

# Experimenting with the Internal Structure of the Syllable in Japanese

Sakiko Yoneda

## 0. Introduction

This paper discusses the experiment which was conducted to examine the internal structure of the syllable in Japanese. According to some experiments on the internal syllable structure (Treiman: 1988, Wang & Derwing: 1993, Kubozono 1993), Japanese internal structure of the syllable is body-coda while English has onset-rime. Since the syllable is real to native speakers' psychological reality, finding out the difference in the internal syllable structure in a language will be fruitful for linguistic investigation. To examine the internal structure in Japanese, Kubozono (1993) used English words as stimulus words to Japanese native speakers in his experiment, which might have produced different results from an experiment using Japanese words. The experiment in this paper used Japanese words for stimulus words to examine the internal syllable structure in Japanese.

This paper will first discuss the importance of the notion of the syllable, and the relation between the syllable and the mora. The conducted experiment then will be discussed in detail.

## 1. What is the syllable?

This section discusses both the notion and importance of the syllable, and the relation between the syllable and the mora. The syllable, both from a phonetic and phonological point of view, is a unit that is larger than a phoneme and smaller than a word. In phonetics, attempts have been made to identify syllables on the basis of the amount of articulatory effort needed to produce them. The psychologist R. H. Stetson argued that each syllable corresponds to an increase in air pressure, which is called the "pulse" or "motor-theory" of syllable production (Crystal 1987: 164). The linguist Otto Jespersen presented the "prominence theory," which defines the syllable in auditory terms, arguing that some sounds, i.e., vowels, are intrinsically more sonorous than others.

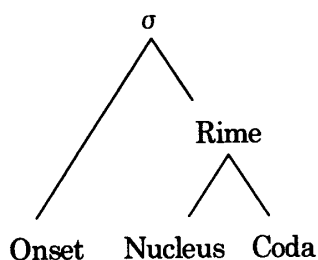
Phonological views of the syllable, on the other hand, focus on the way sounds combine in a language to produce typical sequences. Two classes of sound are established: Sounds that can occur on their own, or are at the center of a sequence of sounds (vowels, usually called "nucleus" in terms of the syllable); and those that cannot occur on their own, or are at the edge of a sequence (consonants; the initial consonant is called "onset" and the final "coda")

Why is the syllable so important? Looking at a baby's first utterances like "dadada" or "bababa," the structure "CV" is the basic pattern for human beings (Roberge 1986: 158). Roberge (1986: 159) reported that illiterate people are more sensitive to syllables than to phonemes. Even though some linguists (e.g., Chomsky & Halle 1968) neglected the importance of the syllable, the syllable plays an important role in terms of mental organization/psychological reality and speech technology (Ladefoged

1993:297, M. Ohala 1994:1, Derwing et al 1988:83-85). The syllable is an important abstract unit in explaining the way vowels and consonants are organized within a sound system. Yet, there is no satisfactory and agreed upon definition so far (Ladefoged 1993, Treiman 1990).

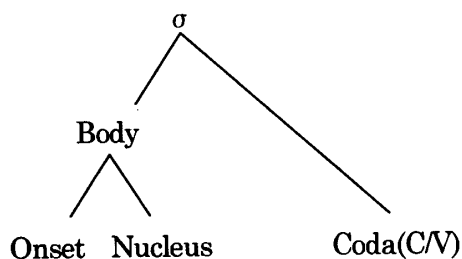
A syllable is organized with phonemes. Based on data from spontaneous speech errors and experiments (Treiman 1988), phonologists claim that three groups form a syllable--an onset, a nucleus, and a coda. In English, there is agreement that the major constituents of the syllable are the onset and the rime (the nucleus/peak-coda unit). Treiman(1988) claims that English speakers tend to prefer the onset-rime pattern. The structure is described as follows:

Fig. 1.



English and Taiwanese are considered to be "onset-rime" languages and Japanese a "body-coda" language. Japanese structure is like Fig. 2:

Fig. 2.



The following are examples that support the structural differences in English and Japanese (examples are mainly taken from Kubozono & Ota (1998) and Kubozono (1989)):

e.g. 1. Word blending and word play

English: breakfast + lunch → brunch

smoke + fog → smog

## Experimenting with the Internal Structure of the Syllable in Japanese

Japanese: o + siQpo → oppo (tail)

(Q indicates a mora constraint)

### e.g. 2. Speech errors

English: You have wasted the whole term. → You have tasted the whole worm.

Japanese: mo · o-ta · a ba · i-ku → mo · i-ta · a ba · i-ku (motorcycle)

(note: '·' indicates mora boundary and '-' syllable boundary. By definition, all syllable boundaries are also mora boundaries (Kubozono 1989: 250).)

### e.g.3. Rhymes

English: Little Jack Horner

Sat in the corner

Eating his Christmas pie;

He put his thumb,

And pulled out a plum,

And said, What a good boy am I.

Mother Goose (Hirano 1992: 105)

Japanese: Tonde isutanburu (We fly to Istanbul)

Uramanainoga ruru (No complaints is the rule)

(a pop music verse)

Kubozono & Ota (1998: 170–171) report that Japanese native speakers recognize the alliteration in “Kudo no ku” but not in “Kato no ku.” This fact suggests the strong linkage between the consonant and the vowel in Japanese speakers’ minds. Kubozono also points out that this type of error—the second segment of the diphthong being substituted by another vowel—as in example 2 above is rarely reported in English or other languages (Kubozono 1989: 252). The mora, a metric unit, plays an important role in Japanese syllables. The syllable in Japanese is composed of one or two moras: V, CV, CVC, VC, where the coda is moraic (nasals, geminates, and long vowels).

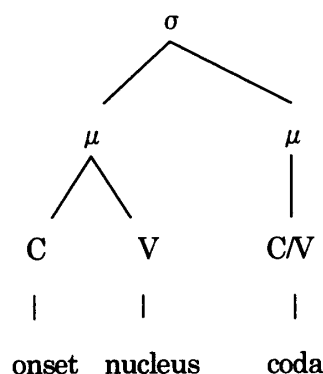
Kubozono (1989), Takada (1990) and Yoshida (1981) claim that there is some evidence for the mora. Looking at speech errors, Kubozono claims that “analysis of blend errors suggests that mora boundaries are the most common switch point in Japanese, which supports the conception of the

linguistic construct as being a psychologically real unit of speech production" and the psychological reality of the mora in Japanese is further substantiated by the analysis of blends. (Kubozono 1989:249-256).

Another example which shows the role of the mora in Japanese is provided by McCawley (1968:130-183) who reported rules about stress assignment for loan words in Japanese based on the mora. From this point of view, 'long syllables' consist of two moras and 'short syllables' consist of one mora. Linguists who take this view would see that [o:ki:] おおきい 'big' has two syllables and four moras and [aoi] あおい 'blue' has one syllable and three moras. For them, the mora is "a temporal unit in Japanese, so that the phonetic duration of utterances crucially hinges upon the number of morae involved" (Kubozono 1989:249).

When we include mora in the internal structure of Japanese, it will be as follows (Kubozono 1993: 2):

Fig. 3.



(μ is the mora. Coda C is a postvocalic consonant, and coda V is a post-nuclear vowel.)

While the mora is claimed to be an inevitable notion in Japanese, generativists view the mora is an unwelcome innovation within the framework of Universal Phonology. They count おおきい /ookii/ [o:ki:] as four syllables and あおい /aoi/ [aoi] as three syllables (Yoshida 1990:331). The notion of the mora is also problematic not only in terms of universal phonology but also in traditional Japanese phonology, especially with words with long vowels like *kanasii* [kanaʃi:] 'sad', and *kooka* [ko:ka] 'school song'. Native speakers of Japanese may say that these words have four and three syllables respectively. Their decision might be affected by the Japanese orthography, some of which are syllabary (Beckman 1982).

Here, a brief illustration of Japanese orthography will be useful for readers to understand the discussion in this paper. Japanese has three types of orthography—*kanji* (logograms derived from Chinese which carry meaning), *hiragana* (a syllabary in which each grapheme corresponds to a spoken syllable, usually a consonant-vowel pair), and *katakana* (also a syllabary used for foreign words except for words of Chinese origin).

e.g. 4. Examples of *hiagana* and *katakana*

a. ひらがな [hiragana]

/hi ra ga na/

b. とうさん [to:saN]

/to u sa N/

c. とおり [to:ri]

/to o ri/

d. ソース [so:su]

/so o su/

e. えいが [e:ga]

/e i ga/

f. エース [e:su]

/e e su/

Note: According to Shibatani (1992: 169), the phonetic value of the word final [N] is not entirely clear, but it is claimed to be close to the uvular nasal [N]. This is also observed when it is followed by a vowel. In this paper, [N] is used for /N/ which is written as ん or ン in Japanese.

The examples show that the problem occurs in words with long vowels and diphthongs. The examples (4b) and (4c) show that the pronunciation [o:] can be described by either ゝ or っ in *hiragana* depending on the lexicon. In (4d), however, “—” is used in *katakana*. The long vowel [e:] is written as “え” + “い” [ei] in *hiragana* and “エ” + “—” [e:] in *katakana* as shown in the examples (4e) and (4f). The fact that “—” is used in *katakana* for long vowels and diphthongs makes Japanese speakers wonder if a long vowel should be counted as one or two syllables.

With regard to acoustic duration, is the pronunciation of a word with two moras twice as long as a word with one mora as Japanese native speakers assume? Beckman (1982: 123) measured the

length of words with a moraic obstruent (e.g., geminates) and those without a moraic obstruent, and concluded that the former's length is 1.66 times as long as the latter's, which did not support the former argument (Homma 1981) that stated the moraic obstruent is double in length. Her experiment indicates that Japanese native speakers assume that the number of letters or moras should be equal to the length of the words. This assumption was not supported by acoustic measurements.

While taking the mora into account in the investigation of the syllable, Kubozono and Ota (1998) state that *haiku* (traditional Japanese poems) and songs indicate the mora plays an important role in Japanese; however, these facts do not exclude the syllable in Japanese. The mora is a notion that is subsumed by the syllable. This topic about the syllable and the mora in Japanese phonology is still controversial.

In the next section, a blending experiment conducted to examine the internal structure of Japanese (with a reduplicated experiment Kubozono, 1993) is discussed.

#### 4. EXPERIMENT

The aim of the experiment is to examine the syllable structure of Japanese: Is it onset-rime or body-coda? As previous research suggests, the syllable structure in Japanese may be body-coda.

The procedure used here is the one Treiman (1988), Derwing (1993) and Kubozono (1993) used, which involves word blending. Kubozono (1993) used English words, however, Japanese words were used for this experiment, so that the stimulus words were in the subjects' native language. The above experiments used monosyllable words, but this limits the number of stimulus words in Japanese since CVC patterns always end with [N] like *kan* (can), *pin* (pin), *hon* (book), *ken* (sword), and *ten* (heaven). Since Japanese internal syllable structure is hypothesized to be body-coda, blending of the words like *kan* (can) and *pin* (pin) may result with either *kan* (can) (when *kan* comes first) or *pin* (pin) (when *pin* comes first), which does not lead to clear results. This experiment therefore did not limit the words to CVC.

The subjects were twenty native speakers of Japanese, seventeen women and three men, ages from nine years old to forty-five years old. The dialectal backgrounds were fourteen standard Japanese speakers, two Kyushu dialect speakers, and one of each of Nagoya, Kanazawa, Osaka, and Tohoku dialects.

The materials were loan words as well as native words with various moraic conditions. The resultant words produced by the subjects in the experimented task were not necessarily real Japanese

words.

Each subject was told to listen to two Japanese words, uttered by the experimenter in a personal interview. The experiment was done individually. The subjects were asked to repeat the two words and then make a third word by combining the initial part of the first word with the end part of the second word. If the listeners misperceived the words, the experimenter corrected them.

The experimenter gave the subject a trial run with the following procedure.

1. /kii/(key)+/hati/(eight)= /kiti/, /kati/
2. /sjuuti/(well-known)+/kaki/(oyster)= /sjuki/, /sjuuki/, /sjaki/
3. /keti/(miser)+/kikku/(kick)= /keku/, /kekku/, /kikku/
4. /hati/(eight)+ /siN/(core)= /haN/, /hiN/
5. /seki/(cough)+ /kaNki/(dry season)= /seki/, /seNki/, /saNki/

With Number 1, for example, when the stimulus words were *kii* and *hati*, then the experimenter said, “*kii, hati,*” and the subject was to say “*kii, hati, kii, hati, ...kiti/kati*.” The notation here is phonological: /ti/ is actually pronounced as [tʃi] in phonetic notation.

## 5. RESULTS AND DISCUSSION

### 5.1 Results

The results of the experiment are as follows. The stimulus words on the left side of the equation indicate that they were combined to produce one of the answers shown on the right side of the equation. The numbers below each answer indicate the result, showing how many subjects answered that way. “Total” indicates the total score and the average percentage of each pattern like CV + CV or C + VCV and so forth.

#### (1)1~3: CVCV + CVVCV

	CV+CV	C+VVCV
1. /kati/ (value)+ /sjeeku/ (shake)= /kaku/(write) /keeku/		
	18	2
2. /seki/ (cough) + /koosi/ (speaker) = /sesi/ /soosi/(loving each other)		
	19	1
3. /seku/ (hurry) + /siitu/ (sheet) = /setu/ /siitu/(sheet)		
	20	0
total	57(95.0%)	3(5.0%)

(2)4~6: CVVCV+ CVCV

	CV+CV	CVV+CV	C+VCV
4. /seeti/ (Holy Land) + /katu/ (win) =	/setu/ (opinion)	/seetu/	/satu/ (police)
	10	8	2
5. /muusu/ (moose) + /keti/ (miser)=	/muti/(ignorance)	/muuti/	/meti/
	14	6	0
6. /keesi/ (superintendent) + /kaki/ (oyster) =	/keki/	/keeki/(cake)	/kaki/(oyster)
	11	9	0
total	35(58.3%)	23(38.3%)	2(3.3%)

(3)7~9: CVCV+CVCCV (The first C of the consonant cluster is a moraic obstraint.)

	CV+CV	CV+CCV	C+VCCV
7. /kati/ (value) + /sessi/ (centigrade) =	/kasi/ (fahrenheit)	/kassi/	/keesi/
	11	9	0
8. /seki/ (cough)+ /kokku/ (cook) =	/seku/ (hurry)	/sekku/	/sokku/
	10	10	0
9. /hati/ (eight) + /tippu/ (tip) =	/hapu/	/happu/	/hippu/ (hip)
	6	14	0
total	27(45.0%)	33(55.0%)	0(0%)

(4)10~12: CVCCV+CVCV (The first C of the consonant cluster is a moraic obstraint.)

	CV+CV	CVC+CV	C+VCV
10. /nattu/ (nut) + /kiti/ (base)=	/nati/ (the Nazis)	/natti/	/niti/ (day)
	7	13	0
11. /sessi/ (centigrade) + /muku/ (innocent) =	/seku/ (hurry)	/sekkku/	/suku/ (comb)
	12	8	0
12. /tikku/(tick) + /kaki/ (oyster) =	/tiki/	/tikki/	/tjaki/(tea set)
	8	12	0
total	27(45.0%)	33(55.0%)	0(0%)

note: For Number 12, /tikku/ is phonecially pronounced as [tʃikku], so [tʃaki] (/tjaki/) is theoretically possible.



(5)13~15: CVCV+CVC (The last consonant of the second word is nasal.)

	CV+C	C+VC
13. /kati/ (value) + /seN/ (line) =	/kaN/ (can)	/keN/ (prefecture)
	20	0
14. /seki/ (cough) + /huaN/ (fan) =	/seN/ (line)	/saN/ (frame)
	19	1
15. /muku/ (innocent) + /kaN/ (can) =	/muN/	/maN/ (ten thousand)
	19	1
total	58(96.7%)	2(3.3%)

(6)16~18: CVC + CVCV (The last consonant of the first word is nasal.)

	CV+CV	C+VCV
16. /biN/ (bottle) + /kaki/ (oyster) =	/biki/	/baki/
	20	0
17. /huN/ (minute) + /keti/ (miser) =	/huti/ (edge)	/heti/
	20	0
18. /hoN/ (book) + /seki/ (cough) =	/hoki/	/heki/ (wall)
	20	0
total	60 (100%)	0(0%)

(7)19~21: CVCV+CVCCV (The second consonant of the consonant cluster is nasal.)

	CV+CV	CV+CCV	C+VCCV
19. /kati/ (value) + /teNki/ (weather) =	/kaki/ (oyster)	/kaNki/ (dry season)	/keNki/
	14	6	0
20. /muku/ (innocent) + /seNki/ (record of battle) =	/muki/ (direction)	/muNki/	/meNki/
	15	5	0
21. /keti/ (miser) + /doNki/ (blunt instrument) =	/keki/	/keNki/ (anaerobic)	/koNki/ (marriageable age)
	14	6	0
total	43(71.7%)	17(28.3%)	0(0%)

(8)CVCCV+CVCV (The second consonant of the consonant cluster is nasal.)

	CV+CV	CVC+CV	C+VCV
22. /taNku/ (tank) + /kiti/ (base) =	/tati/ (sword)	/taNti/ (detection)	/taiti/
	13	7	0
23. /deNki/ (electricity) + /hati/ (eight) =	/deti/	/deNti/ (battery)	/dati/
	11	9	0
24. /kaNki/ (dry season) + /kiti/ (base) =	/kati/ (value)	/kaNti/ (sense)	/kiti/ (base)
	13	7	0
total	37(61.7%)	23(38.3%)	0(0%)

(9)25~27: CVV+ CVC (The last consonant of the second word is nasal.)

	CV+C	CVV+C	C+VC
25. /kii/ (key) + /soN/ (loss) =	/kiN/ (gold)	/kiiN/ (onomatopoeia)	/koN/ (dark blue)
	16	2	2
26. /kaa/ (car) + /siN/ (core) =	/kaN/ (can)	/kaaN/	/kiN/ (gold)
	17	3	0
27. /soo/ (so) + /teN/ (heaven) =	/soN/ (loss)	/sooN/	/seN/ (line)
	19	1	0
total	52(86.7%)	6(10.0%)	2(3.3%)

(10)28~30: CVC+CVV (The last word of the first consonant is nasal.)

	CV+V	CV+VV	C+VV	C+V	
28. /saN/ (frame) + /huu/ (envelope) =	/sau/	/sauu/	/suu/ (number)	/su/	
	16	1	3	0	
29. /siN/ (core) + /hee/ (fence) =	/sie/	/sjee/	/see/	/se/	X
	17	0	0	0	1
	/sii/				
	2				

# Experimenting with the Internal Structure of the Syllable in Japanese

30. /seN/ (line) + /kii/(key) =	/sei/	/seii/	/sii/	/si/	
	19	0	1	0	
total	54(90.0%)	1(1.7%)	4(6.7%)	0 (0%)	1(1.7%)

note: For Number 29, /siN/ is phonetically pronounced as [ʃiN], so [ʃee] (/sjee/) is possible. "X" indicates that no resultant word was made.

(11)31~36: CV+ CVC (The last consonant of the second word is nasal.)

	CV+C	C+VC
31. /ki/ (heart) + /huaN/ (fan) = /kiN/ (gold)		/kaN/ (can)
	16	4
32. /te/ (hand) + /biN/ (bottle) = /teN/ (heaven)		/tiN/
	17	3
33. /ku/ (phrase)+ /soN/ (loss)= /kuN/ (honorific)		/koN/ (dark blue)
	17	3
34. /ke/ (hair) + /saN/ (frame) = /keN/ (sword)		/kaN/ (can)
	18	2
35. /su/ (vinegar) + /kaN/ (can) = /suN/ (measuring unit)		/saN/ (frame)
	16	4
36. /ko/ (child) + /piN/ (pin) = /koN/ (dark blue)		/kiN/ (gold)
	19	1
total	103(85.8%)	17(14.2%)

(12)37~41: CVC + CV (The last word of the first word is nasal.)

	CV+V	C+V	
37. /seN/ (line) + /ka/ (mosquito) =	/sea/	/sa/	X
	0	1	19
38. /hoN/ (book) + /me/ (eye) =	/hoe/	/he/ (fart)	X
	0	1	19
39. /huN/ (minute) + /gi/ (righteousness) =	/hui/	/hi/	X
	0	1	19

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40. /siN/ (core) + /sa/ (difference) =	/sia/	/sja/ (company)	X
	0	1	19
41. /keN/ (sword) + /to/ (door) =	/keo/	/ko/(child)	X
	0	1	19
total	0	5(5.0%)	95(95.0%)

note: For Number 40, /siN/ is phonetically pronounced as [ʃin], so [ʃa] (/sja/) is possible. "X" indicates no resultant word was made.

(13)42~45: CVC + CVC (The last consonant of each word is nasal.)

	CV+C	C+VC
42. /soN/ (loss) + /seN/ (line) =	/soN/ (loss)	/seN/ (line)
	16	4
43. /huaN/ (fan) + /biN/ (bottle) =	/huan/(fan)	/hiN/
	19	1
44. /heN/ (side) + /huN/ (minute) =	/heN/ (side)	/huN/ (minute)
	19	1
45. /kaN/ (can) + /soN/ (loss) =	/kaN/ (can)	/koN/ (dark blue)
	18	2
total	72(90.0%)	8(10%)

The results from the experiment above can be put into a table as follows:

Table . Table of the results  
(unit: %)

No	sequences of stimulus words	Results														
		body-coda								onset-rime						N/A
		cv+cv	cvv+cv	cv+ccv	cvc+cv	cv+c	cvv+c	cv+vv	cv+v	c+vccv	c+vccv	c+vccv	c+vc	c+vv	c+v	
1	cvcv+cvvcv	95.0	-	-	-	-	-	-	-	-	-	5.8	-	-	-	-
2	cvvcv+cvvcv	58.3	38.3	-	-	-	-	-	-	3.3	-	-	-	-	-	-
3	cvcv+cvcv	45.0	-	55.0	-	-	-	-	-	-	0	-	-	-	-	-
4	cvccv+cvcv	45.0	-	-	55.0	-	-	-	-	0	-	-	-	-	-	-
5	cvcv+cvc	-	-	-	-	96.7	-	-	-	-	-	-	3.3	-	-	-
6	cvc+cvcv	100	-	-	-	-	-	-	-	0	-	-	-	-	-	-
7	cvcv+cvcv	71.7	-	28.3	-	-	-	-	-	-	0	-	-	-	-	-
8	cvccv+cvcv	61.7	-	-	38.3	-	-	-	-	0	-	-	-	-	-	-
9	cvv+cvc	86.7	-	-	-	-	10.0	-	-	-	-	-	3.3	-	-	-
10	cvc+cv	-	-	-	-	-	-	1.7	90.0	-	-	-	-	6.7	0	1.7
11	cv+cvc	-	-	-	-	85.8	-	-	-	-	-	-	14.2	-	-	-
12	cvc+cv	-	-	-	-	-	-	-	0	-	-	-	-	-	5.0	95.0
13	cvc+cvc	-	-	-	-	90.0	-	-	-	-	-	-	10.0	-	-	-

## 5.2 Discussion

As the results show, the pattern the subjects preferred was body-coda, in which an onset and a nucleus link together to make a body which is then linked with a coda. Sequences in Number (12) included the stimulus words that can be blended only by using onset-rime, and 95% of the answers were “impossible to make a resultant word.”

The results from sequences Number (1) and Number (2) include words with long vowels or diphthongs. 58.3% of the answers were in the category of CV+CV, while 38.3% were CVV+CV. Also, 86.7% in Number (9) and 90.0% in Number (10) divided the VV sequence. These results show that long vowels and diphthongs tend to be considered separable in Japanese and have a strong linkage with the preceding consonants. Whether this is an effect of orthography needs further investigation.

Looking at sequences Number (3) and Number (4), the patterns including moraic obstruent or geminates, the results show that subjects tend to prefer to include geminates in the resultant words if the stimulus has a geminate. Number (7) and Number (8) also include nasal moraic consonant. These two patterns do not show as strong of a tendency to keep the nasal /N/ in the resultant words as those in Number (3) and Number (4), which was due to the difference between the nasals and non-nasals. However, in terms of the linkage of onset and nucleus, the tendency toward body-coda was also seen in all of these sequences.

The interesting point is that blending of CVC words shows more onset-rime tendencies, although it is not significant (sequences Number (11) and Number (13)).

The orthographical influence, which can be considered an important issue, seems to play a role here. All the resultant words the subject chose can be described in either *hiragana* or *katakana*, especially the resultant words in sequence Number (10) and those in sequence Number (12) show this influence. For 29 in sequence Number (10), the subjects were asked to blend [ʃiN] しん and [he:/hei] へい. Two subjects answered [ʃii], which suggests they were thinking orthographically. Also the words in sequence Number (12) required them to separate the second stimulus word into onset and nucleus. Almost all subjects were not able to make resultant words except for the one who was in the U.S. from the early age of eleven months old to nine years old and spoke English during that duration.

The results here showed the same tendency as Kubozono's results even though he used English words while this experiment used Japanese words. Kubozono claimed that there was no orthographical influence in his data, however, results here suggest some orthographical influence.

Understanding of the syllable also seemed to vary among the subjects. When the experimenter asked the subjects how many syllables they thought the stimulus words had, for the CVCV sequence,

all said two; for CVVCV, some said two, some said three and others said they were not sure. However, the subjects who said two for the CVVCV sequence did not hesitate to split the VV into two parts, which may not occur in English native speakers. This fact seems to lead linguists to posit that diphthongs and long vowels do not exist in Japanese native speakers' minds. For the CVC sequence whose coda C is nasal, many did not treat it as a syllable but some did. For the words including geminates, all the subjects did not treat them as a syllable.

Since the blending experiment did not exclude orthographical influence, future experiments are necessary to conduct to examine the internal structure of the syllable in Japanese.

## 6. CONCLUSION

In this paper, the definition of the syllable, the mora, the influence of orthography in Japanese, and an experiment examining the internal structure of the syllable have been discussed.

As linguists do not agree on the definition of the syllable and the mora, the topic remains to be studied. What was found here is that Japanese native speakers prefer to link the onset and the nucleus whereas English native speakers link the nucleus and the coda. However, the data from the experiment suggest some influence of orthography. At this point, it is dangerous to conclude that the internal structure of Japanese is body-coda. An experiment independent from orthographical influence is necessary in order to substantiate that the body-coda structure represents psychological reality to the native Japanese speaker.

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## APPENDIX

### LIST OF THE WORDS IN THE ORDER OF THE ACTUAL EXPERIMENT

1. /kati/ (value)+ /sjeeku/ (shake)= /kaku/(write); /keeku/
  31. /ki/ (heart) + /huan/ (fan) = /kin/ (gold); /kan/ (can)
  4. /seeti/ (Holy Land) + /katu/ (win) = /setu/ (opinion); /seetu/; /satu/ (police)
  7. /kati/ (value) + /sessi/ (centigrade) = /kasi/ (fahrenheit); /kassi/; /keesi/
  37. /seN/ (line) + /ka/ (mosquito) = /sea/; /sa/
  10. /nattu/ (nut) + /kiti/ (base)= /nati/ (the Nazis); /natti/; /niti/ (day)
  13. /kati/ (value) + /seN/ (line)= /kaN/ (can); /keN/ (prefecture)
  32. /te/ (hand) + /biN/ (bottle) = /teN/ (heaven); /tiN/
  16. /biN/ (bottle) + /kaki/ (oyster) = /biki/; /baki/
  19. /kati/ (value) + /teNki/ (weather) = /kaki/(oyster); /kaNki/(dry season); /keNki/
  38. /hoN/ (book) + /me/ (eye) = /hoe/; /he/ (fart)
  22. /taNku/ (tank) + /kiti/ (base) = /tati/ (sword); /taNti/ (detection); /taiti/
  39. /huN/ (minute) + /gi/ (righteousness) = /hui/; /hi/
  25. /kii/ (key) + /soN/ (loss) = /kiN/ (gold); /kiiN/ (onomatopoeia); /koN/ (dark blue)
  33. /ku/ (phrase)+ /soN/ (loss)= /kuN/ (honorific); /koN/ (dark blue)
  28. /saN/ (frame) + /huu/ (envelope) = /sau/; /sauu/; /suu/ (number); /su/
  40. /siN/ (core) + /sa/ (difference) = /sia/; /sja/ (company)
- (/siN/ is phonetically pronounced as [ʃiN], which can be written as /sja/ phonemically.)



2. /seki/ (cough) + /koosi/ (speaker) = /sesi/; /soosi/ (loving each other)
34. /ke/ (hair) + /saN/ (frame) = /keN/ (sword); /kaN/ (can)
5. /muusu/ (moose) + /keti/ (miser) = /muti/ (ignorance); /muuti/; /meti/
35. /su/ (vinegar) + /kaN/ (can) = /suN/ (measuring unit); /saN/ (frame)
8. /seki/ (cough) + /kokku/ (cook) = /seku/ (hurry); /sekku/; /sokku/
36. /ko/ (child) + /piN/ (pin) = /koN/ (dark blue); /kiN/ (gold)
11. /sessi/ (centigrade) + /muku/ (innocent) = /seku/ (hurry); /sekkku/; /suku/ (comb)
41. /keN/ (sword) + /to/ (door) = /keo/; /ko/ (child)
14. /seki/ (cough) + /huaN/ (fan) = /seN/ (line); /saN/ (frame)
42. /soN/ (loss) + /seN/ (line) = /soN/ (loss); /seN/ (line)
17. /huN/ (minute) + /keti/ (miser) = /huti/ (edge); /heti/
20. /muku/ (innocent) + /seNki/ (record of battle) = /muki/ (direction); /muNki/; /meNki/
43. /huaN/ (fan) + /biN/ (bottle) = /huan/ (fan); /hiN/

(/huaN/ is phonetically pronounced as [faN], so it is possible to make a word [faN] out of /hua/ or [fa] + [N].

23. /deNki/ (electricity) + /hati/ (eight) = /deti/; /deNti/ (battery); /dati/
26. /kaa/ (car) + /siN/ (core) = /kaN/ (can); /kaaN/; /kiN/ (gold)
44. /heN/ (side) + /huN/ (minute) = /heN/ (side); /huN/ (minute)
29. /siN/ (core) + /hee/ (fence) = /sie/; /sjee/; /see/; /se/

(/siN/ is phonetically pronounced as [jiN], so it is possible to make a word [jee], which is phonemically written as /sjee/.)

3. /seku/ (hurry) + /siitu/ (sheet) = /setu/; /siitu/ (sheet)
6. /keesi/ (superintendent) + /kaki/ (oyster) = /keki/; /keeki/ (cake); /kaki/ (oyster)
9. /hati/ (eight) + /tippu/ (tip) = /hapu/; /happu/; /hippu/ (hip)
12. /tikku/ (tick) + /kaki/ (oyster) = /tiki/; /tikki/; /tjaki/ (tea set)

(/tikku/ is phonetically pronounced as [tjikku], so it is possible to make a word /tjaki/ phonemically, which is pronounced as [tjakii])

15. /muku/ (innocent) + /kaN/ (can) = /muN/; /maN/ (ten thousand)
18. /hoN/ (book) + /seki/ (cough) = /hoki/; /heki/ (wall)
21. /keti/ (miser) + /doNki/ (blunt instrument) =

/keki/; /keNki/ (anaerobic); /koNki/ (marriageable age)

24. /kaNki/ (dry season) + /kiti/ (base) = /kati/ (value); /kaNti/ (sense); /kiti/ (base)

27. /soo/ (so) + /teN/ (heaven) = /soN/ (loss); /sooN/; /seN/(line)

30. /seN/ (line) + /kii/(key) = /sei/; /seii/; /sii/; /si/

45. /kaN/ (can) + /soN/ (loss) = /kaN/ (can); /koN/ (dark blue)