On the patterning of voiced stops in loanwords in Japanese

Keren Rice
University of Toronto

In loanwords in Japanese, a consonant gemination process is frequently found. While voiceless stops consistently geminate and are voiceless in the appropriate environment, voiced stops may geminate as voiced stops, may fail to geminate, or may geminate as voiceless stops. A phonetic account grounded in perception has been proposed for the variable patterning of voiced stops under gemination conditions. I argue that while this is a possible explanation, the instability of voiced stops under gemination may also be attributable to the phonological system of Japanese. Thus, the role of perception in the variable patterning of voiced stops remains an open question.

1. Introduction

An important question in phonology concerns the phonological adaptation of words of one language when borrowed into another. The appropriate means to account for adaptation is a topic of much debate in recent work in phonology. Two major perspectives have developed over the years. One is that the adaptation of loanwords is driven by perception, a position held by, for instance, Peperkamp and Dupoux (2003) and Steriade (2004). An alternative view is that the phonology of the borrowing language plays an important role in the phonological adaptation of loanwords, a view argued for by, for example, Hyman (1970), Jacobs and Gussenhoven (2000), and Paradis and LaCharité (1997) among others.

In recent research by Kawahara (2004, 2005) and Steriade (2004), the claim is made that the adaptation of words into Japanese provides strong evidence for the importance of perception in loanword adaptation. Borrowings into Japanese undergo an interesting pattern of gemination of a consonant following a short vowel, as illustrated by the Japanese forms of the English words in (1).

* Versions of this paper were presented at the Symposium on Phonological Theory: Representation and Architecture, held at the CUNY Graduate Center in March 2004 and at the Workshop on Japanese Phonology and Morphology held at the University of Toronto in August 2005. Many thanks to members of the audiences for their questions. Thank you to Manami Hirayama for extensive discussion.

1 Note that in addition, epenthetic vowels create open syllables.
(1) Gemination of stops in borrowings (data from Kawahara forthcoming)
wi[pp]u ‘whip (cream)’
we[bb]u ‘web’
ki[tt]o ‘kit’
ki[dd]o ‘kid’
sura[kk]aa ‘slacker’
sura[gg]aa ‘slugger’

While voiceless stops consistently geminate, voiced stops are not stable. In addition to voiced geminates, as in the examples in (1), voiced stops may geminate but be variably voiceless, as in (2a), or they may retain their voicing but fail to geminate, as in (2b).²

(2) Instability of voiced geminates (data from Kawahara 2005)

a. gu[dd]o ~ gu[tt]o ‘good’ (Kawahara 2005, forthcoming)

b. we[bb]u ~ we[b]u ‘web’ (Hirayama 2003 p.c.)
ra[gg]u ~ ra[g]u ‘rug’ (Hirayama 2003 p.c.)

The difference in patterning between voiceless and voiced obstruents under conditions where gemination is expected leads to several questions. What causes the instability of voiced stops with respect to gemination? Why is it only voiced stops that show this instability? Why is the instability present only in an environment where gemination is found, and not with singletons (voiced singleton obstruents are consistently voiced in borrowings)?

Kawahara (2004, 2005, forthcoming) and Steriade (2004) raise these questions, and provide the following general answers. First, the voicing contrast is more confusable in geminates than in singletons. Thus, voicing distinctions are more likely to be unstable in geminates than in singletons. Second, and closely related to the first point, voicing is more reliably perceived in singletons than in geminates. Thus singletons are likely to be stable in terms of voicing. Finally, these authors argue that the patterning of the voiced consonants illustrates that phonological grammars must reflect phonetic constraints, in this case the perception of voicing.

Kawahara and Steriade develop an account of the instability of voiced geminates along the following lines, appealing to articulatory and perceptual factors. Voiced geminates (DD) tend to be passively devoiced, making them similar to voiceless geminates (TT). Voiced singletons, on the other hand, are not passively devoiced but are voiced. Due to this passive devoicing, DD is more similar to TT than D is to T. This is knowledge that the speaker has. Based on this knowledge, the speaker projects a fragment of the grammar, as in (3).

² Which pattern is found depends on several factors. One, Lyman’s Law, is discussed later in this article. The pattern also relates to the place of articulation of the potentially geminating consonant, discussed briefly later in this work; see Hirayama 2004 and Kawahara 2005 for discussion and references.
(3) \(\text{Ident} [\pm\text{voice}] / [\_\text{-long}] \gg \text{Ident} [\pm\text{voice}] / [\_\text{+long}]\)

The constraint ranking in (3) is to be read as follows: voicing is more stable in short consonants than it is in long consonants, or geminates. Kawahara (2005:115) concludes the discussion of the theoretical implications of the borrowing of voiced geminates in Japanese as follows, a position supported by Steriade: “Phonology is at least partly driven by phonetics. Phonologically, voicing is more easily lost in geminates than in singletons in Japanese. … contrasts signaled by phonetically weak cues are phonologically more prone to neutralization.”

This phonetic approach is an interesting one, and one that suggests that phonetics and phonology are mixed with each other rather than distinct. In the remainder of this paper, I would like to suggest that there is another way of approaching the instability of the voiced geminates in Japanese, namely a phonological approach. More particularly, the phonological system of Japanese guides the variation found in loanword adaptation. I do not attempt to argue for this hypothesis over the phonetically-based one, but simply aim to demonstrate that, with respect to geminates in Japanese loanwords, the jury is still out as to the role that phonetics plays.

2. Some background on Japanese

Japanese has voiceless stops (/p t k/) and voiced stops (/b d g/), with the non-coronal voiced segments often realized as spirants; see, for instance, Vance (1987) for discussion. Japanese also has voiceless geminates, but voiced geminates are absent except in the loan vocabulary. The nature of the inventory is discussed in the literature (e.g., McCawley 1968, Vance 1987, Itô and Mester 1989) on Japanese phonology. Schematic representations of the stops are provided in (4). These representations assume that the feature voice is privative; see, for example, Steriade (1987), Itô and Mester (1989), and Rice (1993) on this.

(4) Japanese representations (stops only)

<table>
<thead>
<tr>
<th>voiceless stop</th>
<th>voiced stop</th>
<th>voiceless geminate</th>
<th>voiced geminate</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>D</td>
<td>TT</td>
<td>*DD</td>
</tr>
<tr>
<td>Voice</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Japanese has a constraint known as Lyman’s Law, named after B.S. Lyman, who wrote about the phenomenon in 1894, and earlier noted by Motoori Norinaga, a doctor and philologist, in the late eighteenth century, that governs morpheme well-formedness. Basically, this constraint demands that a morpheme not contain more than one voiced obstruent. Thus the following morpheme-internal patterns are found. Note that the [f] (and other allophones) functions as the voiceless counterpart of [b]; [p] occurs only as part of a geminate.
A morpheme can contain two voiceless obstruents or a voiceless and a voiced obstruent in either order. However, morphemes do not contain two voiced obstruents. While this is a general constraint over the Japanese lexicon, Kuroda 2003 notes some exceptions, as in (6).

(6) Some exceptions to Lyman’s Law (Kuroda 2003)
    goza ‘mat’
    dobu ‘ditch’

Itô and Mester (1995, 2003) also identify some exceptions, commenting that ‘Also restricted to [Yamato] is the voicing restriction allowing only a single voiced obstruent per morpheme (Lyman’s Law)’ (Itô and Mester 1995:819). They include the following items.

(7) buzaa ‘buzzer’ (Itô and Mester 2003:40)
    dezain ‘design’
    geezi ‘gauge’

3. Some notes regarding data

Before turning to the details of gemination in loanwords, it is worthwhile to provide some background on the mechanisms of borrowing as discussed in the literature on Japanese. Lovins (1975:48), in early work on loanwords in Japanese, mentions that orthographic factors play a role in how a form is borrowed into Japanese, stating that “There has been a tremendous influx of written loans into Japanese and it is not always possible to distinguish orthographic factors from phonetically-motivated individual variation.” She further develops this point, saying that “Despite individual perceptual differences, the Western loanwords in Japanese tend to be standardized up to a point by conventions dependent on Japanese phonology, which can frequently but not always be separated from those derived from Western orthography. Within this range of standardization, variant forms are the norm, reflecting the individual user’s knowledge of and attitude toward the source language; his adherence (or not) to various semi-normative conventions that have become popular at different times for Japanizing the loanwords; and more generally the route by which and date at which the loanword become popular in Japanese. Use of alternative forms may have social significance, if it represents an attempt (conscious or otherwise) to sound ‘very Japanese’ or ‘very English’ and so on.”

Smith (forthcoming) reinforces the point made by Lovins about the role of orthography in loanword adaptation – “It is well known that loanwords usually enter Japanese through written materials rather than spoken English (Lovins 1975, Miura 1993).”

Thus, while the phonology of Japanese loanwords is of great interest to phonological theory, at the same time one must approach the data with some caution.
since the written form plays a large role in the adaptation of these words into Japanese.

4. Loanwords, gemination, and loanwords

In this section, I survey the data on loanwords, examining the borrowing of English words, and some French words. In all of these words, the potentially geminating consonant is a stop. In addition, the stop follows a lax vowel, as this is the environment in which gemination is found. Two consonants must be taken into account, the geminating consonant and the consonant of the syllable that precedes it. This latter is referred to here as the initial consonant, or C1, while the other consonant is referred to as the geminating consonant, or C2.

First if the potential geminating consonant is a voiceless stop, and if the initial consonant of the word is voiceless or a sonorant, then gemination is invariant, as in (8).

(8) C1 voiceless or sonorant; C2 voiceless: no variation

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>cup</td>
<td>ka[p]u</td>
</tr>
<tr>
<td>hip</td>
<td>hi[p]u</td>
</tr>
<tr>
<td>kit</td>
<td>ki[t]o</td>
</tr>
<tr>
<td>hat</td>
<td>ha[t]o</td>
</tr>
<tr>
<td>pick</td>
<td>pi[k]u</td>
</tr>
<tr>
<td>puck</td>
<td>pa[kk]u</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>French</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>nappe</td>
<td>na[p]u</td>
</tr>
<tr>
<td>patte</td>
<td>pa[t]o</td>
</tr>
<tr>
<td>lac</td>
<td>la[kk]u</td>
</tr>
</tbody>
</table>

If the first consonant is voiced and the second voiceless, gemination is invariant.

(9) C1 voiced, C2 voiceless: no variation

<table>
<thead>
<tr>
<th>English (end)</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>book</td>
<td>bu[kk]u-</td>
</tr>
</tbody>
</table>

When the first consonant is voiceless or a sonorant and the second consonant is voiced, variation is found (e.g., Kawakgoe and Arai 2002, Hirayama 2004). Three variants are reported. First, the consonant may be voiced and geminated (10). Second, it may be voiceless, but fail to geminate (11). And third, some report that the consonant may be a voiceless geminate (12). There is disagreement about this pattern, and statistical work suggests that it is a rare pattern. See the discussion below.
(10) C1 voiceless or sonorant, C2 voiced: variation in gemination, voicing (?)

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>cab</td>
<td>kya[bb]u</td>
<td>(Haraguchi ms)</td>
</tr>
<tr>
<td>snob</td>
<td>suno[bb]u</td>
<td>(Kawahara 2004:1)</td>
</tr>
<tr>
<td>web</td>
<td>we[bb]u</td>
<td>(Kawahara 2004:1)</td>
</tr>
<tr>
<td>kid</td>
<td>ki[dd]o</td>
<td>(Haraguchi ms)</td>
</tr>
<tr>
<td>pad</td>
<td>pa[dd]o</td>
<td>(Hirayama 2004 p.c.)</td>
</tr>
<tr>
<td>pig</td>
<td>pi[gg]u</td>
<td>(Steriade, from Kawahara 2003)</td>
</tr>
<tr>
<td>egg</td>
<td>e[gg]u</td>
<td>(Haraguchi, Kawahara 2004)</td>
</tr>
</tbody>
</table>

(11) lob    ro[bb]u / ro[b]u  (Lovins 1975:84)
knob   no[bb]u / no[b]u  (Lovins 1975:84)
rug    ra[gg]u / ra[g]u  (Sunaoshi 1995:204)
tub    ta[b]u      (Sunaoshi 1995:204)
pub    pa[b]u     (Lovins 1975:84)
web    we[b]u     (Hirayama 2004 p.c.)
rug    ra[g]u     (Hirayama 2004 p.c.)

(12) kid    ki[dd]o / ki[tt]o  (Lovins 1975:87)

With voiced stops, two factors are worthy of comment. First, as noted above, the possibility of a voiceless geminate as in (12) is debated in the literature. Haraguchi (ms) states that [kitto] ‘kid’ is ungrammatical, while Lovins (1975:130) remarks of this and a few other forms with the devoiced stops that they “appear not to have been established as the generally accepted versions of the loanwords.” Kawahara (2005, forthcoming) says that devoicing is not found in such cases. Lovins (1975:87) further comments “To geminate a voiced stop but also devoice it is a less recent way of Japanizing this difficult segment [voiced geminate], and the ‘voiceless’ versions of a number of loanwords have become prevalent.” Lovins also cites “popular versions of doublets with voiced geminates”: [rettō] ‘red’, [hetto] ‘head’, [kyuuptide] ‘Cupid’, [handobakku] ‘handbag’. Vance (1987:42) says categorically 3: “… except for recent borrowings, we do not find /Q/ before voiced obstruents. … Bloch (1950:160) says that long voiced obstruents are a feature of the innovating variety. … Kawakami also claims that as a word comes into popular use in Japanese, a voiced consonant after /Q/ becomes voiceless.” Hirayama (2004), based on data from Nishimura (2003), reports very low percentages for devoicing when the first consonant is a voiceless obstruent or a sonorant and the second a voiced stop, although such forms do exist in small numbers.

Second, not all voiced geminates are equally stable. Hirayama (2004) gives percentages of gemination for stops based on work by Kawagoe and Arai (2002). She reports that the percentage of gemination for voiceless stops is around 98% for each place of articulation. Voiced stops, on the other hand, are not stable, and place asymmetries exist as well. Based on Kawagoe and Arai (2002), gemination percentages are 71% for the coronal, 55% for the velar and 23% for the labial. While the exact percentages differ from one to another study, the lower percentages of gemination and the place

---

3 Note that Q represents the first half of an obstruent geminate.
asymmetries are remarked on by several researchers. See Hirayama (2004) and Kawahara (2005) for detailed discussion and references.

Finally, in words with both consonants voiced, variation is found: voiced geminates, voiceless geminates, and voiced singletons are all reported, as shown in (13).

(13) C1 voiced, C2 voiced: variation in voicing, gemination

<table>
<thead>
<tr>
<th>Word</th>
<th>Voicing</th>
<th>Gemination</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>bed</td>
<td>be[dd]o / be[tt]o</td>
<td></td>
<td>(Haraguchi ms, Kawahara forthcoming)</td>
</tr>
<tr>
<td>bag</td>
<td>ba[gg]u / ba[kk]u</td>
<td></td>
<td>(Kawahara 2005, forthcoming)</td>
</tr>
<tr>
<td>good</td>
<td>gu[dd]o / gu[tt]o</td>
<td></td>
<td>(Kawahara 2005, forthcoming)</td>
</tr>
<tr>
<td>thoroughbred</td>
<td>sarabure[dd]o / sarabure[tt]o</td>
<td></td>
<td>(Kawahara 2004)</td>
</tr>
<tr>
<td>gag</td>
<td>gya[gg]u / gya[g]u</td>
<td></td>
<td>(Lovins 1975:84)</td>
</tr>
<tr>
<td>bug</td>
<td>ba[g]u</td>
<td></td>
<td>(Haraguchi ms)</td>
</tr>
<tr>
<td>job</td>
<td>d3o[b]u</td>
<td></td>
<td>(Steriade 2004, from Kawahara 2004)</td>
</tr>
<tr>
<td>bib</td>
<td>bi[b]u</td>
<td></td>
<td>(Lovins 1975:83)</td>
</tr>
<tr>
<td>buggy</td>
<td>ba[g]ii</td>
<td></td>
<td>(Kawahara forthcoming)</td>
</tr>
<tr>
<td>bogey</td>
<td>bo[g]ii</td>
<td></td>
<td>(Kawahara forthcoming)</td>
</tr>
<tr>
<td>Bob</td>
<td>bo[b]u</td>
<td></td>
<td>(Kawahara forthcoming)</td>
</tr>
<tr>
<td>guidance</td>
<td>gai[d]ansu</td>
<td></td>
<td>(Kawahara forthcoming)</td>
</tr>
</tbody>
</table>

Hirayama (2004), based on Nishimura (2003), reports much higher rates of devoicing when the word contains two voiced stops, as in the examples in (13) than when the initial consonant is not a voiced stop – here the rate of geminate devoicing is very small.

To summarize, the following patterns are found when words from other languages are adapted into Japanese. First, if the geminating consonant is voiceless, gemination is regular so long as the first vowel is lax. This is summarized in (14). On the first line, schematic forms are provided where ‘T’ represents a voiceless obstruent, ‘V’ a short vowel, and ‘VV’ a long vowel. The second line summarizes the constraint that is appropriate here. Thus in (14), a constraint that a lax vowel be followed by a geminate and a tense vowel by a singleton is important. I omit the lax vowel constraint in subsequent discussion.

(14) C2 = voiceless: gemination is regular (Lovins 1975:83)

<table>
<thead>
<tr>
<th>Voicing</th>
<th>Gemination</th>
<th>Constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>VTTV</td>
<td>VVTV</td>
<td>*VTV</td>
</tr>
<tr>
<td>lax vowel constraint</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Second, if the second consonant is voiced and the first is a voiceless obstruent or a sonorant, three possibilities arise if the vowel is short. First, there may be a voiced geminate. Second, there may be a voiced singleton. Finally, there may be a voiceless geminate. I have put a question mark next to this final possibility in the summary in (15); see both above and below for discussion.

(15) Voiced C1, Voiced C2: variation in voicing, gemination

<table>
<thead>
<tr>
<th>Word</th>
<th>Voicing</th>
<th>Gemination</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>thoroughbred</td>
<td>sarabure[dd]o / sarabure[tt]o</td>
<td></td>
<td>(Kawahara 2004)</td>
</tr>
<tr>
<td>gag</td>
<td>gya[gg]u / gya[g]u</td>
<td></td>
<td>(Lovins 1975:84)</td>
</tr>
<tr>
<td>bug</td>
<td>ba[g]u</td>
<td></td>
<td>(Haraguchi ms)</td>
</tr>
<tr>
<td>job</td>
<td>d3o[b]u</td>
<td></td>
<td>(Steriade 2004, from Kawahara 2004)</td>
</tr>
<tr>
<td>bib</td>
<td>bi[b]u</td>
<td></td>
<td>(Lovins 1975:83)</td>
</tr>
<tr>
<td>buggy</td>
<td>ba[g]ii</td>
<td></td>
<td>(Kawahara forthcoming)</td>
</tr>
<tr>
<td>bogey</td>
<td>bo[g]ii</td>
<td></td>
<td>(Kawahara forthcoming)</td>
</tr>
<tr>
<td>Bob</td>
<td>bo[b]u</td>
<td></td>
<td>(Kawahara forthcoming)</td>
</tr>
<tr>
<td>guidance</td>
<td>gai[d]ansu</td>
<td></td>
<td>(Kawahara forthcoming)</td>
</tr>
</tbody>
</table>
(15) C2 = voiced: ‘degemination’ and devoicing are possible (Lovins 1975:83)
VDDV VVDV VDV *VVDDV
a. voiced geminate
b. voiced singleton
?c. voiceless geminate

Elaborating on (15c), when the second consonant is voiced, one must also take into account the nature of the first consonant. If the first consonant is voiceless or a sonorant, the patterns in (15a) and (15b) are clearly attested, while that in (15c) is controversial, as discussed above.

Finally, when the first consonant is voiced, a voiceless geminate is a clear third possibility.

(16) C1 and C2 both voiced
a. voiced geminate
b. voiced singleton
c. voiceless geminate

5. A return to the questions

Why are voiced singletons stable? While Kawahara (2004, 2005, forthcoming) and Steriade (2004) argue that this has to do with their phonetic stability, one can also suggest a phonological account. Consider Japanese. As discussed above, there is a contrast between voiced and voiceless singleton stops. This contrast is found in both the source and borrowing languages. Thus there is no motivation to alter voiced (or voiceless) singleton stops based on the borrowing language – they fit a distinction already found in the structure of Japanese, and thus they will not vary in form.

Turning to geminates: why are voiceless geminates stable, always being both voiceless and geminated? I will not try to answer the question of why geminates. Given geminates, it is not surprising that geminates formed from voiceless obstruents are always voiceless, since their source is voiceless. However, given that the source voiced stops have some potential of varying in voicing in the borrowed form, this question is worth pursuing. Recall that there is no distinction between voiced and voiceless geminates in Japanese. In the absence of a contrast, one possibility is variability of realization: one might expect geminates to be able vary in their voicing, realized as either voiceless or voiced, since no contrast is present to constrain their realization. The fact that the geminate is implemented as voiceless most likely has to do with the types of phonetic reasons discussed by Kawahara and Steriade, among others. To quote Kawahara 2004:5, voicing “is hard to maintain in obstruents, let alone in geminates with long closure” (Kawahara 2004:5, citing Hayes and Steriade 2004, Jaeger 1978, Kirchner 1998, Ohala 1983, Westbury and Keating 1984).

The next question concerns why potential voiced geminates are not stable – these potential geminates can be realized as voiced geminates, but also as voiced singletons and, at least sometimes, as voiceless geminates. A phonetically-based account of such variation is possible, but a phonological reason is available as well. As discussed above, voicing is not contrastive for geminates in Japanese. Thus, in order to have voiced
geminates distinct from voiceless geminates, a new contrast must be introduced into the language.

Given the absence of a contrast between voiced and voiceless geminates in Japanese, what strategies might a speaker adopt for dealing with voiced obstruents following a lax vowel, where geminates might be expected? The speaker has three choices, outlined in (17).

(17) a. Possibility 1: A new contrast, /TT/ vs. /DD/, is introduced, and voiced geminates occur.

b. Possibility 2: A singleton voiced stop is found, maintaining the voicing from the source language and fitting the structure of Japanese in terms of contrast (T vs. D) and morpheme shape (TVDV, DVDV). No new contrast is introduced.

c. Possibility 3: A voiceless geminate is found, maintaining the length expected in this position in loanwords and fitting the structure of Japanese in terms of contrast (TT, *DD) and morpheme shape (TVTTV, DVTTV). This is a possibility if the morpheme begins with a voiced obstruent; disagreement exists as to whether voiceless geminates are possible if the morpheme starts with a voiceless obstruent.

As in (17a), one possibility is to introduce a new contrast, creating a voiced geminate in the system. Other possibilities do not introduce a new contrast. One, in (17b), keeps the voicing of the consonant, but the consonant fails to geminate. This possibility makes use of a contrastive sound of Japanese since voiced obstruents are found in the language; it fails to create a geminate following a short vowel, making the voiced obstruents pattern differently than the voiceless ones. Finally is the possibility outlined in (17c). In order to avoid a new contrast and geminate, a voiceless geminate is possible. As discussed above, while this pattern is possible, it appears that it is rare unless the initial consonant of the word is a voiced obstruent.

Why is there a difference in the patterning of voiced obstruents in the geminating position depending upon whether a word starts with a voiced obstruent or a voiceless obstruent? As discussed in section 2, Lyman’s Law controls the occurrence of voiced obstruents in Japanese. In potential TVDDV environments, no trigger for devoicing exists, in DVDDV, on the other hand, the co-occurrence of voiced obstruents in C1 and C2 positions is influential in triggering devoicing. The usual repair strategy is degemination, maintaining the voicing contrast, with devoicing in a more restricted environment.

A summary of the patterns found in the adaptation of stops in the geminating position is given in (18).

(18) /TVD/ /DVD/ source language

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| TVDDV  | DVDDV  | new contrast
| TVDV   | DVDV   | no new contrast; Japanese model (TVDV, DVDV)
|        | DVTTV  | no new contrast; Japanese model, trigger
| ?*TVTTV|        | no new contrast, Japanese model, no trigger

There is one final question that one might ask. In Japanese, sequences that might
be realized as voiced geminates can arise through morpheme concatenation. In such cases, the initial consonant is replaced by a nasal. This can be seen in several environments. One is intensive affixation, which requires that a consonant be geminate. With voiceless stops, there is a true geminate, while with voiced stops instead a nasal-voiced stop sequence is found. See Hirayama (2004) and the sources given there for details.

(19) voiceless stop
    su[pp]ori  ‘(cover one’s head) completely’ (Kuroda 1979:205)
    yu[tt]ari  ‘easy, comfortably’ (Kuroda 1979:205)
    ka[kk]ari  ‘just, sharp’ Kuroda (1979:205)

(20) voiced stop
    no[Nb]iri  ‘relieved, at ease; postponed’ (Martin 1952:68)
    ko[Ng]ari  ‘(toast) brown’ (Kuroda 1979:205)

The same pattern can be seen with the past tense suffix -ta/-da. The voicing of the initial consonant of the suffix is determined by the voicing of the final consonant of the previous morpheme. While the segmental details are complex, basically if the previous consonant is a voiceless stop, then a geminate is formed, while if the previous consonant is a voiced stop, then it becomes a nasal.

(21) kat ‘win’   kat-ta    ‘win, past’ (Hirayama 2004)
    yob ‘call’   yoN-da   ‘call, past’ (Hirayama 2004)

One might ask why the type of nasal substitution found in Japanese is not present in the loan vocabulary. This is a question that is asked by Kawahara and Steriade. Why not adopt the Japanese pattern that is found when stop-stop sequences are derived of, essentially, nasal substitution? Here is a place where perception might play a role: the geminate (or singleton) is closer to the singleton voiced stop than the nasal-stop sequence is. However, a phonological reason might exist as well: nasal substitution is found in morphologically derived environments in Japanese, but this is not the case within a morpheme, and thus is perhaps not to be expected.

6. Summary

In the borrowing of words into Japanese, gemination of obstruents is common in certain positions. Voiceless obstruents are consistent in their gemination. Voiced obstruents, on the other hand, show variation. While a phonetic explanation for this variation has been proposed, there is also the possibility of a phonological account. The introduction of voiced geminates forces a contrast in Japanese where none exists, between TT and DD. The introduction of a new contrast perhaps disfavours the creation of voiced geminates. Either voiced singletons or, at least under certain conditions, voiceless geminates are possible – each of these has models in Japanese. Thus, the patterns that are found follow from the structure of the lexicon of Japanese. While reference to phonetics may indeed play a role, this is not a clear-cut case of the need for phonetic information in the phonology.
ON THE PATTERNING OF VOICED STOPS IN LOANWORDS IN JAPANESE

References

Haraguchi, Shosuke. ms. “A theory of voicing.”
Hayes, Bruce & Donca Steriade. 2004. “Introduction; The phonetic bases of phonological markedness.” In
Phonetically-based Phonology, Bruce Hayes, Robert Kirchner, & Donca Steriade (eds.). Cambridge: Cambridge University Press.
loanwords.” Generals paper, Department of Linguistics, University of Toronto.
Japanese mimetics.” Language 65, 258–293.
Cambridge, Massachusetts: MIT Press.
In Optimality Theory: Phonology, Syntax, and Acquisition, Joost Dekkers, Frank van der Leeuw, &
Linguistics Society 4, 311–329.
at HUMDRUM, Rutgers University. May 2004.
UMOP 31, Kathryn Flack & Shigeto Kawahara (eds.), pp. 87–120.
Kawahara, Shigeto. forthcoming. “A faithfulness ranking projected from a perceptibility scale: The case of
California, San Diego.
Co.
of Linguistics 33, 379–430.
Peperkamp, Sharon & Emmanuel Dupoux. 2003. “Reinterpreting loanword adaptations: the role of
Perception.” ICPhS 14, 367–370.
Quackenbush, Hiroko & Mieko Ohso. 1990. Gairaigono keisei to sono kyoiku [Formation of loanwords and
loanwords in teaching]. Tokyo: Okurasyo Insatukyoku. Kokuritu Kokugo Kenkyuyo [The National
Language Research Institute].
Language 69, 308–344.
Shinhara, Shigeko. 2004. “Emergence of Universal Grammar in foreign word adaptations.” In Constraints
Cambridge: Cambridge University Press.


