

Syllable intrusion in Japanese puns, *dajare*

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1. Introduction

This paper reports a corpus-based study of a particular pattern in Japanese puns. In Japanese puns, speakers pair two similar or identical phrases to create an expression. In a series of recent projects, we have been analyzing Japanese puns—known as *dajare*—to investigate linguistic knowledge of similarity (see Kawahara 2009a and Kawahara’s website for overviews). This paper reports on a subproject of this larger enterprise, which specifically looks at cases in which one phrase contains an internal extra internal syllable, which does not appear in the other corresponding phrase. The first aim of this paper is descriptive: we investigate what kinds of syllables Japanese speakers allow to intrude in this way when creating puns. Second, through the analysis of such patterns, we argue that in composing puns, Japanese speakers define the measure of similarity of a given syllable with \emptyset based on various phonetic and psycholinguistic considerations. Finally, we point out parallels between pun pairing patterns and some sound patterns in natural languages.

In analyzing Japanese pun patterns, we have been testing two general theses about linguistic organization proposed by Steriade (2001/2008), which are shown in (1) and (2). (See Kawahara 2009b for a review of a recent body of work building on (1) and (2).)

- (1) Speakers attempt to minimize the differences between corresponding segments in verbal art patterns and in phonology.
- (2) The measure of similarity has psychoacoustic or perceptual grounds.

Steriade (2003) has supported these theses by analyzing Romanian half rhymes. Building on her work, our previous studies also have supported these theses through the analysis of half rhymes in Japanese rap lyrics (Kawahara 2007) and consonant mismatches and vocalic mismatches in Japanese imperfect puns (Kawahara and Shinohara 2009, 2010). In this paper, we further support these theses by analyzing syllable intrusion in Japanese puns.

Specifically, in this paper we argue that (i) speakers minimize the differences between corresponding segments in the syllable intrusion patterns, (ii) the measure of similarity has psychoacoustic or perceptual grounds, (iii) the psycholinguistic non-salience of affixal elements may also affect pun pairing patterns, and (iv) we find parallels between pun pairing patterns and phonological patterns in natural languages.

2. Background: Japanese puns (*dajare*)

In composing puns (*dajare*), Japanese speakers create expressions using identical or similar sounding words/phrases. The correspondence between the two elements in Japanese puns can be perfect or imperfect. In perfect puns, an identical sound string appears twice. An example appears in (3), in which the same sound sequence [arumikan] is repeated twice. (In this paper, we represent Japanese sentences with *romaji*, the Romanization of Japanese, for the sake of exposition.)

- (3) arumikan-no ue-ni aru mikan
aluminum.can-GEN top-LOC exist orange
‘An orange on an aluminum can.’

Imperfect puns, on the other hand, involve similar, but not identical, sound sequences, as in (4)-(6), where

underlining indicates the corresponding similar sound sequences, and bold face indicates mismatched sounds. The example in (4) includes a consonantal mismatch, where [m] and [n] are a pair of different, but similar, sounds (Kawahara and Shinohara 2009). The example in (5) involves a vocalic mismatch between [i] and [e] (Kawahara and Shinohara 2010). The example in (6) has an internal extra syllable [ku] in the second word, which is not included in the first word that stands in correspondence.

- (4) okosama-o okosanaide
 kid-ACC don't.wake.up
 'Don't wake up the kid.'
- (5) Haideggaa-no zense-wa hae dek-ka?
 Heidegger-GEN previous.life-TOP fly be-Q
 'Was Heidegger a fly in his previous life?'
- (6) Shopan-no shokupan.
 Chopin-GEN bread
 'Chopin's bread.'

In all the cases in (3)-(6), the two words/phrases in correspondence are overtly expressed. In addition to these examples, we find puns where one of the phrases is not overtly expressed, as in (7).

- (7) matcho-ga uri-no shoojo
 macho-NOM specialty-GEN girl
 'A girl who is proud of being a macho.'

There are not two corresponding words or phrases in (7). Instead, the entirety of (7) implicitly corresponds with the name of a story *Matchi-uri-no shoojo* 'Little Match Girl'. In our previous studies as well as the current study, we have set aside these cases in which only one element is overtly expressed, although we do not wish to imply that the patterns like (7) are not interesting to analyze.

In summary, there are several types of Japanese puns.¹ Building on our previous work (Kawahara and Shinohara 2009, 2010), the present paper focuses on the type illustrated by the example in (6), that is, the cases of syllable intrusion. Some other examples of syllable intrusion are shown in (8)-(9).

- (8) bundoki-o bundottoki.
 protractor-ACC take.away
 'Take away the protractor (from him).'
- (9) ribaundo shinai yooni ribaa-de undoo.
 rebound do.not so.that river-LOC exercise
 'I will exercise in the river so that I won't gain weight again.'

3. Goals of the study

Recall that our general enterprise aims to test the theses in (1) and (2) by analyzing Japanese puns. These theses are general linguistic principles, and we can recast them more specifically as (10) and (11), as applied to puns.

- (10) When pun-makers compose puns, they attempt to minimize the differences between corresponding elements in puns.
- (11) The measure of similarity between corresponding elements has psychoacoustic or perceptual grounds.

Our previous studies on Japanese puns have supported (10) and (11) (Kawahara and Shinohara 2009, 2010). In this study, we further test these theses by studying the cases of syllable intrusion in Japanese imperfect puns. We observe that when syllables are intruded, speakers prefer those that are similar to \emptyset ; in other words, the more similar to \emptyset an intruding syllable is, the more frequently it is observed. We thus argue for the following three points:

- (12) Speakers minimize the differences between corresponding segments in the syllable intrusion pattern: specifically, they minimize the differences between the intruded syllables and \emptyset .
- (13) The measure of similarity has psychoacoustic or perceptual grounds.
- (14) The psycholinguistic non-salience of affixal elements may affect pun pairing.

4. Method

First to achieve our descriptive goal—to investigate what kinds of syllable intrusion patterns Japanese speakers allow in composing puns—we analyzed puns with syllable intrusion: puns in which one phrase contains an extra internal syllable (intruding syllable) which is not contained in the other phrase. We collected examples from 17 summary websites of *dajare* (see appendix 1), and elicited examples from several native speakers by asking them to compose puns out of the blue. We found about 3,200 examples with several types of mismatches (consonantal mismatch, vocalic mismatch, syllable intrusion, metathesis, and others). Among them, we selected examples of syllable intrusion where one phrase internally contains an extra syllable that is not included in the other phrase. We did not include cases in which one phrase is a subset of the other phrase, e.g. *buta-ga butareta* ‘A pig was hit’, because these cases may involve pun domains which do not simply coincide with word boundaries. We also excluded examples where an intruded vowel forms a diphthong with the preceding vowel or is identical to the preceding vowel with no intervening consonant. This process resulted in a total of 149 examples.

Based on the 149 examples, we counted the number of each vowel [a], [i], [u], [e], [o] to investigate which vowel is most frequently intruded and compared the intruded vowel with adjacent vowels. We analyzed only vowels, not consonants, because vowels are (psycho-)acoustically more salient than consonants and because the number of samples we obtained was not large enough to analyze consonants. Japanese has only five vowels but many more consonants—testing the behavior of intruding consonants would require a bigger database; however, see Kawahara and Shinohara 2009: section 4.4 for discussion of consonants that are likely to correspond with \emptyset in Japanese puns.

To calculate the reliability of our estimates, because the distributions of these vowels are unknown, we calculated 95% bootstrap intervals using a bootstrap method (Efron and Tibshirani 1993). We created 50,000 samples using resampling with replacement, and calculated 95% percentiles over those 50,000 samples. The simulation was done using R (R Development Core Team 1993-2010): the code is illustrated in appendix 2.

5. Results

We found three major patterns of syllable intrusion patterns: [1] copy vowel intrusion, [2] high vowel intrusion, and [3] affixal vowel intrusion. First, about 60% (89 out of 149) of the intruded vowels are copies from one or both of the adjacent syllables. If copied, all kinds of vowels are allowed, as in (15)-(19). The preceding vowels are copied in (15)-(17), and the following vowel is copied in (18). In (19), the intruded

vowel comes from either the preceding or the following vowel.ⁱⁱ

(15) kanashibari-no kanashii hibari
be.bound.hand.and.foot -GEN sad lark
'A sad lark is bound hand and foot.'

(16) Asaka Mitsuyo-ni asa kamitsuku-yo
Asaka Mitsuyo-LOC morning bite-PARTICLE
'I bite Mitsuyo Asaka in the morning.'

(17) esukareetaa-de eree tsukare-ta
escalator-LOC very tired-PAST
'I got very tired on the escalator.'

(18) Tomakomai-ni-wa tomato ko-mai
Tomakomai-LOC-TOP tomato come-not
'Tomatoes will not come to Tomakomai.'

(19) azarashi-ga amazarashi
seal-NOM rain.exposed
'The seal is left in the rain.'

Second, if not copied, high vowels /i, u/ often appear in intruded syllables (46 out of 60 non-copy vowels; 76.7%), as in (20)-(21).

(20) Shootokutaishi-o shoodoku shitai-shi
Shootokutaishi-ACC sterilize want.to.do-PARTICLE
'I want to sterilize Shootokutaishi.'

(21) Shopan-no shokupan.
Chopin-GEN bread
'Chopin's bread.'

Finally, if the intruding vowels are neither copied nor high, then they must usually be affixal vowels (11 out of 14 non-copy, non-high vowels; 78.6%). In (22)-(24), *-de* and *-da* are all affixes.

(22) ribaundo shinai yooni ribaa-de undoo
rebound do.not so.that river-LOC exercise
'I will exercise in the river so that I won't gain weight again.'

(23) Kinshichoo-e iku-no-wa kinshi-de choo
Kinshichoo-to go-GEN-TOP prohibited-CONJ PARTICLE
'It is prohibited to go to Kinshichoo.'

(24) Koronbusu mite koron-da busu
Columbus see fall.down-PAST ugly.girl

‘An ugly girl who saw Columbus and fell down.’

Table 1 shows the counts of these three types of vowels (copy, high, and affixal).

Table 1: The distribution of intruded vowels. The instances of affixes are subsets of non-high, non-copy vowels.

	[u]	[i]	[o]	[e]	[a]	Total
Copy	19	16	22	3	29	89
Non-copy	26	20	4	8	2	60
Affix	-	-	(2)	(7)	(2)	

To summarize then, we observe the following three patterns of syllable intrusion:

- [1] Copying of adjacent vowels.
- [2] High vowels [i, u].
- [3] Affixal vowel intrusion.

Out of 149 examples, there are only three examples that do not fit in any of these categories (two [o] and one [e]). Table 2 provides the 95% bootstrap confidence intervals to test the generalizations in [1]-[3]. They show that the patterns in [1]-[3] are generally statistically reliable. First, the 95% confidence intervals for copied vowels do not overlap with zero except for the one for [e], which means that vowel copying did not presumably occur by chance. Second, among non-copied vowels, the 95% bootstrap intervals for high vowels do not overlap with zero. Third, the 95% bootstrap confidence interval for the affixal [e] does not overlap with zero, although those for [o] and [a] do.

Table 2: The 95% bootstrap intervals of the intruded vowels.

	[u]	[i]	[o]	[e]	[a]
Copy	11-27	9-24	14-31	0-7	20-39
Non-copy, high	17-35	12-28	-	-	-
Non-copy, non-high, affix	-	-	0-5	2-12	0-5
Non-copy, non-high, non-affix	-	-	0-5	0-3	0-0

6. Discussion

6.1. Phonetic and psycholinguistic grounding

Three patterns of syllable intrusion exist: [1] copy vowel intrusion, [2] high vowel intrusion, and [3] affixal vowel intrusion, although the third generalization is not as statistically secure as the first two. All three patterns ([1]-[3]) seem to have psychoacoustic or psycholinguistic grounds: intruding syllables cause differences between corresponding phrases in puns; therefore, the principles of similarity maximization in (10) and (11) predict that the less salient the intruded syllable is—i.e., the closer it is to \emptyset —the better. We now argue that the observed syllable intrusion patterns make phonetic or psycholinguistic sense in this regard.

First, copy vowels: human auditory systems are sensitive to changes (Delgutte 1997). Therefore, whereas adding a non-copy vowel would be noticeable, adding a copy vowel would allow that vowel to perceptually blend into their environment, making the copy vowel less noticeable. In other words, our auditory system is more likely to detect a vowel if that vowel involves a change from surrounding vowels

(This hypothesis must be tested experimentally.)

Second, there are several reasons that high vowels are perceptually non-intrusive. First high vowels [i, u] are the shortest vowels in Japanese and in other languages (Lehiste 1970) because the lower the vowel, the longer the jaw has to travel. Table 3 summarizes the results of previous production studies on the durations of the five vowels in Japanese, all of which show that the two high vowels are the shortest vowels in Japanese. Due to the shortness of high vowels, they are least perceptually intrusive among (non-copied) vowels (see also Steriade 2001/2008). Second, high vowels can devoice between voiceless consonants and other environments in Japanese, becoming less audible (Tsuchida 1997), which would make high vowels even less intrusive. On the other hand, non-high vowels rarely if ever get devoiced, maintaining their periodic intensity. Third, high vowels may be less intense to begin with than non-high vowels because high vowels involve narrower apertures, although cross-linguistic measures of this correlation are not always consistent (see Parker 2002: Chapter 4).

Table 3: Phonetic durations of Japanese vowels. The data from Han (1962) are ratios with respect to the duration of [u]. Otherwise they are in milliseconds.

[u]	[i]	[o]	[e]	[a]	sources
1.00	1.17	1.26	1.37	1.44	Han 1962
62	70	88	93	99	Sagisaka 1985 (in real words)
58	61	71	79	86	Sagisaka 1985 (in nonce words)
58.3	69.8	77.7	80.0	83.7	Campbell 1992
56.8	67.5	75.4	85.7	82.3	Arai, Warner and Greenberg 2001

Finally, affixal elements are non-salient psycholinguistically, and hence they have a possibility of being ignored in pun pairing patterns. For example, Jarvella and Meijers (1983) show that Dutch listeners can make quicker same/different judgments about roots than about inflection forms. Affixal elements are therefore psycholinguistically non-salient (see Beckman 1997; Smith 2002 for summaries of evidence for psychological non-salience of affixal elements). To summarize then, those vowels that can appear in the syllable intrusion patterns in Japanese are those that are perceptually or psycholinguistically less salient.

6.2. Parallels with linguistic patterns

There may exist phonetic and psycholinguistic grounding of syllable intrusion patterns. These groundings have interesting parallels with phonological patterns in natural language. First, many languages use copy vowels for epenthesis (insertion of vowels that are not present in the underlying representations) (Kawahara 2004; Kitto and de Lacy 1999; Uffman 2006). For example, when Japanese speakers adapt foreign words, they insert a vowel after a word-final consonant. When the word-final consonant is [h] (or its allophones), copy epenthesis occurs, as in (25) (Kawahara 2004). Another example comes from Kolami (Zou 1991: 463) shown in (26), where copying takes place to break up tri-consonantal clusters. In (25) and (26), the epenthesized vowels are copies of the preceding vowels.

- (25) a. Bach → [bahha]
 b. Gogh → [gohho]
 c. Zürich → [tʃuuriççi]

- (26) a. /ayk+t/ → [ayakt] ‘swept away’ cf. /ayk/ → [ayk]
 b. /erk+t/ → [erekt] ‘lit (fire)’ cf. /erk/ → [erk]

Second, high vowels are commonly used as epenthetic vowels as well. In Japanese loanword adaptation, when the word-final consonants are not [h], high vowels are commonly inserted: [i] after [tʃ] and [u] after other consonants, as in (27) (Katayama 1998: 39-40) (they exceptionally insert [o] after coronal stops, presumably because Japanese phonology does not allow coronal stops preceded by high vowels.).

- (27) a. church → [tʃaatʃi]
 b. spark → [supaaku]

Other languages, for example, Turkish, also have high vowel epenthesis, as shown in (28) (Clements and Sezer 1982: 243-244; Howe and Pulleyblank 2004: 11; Steriade 2001/2008). In Turkish nominative forms where there is no vocalic suffix, the stem-final consonant clusters are broken up by high vowel epenthesis.

- | | | | |
|------|------------|---------|---------|
| (28) | NOM.SG | 3.POSS | Gloss |
| | [i] fikʲir | fikʲr-i | ‘idea’ |
| | [u] kojʊn | kojn-u | ‘bosom’ |

The use of copy vowels and high vowels as epenthetic vowels makes phonetic sense if speakers are minimizing the perceptual disparities between inputs and outputs and if copy and high vowels are perceptually non-intrusive.

Third, recall that in the syllable intrusion patterns, Japanese speakers sometimes allow affixal vowels to intrude, i.e. speakers can treat affixal elements almost as if they are not there. We again find a parallel in natural language patterns, specifically in the context of reduplication. In reduplication, languages prefer to copy material from roots, rather than from affixes (Nelson 2003: 39; Spaelti 1997: Chapter 4; Urbanczyk 2007: 490). In other words, affixal segments are more easily ignored than root segments in reduplication, just as in pun pairing patterns. For instance, in Axininca Campa, reduplication mainly targets root morphemes, as exemplified in (29), rather than copying from the many affixes present (McCarthy and Prince 1993: 63; Urbanczyk 2007: 490).

- | | | | |
|------|-----------|-----------------------------|---------|
| (29) | Root | Reduplicated form | Gloss |
| | a. kawosi | noŋ-kawosi-kawosi-wai-t-aki | ‘bathe’ |
| | b. tʰaŋki | noŋ-tʰaŋki-tʰaŋki-wai-t-aki | ‘hurry’ |
| | c. kintʰa | noŋ-kintʰa-kintʰa-wai-t-aki | ‘tell’ |

7. Conclusion

When creating puns, Japanese speakers are willing to intrude syllables with copy and high vowels, and to a lesser extent, with affixal vowels. Based on this observation and our previous work, we argued that (i) speakers attempt to minimize the difference between corresponding segments in syllable intrusion in puns (the difference between \emptyset and the intruded syllable), (ii) the measure of similarity has psychoacoustic or perceptual grounds, (iii) the psycholinguistic non-salience of affixal elements may affect pun pairing patterns, and (iv) we find parallels between pun pairing patterns and natural language patterns. More generally, our work supports the theses proposed by Steriade (2001/2008) concerning how similarity affects phonological organization (see (1)/(2)).

The present study also suggests by way of a case study that perceptual aspects of sounds can be an interesting topic in cognitive linguistics. Although collaboration between cognitive linguists and phonologists/phoneticians has not been much pursued, we suggest that a collaborative effort between these

researchers may create a new and interesting field of study.

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Notes:

ⁱ There are also other types of puns such as those that involve metathesis, phrasal boundary mismatches, and accentual mismatches, which would be all interesting to analyze (Kawahara 2009a). See the second author's website (<http://www.rci.rutgers.edu/~kawahara/pun.html>) for remaining agendas for this project.

ⁱⁱ We find that copying from preceding vowels is more common than copying from following vowels, as shown in Table A, although the 95% bootstrap confidence intervals overlap for [u, i, e]. To the extent that this difference in directionality is reliable, it may show that copying from preceding vowels is less intrusive than copying from following vowels.

Table A: The directionality of copying. The values in parentheses show 95% confidence intervals.

	[u]	[i]	[o]	[e]	[a]
From preceding vowel	11 (5-17)	8 (3-14)	15 (8-22)	3 (0-7)	18 (11-26)
From following vowel	4 (1-8)	5 (1-10)	3 (0-7)	0 (0-0)	2 (0-5)
From both	4 (1-8)	3 (1-10)	4 (1-8)	0 (0-0)	9 (1-8)

Appendix 1: The list of the websites used for data collection

<http://www.dajarenavi.net/>
<http://dajare.jp/>
<http://www1.tcn-catv.ne.jp/h.fukuda/>
<http://dajare.noyokan.com/museum/coin.html>
<http://dajare.noyokan.com/music/index.html>
<http://www.ipc-tokai.or.jp/~y-kamiya/Dajare/>
<http://www.geocities.co.jp/Milkyway-Vega/8361/umamoji3.html>
<http://www.webkadoya.com/noumiso/aho/dajare1.htm>
<http://www.bekkoame.ne.jp/~novhiko/joke.htm#1>
<http://planettransfer.com/natsumi/oyajigag/>
<http://planettransfer.com/natsumi/keijiban/>
<http://planettransfer.com/natsumi/touko/>
<http://karufu.net/joke/joke.html>
<http://www.koyasu.org/royal/neta81.html>
<http://home.att.ne.jp/zeta/sano/dajyare/d-hist.htm>
<http://www5e.biglobe.ne.jp/~kajilin/tencho-100man-en-hairimasu.html>
<http://www5d.biglobe.ne.jp/~katumi/newpage19.htm>

Appendix 2: the bootstrap code

```
# This program uses a Bootstrap method and calculates 95% bootstrap confidence intervals of all the elements in a sample. The number of the original sample is n; resampling is repeated m times. To save space, this code is not complete. Contact the second author to obtain the whole code.
```

```

X<-read.csv("intrusion_bootstrap.csv",header=T)
x<-X[,1] # the list of elements
p<-X[,2] # the probabilities of the elements
n<-149 # specify the size of the original sample
m<-50000 # specify the number of resampling you like

my.boot.u1<-numeric(0)# create a hash for [u1] etc...
my.boot.i2<-numeric(0)# 1=copy, 2=non-copy, 3=affix
my.boot.a3<-numeric(0)
...
for(i in 1:m) {
  y<-sample(x,n,replace=TRUE,prob=p) #resampling
  my.boot.u1[i]<-length(grep("u1",y)) # count the number of elements and store it
  my.boot.i2[i]<-length(grep("i2",y))
  my.boot.a3[i]<-length(grep("a3",y))
  ... }

Y<-matrix(nrow=13,ncol=2) # prepare a matrix to store results

Y[1,1-2]<-quantile(my.boot.u1,p=c(0.025,0.975)) # calculate the confidence intervals
Y[2,1-2]<-quantile(my.boot.i2,p=c(0.025,0.975)) # and store them in Y
Y[3,1-2]<-quantile(my.boot.a3,p=c(0.025,0.975))
...

```

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