



# ‘Englishness’ of rhythm: comparison of the nPVI values between English songs and their counterparts in Japanese

Noriko Hattori

Mie University, Japan

hattori@human.mie-u.ac.jp

## Abstract

This study utilized one of the rhythm metrics, nPVI (normalized Pairwise Variability Index), to detect differences in the arrangements of musical notes, comparing the vocalic nPVI values of ten English songs composed before 1965 with those of their counterparts translated into Japanese. As vowels form the core of syllables, previous studies have assumed that musical notes are nearly equal to syllables and compared vowel-based rhythmic measures of speech to note-based rhythmic measures of music [1]. This paper is based on the following assumptions: (1) mora-timed languages, as represented by Japanese, tend to use notes of equal length, while stress-timed languages, as represented by English, prefer dotted notes or a combination of notes of large and small values (e.g., 8th and 16th notes) and (2) the sequential order of stressed and unstressed syllables in English lyrics exerts a considerable influence on the output nPVI values of musical notes. The central hypothesis is that, as the vocalic nPVI of English speech is larger than that of Japanese speech, the same relationship will hold for English songs translated into Japanese, because the arrangement of notes should be kept similar in order to sound like the same tune. The results suggest that this relationship is basically preserved in the process of translation.

**Index Terms:** English rhythm, musical notes, nPVI, stress-timed language, mora-timed language

## 1. Introduction

The aim of this paper is to show ‘Englishness’ in terms of rhythm. A dual approach is taken to examine the issue, one being the use of nPVI in vocal music, and the other being text-setting summarized via the Syllabic Distribution Algorithm (hereafter SDA) [2]. For comparison, Table 1 shows the nPVI values of English, a stress-timed language, and those of French, a syllable-timed language, in speech and instrumental music [1].

Table 1: nPVI values in English and French.

	English nPVI	French nPVI	<i>p</i>
Speech (vowels)	55.0	35.9	< 0.001
Music (notes)	47.1	40.2	< 0.01

These data come from instrumental music from around 1900 produced by English and French composers who spent their entire lives in the countries of their birth and were active in the period of ‘nationalism’ in the history of music [3]. Another study used a different set of sentences to calculate nPVI, with English scoring around 65 and Japanese around 50 [4].

Another line of research on the speech-music interface is text-setting. English shows a strong tendency for matching stressed syllables with musically strong beats, called “stress-to-strong”. In conventional musical notation, in the time signature of 4/4, the first beat immediately after a bar line is the strongest; the third beat is also strong, but not as strong as the first one [5]. In the grid notation used in text-setting as shown in Figure 1, horizontal lines of ‘x’ represent series of isochronic beats, while the columns indicate how strong each beat is [6].

Whole note (Extra strong): x x  
Half notes (Strong): x x x x  
Quarter notes (Medium): x x x x x x x x  
Eighth notes (Weak): x x x x x x x x x x x x

Figure 1: Grid notation used in text-setting.

This grid plays the same role as bars and time signature in conventional musical notation. In English text-setting, stressed syllables are mapped onto strong beats and remaining unstressed syllables are mapped onto weaker beats, according to the SDA [2]. For example, when the sequential arrangements of the musical notes in *Let it be* and *Michelle* by the Beatles are compared, the following two points are observed:

- a significant difference in the nPVI (62.3 vs. 37.9)
- ‘un-English’ text-setting in *Michelle*

In *Michelle*, the lyric ‘go together’ is set to four notes of equal length, as in (1a), but native speakers of English would prefer a longer note on ‘go,’ as in (1b).

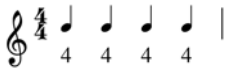
(1) a. b.

The figures under the lyrics will be explained in section 2.2. It is worth mentioning that Paul McCartney said of *Michelle* that he attempted to ‘write a French-sounding song’ [7]. The rules of the SDA utilize the general principle that ‘rhythmically strong units tend to be long as well’ [2]. In this way, the interaction of the SDA and the nPVI can be observed.

## 2. Method

In the time signature of 4/4, mora-timed and syllable-timed languages tend to use notes of equal length, as in (2a), while stress-timed languages like English prefer dotted notes or a combination of notes of large and small values (8th and 16th notes), as in (2b).

(2) a.



b.



The sequential order of stressed and unstressed syllables in lyrics exerts a considerable influence on the output nPVI values of musical notes. The hypothesis is that, as the nPVI of English speech is larger than that of Japanese speech ([1], [3], and [4]), the same relationship will hold when English songs are translated into Japanese because the arrangement of notes should be kept as similar as possible in order to sound like the same tune.

- nPVI (speech): English > Japanese [attested]
- nPVI (vocal music):  
Original English songs ≥ Songs translated into Japanese

### 2.1. Japanese songs translated from English

The nPVI values of ten Japanese songs translated from English were calculated and compared with those of the original English songs. The titles of the ten songs examined are shown in Table 2.

Table 2: Titles of the ten songs examined.

	English titles	Year of Copyright
1	Rudolph the Red-Nosed Reindeer	1949
2	Jenny Jenny	1957
3	Pretty Little Baby	1961
4	Too Many Rules	1961
5	Kissin' on the Phone	1961
6	Vacation	1962
7	Johnny Angel	1962
8	Please Please Me	1962
9	I Want to Hold Your Hand	1963
10	Can't Buy Me Love	1964

The songs were all translated by Sazanami, a Japanese artist who actively translated American pop music in the 1960s. He also translated some early Beatles songs (e.g., Nos. 8, 9 and 10 in Table 2) before giving up, saying that 'the Beatles do not fit well into the Japanese language.' ([8] and [9]). It is more than coincidence that Trudgill comments on Beatles songs 'from around 1964,' saying that their 'early songs are often clearly in the rock-and-roll mould, while later songs tend to be more complex, contemplative, poetic, and so on' [10, p. 153]. The linguistic variable of the post-vocalic /r/ (e.g., *girl*, *cart*) in their music decreases dramatically after 1967 [10, pp. 150-153]. Combined with other linguistic variables, such as intervocalic /t/ (e.g., *better*, *at all*), they sound less American after 1967 [10]. A quick survey of the Beatles' scores after 1967 shows increased use of 16th notes. For comparison, the nPVIs of two songs by the Beatles were calculated as well.

Table 3: Titles of two songs from the Beatles.

	English titles	Year of Copyright
11	Michelle	1965
12	Let it Be	1970

The notes in the first verse (and refrain, if any) were counted.

### 2.2. Conversion of musical notes into values

Musical note values were converted as shown in Figure 2. A 16th note was assigned a duration of 1, an 8th note was assigned a duration of 2, a quarter note 4, and so on. This way of conversion is in line with what has been used in previous studies on the interface between speech and music ([3] and [11, pp. 162-164]).

	Whole note /Half note/Quarter note/Eighth note/Sixteenth note
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
♩	16
♪	8
♫	4
♫	2
♫	1

Figure 2: Note values as a basis of nPVI calculation.

### 2.3. Normalized Pairwise Variability Index (nPVI)

As a device for detecting differences in the arrangement of musical notes, the normalized Pairwise Variability Index is used, with the following equation ([3], [4], [12] and [13]).

$$(3) \quad nPVI = \frac{100}{m-1} \times \sum_{k=1}^{m-1} \left| \frac{d_k - d_{k+1}}{d_k + d_{k+1}} \right|$$

Vocalic nPVI values were calculated for ten English songs and their counterparts in Japanese.

## 3. Results

The results for the ten songs analyzed are shown in Table 4.

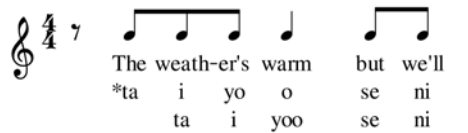
Table 4: nPVI values of ten English songs and their Japanese translations.

	English				Japanese			
	Data points	nPVI	SD	Mean	Data points	nPVI	SD	Mean
1	110	47.4	3.7	4.7	110	42.0	4.1	4.7
2	62	33.0	1.2	2.5	60	28.9	1.2	2.7
3	134	25.7	1.3	2.9	134	25.7	1.3	2.9
4	71	44.2	3.8	5.7	71	43.7	3.9	5.9
5	59	75.2	1.5	2.8	58	30.4	1.8	3.0
6	54	41.8	2.4	3.5	53	42.6	2.4	3.5
7	106	34.4	2.6	3.2	106	35.0	2.6	3.2
8	85	36.0	2.0	3.2	84	39.3	2.3	3.4
9	73	54.4	3.1	3.7	79	38.2	3.0	3.7
10	50	32.6	3.6	5.8	50	32.6	3.6	5.8
Cf.								
11	69	37.9	2.5	4.6	No translation			
12	80	62.3	1.1	1.9	No translation			

The results of seven out of the ten songs (Nos. 1, 2, 3, 4, 5, 9, and 10) support the hypothesis, as their English nPVI values were equal to or larger than those of their Japanese counterparts. Of the remaining three (Nos. 6, 7, and 8), Nos. 6 and 7 are easy to explain. Japanese has a long mora whose

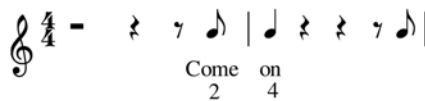
second vowel is called the dependent mora. Part of the bars in No. 6 is shown in (4). The long mora 'yoo' is mapped as a whole onto the 4th note in the Japanese translation. To reflect the change in note values, the 8th note rest in English is replaced by a quarter note rest in Japanese.

(4)

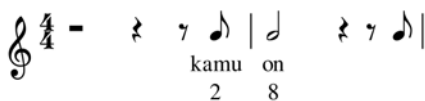


The nPVIs of No. 7 are attributed to a similar choice of the length of rests in the Japanese translation. The difference in the nPVI values of No. 8 comes from the lengthened vowels in the Japanese translation, as shown in (5).

(5) a. English

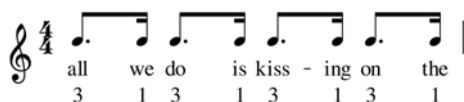


b. Japanese



Of the cases which support the hypothesis, No.5 showed a particularly large difference in the nPVI values of the two languages, with English value being more than double the Japanese one (75.2 vs. 30.4). This is because the Japanese lyrics were set to notes of equal length, as shown in (6).

(6) a. English



b. Japanese



The use of dotted notes in English boosted the relevant nPVI values.

## 4. Discussion and conclusions

It is noteworthy that the English means in Table 4 are all equal to or smaller than the Japanese means. The smaller means indicate that musical notes of smaller values were used in the scores. A glimpse at the scores of *Let it Be*, which was composed after 1964, shows many uses of 16th notes, which is reflected in the low mean value (1.9). Figures 3 and 4 show the visual representations of the breakdown of notes used in *Let it Be*, while Figures 5 and 6 show the same for *Michelle*.

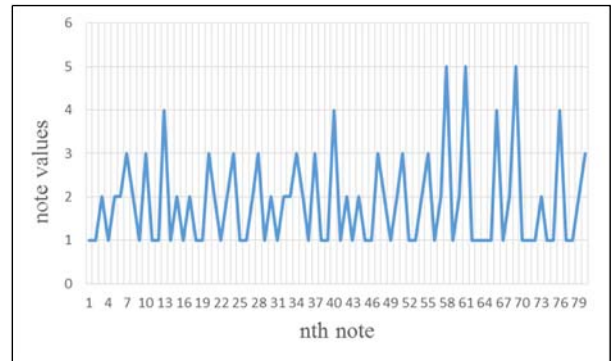


Figure 3: Sequential arrangement of note values in *Let it Be*.

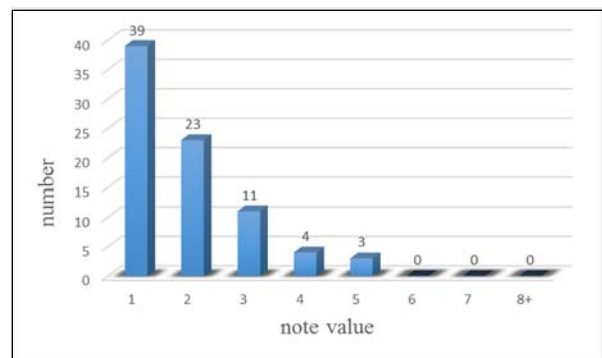


Figure 4: Distribution of note values in *Let it Be*.

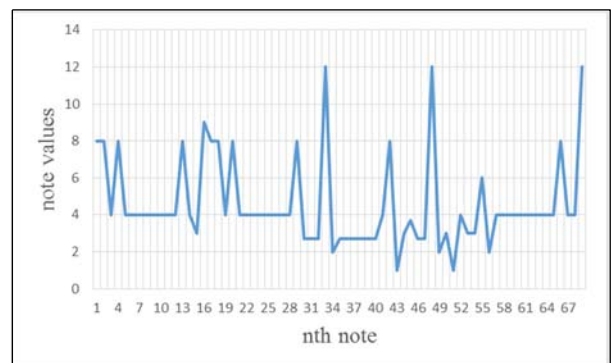


Figure 5: Sequential arrangement of note values in *Michelle*.

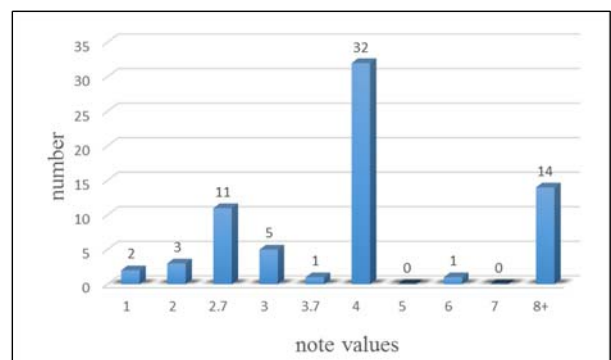


Figure 6: Distribution of note values in *Michelle*. A note value of '2.7' means a triplet (=a half note divided into three).

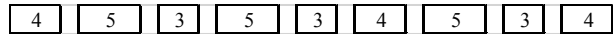
No. 1 in Table 4 is a good example of how the means and the nPVI can differ. As advocates of nPVI point out, two events with the same set of durations may result in different nPVI values depending on the size of contrast in duration [based on 11, pp. 131-132]. For example:

(7)

A.



B.



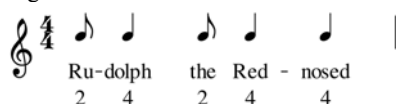
The means and nPVIs of these each events are shown in Table 5.

Table 5: Means and nPVIs of two events with different contrast in duration.

	Data points	Mean	nPVI
A	9	4	6.4
B	9	4	37.7

The nPVI has an advantage over the mean in detecting the differences in the size of contrast in duration. In No. 1, while the means are the same in English and Japanese, the nPVI values differ. This is attributed to the difference in the arrangements of notes in the following bar.

(8) a. English



b. Japanese



While they consist of the same set of notes, they differ in their sequential order. This difference appears in six bars (six times) in the song, resulting in a larger nPVI in English.

The aim of this paper was to show that the attested differences in the nPVI values between English and Japanese speech should also be reflected in English songs and their Japanese translations. One of the rhythmic metrics, nPVI, was used to detect differences in the arrangement of notes in songs. The relationship that holds for English and Japanese speech in terms of nPVI was basically preserved in the ten songs examined. Some apparent reversals in nPVI values were attributed to local variations in interpreting the original tunes. The songs investigated were translated into Japanese by Sazanami as true to the original tune as possible, with rhythmic transformation being as limited as possible. On the other hand, some examples of vocal music are less translations and more ‘adaptations’. In the latter, the values of musical notes are altered in the process of translation. We confined our study to songs that could be considered translations to investigate the reflections of rhythmic typology in vocal music. All Japanese song data in this study were derived from Sazanami’s translations, and the period in which the original songs were written was limited to 1949-1964. Further study will be necessary and is in fact in progress to overcome these

limitations. This line of approach could be extended to a comparison of songs not only between languages belonging to different rhythmic classes, but also between languages of the same rhythmic typology. It would be interesting to see if musical notes do not have to be altered substantially in the process of translation in the latter group.

## 5. Acknowledgements

This work was supported by a Grant-in-Aid for Scientific Research (C) (Japan Society for the Promotion of Science, Grant No. 16K02763). Part of an earlier version of this paper was presented at the 7th Biennial International Conference on the Linguistics of Contemporary English (30 September 2017). I would like to thank two anonymous reviewers whose comments were very helpful.

## 6. Appendix

The original writers of the songs and translated Japanese titles are as follows (cited from *Ruutsu wa sikkusutiizu: Sazanami Kenji no wandaa rando* [Roots were in the 60’s: Sazanami Kenji’s wonderland] Tokyo: Shinko Music, 1998). The original English musical scores were consulted as far as they were available.

[Words and music by]

1. Johnny Marks
2. Enotris Johnson and Richard Penniman
3. Don Stirling and Bill Nauman
4. Gary Knight, Don Stirling and Harold Temkin
5. Earl Wilson and Leonard Whitcup
6. Connie Francis, Hank Hunter and Gary Weston
7. Lee Pockriss and Lyn Daddy
8. John Lennon and Paul McCartney
9. John Lennon and Paul McCartney
10. John Lennon and Paul McCartney

[Japanese titles]

1. *Akahana no Tonakai*
2. *Jeni jeni*
3. *Kawaii beibii*
4. *Otona ni naritai*
5. *Dennwa de kissu*
6. *Vakeishon*
7. *Jonii enjeru*
8. *Puriizu puriizu mii*
9. *Dakishimetai*
10. *Kyanto bai mii rabu*

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