Phonological Changes when English Words are Borrowed into Japanese

Jun NAGAO

1. Introduction

The Japanese language has borrowed a large amount of words from English. It was reported by the Japanese National Language Research Institute (1964) that Western loanwords constituted (at that time) about 10% of the total Japanese lexicon, and 80.8% of the Western loanwords were from English. More interestingly, 60% to 70% of new words in the annually revised dictionaries of neologisms come from English. In a more recent study, Ishi (2007) reports that 9.5% of the words in the audio in TV commercials and 10.9% of the written catch phrases on the screen are foreign. They are mostly from English. According to Takashi (1992), English words and phrases are borrowed not only to fill a lexical gap, but also for affective reasons. That is, English loan words tend to appeal to an audience because of the positive social value attached to English.

Those English loan words in Japanese sound quite different from how they are pronounced in English. "McDonald's" [məkdɑnəldz], for instance, becomes [makɯdonaɾɯdo] in Japanese, and the word sounds different from the source because it has been made consistent with Japanese phonology.

In this paper, I intend to report on major phonological sound changes that take place when English words are borrowed into Japanese. In the first section, substitution rules will be discussed, and then in the next section, phonological rules and constraints will be discussed. Finally, I will discuss some educational implications for native speakers of English who are learning Japanese as a second/foreign language.

2. Substitution Rules

2.1. Vowels

In order to look at the phonological changes that happen when English words are borrowed into Japanese, it is important to look at the inventory of sounds of each language. Standard American English has 10 different monophthongs that are distinguished from each other by the position and the tensity of the tongue (i.e. front/back, high/low, and tense/lax) and five diphthongs, which are formed by the combination of two vowels in the same syllable. Although the number varies depending on dialect and the way that we analyze diphthongs, it is important to note that American English has a far more complex vowel system than Japanese. The representation of monophthongs and their articulatory positions as well as the transitions of the diphthongs are shown in Figure 1.
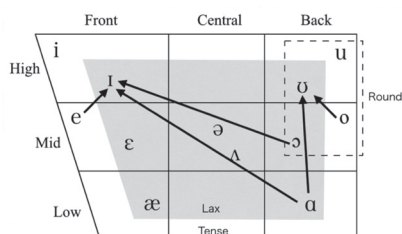

Figure 1 American English Vowels (Mihalicek and Wilson 2011: 57)

junnagano@ha.shotoku.ac.jp

In figure 1, lax vowels are in the shade, and rounded vowels are grouped in the dotted line. The arrows indicate the transitions of diphthongs. The monophthongs include: /i/ as in "eat", /ɪ/ as in "it", /ɛ/ as in "bed", /æ/ as in "cat", /ʌ/ as in "hut", /ə/ as in "about", /ɑ/ as in "hard", /ɔ/ as in "saw", /ʊ/ as in "put", and /u/ as in "pool". Note that /e/ and /o/ only appear in diphthongs. The diphthongs include: /ɑj/ (ɑ+ɪ) as in "ice", /ej/ (e+ɪ) as in "eight", /ɔj/ (ɔ+ɪ) as in "boy", /ɑw/ (ɑ+ʊ) as in "owl", and /ow/ (o+ʊ) as in "boat".

Unlike the English complex vowel system, Japanese has a very simple vowel system, and the vowels are quite similar to some of the English vowels. The following list by Kimizuka (1967) demonstrates Japanese vowels in comparison with English vowels.

/i/ -- High-front vowel. It is pronounced with the jaw lower and with less tension than the American /i/.

/e/ -- Mid-front vowel. It is approximately the same as the American /e/, but it is pronounced with the jaw less dropped.

/a/ -- Low-central vowel. It is approximately the same as the American /a/.

/o/ -- Mid-back vowel. It is pronounced with less protruded and less rounded lips than the American /o/. It is not diphthongized.

/ɯ/ -- High-back vowel. It is close to the American /u/. However, it is pronounced with less protruded and less rounded lips than the American /u/.

(Kimizuka 1967: 51)[1]

Japanese has a five-vowel system, namely [a, i, ɯ, e, o] and they can be lengthened as [aa], [ii], [ɯɯ], [ee] [oo], respectively. The lengthening of these vowels is phonemic in Japanese. Clearly, Japanese lacks some of the vowels that English has. Because of these gaps, the English vowels that Japanese does not have are typically merged into the closest Japanese vowels when words are borrowed.

Based on Quackenbush (1977), the sound transformation of English loan words can be listed as follows:

Short Vowels

				English	Japanese
(1)	ɪ → i		gin	[gɪn]	[dʒin̪]
(2)	ɛ → e		pet	[pɛt]	[petto]
(3)	æ				
		→ a	pat	[pæt]	[patto]
	ʌ		lunch	[lʌntʃ]	[ɾant̠ʃi̥]²
(4)	ɑ				
		→ o	hot	[hɑt]	[hotto]
	ɔ		yacht	[jɔt]	[jotto]
(5)	ʊ → ɯ		foot	[fʊt]	[ɸu̠tto]

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[1] According to Kimizuka (1967), American /i/, /ɛ/, and /ɔ/, are sometimes heard among the Japanese as an allophone of Japanese /i/, /e/, and /o/, respectively, and /ɛ/ is often heard as an allophone of /e/ in the northern part of Japan.

[2] The small circle under the phonetic arphabet indicates that the sound is devoiced, which will be explained in 3.2.2.

(6) ə → i, e, o, a alibi   [ǽləbaj]   [aribai]
                     television [teləvɪʒən]   [terebi]
                     gasoline   [gǽsəlin]   [gasorin]
                     vanilla   [vənɪlə]   [banira]

Long Vowels

				English	Japanese
(7)	i	→	ii	green	[gɾiin]
(8)	ɔː[3]	→	oo	ball	[booɾɯ]
(9)	u	→	ɯɯ	boot	[bɯɯto]

(7) i   → ii green [gɹin]   [gɯɾiiɴ]
(8) ɔː[3] → oo ball   [bɔːl]   [booɾɯ]
(9) u   → ɯɯ boot   [but]   [bɯɯto]

According to Quackenbush (1977), the English schwa [ə] is replaced with [i], [e], [o], or [a] depending on the orthographic spelling of the source words rather than the sound.

Lovins (1975) summarizes the sound change of English diphthongs:

(10) ej → ei, ee
      bait   [bejt]   [beito, beeto]
      eight   [ejt]   [eito, eeto]

(11) ow → oo
      boat   [bowt]   [booto]
      oat   [owt]   [ooto]

(12) oj → oi
      oil   [ojl]   [oiɾu]

(13) aj → ai
      pipe   [pajp]   [paipu]
      side   [sajd]   [saido]

(14) aw → aɯ
      out   [awt]   [aɯto]
      gaun   [gawn]   [gaɯɴ]

For rule (14), it is important to note that when the diphthong [aw] is followed by a vowel that changes into [a] in Japanese, [w] is perceived as a syllable initial glide. For example, shower [ʃawɚ] in English becomes [ʃawaa] instead of [ʃaɯaa] in Japanese (Lovins 1975 p.65).

English diphthongs change into a combination of Japanese short vowels or to a long vowel. In addition to the differences in the places of articulation, Kohmoto (1970) notes that the Japanese pronunciation of an English diphthong may give each component equal time value, unlike the original pronunciation of American English.

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[3] The lengthening of /ɔ/ is allophonic.

2.2. Consonants

The following charts show English consonants and Japanese consonants. It is clear that some of the English phonemes are absent in Japanese. They are /f/, /v/, /θ/, /ð/, /ɹ/, and /l/.

	bilabial		labio-dental		labio-dental		labio-dental		interdental		palatal		velar		glottal	
Stops	p	b					t	d					k	g	ʔ	
Fricatives			f	v	θ	ð	s	z	∫	ʒ					h	
Affricates							tʃ	dʒ									
Nasals								n						ŋ		
Liquid								l								
Glide								ɹ								
Stops	w̥										j					

Chart 1 English Consonants (Mihalicek and Wilson 2011: 52)

	bilabial		alveolar		alveo-palatal		palatal		velar		labio-velar		glottal	
Stops	p	b	t	d					k	g				
Fricatives	ɸ		s	z	∫	ʒ	ç						h	
Affricates			tˢ	dᶻ	tʃ	dʒ								
Nasals	m		n		(ŋ)		(ɲ)		ŋ		N			
Liquid			ɾ											
Glide							j		w					

Chart 2 Japanese Consonants. (Tsujimura 1996: 16)[4]

In contrast, there are some sounds that are present in Japanese but are absent in English. They are: /ɸ/ as in *futari* [ɸɯtaɾi] (two persons), /ç/ as in *hitori* [çi̥toɾi] (one person), /tˢ/ as in *tsunami* [tˢɯnami], and /dᶻ/ as in *mazushii* [madᶻɯ∫ii] (poor). Also, the nasal sound /N/ is peculiar to Japanese. This sound is pronounced with the tongue body touching the uvula and occurs before a pause (Tsujimura 1996). American English /r/ is retroflexed. That means that /r/ is made with the tip of the tongue curled back to articulate with the area at the back of the alveolar ridge (Rogers 1991). This /r/ is transcribed as [ɹ]. In contrast, Japanese /r/ is pronounced with the tongue that achieves very quick contact at the alveolar ridge, and this sound is transcribed as [ɾ](Tsujimura 1996).

Naturally, when words are borrowed from English into Japanese, the missing sounds are substituted by the closest sounds that exist in Japanese. Several researchers (Tsujimura 1992; Hoffer and Honna 1988; Quakenbush 1977) discuss the following sound substitutions.

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[4]   In Chart 2, the parentheses indicate that the sounds are allophonic.

(15)	f	→	ɸ	fork	[fo̞ɹk]	[ɸooku̜]
(16)	v	→	b	vanilla	[və̠nɪlə]	[ba̠niɾa]
(17)	θ	→	s	booth	[bu̜θ]	[bu̜ɯsu̜]
(18)	ð	→	z	leather	[lɛðə̠ɹ]	[ɾeza̠a̠]
(19)	l	→	ɾ	class	[klæs]	[ku̜ɯza̠su̜]
(20)	r (at onset⁵)	→	ɾ	cream	[kɹim]	[ku̜ɾiimɯ]
(21)	r (at coda⁶)	→	lengthening the preceding vowel			
				color	[kə̠lə̠ɹ]	[ka̠ɾa̠a̠]
(22)	n	→	ɴ	pan	[pæn̠]	[pa̠ɴ]

These rules are examples of the sound substitutions of consonants. These English sounds are changed into ones that exist in Japanese and are close to the sounds in terms of the place and manner of articulation. The rule (21) appears to be an exception, but knowing that [ɹ] in coda position in American English is co-articulated with the preceding vowel and pronounced as [ɚ], lengthening the vowel seems to be the closest substitution.

3. Phonological Constraints

The sound changes that have been discussed are substitutions of sounds. In this section, we will look at sound changes that are affected by the conditioning environment.

3.1. Consonants

3.1.1. Japanese Phonotactics

As Chart 2 indicates, Japanese has /t/; however, /t/ is realized as [tʃ] when it is followed by /i/, and it is realized as [tˢ] when it is followed by /ɯ/. For instance, the underlying form /tikaku̜/ "near" is pronounced as [tʃikaku̜] in its surface form, and /tɯnami/ is pronounced as [tˢɯnami]. When English words are loaned into Japanese, they have to go through the following CV sequence rules as well. The rules can be stated as follows:

					English		Japanese
(23)	t	→	tʃ / ___ i	team	[t̠im]		[t̠ʃiimɯ]
(24)	t	→	tˢ / ___ u	two	[t̠u]		[tˢɯɯ]

(Hoffer and Honna 1988: 20)

Similarly, there are some other allophonic alternations in Japanese that affect English loan words. They are as follows:

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⁵ An onset is the part of the syllable that is placed before the vowel of the syllable.
⁶ An coda is the part of the syllable that is placed after the vowel of the syllable.

(25)　s　→　ʃ　/ ＿ i　　　　　sea　　　[s̩ij]　　　　[ʃii]
(26)　z　→　ʒ　/ ＿ i　　　　　zigzag　[z̩igzæg]　　[ʒiɡɯzaɡɯ]
(27)　h　→　ɸ　/ ＿ u　　　　　who　　　[h̩u]　　　　[ɸuu]
(28)　h　→　ç　/ ＿ i　　　　　hippie　[h̩ɪpi]　　　[çippii]

The sequences [ti], [tɯ], [si], [zi], [hɯ], and [hi] violate Japanese phonotactics. Loan words as well as native Japanese words are subject to the rules from (23) to (28). However, Quackenbush (1977) argues that these constraints are often waived in the phonology of more innovative speech. Observe the following examples:

	Innovative	Conservative	
ti	[t̞iimɯ]	[tʃiimɯ]	team
tɯ	[t̞ɯɯ]	[tˢɯɯ]	two
si	[s̞ii]	[ʃii]	sea
zi	[z̞ippaa]	[ʒippaa]	zipper

As is mentioned earlier, English has a positive social value in contemporary Japanese, and using English words often makes the speaker appear more sophisticated (Ui 1985). Because of this norm, it seems that these variables are correlated to a large extent with sociolinguistic factors such as age and social status.

3.1.2. Consonant Gemination

Another set of sound changes that are triggered by specific environments is consonant gemination. The following are a summary of the gemination rules from Koo and Homma (1989) and Quackenbush (1977).

		English	Japanese
(29)　C_i → $C_i C_i$ / V ___ #		pocket pocket [pɑkɪt]	[poketto]
$\begin{bmatrix} +cons \\ -cont \end{bmatrix}$ [+short]		necklace [neklɪs]	[nekkɯresɯ̥]
(30)　C_i → $C_i C_i$ / ___ $\left\{ \begin{matrix} n \\ l \\ s \end{matrix} \right\}$		lesson [lɛsn]	[ressɯɴ]
[+cons]		couple [kʌpl]	[kappɯrɯ]
		box [bɑks]	[bokkɯsɯ̥]
(31)　ʃ → ʃʃ / ___ #		rush [ɹʌʃ]	[raʃʃɯ̥]

In addition to these rules, it is important to note that voiced geminates tend to become voiceless, because Japanese does not allow for voiced geminates (Koo and Homma1989). For example, the English word ﹁bed﹂ [bɛd] is usually pronounced as [betto] instead of [beddo].

3.1.3. Treatment of Glides

Japanese has glides, /j/ and /w/; however, they only occur in very restricted environments: /j/ occurs only before /a/, /u/, and /o/; and /w/ occurs only before /a/ (Lovins 1975). Naturally, when English words with glides in other environments come into Japanese, some sound changes have to occur. Oshio

(1971) gives rules for the treatments of prohibited occurrences of glides:

		English	Japanese
(32) Glide → Ø / ___ Vowel		yeast [y̱ijst]	[iisu̥to]
[α back]	$\begin{bmatrix} α\ back \\ -\ low \end{bmatrix}$	wool [w̱ul]	[ɯɯrɯ]

(33)   w   →   ɯ / ___ $\left\{ \begin{matrix} i \\ e \\ o \end{matrix} \right\}$ weight [w̱ejt] [ɯeito]

   [+cons]

(34)   j   →   i / __e   yellow [j̱elow][ieɾoo]

3.2. Vowels

3.2.1. Vowel Insertion

When we look at English loanwords in Japanese, one of the most noticeable sound changes is the insertion of a vowel. Kubozono (1995) generalizes the vowel insertion rules as follows: (i) /o/ after /t/ and /d/; (ii) /i/ after /tʃ/ and /dʒ/; (iii) /ɯ/ elsewhere. These generalizations can be restated as following:

		English	Japanese
		English	Japanese
(35) Ø → o / $\left\{ \begin{matrix} t \\ d \end{matrix} \right\}$ __		hot [hɑt]	[hotto]
(36) Ø → i / $\left\{ \begin{matrix} tʃ \\ dʒ \end{matrix} \right\}$ __		dodge [dɑdʒ]	[dodʒdʒi]
(37) Ø → ɯ / elsewhere		ball [bɑl]	[booɾɯ]

As the rules above indicate, [o] is inserted when a syllable ends with a consonant that is either /t/ or /d/. [i] is inserted when a syllable ends with a consonant that is either [tʃ] or [dʒ]. [ɯ] is inserted when a syllable ends with a consonant that is other than [t], [d], [tʃ], or [dʒ]. The Japanese syllable structure is (C)(y) V, and a consonant can be coda without a following vowel only in the case of a moraic nasal (i.e. /N/) or a geminate consonant. The motivation of the vowel insertion can be analyzed as an attempt to avoid the violation of the syllable structure.

3.2.2. Vowel devoicing

Certain vowels in Japanese exhibit the devoicing phenomenon in a particular environment. The vowels that undergo devoicing are the high vowels, i.e. /i/ and /ɯ/, although in certain dialects in the Kansai area the devoicing phenomenon is not common (Tsujimura 1997). Tsujimura (1997, p.28) formulates the devoicing rule as follows:

(38)   V   →   V̥   / C __ $\left\{ \begin{matrix} C \\ [-\ voice] \\ \# \end{matrix} \right\}$ [kɯ̥sai] "smelly"

   [+high]   [- voice]   [mɯki̥] "direction"

The rule indicates that the high vowels, /i/ and /ɯ/, become voiceless when they are between voiceless consonants or when they are at the end of the word and are preceded by a voiceless consonant. This phenomenon is observed in English loan words, and this rule also applies to a vowel that is inserted in rules (35), (36), and (37). Observe the following example:

	English	Japanese
Ice cream	[ajskɹim]	[aisɯ̥kɯriimɯ]

First, the English diphthongs [aj] and [i] are substituted with [ai] and [ii] respectively: rule (13) and (7). Secondly, English [ɹ] is replaced with [ɾ]: rule (20). Thirdly, the vowel insertion is observed, namely, [ɯ] is inserted between [s] and [k], after [k], and after [m]: rule (37). Lastly, the [ɯ] between [s] and [k] is devoiced: rule (38). The vowel insertion rule (37) must take place before the devoicing rule (38) because if rule (38) occurred before (37), the surface would have been *[aisɯkɯriimɯ].

4. Implications for Native Speakers of English who are Learning Japanese

This section explores some educational implications of the phonological differences reported in this paper for native speakers of English who are learning Japanese as a second or foreign language. Stevicks (1989) argues that pronunciation is the primary medium for communication. Even if a second language speaker can produce sentences with a great degree of accuracy in grammar, s/he cannot expect to have successful consequences without proper pronunciation. Most learners of a foreign/second language have to face this stumbling block when they interact with a native speaker of the target language. When it comes to two languages that are considerably different in terms of their pronunciation, the learner has to invest tremendous time and effort to attain a native-like pronunciation. Native English speakers who are learning Japanese, naturally, have difficulty producing accurate Japanese pronunciations for loanwords in Japanese that came from English. The sounds of English loanwords are considerably modified from the original, and producing them in a natural and comprehensible way requires knowledge of the sound change rules reported in this paper.

One of the quickest ways to make the pronunciation of English loanwords in Japanese natural and comprehensible is to follow the vowel insertion rules that are described in (35), (36), (37). By inserting the right vowel(s) when there is a consonant cluster and when the word ends with a consonant (excluding /ɴ/), the utterance starts to sound natural to Japanese ears. Following Japanese phonotactics seems far more effective than producing each individual phoneme accurately.

As far as American learners of Japanese are concerned, the vowel devoicing rule in (38) seems not to be an obstacle. This may be attributed to the fact that American English has a similar phonological rule: Shwa /ə/ becomes devoiced between certain voiceless obstruents in rapid speech (Stahlke 2000). Thus, the Japanese vowel devoicing rule is not a new concept to learn or acquire for them. Rather, American learners only have to reinterpret and adjust the phonological rule of vowel devoicing that they already have. Furthermore, even if they do not follow the rule in (38), the utterance sounds fairly natural. Even native speakers of Japanese do not always follow the rule in (38), and arguably there should be more restrictions to the rule than indicated in (38). Or simply, vowel devoicing is not a very noticeable

characteristic overall.

As mentioned in Section 2.1, Japanese has only five vowels, and they are quite similar to some of the English tense vowels. If learners desire to acquire native-like vowel sounds, however, these sounds need to be reinterpreted. They have to, for example, learn that Japanese /ɯ/ and /o/ are less rounded. Also, native speakers of English may mistakenly transfer English vowels that Japanese does not have, especially when syllables are not accented. In other words, they have to "forget" English sounds, /ɪ/, /ʌ/, /ə/, /æ/, /ɔ/, and /ʊ/ when speaking in Japanese.

There are some consonants that are present in Japanese but absent in English. They are: /ɸ/ as in furii [ɸɯɾiː] (free), /ç/ as in hisutorii [çi̥sɯ̥toɾi] (history), /tˢ/ as in tˢurii [tˢɯɾiː] (tree), and /dᶻ/ as in zuu [dᶻɯː] (zoo). Although it seems as though the voiceless alveolar affricate /tˢ/ is peculiar to Japanese, it also appears in word finals in English (e.g. dots [dɑ́ts]). Therefore, the Japanese /tˢ/ should not be a serious obstacle for native speakers of English. Furthermore, several researchers (Shibatani 1990, Vance 1987, Tsujimura 1996) argue that /dᶻ/ does not display a clear contrast with /z/ for most Japanese people. If native English speakers pronounce /dᶻ/ as /z/ or vice versa, it still sounds fairly natural. The /ç/ sound should not be an obstacle for native English speakers either. English has an allophone of /h/ that is almost identical to Japanese /ç/. When /h/ is followed by a high vowel, /h/ is often palatalized and pronounced as [hʲ] as in huge [hʲúːʤ] and heat [hʲíːt], and they sound the same as Japanese /ç/. However, /ɸ/ is a completely new sound for native English speakers to acquire. In fact, it is often observed that native English speakers substitute /h/ or /f/ for /ɸ/ when they pronounce English loanwords (e.g. [famiɾiː] in stead of [ɸamiɾiː] for famirii).

The American English /r/ is always retroflexed, while Japanese /ɾ/ is pronounced with the tongue achieving very quick contact at the alveolar ridge. Thus, American learners have to reinterpret the /r/ sound. However, the Japanese /ɾ/ is present in American English as an allophone of /t/ (e.g. water [wɔɾɚ]), and producing the sound should not be difficult, but using it in the right environment requires some practice.

Guessing the original English word just by looking at Katakana is sometimes rather challenging. For example, Japanese /ɾ/ can be from English /r/ or /l/. Therefore, Riidaa [ɾiːdaː] can come from either reader or leader depending on the context. Without any context, it is impossible to tell whether faasuto [ɸaːsɯ̥to] refers to fast or first. Also, Japanese people often shorten and combine English words and create a new word for a new concept, which makes it almost impossible to guess the original English word. For example, nuuhara [nuːhaɾa] comes from the English word noodles and harassment, and it means to subconsciously harass someone from overseas with the sound of slurping noodles.

5. Conclusion

I have reported on major sound change rules for English loanwords in Japanese. Because Japanese has a simpler vowel system and different consonant inventory, many substitution rules are observed when we look at English loanwords in Japanese. Japanese phonological rules that occur in specific environments are observed to apply to English loanwords in order to maintain the Japanese syllable structure and phonological restrictions. The rules that are reported in this paper capture the majority of the English loanwords existing in Japanese, although there seem to be some regional and sociolinguistic variations for determining the applications of some of these rules.

Japanese is simpler than English in its sound system as far as the number of the sounds is concerned. However, it does not mean that native speakers of English can easily master the Japanese pronunciation for English loanwords. Many errors that native English speakers make are caused not just by differences of the phonetic inventories of the two languages, but also by their phonological rules and constraints. Every language has its own phonological rules that are difficult for learners of the language. Looking at sound changes when English words are borrowed into Japanese brings out major Japanese phonological rules and constraints which English does not have. This suggests the importance of verbal input of each English loanword for native speakers of English who are learning Japanese, regardless of the fact that these words come from English. After all, once English words are borrowed into Japanese, they are no longer English words.

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