Lyman's Law in Loanwords

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ABSTRACT. It is generally believed that Lyman's Law, one of the phonological restrictions in Japanese, governs only *Yamato* (native) vocabulary and it has nothing to do with loanwords. In this paper, I point out that not only *Yamato* vocabulary but also loanword vocabulary is affected by this restriction by examining geminate obstruent devoicing (e.g., doggu~dokku 'dog'). The paper offers a theoretical account of this fact within the framework of Optimality Theory. I claim that the previous analyses of the Japanese lexicon sometimes predict ungrammatical geminate devoicing. To correctly explain the Lyman's Law effect in loanwords, Local Conjunction should be introduced into the analysis.

Keywords: loanwords, Lyman's Law, geminate devoicing, Local Conjunction, lexical stratification

1. Introduction

In this paper, I want to achieve two goals. The first is to illustrate the Lyman's Law effect (i.e., the OCP effect on obstruent voicing) in Japanese loanwords. Lyman's Law, one of the phonological restrictions in Japanese, allows at most one voiced obstruent (stop, fricative, and affricate) per stem.[1] It is generally believed that *Yamato* (native Japanese) is the only lexical class this restriction governs (see Itô & Mester 1986, 1998 among others). I point out, however, that geminate devoicing in loanwords is also affected by this restriction.

The second aim of this paper is to reconsider how foreign vocabulary should formally be dealt with in the Japanese lexicon by taking the Lyman's Law effect into account. I analyze the phenomenon within the framework of Optimality Theory (Prince & Smolensky 1993). To give a good account of the problem, I introduce Local Conjunction and free ranking of constraints into the analysis.

2. Fact: Geminate devoicing and the Lyman's Law effect

In *Yamato* vocabulary, at most one voiced obstruent is allowed per stem. Such a phonological restriction is called the Lyman's Law effect. See the following examples:

    (1) a. futa 'lid', buta 'pig', fuda 'label', *buda

        b. i. nise+kaki → nisegaki 'fake persimmon'

          ii. nise+kagi → nisekagi, *nisegagi 'fake key'

As seen in (1a) *futa, buta,* and *fuda* are possible and actual forms as *Yamato* stems but *buda* is not since it contains two voiced obstruents. In (1b) *rendaku* (sequential voicing) is blocked by the Lyman's Law effect. While *rendaku* operates on *kaki,* which does not carry any voiced obstruent as shown in (i), the operation is blocked in (ii) because the given stem *kagi* already contains a voiced obstruent.

By contrast, it is generally believed that the Lyman's Law effect does not govern foreign vocabulary since a great number of foreign stems violate it. A few examples are given below:

    (2) doraibu 'drive'   gaido 'guide'   dabide 'King David'
        baburu 'bubble'   bradʑiru 'Brazil'   dʑanguru 'jungle'

Although each of the stems in (2) contains more than one voiced obstruent, they are grammatical. I claim, however, that foreign vocabulary is also under the effect of Lyman's Law. Consider the following examples. (See the appendix also for further support.)

    (3) a. doggu~dokku 'dog'   deddo~detto 'dead'   beddo~betto bed'
          gebberusu~gepperusu 'Goebbels'
          guddzu~guttsu 'goods' baddʑi~battʃi 'badge'
       b. eggu, *ekku 'egg'   teddo, *tetto 'Ted'   mobbu, *moppu 'mob'
          kiddzu, *kittsu 'kids'   mariddʑi, *marittʃi 'marriage'

The examples in (3) show the voiced/voiceless alternation on an obstruent geminate in foreign stems. In this class, while voiced obstruents can be geminated, such sequences are sometimes devoiced as in (3a). Remark that these stems violate Lyman's Law unless geminate devoicing applies. If a given stem does not violate it, that is, if it does not contain any voiced obstruent other than a geminate, devoicing is not permitted as shown in (3b). The minimal pair *deddo* 'dead' and *teddo* 'Ted' is a good illustration of this contrast; while the former has a devoiced counterpart, *detto*, the latter does not.

It must be noted that in other Japanese lexical classes, namely *Yamato*, Sino-Japanese and Mimetics, voiced obstruent geminates are generally prohibited as illustrated below.

    (4) a. *Yamato*: katta 'win-PAST'   kanna 'plane'   *kadda
       b. Sino-Japanese: i. hat(u) 'beginning' + ka 'fire'→ hakka 'ignition'
                 ii. hat(u) + ga 'bud' → hatsuga 'germination', *hagga
       c. Mimetics: i. gusari → gussari 'plunging (a dagger)'
               ii. zaburi, → zamburi 'plumping (into the water),' ?*zabburi

In (4a) both *katta* and *kanna* are possible and actual forms as *Yamato* words, but *kadda* is not. (4b) shows compounding in Sino-Japanese. When stem final [t] (or [tu] if an underlying vowel is assumed to exist) is followed by another voiceless consonant at a morpheme boundary, root fusion takes place and a geminate cluster is formed as in (i). However, when the latter consonant is voiced, a vowel is inserted to avoid a voiced obstruent geminate as in (ii). (4c) shows emphasis by mora epenthesis in Mimetics. In emphatic forms, while a voiceless obstruent is geminated as in (i), a voiced obstruent geminate is prohibited and a nasal counterpart is inserted as in (ii).

Taking these facts into account, geminate devoicing in foreign stems can be generalized as follows: devoicing of an obstruent geminate is possible only in a stem which violates both of two prohibitions, Lyman's Law and the voiced obstruent geminate prohibition. These two restrictions are at work in the major part of Japanese vocabulary. To put it another way, the Lyman's Law effect is visible only if a voiced obstruent geminate co-occurs with another

voiced obstruent within a single stem (henceforth a "*deddo*-type" stem). There is no such effect in a stem which does not contain any voiced obstruent other than a geminate (henceforth a "*teddo*-type" stem). According to view, geminate devoicing is well motivated: violation of the two prohibitions is avoided by a single devoicing operation. That is, geminate devoicing serves a double purpose in these cases.

I emphasize that geminate devoicing in this class is productive, that is, this operation is permitted whenever the conditions for application are met. Itô & Mester (1995a,b) and other related works, which we will discuss in the next section, argue that this alternation is possible only in well-established stems, but that is not the case. This operation can also take place in a stem which is not well established. Consider the following example:

(5) haiburiddo~haiburitto 'hybrid'   doreddo~doretto 'dreadlocks'
    doraggu~dorakku 'drug'   debaggu~debakku 'computer debugging'

Although these stems entered Japanese in relatively recent years, their voiced geminates are sometimes devoiced. On the other hand, if a stem does not violate Lyman's Law, the operation is prohibited however established it might be as we have seen in (3b). These data cannot be explained in terms of Itô & Mester's assumption. Voiced obstruent geminate prohibition alone cannot be the trigger for geminate devoicing. Taking the Lyman's Law effect into account, geminate devoicing is correctly predicted to be a productive operation.

3. An Optimality Theoretic Analysis

In the rest of this paper, an account is given of the phenomenon illustrated in the previous section within the framework of Optimality Theory (henceforth OT) (Prince & Smolensky 1993). As we have seen, the trigger of devoicing in loanwords is co-occurrence of a voiced obstruent and a voiced geminate within a single stem. This fact is formally explained in the OT framework by introducing Local Conjunction (Smolensky 1993, 1997).

3.1 Previous analyses

The Japanese lexicon is classified by etymology into several strata, namely the *Yamato*, Sino-Japanese, Mimetics and Foreign strata, and each of these is ruled by stratum-specific phonology (see McCawley 1968 and Itô & Mester 1995a, among others). Fukazawa, Kitahara & Ota (1998) and Itô & Mester (1999) explain this stratification by assuming that each of the strata has its own set of faithfulness constraints, and that these are separately ranked in the constraint hierarchy according to degree of nativization of each stratum. I call their analysis the multiple faithfulness approach.

Let us look at how alternation in geminate voicing in foreign vocabulary is explained in their approach. Itô & Mester (1995b) propose a markedness constraint ***DD** which prohibits voiced obstruent geminates.

(6) ***DD**: No voiced obstruent geminate

Geminate devoicing is possible if this constraint is ranked above a voicing faithfulness constraint shown in (7).

(7) IDENT(voice): Output correspondents of an input [αvoice] are also [αvoice]. (After McCarthy & Prince 1995)

In their approach, loanwords are classified into two lexical strata in accordance with each word's degree of nativization, and each of the two strata carries its own IDENT(voice), namely IDENT(voice)-Unassimilated Foreign(UF) and IDENT(voice) -Assimilated Foreign(AF). Itô & Mester and Fukazawa et al. explain geminate devoicing by assuming *DD is sandwiched between these two constraints as shown in the constraint ranking in (8).

(8) IDENT(voice)-UF >> *DD >> IDENT(voice)-AF

This ranking corresponds to the tableaux in (9). The stratum of each input is indicated by an index.

(9) Input: /deddo/ 'dead'

		IDENT(voice)-UF	*DD	IDENT(voice)-AF
i. /deddo/$_{UF}$	→a. deddo		*	N/A
	b. detto	*!		N/A
ii. /deddo/$_{AF}$	a. deddo	N/A	*!	
	→b. detto	N/A		*

While the winning candidate in UF contains a voiced geminate, its devoiced counterpart wins in AF. In this way, their approach correctly predicts devoicing for *deddo*-type stems.

It is, however, obvious that they leave the Lyman's Law effect out of consideration as I pointed out in the previous section. Therefore, their analysis produces an impossible form as the AF output of a *teddo*-type stem. Although a *teddo*-type stem does not have a devoiced form as we have seen in section 2, devoicing would take place in the AF stratum within the constraint hierarchy in (8). Consider the following tableaux:

(10) Input: /teddo/ 'Ted'

		IDENT(voice)-UF	*DD	IDENT(voice)-AF
i. /teddo/$_{UF}$	→a. teddo		*	N/A
	b. tetto	*!		N/A
ii. /teddo/$_{AF}$	a. teddo	N/A	*!	
	×b. tetto	N/A		*

While a grammatical form is correctly singled out in the UF stratum as in (10i), an ungrammatical devoiced form (denoted by the cross) wins in the AF stratum as in (10ii). We need a new analysis which rules out this incorrect outcome.

3.2 Local Conjunction

To explain geminate devoicing correctly, I introduce Local Conjunction (Smolensky 1993, 1997) into the analysis. The basic idea of Local Conjunction is that two violations within a local domain are worse than any number of non-local violations. Under this additional assumption, two constraints can conjoin and behave as a single constraint.

According to Itô & Mester (1998), it is possible for the two componential constraints in a conjoined constraint to be identical. They claim that the Lyman's Law effect in Yamato shown in (1) is caused by the locally self-conjoined constraint of VOICEDOBSTRUENT-

PROHIBITION (VOP). VOP is shown in (11).

(11) **VOP**: No voiced obstruent

This constraint solely prohibits obstruents from being voiced. The self-conjoined constraint **[VOP²]stem** prohibits co-occurrence of voiced obstruents with itself within one stem.[2] Since **[VOP²]stem** dominates IDENT(voice)-*Yamato*, a stem in the *Yamato* stratum has at most one voiced obstruent.

As we have seen in section 2, voicing alternation on an obstruent geminate in this stratum is possible when a stem contains a voiced obstruent besides a voiced geminate, in other words, when a stem violates **[VOP²]stem**. This operation is formally explained by assuming that **[VOP²]stem** and ***DD** in (6) are locally conjoined as **[[VOP²]stem &*DD]stem**. This conjoined constraint is violated if both **[VOP²]stem** and ***DD** are violated within one stem. Ignoring the optionality of the operation of devoicing, this conjoined constraint correctly triggers geminate devoicing. Under the ranking in (12), geminate devoicing only takes place in a *deddo*-type stem but not in a *teddo*-type stem as shown in the corresponding tableaux in (13):

(12) **[[VOP²]stem &*DD]stem** >> IDENT(voice)-Foreign >> **[VOP²]stem, *DD**

(13) Input: (i) /deddo/ 'dead', (ii) /teddo/ 'Ted'

		[VOP² & *DD]	IDENT(voice) -Foreign	VOP²	*DD
i. /deddo/Foreign	a. deddo	*!		*	*
	→b. detto		*		
	c. teddo		*		*!
	d. tetto		**!		
ii. /teddo/Foreign	→a. teddo				*
	b. tetto		*!		

In tableau (i), candidate (b), whose geminate is voiceless, is singled out as an optimal form for the *deddo*-type stem. Although candidates (c) and (d) also do not violate **[[VOP²]stem & *DD]stem**, they incur more serious violations than candidate (b) does. At the same time, as in tableau (ii), a faithful form is singled out for a *teddo*-type stem, that is, no devoicing takes place in this case.

3.3 Optionality of Geminate Devoicing

Now let us turn to the fact that geminate devoicing in the Foreign stratum is optional. Under the ranking in (12) devoicing is obligatory, but what is needed is a theory that can deal with optionality. In this paper, I explain the optionality of geminate devoicing by appealing to the notion of free ranking of constraints which was originally proposed by Prince & Smolensky (1993) and theoretically developed by Anttila (1995, 2002). While constraints are strictly ranked under the canonical framework of OT, this proposal permits some parts of this ranking to be absent.

I claim that the voicing alternation on geminates also involves partial absence of ranking. If the ranking between **[[VOP²]stem &*DD]stem** and IDENT(voice)-Foreign is not

fixed, then two total rankings are possible as in (14).

(14) i. IDENT(voice)-Foreign >> [[VOP^2]stem &*DD]stem >> [VOP^2]stem, *DD

ii. [[VOP^2]stem &*DD]stem >> IDENT(voice)-Foreign >> [VOP^2]stem, *DD

The tableaux in (15) show the optional application of geminate devoicing in a *deddo*-type stem reflecting the two constraint rankings in (14). (14i) and (14ii) correspond to (15i) and (15ii) respectively.

(15) Input: /deddo/ 'dead'

Tableau (i)	IDENT(voice) -Foreign	[VOP^2 & *DD]	VOP^2	*DD
→a. deddo		*	*	*
b. detto	*!			
Tableau (ii)	[VOP^2 & *DD]	IDENT(voice) -Foreign	VOP^2	*DD
a. deddo	*!		*	*
→b. detto		*		

Two different forms are singled out in (15). In tableau (i) a faithful form wins and in tableau (ii), its devoiced counterpart wins. Consequently, both forms are optimal.

Then let us turn to a *teddo*-type stem in which geminate devoicing does not take place. Recall that this type of stem never violates the conjoined constraint [[VOP^2]stem &*DD]stem as in (13ii). This means that the ranking between [[VOP^2]stem &*DD]stem and IDENT(voice)-Foreign is not crucial for them. Therefore, whichever of the two possible rankings in (14) is chosen, the identical candidate, i.e. that in which the voicing value of the geminate is preserved, is singled out in this case. This is the crucial point of this analysis using free ranking.

To sum up, optional geminate devoicing in the Foreign stratum is correctly predicted by positing a partially unranked constraint hierarchy. Within this approach, the productivity of the operation is guaranteed by the grammar which provides two ways of evaluation.

4. Concluding Remarks

I have argued that not only *Yamato* vocabulary but also foreign vocabulary is affected by Lyman's Law by taking geminate devoicing into account. Introducing Local Conjunction, the Lyman's Law effect in this class was formally explained within the OT framework. I have also indicated that free ranking should be introduced to explain an operation which is optional and productive. I believe that my finding invites further investigation of the organization of the Japanese phonological lexicon.

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Notes

[1] Lyman's Law was originally reported as a morpho-phonological restriction which blocks *rendaku* under certain conditions (Lyman 1894). Itô and Mester (1986) further generalized this restriction as a morpheme structural constraint.

[2] It must be noted that $[VOP^2]stem$ concerns the number of features and not the number of segments. Therefore, voiced obstruent geminates which share an identical feature do not violate this constraint independently.

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Appendix

In this appendix, I compare *deddo*-type stems with *teddo*-type stems to reveal in what context geminate devoicing takes place. Data were collected from *The Corpus of Spontaneous Japanese* (CSJ) compiled by The National Institute for Japanese Language. This corpus contains 3302 speeches (approximately 660 hours) of spoken Japanese. I counted up every stem with a voiced obstruent geminate or its devoiced counterpart in the whole of the CSJ. I also counted speech files which contain such stems. A single speech file is repeatedly counted if it contains two or more different stems. The results are shown below.

a. # of stems	voiced	devoiced	sum
teddo-type	743 (95.0%)	39 (5.0%)	782 (100%)
deddo-type	379 (55.0%)	310 (45.0%)	689 (100%)
sum	1122	349	1471

$X^2=323.9$, $P<.001$

b. # of speech files	voiced	devoiced	sum
teddo-type	299 (90.6%)	31 (9.4%)	330 (100%)
deddo-type	178 (50.0%)	178 (50.0%)	356 (100%)
sum	477	209	686

$X^2=133.3$, $P<.001$

In both cases, there are statistically significant differences between the frequencies of devoicing on the two groups. These data support my generalization on geminate devoicing in this paper.