt*** (English), while in others it must be filled with a vowel, e.g. [pjetra] *pie**tra*** – 'stone' (Italian). The Italian case may be contrasted with Polish [vʲatr∅] *wia**tr*** – 'wind'. FEN in Polish can government-license 'branching onsets', while in Italian that is impossible and these nuclei must be filled with vowels. Additionally, in languages like Hawaiian, empty nuclei cannot license either single onsets or consonant groups. For example, the English *brush* is realized as [palaki] in Hawaiian, which means that double epenthesis needs to occur.

What also matters is the structures of segments that can govern and those which are governed. In both standard GP and CSL, the structures of segments are expressed in terms of the so-called elements (Harris 1990, 1994; Backley 2011). These are acoustic and articulatory primes whose presence or absence contributes to a segment's governing force. The elemental makeup of a segment may differ from language to language. The elements which are necessary here are shown below (based on Harris 1994 and Backley 2011):

[7] Such clusters are not common, but [tl] can be found word-medially and finally in Nahuatl (Aztec), e.g. [atlatl] – 'spear-thrower'.

(2)

{U̲} – labiality[8] {U} – velarity {A} – coronality {h} – noise {N} – nasality
{ʔ} – occlusion {L} – low tone/ voicedness {H} – high tone/ voicelessness/ aspiration

For example, therefore, the English [t] would include {A, ʔ, h, H}, while [n] would be made of {A, N}. Moreover, [b] would be composed of {U̲, ʔ, h}, whereas [r] of the element {A} alone.[9] Summing up, the more elements a segment includes, the better governor it is (Harris 1990). CSL assumes complexity scales: more complex consonants govern less complex ones. The more primes a consonant needs to govern, the more difficult the governing relation is (governee complexity) and the fewer primes the governor has, the more difficult the governing relation (governor complexity).

The final part of the theoretical presentation is the diagram below, based on Cyran (2010: 98, 103), where the ease of government-licensing is depicted.

(3)

ease of government-licensing

easy → *difficult*

a. *geminate*	b. *partial geminate*	c. *ordinary RT cluster*	d. *TR cluster*
R N T N	R N T N	R N T N	T N R N
. < β	μ β	λ β	β λ
. < γ	. < γ	(π) (τ)	δ (ρ)
(.) < (δ)	δ	(σ) (π)	(γ)[10]
(.) < (π)	(π)		(π)

This scale shows that the element complexity of the governee (R) in (3a) may be null, since all the primes are included in the governing (T) position and are spread to (R). Thus, the ratio is always (2:0, 3:0 or 4:0). This makes the government between (T) and (R) extremely easy and the government-licensing by the following nucleus also unproblematic. Moreover, the fewer elements a governing nucleus must government-license, the better. A partial geminate in (3b), that is, a cluster habitually composed of a nasal followed by a homorganic obstruent, is also fairly easy as regards government-licensing since one or more elements are provided by the governor (T), the ratio being (3:1 or 4:1). An ordinary RT group in (3c) is more difficult to government-license, because few, if any, elements are shared between (R) and (T) and a complexity slope may not be present (T and R are equally complex). For instance, the

[8] The element {U} may stand for two places of articulation. When underlined ('headed'), i.e. {U̲}, it represents labials, while the 'headless' {U} stands for velars. For more details, see e.g. Kijak (2017).

[9] Obviously, the elements for vowels are also part of the theory. However, these are not important for this analysis.

[10] In this diagram, the phonological elements are represented by Greek characters, which are purely symbolic, so as to illustrate element complexity. The maximum number of primes for T consonants is 4. Let us note that between every RT or TR there is always N.

cluster [kt] in the English word [ækt] *act* displays a so-called sonority plateau and the number of elements is the same under both (R) and (T). Finally, the TR group in (3d) is the most difficult structure to government-license in view of the fact that the government-licensing provided by the following (N) here is indirect, as compared to the three structures shown in (3a-c). Therefore, there is an implicational universal: languages with TR clusters also have RT clusters, but the reverse is not true as TR is a much more extreme cluster than RT.[11]

Regarding the number of elements under (T) and under (R), the greater the complexity slope between the governor and the governee (i.e. the more elements in (T) and the fewer in (R)), the easier the cluster is to be government-licensed. Thus, in English the complexity ratio between [t] and [r] in *try* is (4:1). If this differential were, say (4:3), e.g. [kn], it would not be tolerated by many languages, including English. Let us also recall that between any (R) and (T) the empty nucleus is licensed by the IO relation to stay mute. Therefore, CSL adopts complexity: the more complex consonants govern the less complex ones. Government-licensing is also scalar: the ease of government depends on the potential of the licensing nuclei and the number of elements in consonants. As depicted under (1) and below, the nuclear potential also matters – vowels/schwas can government-license more than empty nuclei.

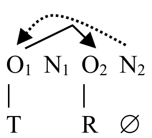
2.2. Typical adaptation strategies predicted by CSL

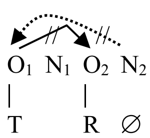
When we turn to word adaptation and structural differences between borrowed words in L1 and L2, CSL offers a few repair strategies which are relevant to the present analysis. In most languages of Europe, IO relations occur. In target languages from outside Europe, these are frequently decomposed, which may result in a few adaptation strategies, the most typical of which are graphically represented below:

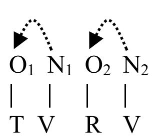
(4)

DONOR LANGUAGE > TARGET LANGUAGE > RESULT

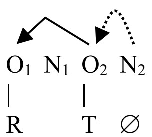
a. *RIO_#* — *lack of GL* — *double epenthesis*

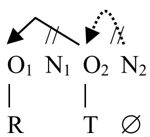


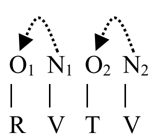




b. *LIO_#* — *lack of GL* — *double epenthesis*







[11] Interestingly, although geminates are the easiest consonant groups to government-license, they are absent from the majority of the world's languages, which is most probably parametric. Parameter GEMINATES = OFF.

c. *RIO*	*lack of GL*	*epenthesis*
O_1 N_1 O_2 N_2	O_1 N_1 O_2 N_2	O_1 N_1 O_2 N_2
| | |	| | |	| | | |
T R V	T R V	T V R V
d. *LIO*	*lack of GL*	*epenthesis*
O_1 N_1 O_2 N_2	O_1 N_1 O_2 N_2	O_1 N_1 O_2 N_2
| | |	| | |	| | | |
R T V	R T V	R V T V

The adaptation strategies shown above result from the differences between what is allowed by L1 and L2 in terms of word architecture. In (4a) and (4b) we observe word-final RIO ('branching onset') and LIO ('coda-onset') relations, respectively, which are found in the donor languages. The lack of government-licensing (//) in the target language leads to the break-up of both original clusters and IO relations. Let us recall that in many languages, including Hawaiian, Italian and Japanese, all words must end in vowels, i.e. FEN are not licensers of anything consonantal. As a result, vowel epenthesis occurs in both (N_1) and (N_2). The representations in (4c) and (4d) depict analogical relations, this time word-medial or initial. Given that no GL is provided even by a full vowel under (N_2), the IO relations are undone and an epenthetic vowel surfaces under (N_1). What is also important to note is that the CVCV or ONON structure is universal and whatever consonant configurations appear on the surface in whatever language, the skeleton is stable. Whenever vowel epenthesis occurs, no skeletal restructuring is needed as the nuclear slot is always there.[12]

3. Japanese and borrowings

3.1. Sounds and words of Japanese

The vocalic system of Japanese includes five short vowels, close to cardinal (Vance 2008). Five long vowels also occur there and length distinction is contrastive, e.g. [hiɾɯ] – 'leech' vs. [hiːɾɯ] – 'heel'. Japanese does not observe reduced vowels, also called schwas [ə].[13]

[12] Other repair strategies, such as consonant loss, also occur in L2. In the examples presented here, this option is irrelevant.

[13] I am very grateful to Dr. Mayuki Matsui and Dr. Masanori Deguchi for verifying my data. My consultants do not agree on accepting the unrounded back vowel [ɯ] as comparable to schwa, which was suggested by one of the reviewers.

Voicing in single consonants is distinctive (Itô & Mester 1986; Vance 2008), e.g. [kɑ] – 'mosquito' vs. [gɑ] – 'moth', although in the contemporary (especially acoustic) literature the question of whether or not Japanese is a truly voicing language frequently appears on acoustic grounds (e.g. Vance 1982; Kitahara & Tajima & Yoneyama 2019). Nonetheless, the possible fortis vs. lenis distinction is irrelevant herein, since in the case of single obstruents contrast is always present. Finally, a single [p] is normally disallowed in the native vocabulary (Itô & Mester 1995).

Syllable structure-wise, Japanese is basically a CV language, where consonant clusters are rare (Yoshida 1996). In traditional terms, there are no branching onsets in it, while coda-onset groups must be made of nasals followed by homorganic obstruents, e.g. [kaŋkei] – 'relation'. A coda-onset group may also be occupied by a voiceless geminate, e.g. [katːe] – 'buying'. Voiced geminates are tolerated exclusively in loanwords. It is also worth noting that, from the perspective of CSL, Japanese allows only these consonant groups which are easiest to government-license, geminates in (3a) and partial geminates in (3b). Finally, every word ends in a vowel, e.g. [kɯː] – 'void', or the 'moraic nasal' [ɴ], e.g. [hoɴ] – 'book', whose consonantal or vocalic properties are debatable.[14]

3.2. Diachronic constraints and loanword strategies in Japanese

As observed by Itô & Mester (1995, 1999), the Japanese language has a lexicon made of at least three historically-determined strata. The Yamato layer refers to the most basic and ancient native vocabulary. Sino-Japanese embraces usually technical words borrowed from Chinese in the Middle Ages. The third stratum includes loanwords, also known as *gairaigo*, which may be assimilated, partly assimilated or unassimilated. Their arrival began in the second half of the sixteenth century, at first from Portuguese.

In the table below (adapted from Itô & Mester 1995, 1999), three main constraints on two-consonant combinations are presented. The first forbids voiced geminates, e.g. *[gː], and clusters involving nasals and voiceless obstruents, e.g. *[nt]. The second one still bans voiced geminates in the language, allowing nasals followed by voiceless stops, while the third shows no restrictions:

(5)

constraints	no voiced geminates	no nasal+voiceless plosive clusters
Yamato	e.g. *Nippon* – 'Japan' vs. **bb*, **dd*, **gg*	e.g. *hunde* – 'brush' vs. **mp*,**nt*, **ŋk*
Sino-Japanese	e.g. *katte* – 'buying' vs. **bb*, **dd*, **gg*	e.g. *sampo* – 'walk'
Foreign/gairaigo	e.g. *beddo* – 'bed'	e.g. *banku* – 'bank'

[14] The 'moraic nasal' [ɴ] is usually viewed as phonetically indistinguishable from the nasalized back unrounded vowel [ɯ̃] and its consonantal properties manifest themselves only if it is followed by an obstruent in 'coda-onset' groups. See e.g. Yoshida (1996, 2001, 2003) or Youngberg (2020, 2021) for more detailed analyses.

Historically speaking, as observed by Itô & Mester (1995, 1999), Kawahara (2005), Rice (2006) and Labrune (2012), voicing contrast in Japanese geminates was not obviously present at the outset (Yamato). Nor was there clear voicing difference in nasal-stop groups. Voicing was treated more as a prosodic property than segmental. There were no minimal pairs involving clusters, so voicing opposition was also frequently absent from orthography in the historical literature. Specifically, geminates were originally voiceless, while nasal-obstruent groups were voiced. Apparently, that was the only voicing opposition in Yamato which concerned groups of consonants. Perhaps that contrast was not purely laryngeal, because geminates were structurally different from partial geminates. In Sino-Japanese, however, the circumstances began to change when clusters composed of nasals and voiceless obstruents started to enter Japanese. Seemingly, the laryngeally agnostic Japanese system had to react to the influx of loanwords from Chinese in which voicing in consonant groups was phonologically crucial.[15]

Regarding Japanese adaptation strategies, these mainly follow the constraints depicted above. Branching onsets, non-homorganic coda-onset groups and word-final consonants are banned and the situation is resolved by vowel epenthesis, e.g. [brʌʃ] > [bɯɾɑɕi] – 'brush', while coda-onset sequences made of nasals and homorganic obstruents are allowed, e.g. [taŋgo] (Spanish) > [tɑŋgo] – 'tango'.

Another approach is the gemination of original single stops after short vowels, especially in Western monosyllables, e.g. [nap] > [napːɯ] – 'table cloth' (French) and [bed] > [bedːo] – 'bed'. This is to a certain extent debatable, though. Rice (2006: 16) observes that the gemination of [p, t, k] is fairly regular (about 98%), while the doubling of [b, d, g] is rather irregular (less than 50%), so the English *bed* may also be pronounced as [betːo] by about 50% of speakers. Moreover, sometimes gemination does not occur, e.g. [pʌb] > [pɑbɯ] – 'pub'. Thus, we may speak of fluctuation or free variation here. The reasons for geminating the original L1 singletons are vague and will be addressed below.

3.3. Loanwords from European languages

The following examples show Japanese borrowings from a few European languages[16] such as (E)nglish, treated as default, and also (D)utch, (F)rench, (G)erman, (P)ortuguese, (R)ussian and (S)panish.[17] The first set of borrowed items includes words which display two or three consonants in a row in the source languages. These are regularly decomposed in Japanese.

[15] This is how far my understanding goes. For more information see, e.g. Itô & Mester (1995, 1999), Kawahara (2005), Rice (2006) and Labrune (2012).

[16] https://www.sljfaq.org/afaq/gairaigo.html; Tomoda (1999), Menton (2001), Irwin (2011), Þórdísarson (2016).

[17] Menton (2001: 28) argues that very few Spanish borrowings are now present in Japanese.

(6) Western clusters in Japanese

E/D/F/G/P/R/S	Japanese	*Spelling* (E)/*Gloss*	Change		
a. TR initial and medial clusters					
[**bl**ik]	[bɯɾici]	‘tin’ (D)	[bl]	>	[bVɾ]
[**br**ʌʃ]	[bɯɾɑɕi]	*brush*	[br]	>	[bVɾ]
[**dr**es]	[doɾesɯ]	*dress*	[dr]	>	[dVɾ]
[**gl**ɑs]	[gɑɾɑsɯ]	‘glass’ (D)	[gl]	>	[gVɾ]
[**gʁ**upə]	[gɯɾɯpːe]	‘group’ (G)	[gr]	>	[gVɾ]
[**pl**ʌs]	[pɯɾɑsɯ]	*plus*	[pl]	>	[pVɾ]
[**pr**əʊ**gr**æm]	[pɯɾogɯɾɑmɯ]	*program*	[pr]	>	[pVɾ]
		and	[gr]	>	[gVɾ]
[**tr**oika]	[toɾoikɑ]	‘troika’ (R)	[tr]	>	[tVɾ]
[**kr**us]	[kɯɾosɯ]	‘cross’ (P)	[kr]	>	[kVɾ]
[**kl**ʌb]	[kɯɾɑbɯ]	*club*	[kl]	>	[kVɾ]
[**fl**ameŋko]	[ɸɯɾɑmeŋko]	‘flamenco’ (S)	[fl]	>	[ɸVɾ]
[**fr**asku]	[ɸɯɾɑsɯko]	‘flask’ (P)	[fr]	>	[ɸVɾ]
[**θr**il]	[sɯɾiɾɯ]	*thrill*	[θr]	>	[sVɾ]
[ɪŋ**gl**ɪʃ]	[iŋgɯɾiɕːɯ]	*English*	[gl]	>	[gVɾ]
[vi**dr**u]	[biːdoɾo]	‘glass’ (P)	[dr]	>	[dVɾ]
[ə**pr**əʊtʃ]	[apɯɾoːt͡ɕi]	*approach*	[pr]	>	[pVɾ]
[weɪ**tr**əs]	[uweitɯɾesɯ]	*waitress*	[tr]	>	[tVɾ][18]
[sa**kr**amentu]	[sɑkɑɾɑmento]	‘sacrament’ (P)	[kr]	>	[kVɾ]
[i**kr**a]	[ikɯɾɑ]	‘caviar’ (R)	[kr]	>	[kVɾ]
b. *s*C(C) initial[19]					
[**sp**iːk]	[sɯpiːkɯ]	*speak*	[sp]	>	[sVp]
[**ʃt**ok]	[sɯtokːɯ]	‘stock’ (G)	[st]	>	[sVt]
[**st**ɑːt]	[sɯtɑto]	*start*	[st]	>	[sVt]
[**sk**ɪl]	[sɯciɾɯ]	*skill*	[sk]	>	[sVk]
[**sl**ɪpə]	[sɯɾipːɑː]	*slipper*	[sl]	>	[sVɾ]
[**str**es]	[sɯtoɾesɯ]	*stress*	[str]	>	[sVtVɾ]
[**skw**ɒʃ]	[sɯkɑʃːɯ]	*squash*	[skw]	>	[sVkVʃ]
c. ordinary medial and final RT clusters (no nasal+obstruent)					
[a**lk**əɣɔl]	[ɑɾɯkoːɾɯ]	‘alcohol’ (D)	[lk]	>	[ɾVk]
[kʌ**lt͡ʃ**ə]	[kɑɾɯt͡ɕɑː]	*culture*	[lt͡ʃ]	>	[ɾVt͡ɕ]

[18] Let us note word-initial epenthesis here. I have found no explanation for this development yet.

[19] According to the whole GP tradition, [s] is always the ‘coda’ if followed by an obstruent, even word--initially.

[a**ʁb**ait]	[ɑɾɯbɑito]	'work' (G)	[rb]	>	[ɾVb]
[ɔ**rɣ**əl]	[oɾɯgoːɾɯ]	'music box' (D)	[rɣ]	>	[ɾVg]
[ga**ʁs**õ]	[gɑɾɯsoɴ]	'boy' (F)	[rs]	>	[ɾVs]
[a**sp**iʁin]	[ɑsɯpiɾiɴ]	'aspirin' (G)	[sp]	>	[sVp]
[dɪ**sk**əʊ]	[disɯko]	*disco*	[sk]	>	[sVk]
[pi**st**oːl]	[pisɯtoɾɯ]	'pistol' (D)	[st]	>	[sVt]
[ve**kt**əʁ]	[bekɯtoɾɯ]	'vector' (G)	[kt]	>	[kVt]
[t͡ʃæ**pt**ə]	[t͡ɕɑpɯtɑː]	*chapter*	[pt]	>	[pVt]
[he**lp**]	[heɾɯpɯ]	*help*	[lp]	>	[ɾVp]
[me**lk**]	[miɾɯkɯ]	'milk' (D)	[lk]	>	[ɾVk]
[fɪ**lm**]	[ɸiɾɯmɯ]	*film*	[lm]	>	[ɾVm]
[pu**ls**]	[pɯɾɯsɯ]	'pulse' (G)	[ls]	>	[ɾVs]
[mɑ**st**]	[mɑsɯto]	'mast' (D)	[st]	>	[sVt]
[de**sk**]	[desɯkɯ]	*desk*	[sk]	>	[sVk]
[krɪ**sp**]	[kɯɾisɯpɯ]	*crisp*	[sp]	>	[sVp]
[gɪ**ft**]	[ɟiɸɯto]	*gift*	[ft]	>	[ɸVt]

d. other medial and final clusters (3 consonants)

[u**ltʁ**ə]	[ɯɾɯtoɾɑ]	'ultra' (G)	[ltr]	>	[ɾVkVɾ]
[e**spʁ**i]	[esɯpɯɾi]	'spirit' (F)	[spr]	>	[sVpVɾ]
[te**kst**]	[tekɯsɯto]	*text*	[kst]	>	[kVsVt]
[bo**rʃt͡ʃ**]	[boɾiɕit͡ɕi]	'borsch' (R)	[rʃt͡ʃ]	>	[ɾVɕVt͡ɕ][20]

In (6a) we observe word-initial and medial combinations made of plosives followed by sonorants in the source languages.[21] Vowel epenthesis is a norm here when these words are filtered by Japanese phonotactics. The unrounded [ɯ] is most commonly inserted as epenthetic. It is believed to be default, except in the vicinity of consonants which are palatalized or palato-alveolar, where the epenthetic vowel is normally [i]. Other vowels appear as inserted only occasionally, as can be seen in the data here. In (6b) the initial [s] is followed by one or two consonants and the repair strategy is the same. There are apparently only two L1 clusters where [s] precedes two consonants, i.e. [str] and [skw], and epenthesis occurs twice in the former case, while we notice the loss of the original [w] in the latter. It may seem, then, that a cluster involving a semivowel is perceived as one without the third consonant. Or, perhaps, the original [w] undergoes metathesis and surfaces as [ɯ].[22] Also the L1 consonant clusters shown in (6c-d) follow suit. In (6d) we can see two epenthetic vowels. It goes without saying that at the end of each word epenthetic vowels appear automatically and that process has little to do with original L1 clusters.

[20] An interesting example is ***Amsterdam***, whose Japanese version is [ɑmɯsɯteɾɯdɑmɯ] (four epenthetic vowels).

[21] The number of medial TR clusters is smaller. This set reflects the number of tokens found in the literature.

[22] Examples like this are marginal and it would be a waste of limited space to discuss them broadly.

To sum up the description of the data shown in (6), loanword adaptation strategies in Japanese begin, as expected, with eliminating the structures which are banned by its phonotactics. Since no word in Japanese must end in a vowel, word-final epenthesis dominates the whole process. What comes next is epenthetic vowels in word-medial position. ‘Branching onsets’ as well as non-homorganic ‘coda-onset’ groups are divided by inserted vowels. These come in abundance, but not everywhere. In particular, some consonant clusters are saved from being split with epenthetic vowels. Consider the following examples:

(7) homorganic clusters (partial geminates)

a. nasal+voiced obstruent

[hipoːxɔ**ndr**i]	[hipokondeɾiː]	‘hypochondria’ (D)	[ndr]	>	[ndVɾ]
[tu**ndr**a]	[t͡sɯndoɾɑ]	‘tundra’ (R)	[ndr]	>	[ndVɾ]
[fiːli**ŋ**]	[ɸiːɾiŋgɯ]	*feeling*	[ŋ]	>	[ŋg]
[ta**ŋg**o]	[tɑŋgo]	‘tango’ (S)		-	
[əreɪ**nd͡ʒ**]	[ɑɾend͡ʑi]	*arrange*	[nd͡ʒ]	>	[nd͡ʑ]
[mɑ**ŋɣ**aːn]	[mɑŋgɑɴ]	‘manganese’ (D)	[ŋɣ]	>	[ŋg]
[ko**mb**inat]	[kombinɑːto]	‘combine’ (R)		-	

b. nasal+voiceless obstruent

[lɑ**mp**]	[ɾɑmpɯ]	‘lamp’ (D)		-	
[te**mp**ura]	[tempɯɾɑ]	‘tempura’ (P)		-	
[bæ**ŋk**]	[bɑŋkɯ]	*bank*		-	
[ã**k**oʁ]	[ɑŋkoːɾɯ]	‘encore’ (F)	[ãk]	>	[ŋk]
[fre**nt͡ʃ**]	[ɸɯɾent͡ɕi]	*French*	[nt͡ʃ]	>	[nt͡ɕ]
[dɑ**ns**]	[dɑnsɯ]	‘dance’ (D)		-	

In (7a) the homorganic clusters from the source languages either remain unchanged or undergo cosmetic phonetic modifications, which is hardly surprising, since in Japanese nasals can be followed by voiced obstruents. On the other hand, the cases in (7b) are less obvious, because in Yamato such combinations are forbidden. Nonetheless, in Sino-Japanese these are allowed and this type of borrowing should be treated as one that concerns this stratum.

Finally, let us take a closer look at the transformation of single obstruents (stops and affricates) into geminates in Japanese.

(8)

a. voiceless geminates

[hæ**p**i]	[hɑpːiː]	*happy*
[kɔ**p**]	[kopːɯ]	‘cup’ (D)
[na**p**]	[napːɯ]	‘table cloth’ (F)
[tɪ**p**]	[t͡ɕipːɯ]	‘tip’
[tɪkɪ**t**]	[t͡ɕiketːo]	*ticket*

[fɪ**t**]	[ɸitːo]	*fit*
[kʌ**t**ə]	[kɑtːɑː]	*cutter*
[blæ**k**]	[bɯɾɑkːɯ]	*black*
[ko**k**]	[kokːɯ]	‘cook’ (D)
[ʃto**k**]	[sɯtokːɯ]	‘stock’ (G)
[ʃpi**t͡s**]	[sɯpit͡sːɯ]	‘spitz’ (G)

b. voiced geminates

[be**d**]	[bedːo]	*bed*
[flʌ**d**]	[ɸɯɾɑdːo]	*flood*
[dɒ**g**]	[dogːɯ]	*dog*
[be**g**]	[begːɯ]	*beg*
[kɒlɪ**d͡ʒ**]	[kɑɾed͡ʑːi]	*college*
[dʒʌ**d͡ʒ**]	[d͡ʑɑd͡ʑːi]	*judge*

This set of data seems to be the most interesting. Let us first note that Japanese gemination occurs only after short vowels in the donor languages which do not have geminates. The transformation of L1 voiceless stops (and sometimes affricates) into geminates need not look obvious at first glance, although it can be viewed as related to the Yamato constraint on a single [p]. Thus, the doubling of [p] may result from that constraint, while the other voiceless sounds may simply follow this pattern. Kubozono & Itô & Mester (2009: 955-961) mention a ‘striking tendency’ in Sino-Japanese which refers to syllable weight and serves ‘to improve prosodic well-formedness’. In a nutshell, they claim that in this layer of Japanese the penultimate syllable of the borrowed word should be heavy.[23] In syllabic terms, a short vowel followed by an onset is not enough and a coda to the left of the onset should be provided. Thus, [kokːɯ] is somewhat ‘better formed’ than [kokɯ]. Seemingly, the voiceless stops are ambisyllabic and this results in a reanalysis of the L1 structure.

However, the creation of voiced geminates that do not occur in the strata of either Yamato or Sino-Japanese vocabulary is much less evident. Kawahara (2005), Rice (2006) as well as Kubozono & Itô & Mester (2009) remark that voiced geminates are unstable and are frequently pronounced as voiceless, e.g. [bedːo] vs. [betːo] – ‘bed.’ There are also words in which gemination does not take place at all, e.g. [web] > [webɯ] – ‘web’, [dædɪ] > [dɑdi] – ‘daddy’ and [bʌg] > [bɑgɯ] – ‘bug’, or ones in which both versions are possible, e.g. [nɒb] > [nobɯ] or [nobːɯ] – ‘knob’.

And this takes us to the relative perception of voicing, which may vary from individual to individual, from dialect to dialect and whose general analysis cannot be successfully provided.[24] Since there is apparently no contrast between voiceless and voiced geminates in the

[23] Obviously, when a monosyllabic word ending in a consonant enters Japanese, it automatically becomes disyllabic and the sole syllable in L1 becomes penultimate in L2.

[24] The issue of laryngeal relativism in Polish is addressed in e.g. Cyran (2014) and Scheer & Cyran (2018: 314-317). For example, Cyran (2014) provides an analysis of Polish where he argues that in the contemporary language there may be two laryngeal systems, one with the high tone {H} and the other with the low tone {L}.

first two layers of Japanese, Rice (2006: 19) proposes that some speakers may try to preserve the voicing difference from the source language, while others follow the native constraints. Steriade (2004) and Kawahara (2005) maintain that voiced geminates are likely to be passively devoiced, while voiced singletons are far from that. Thus, voiced geminates are similar to voiceless geminates, whereas voiced singletons are quite different from their voiceless counterparts. It seems, then, that the reasons for gemination are phonetic and perceptual, rather than phonological.

As regards word adaptation in general, there exist numerous theories arguing for the ways in which languages borrow words from other sound systems. For example, one view says that surface phonetic constraints are counterfactual and play no role in phonology (Kaye & Nykiel 1981). In other words, whatever surface forms appear in L1, L2 will mostly adhere to its basic principles. What is more recently habitually assumed is the role of perception of L1 in L2 (e.g. Kenstowicz 2004; Adler 2006; Peperkamp & Vendelin & Kimihiro 2008; Boersma & Hamann 2010; Jacobs 2014). Basically, users of L2 are familiar with their own language, perceive L1 through that prism and adapt their pronunciation of foreign words to their native habits. Structure preservation in terms of syllabic structures is taken into account as well (e.g. Otaki 2012). Practically, users of L2 try to maintain the syllabic structure of L1 in their own system. It is also postulated that what matters is a complex combination of orthography, pronunciation and reinterpretation of both (e.g. Szpyra-Kozłowska 2016).

As for the so-called 'branching onsets' or TR clusters from L1, no acceptance is found among Japanese users and these groups must be split with epenthetic vowels. Thus, L2 rejects L1 here, to begin with. 'Coda-onset' clusters, which are not composed of homorganic nasal+obstruent group, are also disfavoured. Nasal+obstruent configurations are welcome, as expected, in both Yamato Sine-Japanese.

Regarding gemination, however, we may assume that speakers of Japanese could perceive loanwords in terms of native 'tendencies' of 'prosodic well-formedness' (gemination of voiceless stops). They may also remain faithful to the orthography of L1 (gemination of voiced stops), or they may not be sure how to interpret foreign consonant groups. By all means, this is likely. None of these procedures seem to be phonological, though.

In the ensuing section an attempt will be made to demonstrate precisely how the above--mentioned phenomena are perceived by CSL.

4. A CSL analysis of European clusters in Japanese loanword phonology

Above we have seen what adaptation of Western clusters looks like in Japanese. Now we are going to see how these clusters look in *gairaigo* from the viewpoint of CSL.

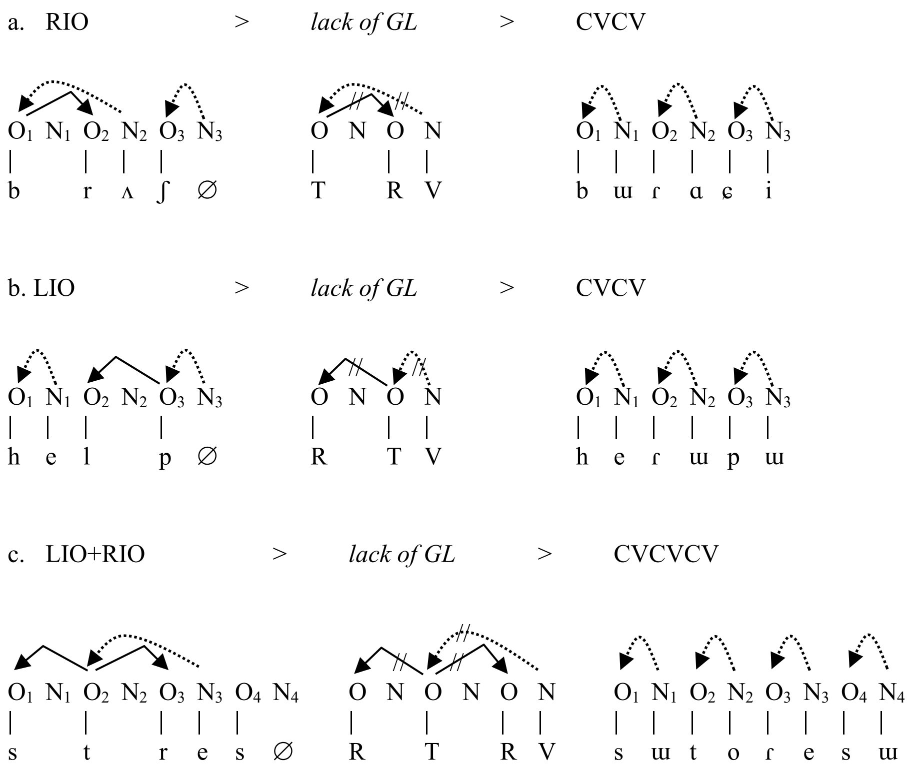
Let us begin with consonant groups included in (6a-d). CC or CCC clusters in the donor language, that is, TR combinations in (6a), *s*C(C) initial groups in (6b) as well as medial and final clusters displaying RT and other sequences in (6c-d), all decompose into CVCV or

The users of Polish are unaware of this. It is not unlikely, then, that many Japanese speakers are also unconscious of accepting foreign properties such as voicing in geminates.

CVCVCV in Japanese. All these decompositions result from the impossibility of Japanese nuclear power to license word-final singletons (parameter FEN = OFF) or government--license consonants groups (parameter TR = OFF). Vowels in Japanese can license single consonants and government-license only the easiest groups shown in (3) above.

It can be said that the original governing relations are broken up and, as a result, the clusters are divided by epenthetic vowels in the target language, because Japanese vowels are prosodically too week to government-license either RIO (most difficult) and non-homorganic LIO (also not too easy). A LIO+RIO combination taken from English, i.e. [str], is also presented below. Thus, we obtain [bɯɾaɕi] from [brʌʃ] – 'brush', [heɾɯpɯ] from [help] – 'help', and [sɯtoɾesɯ] from [stres] – 'stress'. All these are depicted in (9):

(9)



In the left-hand column we can observe the situation in the donor languages, that is, RIO in (9a), LIO in (9b) and a fusion of both in (9c). All these inter-onset governing relations are broken up because Japanese vowels are not able to government-license consonants to govern other consonants, as illustrated in the central column. The lack of IO and government-licensing is marked with (//). Finally, epenthesis is shown in the right-hand column, since the empty nuclei need to be filled with melody.

Let us recall again that word-final epenthesis is automatic, i.e. (N_3) in (9a, b) and (N_4) in (9c). Word-final epenthesis apart, the other ‘locked’ or ‘buried’ empty nuclei now appear to be fairly important, since (N_1) in (9a), (N_2) in (9b), as well as (N_1) and (N_2) in (9c) are unlocked or unburied in Japanese. They now serve as licensers of the preceding onsets, respectively. The skeleton is stable, but the CV architecture is quite different in Japanese.

As regards voiced partial geminates, whose representatives are shown in (7) above, these undergo no structural modification since they are present in the native Japanese vocabulary. From the CSL viewpoint, such structures are fairly easy to government-license by nuclei, now always filled with melody in Japanese. Interestingly, the clusters composed of nasals and voiceless obstruents are banned in Yamato but present in Sino-Japanese and in gairaigo. Let us consider both types of clusters in the following diagrams. The relevant partial geminates in [taŋgo] – ‘tango’ (S) and [baŋkɯ] – ‘bank’ are represented with the phonological elements:

(10)

```
a.                                      b.
   O1 N1 O2 N2 O3 N3                       O1 N1 O2 N2 O3 N3
   |  |  |  |  |  |                        |  |  |  |  |  |
   x  x  x  x  x  x                        x  x  x  x  x  x
   |  |  |     |  |                        |  |  |     |  |
   t  a  N     h  o                        b  a  N     h  ɯ
         .  <  U                                 .  <  U
               ʔ                                       ʔ
                                                       H25
```

The CSL interpretation of these diagrams is as follows. In both (10a) and (10b) the nuclei (N_1) license the preceding onsets (O_1). The final nuclei (N_3), on the other hand, government-license the onsets (O_3) to LIO govern the onsets (O_2). The nuclei (N_2) are licensed to be mute by the LIO relations in both cases. In (10b) word-final epenthesis occurs. What makes these two diagrams different is the stops docked onto the onsets (O_3). The structure in (10a) contains the L1 voiced cluster [ŋg], which is also licit in Japanese. In this group, the velar nasal is composed of {N}, the place of articulation element {U} being provided by the homorganic stop. This stop includes {h, U, ʔ}, which means that the element complexity ratio equals (1:3). In (10b), the make-up of the plosive is {h, U, ʔ, H}, the cluster being illicit in Yamato. Element-wise, the cluster’s result is (1:4).

At this juncture, one might argue that the complexity slope must be expressed by at least a two-element difference. However, epenthesis in [aʁbait] (G) > [aɾɯbaito] – ‘work’, where [ɾ] has only one element {A} and the labial stop [b] is made of three, i.e. {U, ʔ, h}, does not support this view. The example of [dans] (D) > [dansɯ] – ‘dance’ may be helpful here. The sibilant also has three primes, that is {A, h, H}, and yet no epenthesis can be observed in this word and the LIO relation holds. Thus, it is not the complexity differential that plays the main role in keeping the L1 cluster intact. It is rather the homorganicity factor. Element-wise,

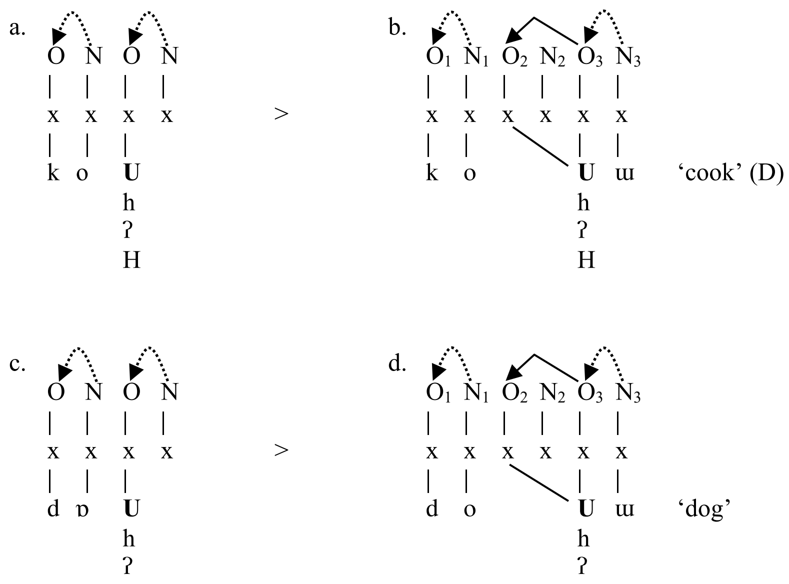
[25] It seems that in Modern Japanese the high tone {H} needs to be selected as a laryngeal marker of voicelessness (Yoshida 1996; Riney *et al*. 2007).

the governee must include only one prime and that must be {N}. Nonetheless, the element difference should by no means be neglected. In Yamato, the ratio of (1:3) was sufficient, while in Sino-Japanese it must be (1:4). It might be speculated that, since Sino-Japanese is a less native layer, the complexity slope must be greater. This issue will return below.

Let us now deal with geminates, both voiced and voiceless, which occur in adapted loan-words but are absent from L1. Let us recall that voiceless geminates are perceived as licit in both Yamato and Sino-Japanese, while voiced geminates are banned in the native lexicon.

The structural changes from a single Dutch/English consonant to a geminate in Japanese is represented graphically in (11), i.e. [kok] (D) > [kokːɯ] – 'cook', and [dɒg] > [dogːɯ] – 'dog', respectively:

(11)



What we can see above is the process of gemination. The examples with velars also hold for all the other consonants. In (11b) and (11d) new LIO relations are contracted between the governors (O_3) and the governees (O_2), which are government-licensed by the epenthetic vowels [ɯ] under (N_3). In the first case, that is (11a-b), voiceless stops undergo that process. All the elements are provided by the governor and the complexity ratio is (0:4). The primes for [k] include {U, h, ʔ, H} and these spread from (O_3) to occupy (O_2). Nonetheless, in the other development, namely (11c-d), things are different. The number of elements has shrunk by one, that is {H}, and the differential is (0:3). As already said, from the viewpoint of CSL, the easiest clusters to government-license are geminates. The question now is why new ON structures are inserted in (11).

As mentioned in (3.3) above, a ‘tendency’ concerning the Sino-Japanese level is that the penultimate syllable of any word borrowed from the West should be heavy. When a monosyllabic word is adapted, automatic word-final epenthesis changes it into disyllabic and the only syllable automatically becomes penultimate. When that syllable is penultimate, it ‘should be heavy’. This development has much to do with syllable well-formedness and with phonetic perception of L1 single obstruents by L2 users, but little to do with phonology. CSL finds no mechanism for that, since neither complexity nor licensing scales are at work here. A new ON sequence is added *ex nihilo* and then the phonological process of spreading the primes from (O_3) to (O_2) commences.

5. Discussion

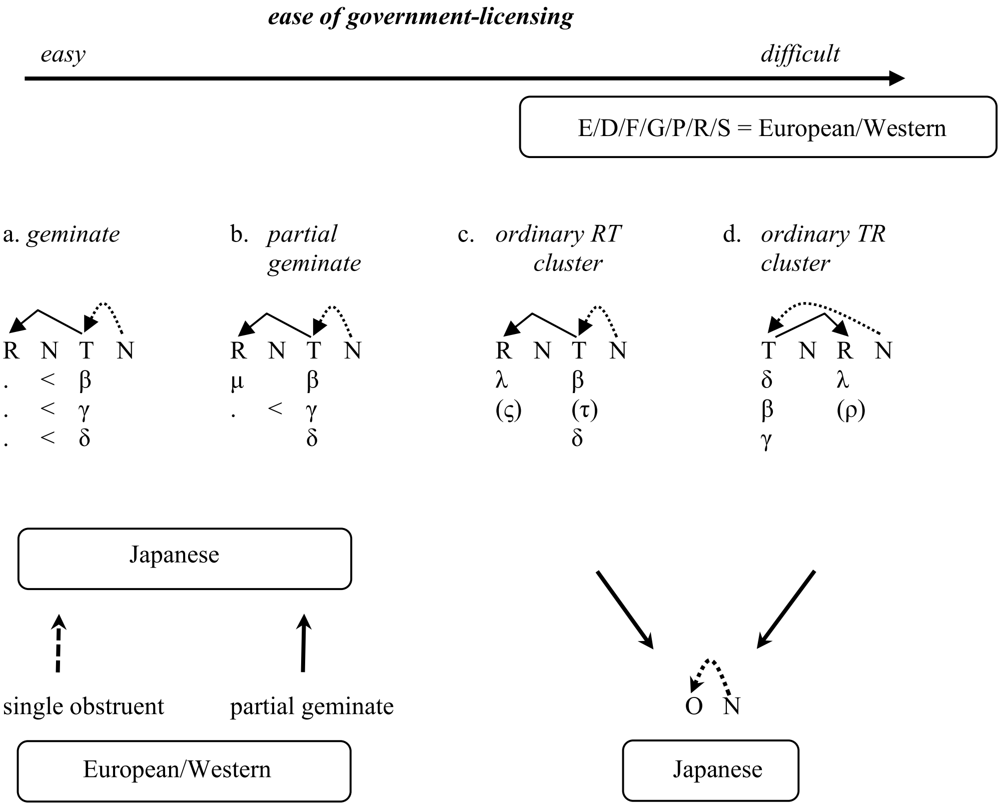
What CSL can deal with is the question of complexity slopes in geminates and homorganic partial geminates. As already said, the element differential for loanwords from the West must be at least (0:3) from geminates, while it must be at least (1:3) for partial geminates, with {N} being the element in the governee position. If the scale shown in (3) above is correct and geminates are easier to government-license than partial geminates, these two ratios make little sense. In other words, CSL makes no sense for Japanese gemination. We need to bear in mind that Japanese, like any other language, is made of diachronic layers of constraints. It seems, though, that in Japanese these layers influence the present language to a greater extent than in many other sound systems.

The Yamato phonological system was most probably laryngeally agnostic: the geminates were allegedly only voiceless, while partial geminates were supposedly only voiced. That being true, in GP and CSL terms, the parameter regarding voiced geminates was OFF, while on their voiceless counterparts it was ON. Consequently, the parameter on nasal+voiced consonant was ON, while it was OFF if clusters were made of nasals and voiceless consonants. There is little hard evidence to say that there was any voicing contrast between consonant groups, since minimal pairs were absent. Thus, it is likely that clusters differed only in their structure, including either two identical stops or a nasal followed by a homorganic stop. Voicing contrast began to matter when Chinese words (voiceless partial geminates) started to appear in Japanese. At that time, complexity slope was apparently also parameterized and set as the minimum of two primes (1:3). About a thousand years later, when the first loanwords began to arrive from the West, the Sino-Japanese system was a basis for the incorporation of new lexical items. The new system was most likely laryngeally dissimilar to Yamato and its restrictions were also parameterized in a different way. As regards geminates, the complexity ratio was set as (0:3) in Sino-Japanese, but many speakers still find that as too lenient and prefer (0:4), thus making the gemination of voiced obstruents impossible.

Phonology proper does not have a say in the gemination of L1 voiceless singletons, while L1 partial geminates are adapted with only cosmetic modifications.

Let us now see how the foregoing discussion can be summarized and represented graphically:

(12)



Beginning from the left-hand side, the interpretation of this diagram should be as follows. Single obstruents from European/Western languages may be geminated in Japanese (12a), hence the broken line. Partial geminates (12b), where nasals are followed by homorganic obstruents, are adapted with no major changes. Regarding (12c, d), Western clusters are broken up by epenthetic vowels and simple ON structures surface in Japanese.

6. Conclusion

Consonant combinations in Japanese loanwords from European tongues undergo many modifications which have been analyzed in terms of Complexity Scales and Licensing. The donor consonant groups which are most difficult to government-license, i.e. TR clusters and ordinary RT sequences, are invariably split with epenthetic vowels. That happens since Japa-nese nuclei have a very limited government-licensing potential. The clusters which are easier to government-license, that is partial geminates, remain intact and are sometimes phonetically adjusted to the consonant inventory of Japanese. Moreover, the original single obstruents are frequently geminated, which is in accordance with the CSL view that geminates are the consonant sequences easiest to government-license. However, that gemination is a result of a structural reanalysis and/or is caused by phonetic perception of L1 singletons by the users of Japanese, which has little to do with phonology.

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