A PHONOLOGICAL STUDY OF SOME ENGLISH LOAN WORDS IN JAPANESE

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1. Principles of Borrowing

Loan words sometimes bring into a language new sounds or new sequences of sounds, but in many cases foreign sounds are changed to conform to the native phonological system. Furthermore, the manner of nativization is quite regular. People don't simply substitute an arbitrary native segment for a foreign sound. Thus, an adequate theory of phonology has to explain the process of adaptation of foreign words, and their nativized phonological and phonetic representations.

That they cannot be explained adequately in terms of a 'phonetic approximation' hypothesis or by 'phonemic approximation' based on the theory of taxonomic phonemics was convincingly demonstrated by Hyman (Hyman, 1970). Hyman attempted to view the phenomena of borrowing in the light of generative phonology. Working with loan words in Nupe, a Kwa language of Central Nigeria, he has proposed principles which account for the data, but do not seem adequate for borrowing processes in general. That is, there seem to be some cases where his principles allow several alternative substitutions for certain foreign segments, but without any principled way of choosing among them. Since the data suggest that the process of nativization does not allow so many alternatives, his principles need revision. In the following section I will first discuss the cases where Hyman's hypotheses result in indeterminacy and then some alternative principles which seem to account for borrowing more adequately.
1. Hyman's Hypotheses

Hyman's principles of borrowing are:

1. Foreign sounds are perceived in terms of underlying forms. (19)

2. Foreign segments equivalent to native segments derived by rule are lexicalized as the corresponding native underlying forms. (39)

There is a partial contradiction between these two hypotheses. If a language has phonetic sequence \( xx \) which is derived from the underlying sequence \( xy \) by a rule \( x \rightarrow y \), and it also has an underlying sequence \( xy \), does the language lexicalize the borrowed sequence \( xx \) as \( xx \) or \( xy \)? Where the opposition of underlying \( x \) and \( y \) completely neutralizes in the environment of \( xx \), the sequence will be lexicalized as \( xx \) according to his first principle and \( xy \) according to his second principle. Hyman gives no resolving principle.

Secondly, his principles cannot give a sufficient explanation for why Nupe speakers create an openthetic vowel in borrowing a consonant cluster inadmissible in the native system. He says it is because that morpheme structure of Nupe is (V)CV(CV). But this doesn't tell why Nupe speakers insert a vowel rather than simplify the consonant cluster. Either process would change an inadmissible cluster to conform to the native (V)CV(CV) pattern.

Finally I would like to consider his third principle:

3. When a foreign segment appears in an environment in which the equivalent native derived segment does not appear, that the form of the incoming foreign word is modified so that the structural description of that
rule is set and the segment in question is then derived in the appropriate environment. (Hyman, 40).

It means that when a language which has a rule \( x \rightarrow y \) borrows a sequence \( xy \) where \( x \) is distinct from \( y \), \( y \) is changed to \( z \) so that \( x \) is derived in the appropriate environment by the rule \( x \rightarrow y \). This principle is too strong, because it allows more than one substitution for a segment and doesn't predict what will actually happen. For example, Japanese has a rule which palatalizes a consonant before the high front vowel \( \mathcal{A} \) and the high front glide \( \mathcal{Y} \). By this rule, there are the sequences \( \mathcal{F}_1 \), \( \mathcal{F}_3 \), \( \mathcal{F}_4 \) and \( \mathcal{F}_u \), but no \( \mathcal{F}_2 \). There are no \( \mathcal{F}_4 \) or \( \mathcal{F}_5 \), since the glide \( \mathcal{Y} \) is deleted before the front vowels, before the palatalization rule applies. \( \mathcal{F}_4 \), \( \mathcal{F}_5 \) and \( \mathcal{F}_u \) become \( \mathcal{S}_3 \), \( \mathcal{S}_0 \) and \( \mathcal{S}_u \), respectively, by the rule which deletes \( \mathcal{Y} \) after palatalized consonants. In summary, Japanese has the sequences \( \mathcal{S}_1 \), \( \mathcal{S}_2 \), \( \mathcal{S}_3 \), \( \mathcal{S}_4 \), but no \( \mathcal{S}_5 \). Now, according to Hyman's hypothesis 3, when Japanese borrows a sequence \( \mathcal{S}_4 \), speakers would change its vowel \( z \) to some other segment, so that the palatalized consonant is derived in the appropriate environment by the palatalization rule of Japanese. What is unclear here is how a new environment will be chosen when there are several alternatives. In this case all the following substitutions are possible.

\[
\begin{align*}
\mathcal{S}_1 & \quad \mathcal{S}_2 \\
\mathcal{S}_0 & \quad \mathcal{S}_4 \quad \text{(Cyo)} \\
\mathcal{S}_u & \quad \text{(Cyu)} \\
\mathcal{S}_a & \quad \text{(CyB)}
\end{align*}
\]
It seems that he tacitly assumes that the segment closest to the original one (in terms of the composition of distinctive features) is chosen in such a case. \( \ddot{a} \) and \( \ddot{o} \) are closer to \( a \) than \( u \) and \( \ddot{a} \), because they differ from \( a \) by only one feature, while \( u \) and \( \ddot{a} \) differ from \( a \) by two, so that \( \ddot{a} \) or \( \ddot{o} \) would be chosen. But still there is no way to choose one of them systematically. Furthermore, Japanese data show that the change of environments indicated by principle 3 is very rare. In the case of \( \ddot{a} \), the consonant is depalatalized, when nativized. But the case of vowel insertion in Japanese observed in the borrowing of words with consonant clusters or with a word final consonant, suggests that some weaker version of such a principle is necessary. The Nupe data which required Hyman to set up principle 3, on the other hand, could be explained without such a principle, as I shall show in the following section.

1.2. Borrowing in Natural Phonology

I would now like to examine borrowing based on the theory of natural phonology. (Stampe, 1968, 1969) It is possible to view the borrowing process as parallel to children's acquisition of phonological representations. If incoming foreign sounds are admissible underlying segments in the native phonological system, they will be represented in the lexicon without change. That is, the foreign phonetic representations will be adopted as underlying forms. In this case there will be no conflict between Hyman's principles 1 and 2. In the case I cited, \( \ddot{a} \) will be lex-
ialized as $xa$ unless some information is available which prevents this underlying representation. If, on the other hand, some foreign sounds are underlyingly inadmissible, they will be analyzed by suitable native rules to obtain admissible representations. That is, segments will be analyzed according to certain rules only when they are inadmissible in the lexicon. I will refer to such rules, which constrain underlying representation, as 'dominant'. Suppose that the native phonological system of a language has a dominant rule $x \rightarrow y$ eliminating $x$ from the lexicon. If it has a rule $w \rightarrow x / \ldots$, dominated by the above rule and allowing a superficial $x$, the foreign sequence $xx$ will be analyzed as $xa$, since $x$ is an inadmissible underlying segment. If $wa$, obtained after analysis, is still inadmissible, further analysis will be carried on until some admissible segment is obtained, provided that some rule is available in the native system which can cope with it.

If some foreign segments cannot be analyzed as any admissible underlying representations in the native system, they will be registered as violations of the rules which prohibit them. Since those rules do apply to them, no learner would ever have the chance to notice the irregular representation in the lexicon of the borrower. He will, therefore, treat them just like the native forms in learning and represent them in the lexicon without any irregularity which is observed in the borrower's lexicon.

The children who are learning a language will finally revise the innate system of rules so that admissible representations
will be gained for all the forms which they hear from adults. But it seems to be very difficult for adults who have once acquired a phonological system of one language to revise it to comprise new segments or new sequences of segments. In many cases perception itself seems to be constrained by the native system, so that speakers perceive foreign sounds in terms of the native phonological system. Thus in case some segments have to be registered in violation of native rules, the borrower will change his inadmissible underlying representations to admissible ones sooner or later, unless he learns to revise the native system to allow them. In other words, the inadmissible forms which were first registered in the lexicon, will be changed to admissible ones by the application of the dominant rules which constrain them. I will refer to this process as the restructuring of the underlying representations.

In summary, foreign segments will be put in the lexicon as they are on the surface unless they are inadmissible underlying segments. If they are inadmissible, they will be analyzed by the native rules until some admissible representation is obtained. If a segment cannot be analyzed as an admissible form in the native system, it will be represented in the lexicon as it is, and it will finally be restructured by the dominant native rules.

1.3. Re-examination of Hyman's data

Let us re-examine some of the Nupe data under the new hypotheses. The foreign phonetic sequence ni which Hyman gives to
exemplify his principle I will be put in the lexicon as it is ac-
cording to our principle, since it is an admissible underlying
sequence of Nupé. Consequently it becomes subject to the phono-
logical rules of Nupé, and will be realized as CVC by the appli-
cation of the Nupé apicant palatalization rule and the general
assimilation rule.

The next problem concerns an apenthetic vowel, for which
there are at least two possible explanations. First, suppose
that the fact that Nupé doesn't have consonant clusters is con-
strained by an apenthesia rule of the form CC −→ CVC, and that
Nupé doesn't have a rule which derives superficial CC. Then CC in
foreign words will be put in the lexicon as such in violation of
the rule CC −→ CVC, because CC cannot be analyzed as an admiss-
able sequence in the native system. In the realization of this
CC, the rule CC −→ CVC will apply and create CVC. The apenthe-
tic vowel is subject to the other constraints Hyman discusses.

The following explanation is also possible. Suppose that
Nupé morpheme structure is constrained by such a rule as CC −→
C, and that Nupé has a rule CVC −→ CC, dominated by the former
rule. The rule CVC −→ CC might not appear under the normal
speed of speech, but (according to Stampe) it is a quite common
rule in fast speech and it is quite plausible for Nupé to have
such a fast speech rule. Then CC would be analyzed as admissible
CVC. Whatever the case it, there is an explanation for the fact
that consonant clusters are broken up by vowels, rather than in
some other way. We need more facts about Nupé phonology to deter-
since exactly what is going on here, of course.

One of the facts which leads Hyman to set up principle 3 is the substitution of vowels after labialized and palatalized con-
sonants in some borrowed words. Nupes speakers change unrounded
front vowels into rounded back ones after labialized consonants
and rounded back ones into unrounded front ones after palatalized
consonants of loan words. Nupe has an assimilation rule which
has the form:

\[ \text{[cons]} \rightarrow \text{[high \_round \_back]} \]

But this assimilation rule doesn't apply to such a foreign se-
quence as \( \ddot{u}u \), for example; rather, the vowel \( u \) in it is converted
into \( i \), so that \( \ddot{u} \) is derived in an appropriate environment by the
assimilation rule. Thus Hyman concludes that a principle like 3
is necessary. What he assumes here is that Nupe has a consonant
assimilation rule but not a rule which changes features of a vowel
depending on the preceding consonant. But it is possible to as-
sume that Nupe has such a rule, since there are other languages
which have this rule and there is no reason why Nupe speakers
cannot employ it. We just cannot observe it normally, since it
is ordered before the assimilation rule and the palatalized and
labialized consonants arise only by this rule. If we assume that
Nupe has such a vowel assimilation rule (VAR), and a Depalatal-
isation-Relabialisation Rule (DRL) which prohibits the underlying
palatalized and labialized consonants, borrowing \( \ddot{u}u \) will be ex-
plained as follows: \( \ddot{u}u \) will be put in the lexicon in violation of
VAR and DR. VAR and DR apply to it in this order to derive ai. That is, ai in the restructured underlying representation. The spirant palatalization and general assimilation rule apply to it in the process of derivation, and it will be realized as ɐi. I will show the process of analysis and realization in the diagram below. The upward arrow refers to an analysis of foreign segments as native underlying representation (including a direct transfer of foreign phonetic representation) and the downward arrow to the realization process in the native system.

\[
(\text{ai}) \uparrow /\text{ai}/ \downarrow /\text{ai}/ \downarrow /\text{ai}/ \downarrow /\text{ai/} \downarrow ɐi \downarrow [ɐi]
\]

VAR DR Spirant General Palatalization Assimilation Restructuring of the Underlying Representation

As shown above, the principles described in Section 1.2 appear to work well and can predict what will happen in the borrowing situation. In the following chapter, I will discuss some English loan words in Japanese according to the above principles.

Footnotes

1Japanese has five vowels which are characterized as follows.

<table>
<thead>
<tr>
<th></th>
<th>high</th>
<th>low</th>
<th>back</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>+</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>e</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>a</td>
<td></td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>o</td>
<td></td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>u</td>
<td></td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

2I will refer to the rule which generates the segment prohibited by a preceding rule to be dominated by that rule. The analysis of underlyingly inadmissible foreign segments is carried out only when there is a rule available in the native system which generates them, dominated by the rule which prohibits them.
2. English Loan Words in Japanese

In addition to numerous Chinese loan words, Japanese has borrowed many words from Western languages — English, German, French, Dutch, Italian and Russian. Modern Japanese is especially full of English loan words, which sometimes make language purists frown.

In this chapter I would like to examine some English loans in Japanese to see whether the hypotheses in the previous section give a correct account of the actual borrowing process. And at the same time I will discuss some properties of the system of Japanese phonology which are revealed in the process of borrowing. All the rules will be presented quite informally.

2.1. Palatalization

In Japanese consonants are palatalized before the high front vowel i or the high front glide u. This is expressed by the following rule of palatalization.

1. Palatalization:

\[
\text{Cons} \rightarrow [\text{Pal}] \quad /\quad \left[\begin{array}{c}
\text{-consonant} \\
\text{high} \\
\text{-back}
\end{array}\right]
\]

Since all superficially palatalized consonants can be derived by Rule 1, we can assume that Japanese has, ordered before Rule 1, a rule which depalatalizes underlying consonants.
2. Depalatalization:

Cons → [-pal]

Rule 2 does not manifest itself in substitutions; it merely requires underlying consonants to be nonpalatal. The glide y is lost after superficially palatalized consonants.

3. "y" loss:

y → [ə] / Cons

Rule 3 merely supplies phonetic detail, but it will be crucial to my account of certain borrowings. I would like to examine first how the English palatalized velar stops k̂ and EDIATE are borrowed into Japanese.

In English k̂ and EDIATE are derived from k̂ and EDIATE respectively by the process of palatalization before and after the front vowels (Bach 1966, 128-9). When velars occur between two vowels, the second vowel determines their value, so k̂ and EDIATE don't occur before a non-front vowel even if they are preceded by a front vowel, that is, k̂ and EDIATE occur in such a position. Thus palatalized velars occur in such words as the following: upert 'keep', izard 'kick', izard 'cake', icket 'ticket', endars 'candy', irt 'sift', ough 'bogie', ernet 'game', uest 'guest', ert 'gap'. I will discuss in this section only how the palatalized velar stops followed by front vowels are borrowed, leaving those preceded by front vowels to the section on vowel insertion.

k̂ or EDIATE followed by the high front vowel in such words as upert, izard, ough, irt will be interpreted as underlying k̂ and EDIATE.
by undoing Rule 1, in order to eliminate the palatalized consonants which are banned by Rule 2. Since the \text{k}_i and \text{k}_u are admissible, they are not subject to further analysis. They will be represented as such in the lexicon and realized as \text{k}i and \text{k}u phonetically by the application of Rule 1. The analysis and realization of these consonants thus exactly parallels that of native words like [k\text{ins}] = /k\text{inu}/ 'silk' and [z\text{im}] = /z\text{imu}/ 'duty'.

Palatalized velars before a non-high front vowel cannot be analyzed as non-palatal by Rule 1 because it applies only before high front vowels. This would require such consonants to be registered as underlyingly palatal, in violation of Rule 2. However, Rule 3 furnishes a way of avoiding this. By Rule 3 a sequence such as \text{k}\text{yu}, where \text{k} is a non-high front vowel, can be analyzed as \text{k}\text{yu}, thus furnishing the high front segment which permits further analysis as \text{ky}\text{u} by Rule 1. Thus such sequences as \text{ko}\text{i} and \text{ko}\text{u} will be analyzed as \text{kyo}\text{i} and \text{kyo}\text{u} by Rule 3, and further as \text{kyo}\text{u} and \text{kyo}\text{u} by Rule 1. \text{o} in \text{kyo}\text{i} and \text{kyo}\text{u} will be replaced by a by rules which determine the vowel system of Japanese. The following diagram shows the process of borrowing and realization of \text{ko}\text{i} and \text{ko}\text{u}.

\[
\begin{array}{cccc}
\text{Rule 3} & \text{Rule 1} & \text{Rule 1} & \text{Rule 3} \\
\text{[k\text{oi}] \uparrow \text{kyo}\text{i} \uparrow /\text{kyo}/ \downarrow /\text{kyo}/ \downarrow \text{kyo} \downarrow [\text{ks}]}
\end{array}
\]

\[
\text{Rule 3} & \text{Rule 1} & \text{Rule 1} & \text{Rule 3} \\
\text{[k\text{ou}] \uparrow \text{kyo}\text{u} \uparrow /\text{kyo}/ \downarrow /\text{kyo}/ \downarrow \text{kyo} \downarrow [\text{fu}]}
\]

Examples:

- English: \text{kan\text{di}} 'candy'
- Japanese: \text{kan\text{di}}
\[ \text{keep} \ 'on\rightarrow \ 'on\text{app} \]
\[ \text{keep} \ 'ga\rightarrow \ 'gapp\]
\[ \text{gang} \ 'ga\rightarrow \ 'gag\]

As described above, \( \text{ke} \) and \( \text{ka} \) in many words come out as \( \text{ka} \) and \( \text{ka} \) in Japanese, but there are also numerous words where they come out as \( \text{ka} \) and \( \text{ka} \), with plain stops, as in the following examples.

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>calendar'</td>
<td>karedan</td>
</tr>
<tr>
<td>catalog'</td>
<td>katarogu</td>
</tr>
<tr>
<td>gas'</td>
<td>gas'</td>
</tr>
<tr>
<td>gallon'</td>
<td>garon'</td>
</tr>
</tbody>
</table>

I think this is because the palatality of the velar stops before \( \text{a} \) in English is relatively weak and sometimes is not perceived by speakers of Japanese, who consequently represent the stops as underlying \( \text{k} \) and \( \text{g} \), without the analysis described above.

To account for the borrowing of \( \text{ka} \) and \( \text{ka} \), we have to take into consideration a rule of Glide Deletion in Japanese.

4. Glide Deletion:

\[
\text{Glide} [\underline{\text{back}}] \rightarrow \underline{\beta} / \text{Vowel} [\underline{\text{back}}] \]

That is, \( \text{g} \) is deleted before the non-low front vowels \( \text{a} \) and \( \text{e} \) and \( \text{y} \) before the back non-low vowels \( \text{i} \) and \( \text{o} \). This rule constrains the underlying representation, so that there can be no underlying \( \text{ka} \).
vs. 8. ke and ge can be analyzed as eye and ege by Rule 3 and then as kye and gye by Rule 1, thereby conforming to the prohibition against palatalized consonants (Rule 2). But kye and gye violate the prohibition against underlying ye imposed by Rule 4. The English sequences ke and ge cannot be analyzed, therefore, as any representation which is admissible in the Japanese system. If they are registered as kye and gye, Rule 4 is violated; if as ke and ge, Rule 2 is violated. In either treatment, the sequences will be pronounced as ke and ge:

\[
\begin{array}{c|c|c}
/\text{kye}/ & \downarrow /\text{ke}/ & \downarrow [\text{ke}] \\
& & \text{Rule 4} \\
/\text{ke}/ & \downarrow /\text{ge}/ & \downarrow [\text{ke}] \\
& & \text{Rule 2} \\
/\text{ge}/ & \downarrow /\text{ge}/ & \downarrow [\text{ge}] \\
& & \text{Rule 4} \\
\end{array}
\]

The learner's representation will be thus restructured to ke and ge, unless he learns to manage the foreign sounds by changing the native system in some way. The following examples confirm the above discussion.

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>ticket</td>
<td>kiketto</td>
</tr>
<tr>
<td>cake</td>
<td>kekko</td>
</tr>
<tr>
<td>guest</td>
<td>gesueto</td>
</tr>
<tr>
<td>gene</td>
<td>gesemô</td>
</tr>
</tbody>
</table>

Next I will discuss how the English palatalized obstruents k, t, y are borrowed.

The voiced sibilant ɡ in Japanese has the tendency to be
affricated. For some speakers ḷ and ḷə are in free variation, and for others they are in complementary distribution. Niek Haan reports on her own speech where ḷə occurs word initially and ḷ in other positions (Haan, 90). The palatalized voiced sibilant, ḷ, on the other hand, is affricated in any environment, though the unaffricated ḷ might appear occasionally in very limited environments. The affrication of the voiced sibilant in the same dialect as Haan’s could be formulated as follows.

5. Affrication of the Voiced Sibilant:

\[
\begin{align*}
\text{Sibilant} & \quad \text{[voiced]} \quad \text{[pal]} \quad \text{[Delayed Release]} \quad \text{/ İş\ldots/} \\
\end{align*}
\]

The coronal stops ḷ and ḷə are affricated before the high vowels, ḷə and ḷə, and the glide ḷə.

6. Affrication of Coronal Stops:

\[
\begin{align*}
\text{Stop} & \quad \text{[con]} \quad \text{[Delayed Release]} \quad \text{/ [high]} \\
\end{align*}
\]

This means that the opposition between ḷə and ḷə neutralizes in certain environments.

The derived (i.e. systematic phonetic) ḷə, ḷə and ḷə are phonetically more like the alveopatal obstruents [ʃ], [ʂ], and [ʃ] than like the palatalized alveolar obstruents [ʂ], [ʐ], and [ʐ]. The points of articulation of these segments are in the pre-palatal region. Hence I will propose Rule 7, which converts ḷ, ḷə and ḷə into ḷ, ḷə and ḷ respectively. This rule merely supplies phonetic
detail, but it plays a role in borrowing abstractmethod x, y and z of English.

7.

\[ \alpha \rightarrow y \]

[\alpha] \rightarrow [y]

English \[y\] will be interpreted as \[\hat{\alpha}\] by Rule 7, hence as underlying \[\alpha\] by Rule 1. It will be realized as \[\hat{\alpha}\] by the application of these rules. \[\hat{\alpha}\] will be analyzed as \[\hat{\alpha}\] by Rule 7, further as \[\alpha\] by Rule 6 and Rule 1, and it will be realized as \[\hat{\alpha}\] by the application of these rules.

There are two possible interpretations for \[\hat{\alpha}\], shown in the following diagram.

(A)

\[
\begin{array}{cccc}
[\hat{\alpha}] & \uparrow & [\hat{\alpha}] & \uparrow & /\alpha/ & & [\hat{\alpha}] \\
& \text{Rule 7} & \text{Rule 5} & \text{Rule 1} & \text{Rule 1} & \text{Rule 5} & \text{Rule 7}
\end{array}
\]

(B)

\[
\begin{array}{cccc}
[\hat{\alpha}] & \uparrow & [\hat{\alpha}] & \uparrow & /\hat{\alpha}/ & & [\hat{\alpha}] \\
& \text{Rule 7} & \text{Rule 6} & \text{Rule 1} & \text{Rule 1} & \text{Rule 6} & \text{Rule 7}
\end{array}
\]

(In case of (B) \[\hat{\alpha}\] could first be deaffricated (Rule 1) and then deaffricated (Rule 6), since the palatalization and the affrication of coronal stops are not in ordered relation, but there is no difference in the obtained form.) There is no empirical evidence as to whether the underlying form of \[\hat{\alpha}\] is /\alpha/ or /\hat{\alpha}/, since in either case the superficial form is \([\hat{\alpha}]\).

The remarks appropriate to \[\alpha\] and \[\hat{\alpha}\] should apply to \[\hat{\alpha}\].
\( \text{Ke} \) and \( \text{Ke} \) as well. That is, we expect them to be depalatalized as \( \text{se} \), \( \text{ce} \), and \( \text{se} \) or \( \text{de} \), respectively. But, unlike \( \text{Ke} \) and \( \text{Ke} \), they are not completely nativized in many cases: the palatality of the consonants before \( \text{g} \) is kept here against the native rule.

The problem of what kind of native rules are easily modified in borrowing is an interesting one, but it is not in the scope of this paper. I couldn't find any example where \( \text{Ke} \) is completely nativized as \( \text{ke} \), but I have some examples where \( \text{Ke} \) and \( \text{Ke} \) are completely nativized. I would like to consider \( \text{Ke} \) here, since there are two possibilities in nativization, namely \( \text{se} \) and \( \text{de} \).

After analysis by Rule 7 as \( \text{ase} \), \( \text{Ke} \) could be registered either as \( \text{ase} \) or \( \text{kase} \) in violation of Rule 2, or \( \text{ase}/ \text{ye} \) or \( \text{kase}/ \text{ye} \) in violation of Rule 4. Let us examine the latter cases first.

(C)

\[
\begin{align*}
\text{Ke} & \rightarrow \text{ase} \\
& \rightarrow \text{ase} \\
\end{align*}
\]

Rule 7 Rule 5 Rule 4 Rule 1 Rule 4 Rule 5

(D)

\[
\begin{align*}
\text{Ke} & \rightarrow \text{ase} \\
& \rightarrow \text{ase} \\
\end{align*}
\]

Rule 7 Rule 6 Rule 4 Rule 1 Rule 4

The y-insertion might apply before deaffrication in analysis, since they are not in ordered relation, but the resulting underlying forms are the same. The phonetic outcome \( \text{ase} \) of (C) appears only word initially in the dialect with which I am concerned. Now the data show that the analysis (C) is actually employed by Japanese.

English

\[ \text{gelatin} \rightarrow \text{gelatin} \]

Japanese

\[ \text{ジェラチン} \]
We could regard that this is because the affrication of coronal stops is ordered before the affrication of the voiced fricative, though this ordering does not manifest itself in the native system. Then the analysis following the reverse order of rules for generation, $\text{du}$ is analyzed as $\text{du}$ rather than $\text{du}$.

Let us consider next whether we can get the same result if $\text{ke}$ is registered as $\text{ke}$ or $\text{ko}$ in violation of Rule 2.

(g)

\[
\begin{align*}
\text{[ke]} & \uparrow \text{ke} \uparrow /ko/ \downarrow /ko/ \downarrow [\text{ko}]
\end{align*}
\]

Rule 7 Rule 5 Rule 1 Rule 5

(F)

\[
\begin{align*}
\text{[ke]} & \uparrow \text{ke} \uparrow /ke/ \downarrow /ke/ \downarrow [\text{ke}]
\end{align*}
\]

Rule 7 Rule 6 Rule 1

The actual adoption of the analysis (E) can be explained in the same way as before.

$\text{ka}$, $\text{ka}$, $\text{ka}$, $\text{ka}$, $\text{ka}$, $\text{ka}$, $\text{ka}$, $\text{ka}$ and $\text{ka}$ will be analyzed as $\text{syu}$, $\text{syu}$, etc. with $\text{y}$ in the underlying representation, as in $\text{ka}$ and $\text{ka}$. Some examples will be given below.

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>sharp</td>
<td>$\text{yampe}$</td>
</tr>
<tr>
<td>shot</td>
<td>$\text{totto}$</td>
</tr>
<tr>
<td>shoot</td>
<td>$\text{youto}$</td>
</tr>
<tr>
<td>charter</td>
<td>$\text{saatoo}$</td>
</tr>
<tr>
<td>chalk</td>
<td>$\text{ookyou}$</td>
</tr>
</tbody>
</table>
2.2. Vowel Insertion

McCawley (1968, 131-4) has claimed that standard Japanese is a mora-counting syllable language in which the syllable functions as the prosodic unit and the mora as the unit of phonological distance. A mora consists of a consonant plus a vowel, a glide plus a vowel, a vowel alone, a mora nasal, or a mora obstruent, so that kii 'key', nai 'pen', yotto 'yacht' are respectively two, two and three moras. Among these moras, the mora nasal and the mora obstruent don't constitute syllables. Each constitutes a syllable with a preceding mora. Thus nai 'pen' and yotto 'yacht' are respectively one and two syllables. A long vowel which is phonologically two identical short vowels also counts as one syllable, as does a diphthong (although both of them are two moras), so that kii 'key' and tai 'tie' are both one syllable words.

There are constraints on the distribution of some of the syllables. The syllable (C)V(C), where the last C is the mora obstruent, cannot occur word-finally. Moreover, the syllable which follows must begin with the same obstruent as the mora obstruent. Thus there are only two kinds of consonant clusters in Japanese, namely the cluster of two identical voiceless obstruents
The above fact about the syllable structure will be described by the following set of rules.

8. \( CC \rightarrow C / [.] \)

9. \( C \rightarrow \text{Obstr} / \_

10. \( \text{Obstr} / \text{[voiced]} \rightarrow [\text{nasal}] / \_

11. \( [\text{nasal}] \rightarrow [\text{sonorant}] \)

12. \( C \rightarrow [\text{sonorant}] / [\text{sonorant}] \)

13. \( C \rightarrow [\text{anterior} \quad \text{sonoral} \quad \text{continuant}] / C [\text{anterior} \\
\quad \text{sonoral} \\
\quad \text{continuant}] \)

14. \( C \rightarrow \# / \_

Rule 8 says that there is no consonant cluster before or after the syllable boundary. Rules 9 and 10 state that syllable-final consonant is an obstruent and a voiced obstruent becomes nasal in this position. Rule 11 changes the nasal obstruent into a sonorant. That the more nasal thus generated is homorganic with the following consonant is stated by Rule 13. Rules 12 and 13 state that syllable-final voiceless obstruent is identical to the following obstruent. Rule 14 says that there is no word final consonant.

Now I would like to examine what processes apply to a consonant cluster or a word-final consonant of English in borrowing. If there were no rule which derived a syllable-final consonant and which was dominated by Rules 3 through 14, medial consonant clusters would be simplified by Rule 8, after which there would
be nasalization and assimilation by Rules 9 through 13, and a
cword-final consonant would be deleted by Rule 16. But Japanese
has a so-called "devoicing" rule which provides Japanese speakers
with the way to cope with numerous consonant clusters or word-
final consonants in English.

The phenomenon of devoicing vowels in Japanese is quite
complicated and an exact description has not been worked out yet.
The following devoicing rule is given by McCawley (127) as a sort
of approximation.

15. Devoicing

\[ \text{[high]} \longrightarrow \text{[-voice]} \quad \text{[voice]} \quad \text{(devoiced)} \]

That is, the high vowels are devoiced between voiceless consonants
or between a voiceless consonant and a word boundary. The above
rule does not express the fact that when several consecutive sylla-
bles each contain a high short vowel between voiceless consonants,
only alternate vowels become voiceless, the choice of the sylla-
bles to be devoiced depending on several factors (such as the
vowels affected, the consonants of the environment, and the pitch
of the syllable). Devoicability also varies with the speed of
speech. According to an acoustic study by Nisako Han (1962, 20)
only the high vowels \( \ddot{a} \) and \( \dddot{u} \) are devoiced under the normal speed
of speech, as in McCawley's formulation. The other vowels are
often weakened under certain circumstances but they are usually
not devoiced at "normal speaking tempo". Han's experiment doesn't
treat fast speech extensively, but at one point she mentions that
such a sequence as /suzuki/ 'Japanese pampas grass' is reduced to [sikki] or even [ski] and /hukuru/ 'discontent' to [hikka] or even to [huku] in fast speech. That is, the high vowels are actually deleted rather than just devoiced under certain environments. Among the consonants, fricatives show the greatest effect on devoicing, then affricates and finally stops. Hence, I postulate that deletion occurs most readily in the environment of fricatives. Since a vowel in inserted in borrowing where there is none in the original word, a stronger form of Rule 15, that is, a rule of deletion rather than just devoicing is the one I consider to be correct. I assume the following fast speech rule is used to analyze words being borrowed which have consonant clusters or word-final consonants.

16. Deletion of High Vowels (fast speech)

\[
\begin{align*}
\text{[high]} & \quad \rightarrow \quad \emptyset \\
/\text{-voice} & \quad \rightarrow \quad \text{[voice]} \\
\end{align*}
\]

The high vowels are usually devoiced or deleted only between voiceless obstruents or a voiceless obstruent and a word boundary, but the insertion in carried on after voiced consonants, too. Hence I will suppose that Rule 16 is expanded to the environment of voiced consonants in borrowing.

Japanese has another rule which deletes high vowels in certain environments (McCawley, 115-20). That is, the final high vowels of Sino-Japanese morphemes ending in -ke, -ku, -te, and -tu are lost when they are followed by voiceless obstruents in case of -te and -tu, by another k in case of -ke and -ku in forming com-
pounds. Thus butu-gatu 'substance' changes to buto-gatu (further to buwagi by the later assimilation rule and so forth), iti-pon 'one alender object' to itipon (iti-pon), sakuku-kuo 'school' to sakuko, etc. This rule of vowel deletion is one which might play a role in borrowing consonant clusters. But since devoicing applies in a much wider context, I assume it is the one that is reversed in coping with consonant clusters of incoming words.

The next problem is which of the two high vowels ı and ı in a cluster as the epenthetic vowel. Man's experiment shows that the vowel ı is more readily devoiced than ı in the same environment. This correlates with the fact that ı is inherently shorter than ı in Japanese (Man, 23).

The high back vowel ı in Japanese is phonetically somewhat centralized with very little lip rounding. It has a quality best transcribed as ı. Since the high central vowel ı in some of Munda languages---one of Munda languages---is also quite short, (Staube, personal communication) the fact that ı is shorter than ı in Japanese might be related to its centralized quality or, to its lack of rounding.

In Papago, the high front and the high central vowels ı and ı are devoiced in much broader environment than the other three vowels, the high back ı, the low back ı and the low central ı (Saxton, 1963). In this language the back vowels ı and ı are rounded. Syncope of ı and ı also takes place between consonants at morpheme boundaries within words and at word boundaries where no pause phoneme is present. Though Saxton does not mention whether there is any difference in devoicing between ı and ı, Papago
agrees with Japanese in that the unrounded high front and central vowels are devoiced or deleted in certain environments.

Due to the fact that in Japanese ɯ is more readily devoiced or deleted than ɨ, ɯ is usually used to break up consonant clusters. Some examples:

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>sup</td>
<td>sōup'</td>
</tr>
<tr>
<td>plat</td>
<td>'plot'</td>
</tr>
<tr>
<td>klab</td>
<td>'club'</td>
</tr>
<tr>
<td>blu</td>
<td>'blue'</td>
</tr>
<tr>
<td>fork</td>
<td>'fork'</td>
</tr>
<tr>
<td>krin</td>
<td>'cream'</td>
</tr>
<tr>
<td>cong</td>
<td>'gog'</td>
</tr>
<tr>
<td>grill</td>
<td>'grill'</td>
</tr>
<tr>
<td>sayf</td>
<td>'knife'</td>
</tr>
<tr>
<td>sayf</td>
<td>'safe'</td>
</tr>
<tr>
<td>stowv</td>
<td>'stove'</td>
</tr>
<tr>
<td>kew</td>
<td>'curve'</td>
</tr>
<tr>
<td>banθ</td>
<td>'bath'</td>
</tr>
<tr>
<td>bell</td>
<td>'thrill'</td>
</tr>
<tr>
<td>blaus</td>
<td>'blouse'</td>
</tr>
<tr>
<td>tomast</td>
<td>'toaster'</td>
</tr>
<tr>
<td>miz</td>
<td>'cheese'</td>
</tr>
<tr>
<td>kem</td>
<td>'cash'</td>
</tr>
<tr>
<td>hem</td>
<td>'ham'</td>
</tr>
<tr>
<td>nilk</td>
<td>'milk'</td>
</tr>
</tbody>
</table>
After the palatalized velars either ŭ or ň is inserted. When ŭ is inserted the palatality of the velar stops in the original English word is not carried over to Japanese. That is, a plain velar is substituted for the palatalized one. As I discussed in the section on palatalization, the palatality of the palatalized velars before the low front vowel æ is sometimes neglected in borrowing; because of the subtlety of the palatalization in this environment, Japanese speakers often perceive fronted stops as plain velars. The same situation happens here. The palatalization of the velar stops in English is a mirror image rule. Each pointed out that in a mirror image rule the influence of the following segment is stronger than that of the preceding one. Thus, a velar which follows a front vowel is more weakly palatalized than is a velar which precedes a front vowel; and it may be that Japanese speakers often do not perceive the weaker palatality of the velar in this post-front vowel position. When they miss the palatality of a velar, they insert ŭ, and when they perceive it, ň; they insert ň. I will give some examples with the palatalized velars below.

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>milkʃ</td>
<td>'milk' → mikʃ</td>
</tr>
<tr>
<td>text</td>
<td>'text' → tekʃ</td>
</tr>
<tr>
<td>keyk</td>
<td>'cake' → keekʃ</td>
</tr>
<tr>
<td>stryk</td>
<td>'strike' → stróraikʃ</td>
</tr>
<tr>
<td>milk ʃeyk</td>
<td>'milkshake' → miruikʃ seekʃ</td>
</tr>
<tr>
<td>brek</td>
<td>'brake' → burrekʃ</td>
</tr>
</tbody>
</table>
kik 'kick' → kik γ
rik 'teak' → ingleton
pakj 'pack' → pak γ
lif 'big league' → bigagy riγγ
bagj 'bag' → bagγ
piγnjikj 'picnic' → pik γnijjk γ

It is also possible to insert γ after the palatalized velars and maintain palatality by reversing Rule 3, which I repeat here.

3. y ——— γ / Dent / [pals] ———

breyk 'broke' for example, could be analyzed as follows.

[breyk] ↑ bureγku ↑ bureγkyu ↑ /ureγkyu/ ↓

Rule 16 Rule 3 Rule 2 Rule 1
dureγkyu ↓ bureγku ↓ bureγk γ

Rule 3 Rule 15

In this analysis two segments, γ and γ, must be inserted where they do not exist in the original English word. The treatment in which γ is inserted is simpler.

[breyk] ↑ bureγk γ /ureγk γ/ ↓ bureγk ↓ bureγk γ

Rule 16 Rule 2 Rule 1 Rule 15

It might be supposed that bureγk 'break' suggests another principle in borrowing, that when two analyses are equally possible, the simpler one is chosen. But I think the reason why γ is chosen
after the palatalized velars lioe rather in the difference of phonetic quality between the palatalized velars before ı and those before the back vowels of Japanese. They are clear before ı and dark before the back vowels. The English palatalized velars are closer to those before ı in Japanese. The same is true of the palatal affricates. The English palatal affricates ʃ and ʒ are phonetically closer to those before ı of Japanese. On the other hand the palatal spirant ʃ in English is more similar to ɕ of Japanese before the back vowels, because it is dark. Thus ı is inserted after the palatal affricates and ɯ after the palatal spirant. Some examples with the palatal affricates and the palatal spirant will be given below.

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>dash</td>
<td>だー ず</td>
</tr>
<tr>
<td>cash</td>
<td>かー ず</td>
</tr>
<tr>
<td>squash</td>
<td>すー がも</td>
</tr>
<tr>
<td>fresh</td>
<td>フラ と</td>
</tr>
<tr>
<td>mushroom</td>
<td>ムッシュ ぐむ</td>
</tr>
<tr>
<td>match</td>
<td>マッチ ぐ</td>
</tr>
<tr>
<td>pinch</td>
<td>ピンチ ぐ</td>
</tr>
<tr>
<td>touch</td>
<td>とっ ぐ</td>
</tr>
<tr>
<td>sausage</td>
<td>サーキュ ぐ</td>
</tr>
<tr>
<td>page</td>
<td>ペー ぐ</td>
</tr>
<tr>
<td>sponge</td>
<td>スポン ぐ</td>
</tr>
</tbody>
</table>

The principle of the simpler analysis, suggested above is palausible, but there is no supporting evidence in Japanese for the more com-
PLICATED ANALYSIS IS ADAPTED IN CASE OF \( \mathfrak{E} \).

The vowel after \( \mathfrak{E} \) and \( \mathfrak{D} \) has to be mentioned next. After \( \mathfrak{E} \) and \( \mathfrak{D} \), neither \( \mathfrak{I} \) nor \( \mathfrak{U} \), but \( \mathfrak{A} \), is usually inserted. The underlying \( \mathfrak{I} \) and \( \mathfrak{D} \) are affricated before \( \mathfrak{U} \) and they are both palatalized and affricated before \( \mathfrak{I} \) in Japanese. The choice of \( \mathfrak{A} \) after them, therefore, seems designed to keep the processes of affrication and palatalization from applying to them. Thus the weaker version of Hyman's third principle seems to be necessary. Hyman's third principle predicts the change of the segment in incoming words which constitutes the environment of a rule of the borrowing language so that a segment is derived in the appropriate environment. It was pointed out in Section 1.1. that this principle is too powerful, in that it allows more than one substitution for the segment of the environment. But in the present case, the epenthetic vowel is chosen so that some processes will not apply to the preceding consonant and so that the quality of the consonant will be kept as close as possible to the original one. So I admit that something like Hyman's third principle is necessary in such cases, where new segments are created rather than substitutions made for existing segments. It still has to be explained why \( \mathfrak{A} \) rather than \( \mathfrak{E} \) or \( \mathfrak{I} \) is chosen. Man's experiment shows that \( \mathfrak{A} \) is the third shortest vowel, following \( \mathfrak{E} \) and \( \mathfrak{I} \). If it is the case that the shorter a vowel is, the easier it is for it to be devoiced or deleted, then \( \mathfrak{A} \) would follow \( \mathfrak{U} \) and \( \mathfrak{I} \) in its ability to be deleted in fast speech. It is usually the high vowels that are devoiced, but \( \mathfrak{A} \) could be devoiced in fast speech. And it would be devoiced more.
easily than \( e \) or \( a \). The following are some examples with \( a \) inserted after \( \ddot{a} \) and \( \dddot{a} \).

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>hit</td>
<td>'hit'</td>
</tr>
<tr>
<td>belt</td>
<td>'belt'</td>
</tr>
<tr>
<td>straw</td>
<td>'straw'</td>
</tr>
<tr>
<td>stryck</td>
<td>'strike'</td>
</tr>
<tr>
<td>band</td>
<td>'band'</td>
</tr>
<tr>
<td>bed</td>
<td>'bed'</td>
</tr>
<tr>
<td>drikk</td>
<td>'drink'</td>
</tr>
<tr>
<td>drihka</td>
<td>'dribble'</td>
</tr>
</tbody>
</table>

There are a few words where \( a \) is inserted and consequently \( \ddot{a} \) and \( \dddot{a} \) have undergone affrication.

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>twist</td>
<td>'twist'</td>
</tr>
<tr>
<td>settlement</td>
<td>'settlement'</td>
</tr>
<tr>
<td>shirt</td>
<td>'shirt'</td>
</tr>
<tr>
<td>cutlet</td>
<td>'cutlet'</td>
</tr>
<tr>
<td>drawrs</td>
<td>'drawers'</td>
</tr>
</tbody>
</table>

Finally, I would like to make one comment on the relation between devoicing and accent. The accented syllable is usually not devoiced (Han, 25), (that is, not deleted in fast speech). The loan words are generally accented on the syllable containing the third-from-last mora (Josephs, 1970). When this syllable contains the vowel inserted in the process of borrowing, the accent is often moved one mora to the left.
tion of the obstruent constitutes the case where Hyman's third principle works. The obstruent is inserted so that a syllable final obstruent is produced in the proper environment.

The problem here is that I cannot find any reason why this specific modification is employed in this case. Why, for example, is the syllable boundary not moved to the left of the sonorant, nativizing *ti-mu* as *ti-mu* (i.e., do people try to keep the closed syllable?) In the case of the liquid ɾ or the nasal m 15, I suppose that this is what has happened, because *gril* 'grill', *drill* 'drill', *ham* 'ham', *ham* 'jam', etc. come out as *puriru*, *poriru*, *hamu*, *ranu* and so forth. I will leave this essential question to further study and describe here some facts about gemination.

Japanese has four voiceless obstruents, namely ɾ, ɻ, h and g, which can occur in syllable-final position. In borrowing, the voiceless obstruents ɾ, ɻ and h occurring alone (not in a cluster) word-finally are always geminated 16, if the vowel preceding them is replaced by a single vowel.

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>slip</td>
<td>surippuf</td>
</tr>
<tr>
<td>step</td>
<td>su-teppuf</td>
</tr>
<tr>
<td>jet</td>
<td>jetto</td>
</tr>
<tr>
<td>bat</td>
<td>katto</td>
</tr>
<tr>
<td>back</td>
<td>bakkuf</td>
</tr>
<tr>
<td>book</td>
<td>bakkuf</td>
</tr>
</tbody>
</table>

15 In this position, however, is not geminated. I will come back to this later.
A single voiceless obstruent preceded by a double vowel is not geminated.

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>teep</td>
<td>teepy</td>
</tr>
<tr>
<td>zip</td>
<td>ٍةيِتُمُّ</td>
</tr>
<tr>
<td>koot</td>
<td>kooto</td>
</tr>
<tr>
<td>nit</td>
<td>ٍةيِتُمُّ</td>
</tr>
<tr>
<td>kayk</td>
<td>ٍةيِتُمُّ</td>
</tr>
<tr>
<td>spiky</td>
<td>ٍةيِتُمُّ</td>
</tr>
</tbody>
</table>

This must be because of another constraint on morpheme structure, that a double vowel followed by a double consonant is inadmissible.

In the case of a single voiceless obstruent which occurs medially, there are examples where it is geminated and others where it is not. I consider this situation to result from the fact that the phonetic syllable boundary in such words is not clear. Thus, for example, batz 'butter' could be syllabified either as ba-tz or as ba-tz. If a Japanese speaker perceives it as ba-tz, it is realized as bataz with a geminate, and if he perceives it as ba-tz, then it is bataz with a single ٍة. For this word, the latter is observed and contrasts with bataz 'batter', which is pronounced [battan].

With gemination:

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>zip</td>
<td>zippaa</td>
</tr>
<tr>
<td>flapz</td>
<td>zippaa</td>
</tr>
<tr>
<td>katx</td>
<td>kattan</td>
</tr>
<tr>
<td>English</td>
<td>Japanese</td>
</tr>
<tr>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>tapik</td>
<td>topiki'w</td>
</tr>
<tr>
<td>atakik</td>
<td>atakik'w</td>
</tr>
<tr>
<td>pokikot</td>
<td>pokotto</td>
</tr>
<tr>
<td>kuriketto</td>
<td></td>
</tr>
</tbody>
</table>

Let us examine now word-final single ضة. In this position,  ض is not geminated as the other voiceless obstruents are. As I mentioned in the section of vowel insertion,  ض constitutes the optimal environment for vowel devoicing. The high vowels, especially the high back ى, are usually deleted when they follow  ض and precede another voiceless consonant or word boundary in fast speech, and sometimes even at the normal speed of speech. The
vowel which is inserted after a in borrowing is u. Thus this vowel being deleted, the closed syllable is actually produced, without geminating a. The argument that word-final single a is not geminated due to the deletion of the following onsetsitic vowel u is supported by the fact that medial single a not followed by a deletable vowel is geminated, provided that the word is syllabified after a.

English | Japanese
---|---
`dressing` | `doressingsu`
`essence` | `essence`
`oscillograph` | `oscirographi`
`message` | `massage`

It is also geminated when it is followed by a liquid or a nasal, since the vowel inserted between them is usually not devoiced or deleted.

- `essence` | `essence`
- `lesson` | `resson`
- `hustle` | `hassuru`
- `whistle` | `hosuru`

But when a is followed by another voiceless obstruent, the inserted vowel is deleted, hence a is not geminated.

- `aspirin` | `aspirin`
- `test` | `testo`
- `last` | `rast`
- `system` | `cystem`
- `desk` | `desk`

---
musk 'mask' → masu
hulski 'whisky' → usuki

In relation to devoicing, the following phenomena are also observed. 'k' and 's' in the clusters ps and ks are geminated word-finally but not medially when they are followed by a vowel which is not subject to devoicing. Observe the following examples.

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>-ps, -ks</td>
<td>-ps, -ks</td>
</tr>
<tr>
<td>chips</td>
<td>kippus</td>
</tr>
<tr>
<td>socks</td>
<td>sokkus</td>
</tr>
<tr>
<td>miks</td>
<td>mikkus</td>
</tr>
<tr>
<td>index</td>
<td>indekkus</td>
</tr>
<tr>
<td>slack</td>
<td>ourakkus</td>
</tr>
<tr>
<td>rapscallion</td>
<td>rapscallion</td>
</tr>
<tr>
<td>yypsy</td>
<td>yipsi</td>
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<tr>
<td>teksan</td>
<td>tekasan</td>
</tr>
<tr>
<td>niksor</td>
<td>mikkasa</td>
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<tr>
<td>boxings</td>
<td>boxings</td>
</tr>
<tr>
<td>taaksi</td>
<td>taaksi</td>
</tr>
</tbody>
</table>

It was pointed out before that when two successive syllables are subject to devoicing, usually only one of them is devoiced, the choice of the syllable to be devoiced depending on the vowel affected, the consonants in the environment, and the accent. When ps or ks occurs word medially, the inserted vowel u is certainly devoiced, since the vowels in the adjacent syllables are not sub-
ject to devoicing. Moreover, the accent is never placed on this syllable. But when \( ny \) or \( nyu \) occurs word-finally, both the inserted \( u \) after \( n \) and the one between the stop and the sibilant are in the environment for devoicing. That is, two successive syllables become subject to devoicing. There is no difference in the vowel involved, both being \( u \). There is no difference in the accent either; both syllables are low-pitched, since loan words are accented on the syllable which includes the third-from-the-last mora.

Thus the consonant in the environment plays a crucial role for the choice of the syllable to be devoiced, and the vowel after \( n \) is devoiced, because it occurs in the most favorable environment for devoicing. Since the vowel after the stop is not devoiced, the stop must be geminated to preserve the original closed syllable.

When the clusters \( nt \), \( st \) and \( t \) occur at the end of a word, the \( n \), \( s \) and \( t \) are not geminated. The vowel inserted between the two obstruents is \( a \), and the one after \( n \) is \( o \). \( o \) is usually not subject to devoicing. Thus the vowel between the two obstruents is devoiced, and closed syllables are produced without gemination.

The above observations on devoicing and gemination raise a difficult problem. Let us consider the word \( bau \) 'bus' as an example. We assume that it is put in the lexicon as \( bau \) after the insertion of \( u \), in violation of Rule 13. Now since Rule 13 precedes Rule 16, we expect \( bauu \) to become \( bauu \) by Rule 13, even if \( u \) is going to be deleted by the later rule. The fact that the later deletion rule somehow prohibits the gemination produces a
serious problem of rule ordering and suggests the postulation of
a derivational constraint. That is, the gemination of the syl-
lable-final voiceless obstruent by the effect of Rules 9 through
12 must be blocked when the later rule deletes the apneustic
vowel after it. The gemination of consonants clearly requires
much more careful study.

2.4. Glides

In this final section I would like to discuss the glides,
which again raise some problems. It is a well-known fact that the
distribution of the glides ŭ and ŭ is quite limited in Japanese.
ŭ occurs only before ŭ and ŭ only before ŭ, ŭ, and ŭ. This re-
striction can be explained by postulating the following rules.

17. Glide Deletion

(A)  Glide [−back] −→ [−back] / Vowel

(B) ŭ Glide [−back] −→ ŭ / Vowel

That is, ŭ becomes ŭ before the front vowels, namely ŭ and ŭ by
Rule 17 (A), and then ŭ is lost before ŭ and ŭ before ŭ
and ŭ by Rule 17 (B).

Now I would like to consider how an English sequence Glide
+ Vowel is treated when it is introduced into Japanese. Since the
sequences ŭŭ, ŭû, ŭû, and ŭû are admissible phonological represen-
tations, they will be registered in the lexicon as they are.
<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>watt</td>
<td>watto</td>
</tr>
<tr>
<td>yarn</td>
<td>yano</td>
</tr>
<tr>
<td>York</td>
<td>yooka</td>
</tr>
<tr>
<td>youth</td>
<td>yumako</td>
</tr>
</tbody>
</table>

But as wi, we, xu, xu, vi, and ve are prohibited by Rule 17, and there is no rule which is dominated by it and can analyze these sequences, we assume that they are registered in the lexicon in violation of Rule 17 and are realized as i, e, u, ə, ɪ, and ə, respectively, by the application of Rule 17. But when we examine the loan words which originally had a GV sequence, we notice that the above prediction is not fully correct. Consider the following examples:

<table>
<thead>
<tr>
<th>English</th>
<th>Japanese</th>
</tr>
</thead>
<tbody>
<tr>
<td>wit</td>
<td>uitto</td>
</tr>
<tr>
<td>wet</td>
<td>uetto</td>
</tr>
<tr>
<td>wood</td>
<td>uddo</td>
</tr>
<tr>
<td>water</td>
<td>ucotso</td>
</tr>
<tr>
<td>yellow</td>
<td>ieroo</td>
</tr>
<tr>
<td>wink</td>
<td>urijok</td>
</tr>
<tr>
<td>wave</td>
<td>weebu</td>
</tr>
<tr>
<td>wool</td>
<td>uru</td>
</tr>
<tr>
<td>wake</td>
<td>uokok</td>
</tr>
<tr>
<td>new</td>
<td>ienak</td>
</tr>
<tr>
<td>year</td>
<td>iyan</td>
</tr>
<tr>
<td>yeset</td>
<td>iinkoto</td>
</tr>
</tbody>
</table>
As we expect, ɔ before ɛ and ɔ before ʊ are lost. But ɔ and ʊ in the other environments are not deleted but are vocalized as ɛ and ʊ respectively, contrary to our hypothesis. If our hypothesis is correct, there must be a rule in Japanese which derives ɔ from ʊ and ɔ from ɛ which can be used to analyze such sequences as ɔw, ɔn, ɔz and ɔs and vocalize the glides in them. There is one fact which suggests the existence of such a rule. That is the gap in the distribution of vowels: any sequence of two vowel in a single morpheme, except *in, *en, *un and *on. This gap in distribution, which looks accidental at first glance, will be explained by postulating a rule which converts ɛ and ɔ into ɔ, and ʊ and ɔ into ɔ before ɛ. And it also suggests some explanation for our present problem. That is, Japanese speakers reverse this rule by expanding its environment and vocalize the glides in ɔw, ɔn, ɔz and ɔs. The choice of ɛ and ʊ rather than ɔ and ɔ could be explained by their closeness to ɔ and ɔ. But the problem still remains. I assumed that the analysis of inadmissible foreign forms was carried out only when there are some rules in the native system which generate them, and which are dominated by the rules that prohibit them. But if there is such a rule ɔv / ɔv [syllabic] / ɔv [low] it is a dominant rule which constrains the underlying representation. It is not dominated by any other rule. I cannot explain why this dominant rule is reversed by expansion of its environment (even to a high vowel from a low vowel in case of ɔw) to vocalize the glides. Why doesn't Rule 17 apply to them? The process of the vocalization of the glides in certain positions is a problem I must leave for further study.
Footnotes

3 Since Japanese has only five vowels which are listed in footnote 1, each English vowel is replaced by one of them. Thus, I am not talking about substitution for vowels in any detail, I will list here typical substitutions which appear in examples from now on. The process of vowel substitution will be omitted as long as it doesn't affect the discussion.

\[
\begin{array}{c|c}
  \text{English} & \text{Japanese} \\
  i & u \\
  e & a \\
  o & a \\
  u & u \\
  u & a \\
\end{array}
\]

4 Disregard the segments in the examples which are not relevant to the present discussion. Some of them, such as vowels inserted word-finally and geminate consonants, will be discussed later. The slanted line on vowels denotes devoicing. Accent will not be indicated unless it is crucial to the discussion.

5 The capital N denotes a mora nasal which sounds like a continuation of the preceding vowel before a vowel or in word-final position. In other positions its point of articulation is assimilated to the following consonant.

6 Prokhnenko pointed out to me that the nasal stops are not palatalized before in British English, hence he suggested that the words with plain velar before might have come in from British English. But there are some words which were obviously borrowed from American English like 'snoopy' 'gasoline' where the velar are not palatalized in Japanese. There is still a possibility that such words were borrowed from a dialect in which the velars are not palatalized before.

7 The mora nasal is phonetically either a nasal or a nasalized segment colored by the surrounding segments. The mora obstruent is phonetically the gemination of the following obstruent. The following four voiceless obstruents can constitute the mora obstruent: N, T, K and G.

8. indicates a syllable boundary and * a mirror image rule.

9 This rule shown up in the derivation of a class of verb.

\[
\begin{array}{c|c|c|c}
  \text{Rule 10} & \text{Rule 11} & \text{Rule 13} \\
  yob-ta & yob-ta & yombata \\
  yom-ta & yom-ta & yomtata \\
\end{array}
\]

(yonda). The interrelation of voiced obstruents and nasality is also observed in some dialects where word-medial voiced obstruent is pre-nasalized.
Notice here that the vowels of two successive syllables are deleted. This is observed only in the environment of fricatives.

The accented syllable is the syllable which contains the last high-pitched mora. Given its location, one can predict the pitch of all moras of the word. Cf. McCawley, 133.

Josephs (1970) gives a number of rules which supplement the basic accentuation rule which places the accent on the third-from-last mora, but a number of these could be explained by the fact that the mora which is created by the vowel insertion is not accented.

The bar indicates the accented syllable nucleus.

Kunihiro (1963) discusses this idea in a slightly different manner.

The mora nasal is substituted for ʰ and ʷ, hence the original closed syllable is kept. Word-final single ʰ is vocalized.

There are a few exceptions in case of ʰ. When ʷ rather than ʰ is inserted after ʰ and the ʰ is consequently affricated, it is not geminized. baître 'bucket' → boket'au

Remember "devoicing" implies deletion in fast speech.

This is the same as Rule 4 in Section 2.1.
3. Concluding Remarks

In this thesis I have discussed how certain phonological processes of Japanese work in the analysis and realization of borrowed English words. The number of processes treated here is very limited, and many of others must be left for future study.

Phonological theory must provide an apparatus to describe the process of adapting foreign words, since they are treated almost uniformly by the speakers of a language when they are modified to conform to the native system. I consider ability to nativize loan words to constitute a part of their competence.

One of the problems which is raised in relation to borrowing concerns perception. In this thesis I assumed that people can perceive any foreign sound, but I think this assumption is obviously wrong in certain cases. It is very difficult for native speakers of Japanese to hear the difference between ı and ɔ of English, whereas we can hear the difference between ʊ and ʌ, although it is hard for Japanese speakers to distinguish them in production. It seems to me that some rules control perception more than others, though I don't know how to characterize such rules at present.

That the glides ɔ and ʊ are lost only before ı and ʊ respectively, but are vocalized in other positions, appears to have something to do with perception. It is very difficult for Japanese to hear a ɔ before ı or a ʊ before ʊ. Japanese speakers can perceive the glides in other positions, though they can't produce them correctly. Here we have a significant problem which needs much more research.


Kunihiro, Tetsuya. (1963), "Onrai Yoooki ni tsuite — Nichi-ku Onrai Taisai no Hakkaku (On orthography of Loan Words — The comparison of the Phonemic systems of Japanese and En-


Umezaki, Minoru. (1965), *Shinmei Siten* (J. Dictionary of Loan Words), Tokyo, Kobundo.

Yamaki, Genkuroo. (1964), "Nihon de Gaigairo (Loan Words in Japan), Tokyo, Yumemishoten."