On some phonological properties of the mimetic vocabulary component of Japanese

Philip Spaelti

Abstract

Japanese is noted for having a structured lexicon with well defined sub-sections. These sections are etymological in origin, but continue to manifest themselves through their phonological properties. Itô and Mester (1999, 2008) have shown that several of these sub-sections, including the oldest native vocabulary, the Sino-Japanese, as well as more recent loanwords, obey a consistent regularity. This paper considers a further sub-section, the expressive mimetic vocabulary. A database was constructed in order to get a better understanding of the phonological constraints on mimetics. Using this database it can be shown that a restriction on non-geminate *p* which is active in the general phonology of Japanese and that on its face seems completely disregarded by the mimetic component, nevertheless has a significant effect.

1.   Introduction

1.1   Goal of the paper

The Goal of this research is to investigate the phonological properties of the mimetic vocabulary component of the Japanese lexicon. Research on the phonology of Japanese has identified different sub-components of the lexicon, which are identified among other things by their phonological properties. As one recent example, Itô and Mester in an ongoing series of papers (Itô & Mester, 1999, 2008) in the framework of Optimality Theory have demonstrated that the different behaviors of identifiable sub-sections of the Japanese lexicon can be accounted for by the general architecture of Optimality Theory. Essentially they argue that the division into different lexical *strata* falls out directly from OT's conception of the grammar as a set of ranked violable constraints. It is against the background of such discussion that this paper seeks to investigate rigorously the phonological properties of one such sub-section, namely that of *Mimetic vocabulary*.

A secondary goal is to make the assumptions behind this investigation accessible and reproducible. To this end, the data on which this investigation is based, and the scripts and algorithms used to evaluate the data have been posted and are being maintained at `http://ksw.shoin.ac.jp/~spaelti/Mimetics/`. While rigor in investigation should be a matter of course, this is made more so by the problem of defining the data under study. Consider for example Hamano (1999) who in an attempt to side-step the question "What is a mimetic form?" limits her object of study to those forms which begin in 'p'. Since the goal here will be

to investigate the phonological properties of mimetics, defining mimetics in terms of phono-logical properties runs the danger of being circular. Moreover since the goal is to investigate whether those properties defining mimetic forms are indeed typical, it becomes imperative to lay out the assumptions on which the definition is based. In absence of a satisfying non-arbitrary definition, I will settle instead for explicitness.

1. 2   Japanese vocabulary strata

The Japanese lexicon can be divided into several sub-sections called STRATA. There are three main strata, which can be labelled Native ('Yamato'), Sino-Japanese, and Foreign.

(1)   Division of the Japanese Lexicon into strata (e.g. (McCawley, 1968; Itô & Mester, 1999), examples from Itô and Mester (2008))

Native ('Yamato')	Sino-Japanese	Forein
kotoba	geŋ-go-gaku	raŋgeeʤ-i-raboratorii
oto	on-in-ron	san-tora
hanaʃi	den-wa	terefon-kaado
kuruma	ʤi-doo-ʃa	pato-kaa

This division is obvious not only to specialists, at least in part, since it is also generally recognized by the orthography of Japanese, with the native words written in a mixture of Kana and Kanji, the Sino-Japanese written entirely in Kanji, and the foreign words written in Katakana. In addition the difference between native and Sino-Japanese is made explicit by the use of the terms *Kun-yomi* (lit. 'national'-reading) for native words and *On-yomi* (sound-reading) for Sino-Japanese words. In addition to these strata, there is another large group of forms in the lexicon which stand apart. I will refer to these as MIMETICS. Some typical examples are shown below, in (3).

(2)   シャキシャキレタス   フンワリオムレツ   カリッとベーコン
         Syaki-syaki retasu   funwari omuretsu   karitto beekon

(3)   **Onomatopoetic/Mimetic**
      pera-pera
      ʃikkari
   suu' (to)
      tʃintʃirorin

Mimetics include two different types of items. The first type are straightforwardly ono-matopoeia, i.e., items that are *sound-imitating*. These are items which attempt to reproduce natural sounds using the phonological resources of the language. A second type includes *sound-symbolic* items. These are items that use speech sounds to convey various feelings or mental states that are not themselves sounds. In the following discussion, I will refer to both types of items together as mimetics. The following discussion will treat them as a single class, which is defensible since they generally have the same prosodic shapes and have many over-lapping aspects. However a more careful investigation will need to consider to what extent each type has distinct phonological properties.[1]

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[1]For example Haruo Kubozono (pc.) has pointed to me that the two types differ with respect to the distribution of voiced sounds.
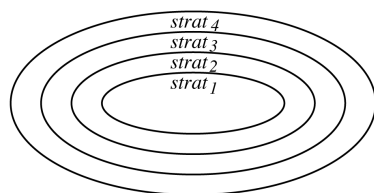
2.   The Core/Periphery model of the Lexicon

The strata of the Japanese Lexicon are primarily a result of the historic development of the language. Successive interaction of Japanese with first Chinese, and then European languages—especially English—has lead to a large infusion of words with characteristics that set them apart from other words in the Lexicon. A standard approach to strata might treat these simply as unstructured classes. According to this model each word is assigned to one, and only one, stratum. The resulting strata form a partition of the Lexicon. This is shown in (4).

(4)   *Partition Model of the Lexicon*
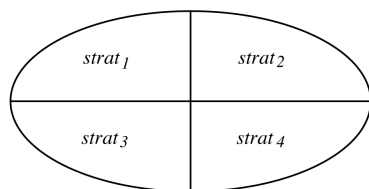
While the partition model recognizes the difference between strata, all strata are essentially equal, and the model is symmetrical. An alternative is a model which takes an asymmetrical view. Mirroring the historical development, the native lexicon forms the 'core' and borrowing adds successive layers to this core, leading to a concentric model.

(5)   *Concentric Model of the Lexicon (Itô & Mester, 1999)*

This proposal which Itô and Mester (1999) call the Core-Periphery model has a number of significant differences. The hierarchical structure of the core-periphery model means that sub-sets of the lexicon are only defined by how native they are. The 'higher' strata are only defined in terms of set complementation. Thus in the case of Japanese, only the Yamato stratum represents a true sub-set of the lexicon. The Sino- Japanese stratum does not have a representation in the core-periphery model, only the sub-lexicon which includes all items are at least as nativized as the Sino-Japanese vocabulary. This sub-lexicon includes the Yamato vocabulary as well.

Another feature of this system is its gradual structure. There are no discrete strata, only degrees of assimilatedness. An example of this is discussed in Itô and Mester (2008). One typical defining characteristic of the Yamato stratum is rendaku—also known as sequential voicing—a change in voicing that occurs with initial obstruents when a word is the second member of a compound. While this alternation is generally restricted to lexical items of the Yamato stratum, a significant number of items that are historically Sino-Japanese nevertheless show the effect as well. A partition model is forced to recategorize such items as Yamato, or leave them as exceptions. The core-periphery model will instead treat these as cases of items with different degrees of nativization.

2. 1   Ranking Consistency

One important advantage of the core-periphery model is that it has a natural interpretation in terms of the theory of Optimality Theory Prince and Smolensky (2004) (henceforth OT). In OT the grammar of a language is the result of set of ranked constraints. The crucial ranking which defines the grammar of any particular language is the following.

(6)   Markedness >> Faithfulness

This ranking defines the language. Any forms which obey this ranking are 'in the language,' while those forms which do not will be perceived to some degree as 'outside the language,' i.e., they are marked.

For an actual language the markedness constraints will not consist of only one constraint, but rather will include a number of constraints which are themselves ranked. The placement of faithfulness within this ranking will define the (native) grammar. When foreign words are added to the language, the words can be adjusted to fit the strictures of the language, or else Faithfulness can be RE-RANKED[2] to accommodate the new items. It is this re-ranking that gives rise to the core-periphery structure of the lexicon.

We can illustrate how this works with the following example, simplified from Itô and Mester (1999). Among the constraints which define Japanese phonology we have the constraints listed in (7). SyllStruc is used here as an abbreviation for the group of constraints that define Japanese syllable structure. These strictures are absolute, and borrowed words are always made to accord with them. For instance all Japanese words must end in a vowel. In addition to the syllable structure constraints, other constraints characterize the phonology as well. We give here two examples: a restriction against non-geminate 'p' and a constraint that requires NC clusters to be voiced.

(7)   Phonological constraints of Japanese

    a. SyllStruc: syllable structure constraints
    b. NoVoicelessLab (No-P):   "No singleton-*p*"
    c. NoNas—Voiceless (No-NT): "Post-nasal obstruents must be voiced" *nt, *mp, *ŋk

While all of the constraints in (7) are fully obeyed in the native vocabulary, their effects differ in the phonology of Japanese as a whole, a fact that can be captured by ranking them as shown in (8).

(8)   **Constraint hierarchy for Japanese Lexicon**
      SyllStruc >> No-P >> No-NT

Unlike the native vocabulary, Sino-Japanese contains significant numbers of items with NC clusters which do not accord with the NoNas-Voiceless restriction, while otherwise still obeying the bulk of constraints of Japanese phonology. In particular Sino-Japanese vocabulary strictly obey the constraint agains non-geminate *p*. These items can be accomodated by re-ranking the faithfulness constraints with respect to the hierarchy in (7).

Finally more recent loanwords, in contrast to both native and Sino-Japanese items, include many items with non-geminate *p*. This signifies a further re-ranking of the faithfulness constraints. A summary of the situation is shown in (9).

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[2]I use the term re-ranking here without prejudice. See Itô and Mester (2008, section 3.1.) for a discussion of the issue of indexed faithfulness vs. co-grammars.

(9)   SyllStruc
       | <<   Faith "Foreign"
       No-P
       | <<   Faith "Sino-Japanese"
       No-NT
       | <<   Faith "Native (Yamato)"

(10)   **Ranking Consistency** (informally)
       Within a language, only faithfulness constraints can be 're-ranked'.

A potential problem which arises in the case of Japanese are the mimetics. Unlike in native words and Sino-Japanese the *p*-sound is common in mimetics. This would seem to make mimetics *less core* than the Sino-Japanese lexical items.

(11)   **non-geminate 'p' restriction** (*single-*p*)

       a.   native   *yes*
       b.   Sino-Japanese   *yes*   ippun 'one minute'
                                      nihun 'two minutes' (*nipun)
       c.   Mimetic   *no*   pikapika 'shiny'

However aside from this, mimetics have much more in common with the native vocabulary, and they generally obey the more tight restrictions that this entails. As one example, they actively obey the restriction on palatalized *r*, in contrast with the Sino-Japanese vocabulary.

(12)   **Palatalized 'r' restriction** (*r^j)

       a.   native   *yes*
       b.   Sino-Japanese   *no*   r^{j}okoo 'travel'
       c.   Mimetic   *yes*   k^{j}orok^{j}oro 'darting around in circles' (*kor^{j}okor^{j}o)

This would seem to represent a serious obstacle for the core-periphery model. In the following I will reconsider in more detail the phonology of the mimetic vocabulary in order to specify more clearly the restrictions.

3.   The mimetic vocabulary database

3.1   Mimetic vocabulary

Japanese has as part of its vocabulary a significant stock of sound imitating and sound symbolic phrases that we are calling Mimetics. These forms stand apart from regular vocabulary in certain ways. For one thing the sound-meaning relationship is often seen as less arbitrary. Grammtically speaking Mimetics are 'quotative' adverbs and must generally be used with a following '-to' (the quotative particle) or '-ni', though certain patterns can leave out the particle.

STRUCTURE OF MIMETICS

Mimetics generally have recognizable prosodic shapes. We can identify several main patterns, as well as a number of lesser patterns. The most commonly used patterns are four mora in length, examples of which are given below.

(13)   **Reduplicated**
       kune=kune

turu=turu
ge=ge
baN=baN

(14) **'-ri' pattern**
nikori
boNyari
noNbiri
baQtiri

(15) **Basic**
gabu
toN
poi

(16) **Basic pattern with a glottal catch or a nasal ending**

dosiQ   dosiN
betaQ   betaN

Probably the single most 'iconic' shape for Mimetics is the reduplicated form, seen in (13). Reduplication is common with onomatopoeic expressions in many languages, including English. Another very common pattern is one where the Mimetic form ends in *-ri*. This *-ri* pattern—where the part preceding the *-ri* is always two syllabes in length—commonly has the middle consonant 'intensified,' either in the form of a geminate or with a nasal cluster. Another common pattern is a simple one or two (rarely more) syllable pattern, seen in (15). This last pattern is most frequently used with either a glottal catch or a nasal ending.

    In addition there are a few less common patterns:

(17)   triplication   gara=gara=gara

(18)   dissimilating   gataN=gotoN
                         metya=kutya

(19)   irregular   hoNwaka
                     kiNkirakiN
                     peQtaNko
                     kokekoQko-

Among these the most interesting is a type of pattern similar to the kind known in English (e.g. *flip-flop*), a reduplicated pattern, without complete identity between the two halves, seen in (18). In such cases either the vowels are dissimlar, typically with a *a-o* or *e-o* pattern, or alternately one of the syllables is matched with a completely different syllable, for example here *me* is matched with *ku*. This type of mismatch commonly involves labial sounds among the mismatched segments.

COMPOSITIONALITY
Many mimetics, but by no means all have a 'two syllable/two mora' theme. For example most reduplicated mimetics are the four-mora reduplication of a two-mora base. Similarly the *-ri* pattern, as already mentioned, is always of the form two syllables + *ri*. This two syllable/mora core can be considered to be a stem. Many mimetics come in families with related forms of different types, all built from the same basic stem.

(20)   *Mimetic family*
       beta=beta
       betaN
       betaQ
       betari
       beQtari
       betyaQ
       betya=betya
       betya=kutya

Seen this way mimetics could be considered compositional, that is actual mimetic forms are the result of either reduplication or the the addition of suffixes (-*ri*, -N, -Q) to a basic stem. Similarly it has long been noted (see for example Chang (1990) for discussion) that mimetics that are based on similar stems have related semantics, though the identification of parts with specific semantic values is controversial.

In keeping with the compositional structure of mimetics, actual mimetic forms can serve as input for new pattern formation. Thus a -*ri*, or -Q form can serve as input for reduplication; a reduplicated form, or a can serve as input for a -N pattern, etc. In this there are only a few limitations. The most obvious are those of the Japanese syllable canon (which would restrict iterative addition of -Q and -N).

3. 2   The Database

In order to investigate the distributions of sounds found among mimetics a databse was constructed, using the following method. Three different mimetic dictionaries were chosen. All forms from each of the three dictionaries were entered into a text file. The transcriptions were regularized. The transcription chosen was a modified form of Kunreishiki, where the the glottal catch and the onset of a geminate are represented with Q, and the moraic nasal with N. Since the mimetics are generally conservative in their sound structure issues such as the *h/f* contrast are not problematic (Vance, 2008).

The dictionaries used and the number of forms from each is provided in (21). Unsurprisingly there was a significant amount of overlap between the forms in the three collections.

(21)   **Database info**

藤田孝 and 秋保慎 (1984)	2267
Chang (1990)	1160
Kakehi, Tamori, and Schourup (1996)	1606
Total number of unique forms	2515

The forms extracted from these dictionaries were evaluated according to the patterns contained. The pattern was 'undone,' and the resulting 'stem' kept for further evaluation. The process was repeated until the form could not be evaluated further resulting in the 'bare stem' of the mimetic forms. Example (22) shows the resulting stem types for the forms in the database.

(22)   **Breakdown of database forms according to stem types**

Disyllabic (CVCV, VCV)	1790
Monosyllabic	614
Irregular	206

As seen here, stems consisting of two monomoraic (CV) syllables are by far the most common type. However monosyllabic stems are also frequent. In addition there are also a number of 'irregular' stems, with three or more syllables.

4.   Does the *p restriction hold in the mimetic lexicon?

A central question of interest for this investigation was the issue of the single-*p* restriction in the mimetic lexicon. Mimetic forms with *p* are extremly common, a fact well borne out by this investigation. As such the title of this section would seem to be a non-sequitur. In fact, however, while forms with stems with an initial *p*, such as *pika-pika*, built from a stem *pika*, are common, forms with a medial *p*, such as hypothetical **kipa-kipa*, from a putative stem *kipa*, are all but non-existant.

In order to further investigate this question, attention was restricted to stems of the prototypical two syllable type. Since monoyllables do not have a medial consonant they are of course irrelevant. Irregular stems pose a different set of issues, and were thus excluded from this study.

The breakdown of the stems according to their initial (C_1) and medial (C_2) consonants is provided in the table in (23).

(23)   **Total count of all forms with medial C**

| C_1\C_2	p	t	k	s	b	d	g	z	m	n	w	y	r	h	
p		98	72	39							1	3	47		260
t	10		37		13	1	2	1	5			3	49		121
k	8	76	15	32	4	2	1		2	6	2	1	60	1	210
s	16	9	34	1	7		3	1	3	8	3	4	35		124
b		66	42	44				1			1	5	52		211
d	2	15	28	23	16	4	2	1			1	3	19		114
g	4	69	37	41	22	2		9	3	9	6	1	54	3	260
z	3	5	29	8	30	4	3		2	1	11		35		131
h		13	23	8		1	1		2	7	12	7	28		102
m		15	14	17			4	11		2	3	3	10		79
n	2	15	16	11	3				5			5	20		77
w			1	3							1	2	2	1	10
y		3	4	5	1						1		13		27
r													1		1
–	2	7	6	5	2	2	3	7	5	1	4	2	6	11	63
Total:	47	391	358	237	98	16	19	31	27	35	45	39	431	16	1790

Initial consonants (C_1) are listed in the rows, while medial consonants (C_2) are given in the columns. The table counts stem tokens. For example the forms *bata-bata* and *battari* both have the same stem bata, which is thus counted twice.

There are a number of notable asymmetries. For instance *r* is only possible as a medial consonant, in which case it is extremely frequent. On the other hand *h* is used medially, only for sound imitative mimetics such as laughs (わはは) and coughs (ごほごほ), and is otherwise limited to initial position.

The graph in (24) summarizes the distribution of initial consonants.

(24) **Initial C**

Total	p	t	k	s	b	d	g	z	h	m	n	w	y	r	–
	260	121	210	124	211	114	260	131	102	79	77	10	27	1	63
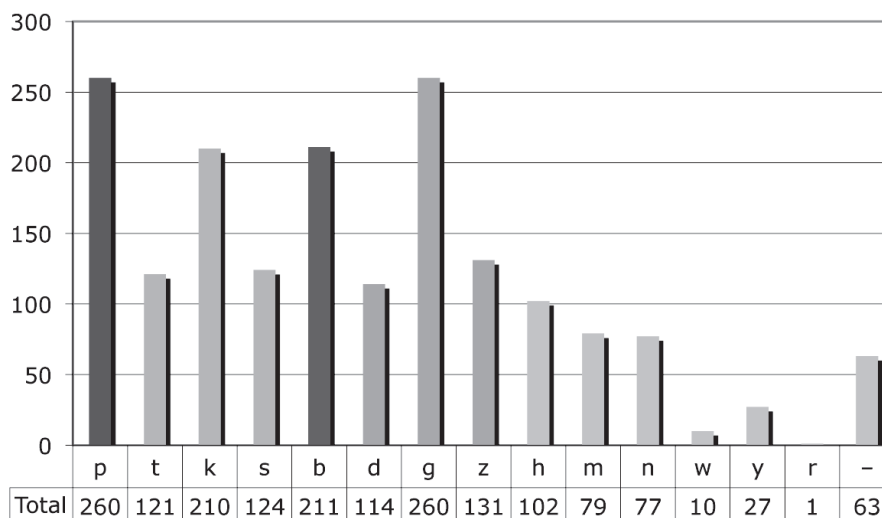
As the graph shows both labial stops are extremely frequent as initial consonants, and *p* is in fact the most frequent stem initial consonant. This situation constrasts strikingly with the situation in medial consonants shown in (25).

(25) **Medial C**

C2	p	t	k	s	b	d	g	z	m	n	w	y	r	h
	47	391	358	237	98	16	19	31	27	35	45	39	431	16
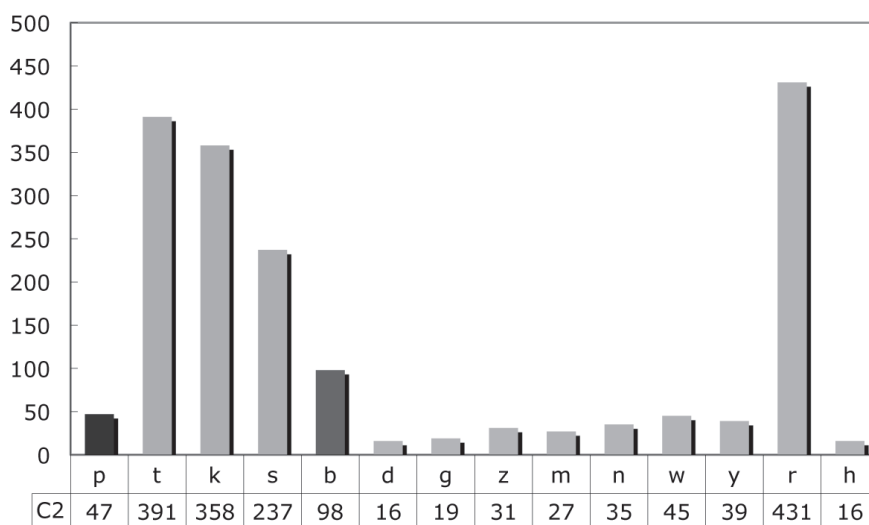
As can be seen here, aside from the very frequent *r*, stem medial consonants are much more heavily biased towards voiceless stops, while voiced stops and sonorants are used sparingly. And again the distribution of labial stops is noteworthy. In contrast to other voiceless stops, the occurrence of *p* as a stem medial consonant is extremely restricted. In a surprising contrast the voiced labial stop *b* is multiple times more frequent than other voiced stops.

Of course as the graph indicates stem medial *p* does occur. It should however be remembered, that the graph represents a generalization across stems, and that stems are something of an abstraction. What's more is that the restiction investigated here is one on singleton *p*. But in a mimetic form such as *sappari*, while there is a medial *p*, the *p* is a geminate. In fact in a majority of the forms with a stem medial *p* the medial *p* is geminate, and this is again in contrast to the other voiceless obstruents.

(26)   **Forms with non-geminate medial C**

        p   47   15   31.9%
        t   391   324   82.9%
        k   358   276   77.1%
        s   237   198   83.5%

As shown by the numbers in (26), while most voiceless obstruents used in medial position are commonly non-geminate, the voiceless labial occurs as a geminate in well over half of the forms. It thus seems that even in mimetics, for *p* the geminate form is the norm.

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Author's E-mail Address: `spaelti@shoin.ac.jp`
Author's web site: `http://sils.shoin.ac.jp/~spaelti/`