

The 'panphonic' text of 'The North Wind and the Sun' for the illustration of the International Phonetic Alphabet of Japanese consonants and its use in the phonetic analysis of Japanese speech

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A 'panphonic' version of the text of 'The North Wind and the Sun' for the illustration of the International Phonetic Alphabet of Japanese (Tokyo dialect) consonants has previously been devised by the present authors (Hiki, Kakita and Okada, Proc. 17th Int'l Cong. on Phonetic Sciences, Hong Kong, 2011, 871-873). The present paper describes the main characteristics of this panphonic text in relation to its use in the phonetic analysis of Japanese speech utterances, providing examples of the result of the analysis of sample recitations. The panphonic text embraces all 16 consonant phonemes, their 11 major positional allophones, and 5 free variants in a short, simple text that consists of 8 sentences (113 words, 294 syllables). The relation among consonant phonemes and their allophones is shown effectively by a new arrangement of rows and columns in the IPA consonant chart. Possible pause locations are systematically indicated using appropriate pause symbols. The text is useful in examining the phonetic properties of Japanese utterances, for example, the effect of consonants on vowel devoicing, and large-scale segmentation of utterances by pauses of different durations.

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INTRODUCTION

The passage ‘The North Wind and the Sun’ was first used in *The Principles of the International Phonetic Association*, published by the International Phonetic Association in 1949, to illustrate the International Phonetic Alphabet (IPA) in world’s languages. The text has proved useful in illustrating the characteristics of basic speech sounds in different languages, but it has sometimes been pointed out that the text is not quite sufficient for the description of a larger inventory of speech sounds. For example, Deterding has shown that the English text lacks some important sounds, and has suggested an alternative text, ‘The Boy who Cried Wolf’, which is considered more suitable for the observation and measurement of a wider variety of English sounds¹⁾.

The Japanese text has similar shortcomings in that a number of basic consonantal sounds, e.g., voiced affricates [dʒ], [dz] and [dʒ̥], allophones of [ɲ], and [j] in CjV type syllables such as [gja] are not represented in the text. In the present study, the passage ‘The North Wind and the Sun’ used to illustrate Japanese in the *Handbook of the International Phonetic Association* 1999 by Okada²⁾ has been modified to create a new ‘panphonic’ version, which embraces, compactly and efficiently, all the consonant phonemes and their major allophones in Japanese (Tokyo dialect).

EDITING OF THE TEXT

In creating the panphonic version of the text, the original English text given in *The Principle of the International Phonetic Association* 1949 was first translated as literally as possible into Japanese. Then, the expressions in the translated Japanese were replaced by synonymous words or phrases that included the consonant phonemes, their allophones and free variants necessary for the illustration. Care was taken to make the text natural enough to adults and plain enough to children (The National Language Research Institute, 1984)³⁾, yet as close as possible to the original English text in wording and syntax. Onomatopoeic, mimetic, and conversational expressions as well as loan words were avoided. The panphonic text consists of 294 syllables, and is about 30% longer than the current Japanese text in the *Handbook*, but is compact enough to be read in less than one minute at a regular speech rate.

TABLE 1. The original English text in *The Principles of the International Phonetic Association*, 1949.

The North Wind and the Sun were disputing which was the stronger, when a traveller came along wrapped in a warm cloak. They agreed that the one who first succeeded in making the traveller take his cloak off should be considered stronger than the other. Then the North Wind blew as hard as he could, but the more he blew the more closely did the traveller fold his cloak around him, and at last the North Wind gave up the attempt. Then the sun shone out warmly, and immediately the traveller took off his cloak. And so the North wind was obliged to confess that the Sun was the stronger of the two.

TABLE 2. Orthographic version of the Japanese panphonic text. Punctuation marks ‘、’ ‘ ’ and ‘。’ ‘ ’ correspond to a comma and a period, respectively, and a pause is normally inserted in these locations. The mark ‘^’ is used to indicate locations where an additional pause may be inserted.

北風と太陽が^どちらが強いかで言い争っているところへ、
偶然にたんぼ道を^旅人が暖かそうな上着にくるまってやってきました。
そこで、その旅人の^上着を脱がせた方が強い^ということにきめました。
まず始めに、北風が旅人に向かってせいっぱい吹きつけました。
しかし、乱暴に吹けば吹くほど^逆に旅人は上着をしっかりと体に巻き付けるので、
脱がせることができません。
北風はくたびれて^ついにあきらめました。
今度は、太陽の番になりました。
太陽が^暖かい光をやりわり地面に注ぐと、やがて旅人は^自分から上着を脱いでしまいました。
それで^北風は残念ながら^太陽の方が強いと認めなければなりませんでした。

TABLE 3. Phonetic transcription of the Japanese panphonic text of ‘The North Wind and the Sun’. Red bold symbols indicate consonant phonemes and their allophones used for the illustration in Table 6. The downward arrow mark \downarrow is used to specify the downstep of voice pitch after an accented syllable. The voiceless mark ̥ and parentheses () are used to indicate the devoicing and eliding of vowels, respectively. The vertical line marks, |, || and |||, correspond to the pause locations specified in the orthography in Table 2 by subscript circumflex mark ̂ , comma , and period . , respectively. The use of shorter pauses (| and ||) may vary according to the speaker, speech rate, style, etc.

[kᵢtakaze to ta'ijo: ŋa | do'teᵢra ŋa tsujo'ika de i:asaso'tte iᵣu tokoᵣo' e ||
 gu:zeᵣᵢ ni tambo'miçi o | tabibito ŋa atakaso't:na uwaᵣi ni kuᵣuma'tte jattekima'ç(i)ta |||
 sokode || sono tabibito no uwaᵣi o nuᵣa'seta ho': ŋa tsujo'i | to ju: koto' ni kimema'ç(i)ta |||
 ma'zu haᵣime ni || kᵢtakaze ŋa tabibito ni mukatte sei'ppai ᵠᵤkitsukema'ç(i)ta |||
 ç(i)ka'ç(i) || dambo: ni ᵠᵤke'ba ᵠ(y)ku' hodo |
 gᵣaku ni tabibito wa uwaᵣi o çikka'ti to kaᵣada ni makᵢts(y)ke'tu node ||
 nuᵣase'tu koto ŋa dekimase'N |||
 kᵢtakaze wa kuᵣabi'tete | tsu'iᵣi akiᵣamema'ç(i)ta |||
 ko'ndo wa | ta'ijo: no ba'ᵣ ni naᵣima'ç(i)ta |||
 ta'ijo: ŋa | atataka'i çikaᵣi o jaᵠwa'ti dzimeᵣi ni soso'ᵣu to ||
 jaᵣate tabibito wa | dzibuᵣ kaᵣa uwaᵣi o nu'ide çimaima'ç(i)ta |||
 soᵣede | kᵢtakaze wa dzannenna'ᵣaᵣa |
 ta'ijo: no ho': ŋa tsujo'i to mitomena'keᵣeba naᵣimase'ndeç(i)ta |||]

TABLE 4. Nearly literal English translation of the Japanese panphonic text.

The North Wind and the Sun were disputing over which was the stronger, when a traveller happened to come along a country road wrapped in a warm-looking cloak. Then they agreed that the side which made that traveller take his cloak off should be considered the stronger. First, the North Wind blew at the traveler with all his might. But the more violently he blew, the more firmly on the contrary, did the traveller fold his cloak around his body, so, the North Wind could not make the traveler take off his cloak. The North Wind became tired, and gave up at last. Next, it was the Sun's turn. The Sun poured warm light gently on the ground, and soon the traveller took off his cloak for himself. And so, the North Wind reluctantly had to admit that the Sun was the stronger.

ILLUSTRATION OF THE CONSONANTS

Table 5 provides the IPA illustration of Japanese consonants and allophones (Tokyo dialect) based on the new panphonic text. The consonants are grouped according to the manner of articulation, and are accompanied by words that contain pertinent phonemes. Allophonic variations are explained too, in relation to their vowel context. A particular type of nasal phoneme called the 'moraic nasal' (/N/) is described in some detail at the end.

TABLE 5: The illustration of the IPA of Japanese consonant phonemes and their major allophones**Bilabial plosive /p/, /b/ and nasal /m/**

/p/ /se:i⁺ppai/ [se: i⁺p⁺ai] ‘with all one’s might’ [p]

In rapid speech, [b] may become [v] or [ɸ].

/b/ /tabibito/ [tabi⁺b⁺ito, tabi⁺v⁺ito, tabi⁺ɸ⁺ito]
‘a traveller’ [b, v, ɸ]

/m/ /kuɾuma⁺ tte/ [kuɾu⁺m⁺a⁺ tte] ‘wrapped’ [m]

Alveolar plosive /t/, /d/ and nasal /n/

/t/ /ta⁺ijo:/ [ta⁺i⁺jo:] ‘the sun’ [t]

/d/ /sokode/ [soku⁺d⁺e] ‘then’ [d]

/n/ /sono/ [so⁺n⁺o] ‘that’ [n]

/n/ before vowel /i/ is alveolo-palatal [ɲ].

/n/ /tsu⁺ini/ [tsu⁺i⁺ɲi] ‘at last’ [ɲ]

Velar plosive /k/, /g/ and nasal /ŋ/

/k/ /kaɾada/ [ka⁺ɾa⁺da] ‘body’ [k]

/g/ /gu:ze⁺nni/ [gu:ze⁺ɲa⁺ni] ‘happen(ed) to ~’ [g]

/g/, when medial, tends to become fricative [ɣ].

Many traditional speakers use nasal [ŋ].

/g/ /nuga⁺seta/ [nu⁺ɣ⁺sa⁺ta, nu⁺ɲa⁺sa⁺ta]
‘made ~ take off’ [ɣ, ɲ]

Alveolar affricate /ts/ and /dz/

/t/ followed by vowel /u/ becomes alveolar affricate [ts].

/ts/ /tsujo⁺i/ [tsu⁺jo⁺i] ‘strong(er)’ [ts]

/d/ followed by vowel /u/ becomes alveolar affricate [dz]. /z/ tends to be affricate initially and after /N/

/dz/ /dzannenna⁺ɲaɾa/ [dzan⁺ne⁺na⁺ɲaɾa]
‘reluctantly’ [dz]

/ts/ and /dz/ become alveolo-palatal before vowel /i/.

/ts/ /do⁺tsiɾaga/ [do⁺t⁺ɕiɾaɲa] ‘which’ [tɕ]

/dz/ /dzime⁺nni/ [dzi⁺me⁺ɲi] ‘on the round’ [dz]

Alveolar fricative /s/ and /z/

/s/ /soso⁺gu/ [so⁺so⁺ɣu] ‘pour’ [s]

/z/ /kitakaze/ [kitaka⁺ze] ‘the North Wind’ [z]

/s/ and /z/ become alveolo-palatal before vowel /i/.

/s/ /si⁺kasi/ [ɕi⁺ka⁺ɕi] ‘but’ [ɕ]

/z/ /hazime⁺ni/ [ha⁺zime⁺ɲi] ‘first’ [z]

Glottal fricative /h/

/h/ /ho⁺:/ [ho⁺:] ‘side’ [h]

/h/ tends to become palatal [ç] and bilabial [ɸ] before vowel /i/ and vowel /u/, respectively.

/h/ /hikaɾi⁺/ [çika⁺ɾi⁺] ‘light’ [ç]

/h/ /huku⁺/ [ɸu⁺ku⁺] ‘blow’ [ɸ]

Alveolopalatal flap /ɾ/

/ɾ/ mainly occurs medially. Postalveolar

approximant [ɹ] or lateral approximant [l] may occasionally occur in some environment.

/ɾ/ /soɾede/ [so⁺ɾe⁺de, so⁺ɹe⁺de, so⁺le⁺de] ‘and so’ [ɾ, ɹ, l]

Initially and after /N/, it is typically an alveolopalatal plosive [d] with short friction.

/ɾ/ /ɾa⁺mb⁺o:ni/ [d⁺a⁺mb⁺o:ɲi] ‘violently’ [d]

Palatal approximant /j/

/j/ /jagate/ [ja⁺ɲate] ‘soon’

/gjakuni/ [gja⁺ku⁺ɲi] ‘on the contrary’ [j]

/j/ is followed by vowels /a, u, o/. /j/ palatalizes the preceding consonants as vowel /i/ does.

Bilabial approximant /w/

/w/ /uwagi/ [uwa⁺ɲi] ‘cloak’ [w]

/w/ is followed by vowel /a/ only.

Uvular nasal /N/

/N/ represents a ‘moraic nasal’ with very variable pronunciations.

/N/ /dekimas⁺eN/ [deki⁺mas⁺e⁺N] ‘could not ~’ [N]

Before a vowel, an approximant, or consonants /h/ and /s/, it becomes a nasalized vowel.

/N/ /ja⁺ɴwa⁺ɾi/ [ja⁺ũ⁺wa⁺ɾi] ‘gently’ [ũ]

Before other consonants, it is homorganic with the following consonant.

/N/ /ko⁺ɴdo/ [ko⁺ɴdo] ‘next’ [ɴ]

/N/ /ta⁺nbomitsi/ [ta⁺mb⁺o⁺mi⁺ɕio] ‘a country road’ [m]

/N/ /ba⁺ɴni/ [ba⁺ɴɲi] ‘(one’s) turn’ [ɲ]

/N/ /zi⁺bun⁺kaɾa/ [dzi⁺bu⁺ɲkaɾa]
‘for oneself’ [ɲ]

CONSONANT CHART

Figure 1 shows the set of Japanese consonant phonemes and their major allophones (Tokyo dialect) selected for the illustration in the panphonic version of the text. The consonants are found in the most fundamental set of Japanese vocabulary, while the allophones are those that occur naturally in everyday speech.

The chart uses the framework proposed in the Handbook, with the following major modifications. A ‘retroflex’ column has been removed and an ‘alveolopalatal’ column has been added instead, for a clearer contrast with the postalveolar column. The rows have been rearranged in such a way that the relation between consonants and their allophones can be more clearly demonstrated. Specifically, an ‘affricate’ row is newly inserted between the ‘plosive’ row and the ‘fricative’ row. The ‘flap’, ‘lateral approximant’ and ‘approximant’ rows form another closely related group. The ‘nasal’ row is at the bottom of the chart.

Manner	Place	Bilabial	Labio dental	Alveolar	Alveolo palatal	Palatal	Velar	Uvular	Glottal
Plosive		/p/ /b/		/t/ /d/	(ɕ)		/k/ /g/		
Affricate				/ts/ /dz/	/tɕ/ /dʑ/				
Fricative		ɸ/ (β)	(v)	/s/ /z/	/ɕ/ /ʑ/		(y)		/h/
Flap				(ɾ)	(ɽ)				
Lateral approximant				(l)					
Approximant		/w/			(ɻ)	/j/			
Nasal		/m/		/n/	/ɲ/		/ŋ/	/ɴ/	Nasalized vowel (̃)

FIGURE 1. Phonetic symbols for Japanese (Tokyo dialect) consonants and allophones coordinated on the IPA consonant chart. Phonetic symbols that simultaneously represent a phoneme are indicated in slashes. A phoneme and the group of related allophones are joined together by broken lines. The allophones in round brackets are free variants.

DEVOICING AND ELIDING OF JAPANESE VOWELS

If a vowel in a Japanese syllable is preceded and followed by voiceless consonants, and the time interval between the laryngeal adjustments for these consonants (to stop vocal fold vibration) is short, there will not be sufficient time for the vocal folds to reach the state of complete vibration for the vowel, and, as a result, the voice source becomes weak. If the interval becomes shorter, the voice source will not build up at all, and the vowel portion will be occupied by silence (‘devoicing’). If the interval becomes extremely short, the laryngeal adjustments for two voiceless consonants will be connected, and the vowel portion will be elided (‘eliding’).

Among the five Japanese vowels [i, e, a, o, u], devoicing and eliding occurs more commonly with [i] and [u], the close vowels with comparatively low sound pressure. Devoicing and eliding do not occur when the vowel is elongated or accented, as the vowel sound becomes longer and stronger. At the end of a tonal section or a sentence, the sound pressure for a vowel becomes low, and consequently vowels in these environments are often devoiced or elided.

Japanese consonants that can occur before vowels [i, u] are as follows. Voiceless plosives [p, k] occur before vowels [i, u] affricates [tɕ] and fricatives [ɕ, ɕ̥] occur before vowel [i] and affricate [ts] and fricatives [s, ɸ] occur before vowel [u]. Consonants that can occur after vowels [i, u] are all those consonants mentioned above, and in addition, plosive [t] and fricative [h] that can precede vowels [a, e, o].

Figure 2 shows various states of vowel devoicing and eliding under different speech rate conditions. The speech material is a part of the panphonic text. A Japanese vowel [u] preceded and followed by voiceless consonants are shown to devoice and elide by degrees as speech rate increases. The indication of vowel devoicing and eliding is also a new and useful feature of the panphonic text.

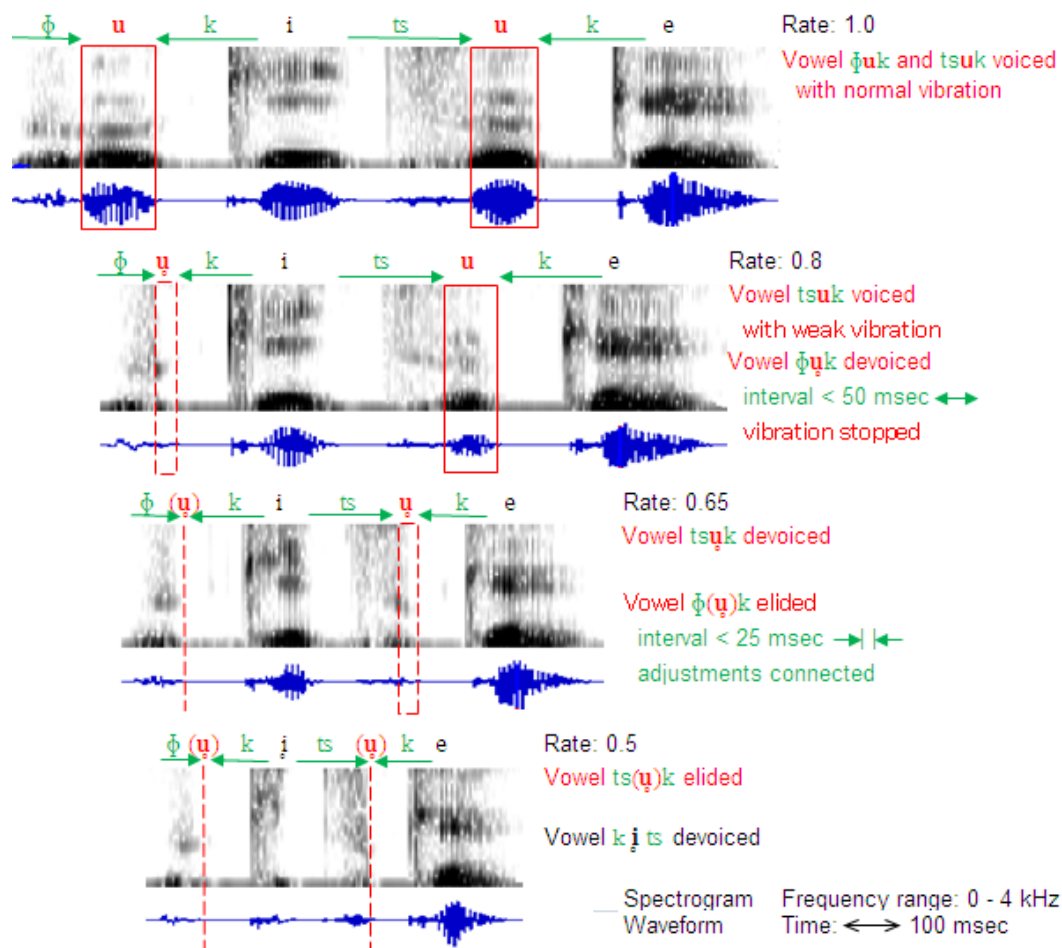


FIGURE 2. Spectrographic display of the devoicing and eliding of a Japanese vowel [u] preceded by voiceless fricative [ϕ] and affricate [ts] and followed by a voiceless plosive [k]. The word selected from the panphonic text is **ϕukitsuke** ma'çita || 吹きつけました。(blew at the traveler.) The speech samples were uttered in the four manners from articulate (Rate 1.0) to quick (Rate 0.5).

DURATIONAL CHARACTERISTICS OF PAUSE

Three types of possible pause locations are specified in the orthographic presentation of the panphonic text, viz., the sentence-final pause location ('。'), the sentence-medial pause location ('、'), and the additional location ('^') where an optional short pause may be inserted. These pause locations are indicated by vertical line symbols, ||, ||, and |, respectively, in the phonetic transcription of the text.

To examine the actual employment of pauses at these 'possible' locations, a recitation of the panphonic text by one of the present authors was analyzed acoustically. It should be mentioned here that, in this paper, the term 'pause' is used interchangeably with the expression 'silent interval'.

The number of pauses inserted at the above mentioned locations (||, ||, and |) was 8, 7, and 9, respectively. A short pause was inserted in most of the 'additional' pause locations.

Figure 3 shows the duration of sentence-final, sentence-medial and ‘additional’ sentence-medial pauses, in relation to the duration of the preceding/following speech segment.

As regards pause duration, there is a clear distinction between sentence-final pauses and sentence-medial pauses. The duration of the sentence-final pauses range from 1.2 s to 2.0 s, while the longest of the sentence-medial pauses is just above 0.6 s. The duration of the ‘additional’ sentence-medial pauses and that of the regular sentence-medial pauses are also fairly distinct from each other, although there is some overlap between the two. The ‘additional’ pauses are generally shorter than 0.3 s. At some of the ‘additional’ pause locations, the speaker did not employ a pause at all.

The duration of the sentence-medial pauses (both regular and ‘additional’) shows positive correlation with the duration of the preceding speech segment, but not with the duration of the following speech segment. The relation between the duration of the sentence-final pause and the duration of the preceding speech segment is not as clear; in some instances, they are negatively correlated.

The ratio of the total pause duration to the total speech duration is approximately 45% in the present recitation sample. For most sentence-medial pauses, this ratio is smaller than the average, whereas the ratio is greater than the average for most sentence-final pauses. This suggests that the sentence-final pauses are more influential in determining the utterance-pause organization of the speech material.

The fact that sentence-final pauses are markedly longer compared with other pauses, and that it does not show any clear correlation with the preceding or following speech segment, suggests that these pauses have more flexibility in incorporating important physiological factors, such as breathing and swallowing, in the realization of their occurrence and duration.

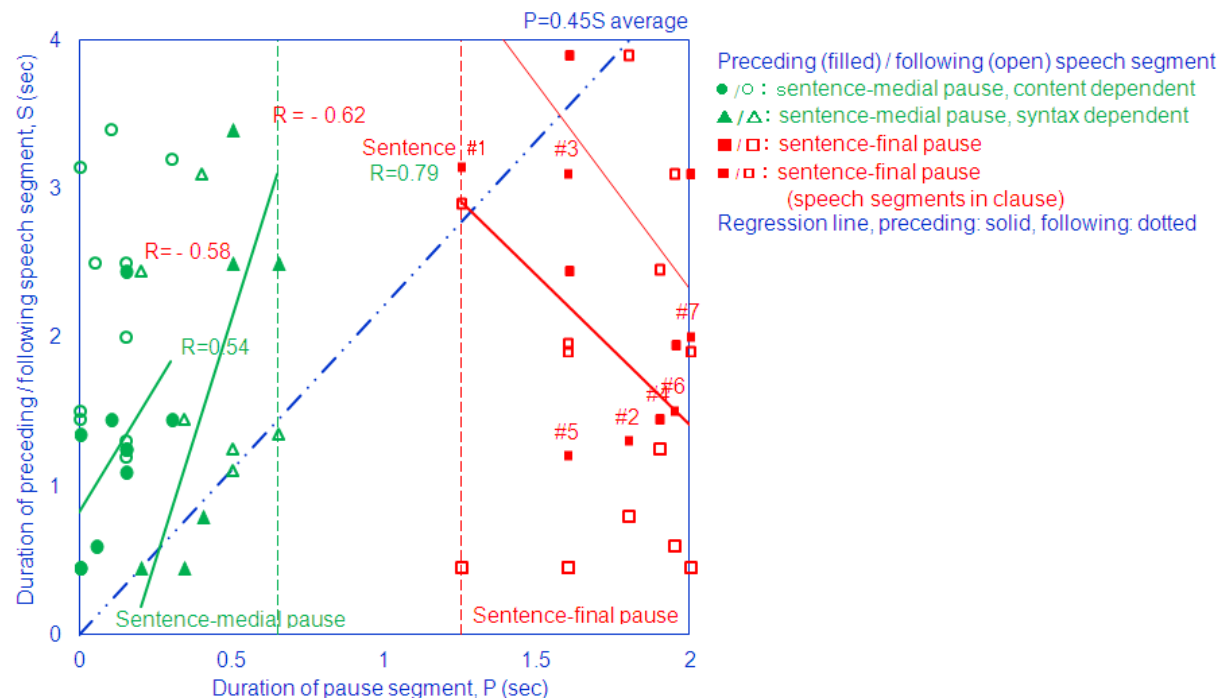


FIGURE 3. The duration of various types of pauses in relation to the duration of the preceding/following speech segment.

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