

Japanese phonology

The phonology of Japanese features about 15 consonant phonemes, the cross-linguistically typical five-vowel system of /a, i, u, e, o/, and a relatively simple phonotactic distribution of phonemes allowing few consonant clusters. It is traditionally described as having a mora as the unit of timing, with each mora taking up about the same length of time, so that the disyllabic [ɲip.poɴ] ("Japan") may be analyzed as /niQpoɴ/ and dissected into four moras, /ni/, /Q/, /po/, and /ɴ/.

Standard Japanese is a pitch-accent language, wherein the position or absence of a pitch drop may determine the meaning of a word: /ha[˥]siɡa/ "chopsticks", /hasi[˥]ɡa/ "bridge", /hasiɡa/ "edge" (see Japanese pitch accent).

Unless otherwise noted, the following describes the standard variety of Japanese based on the Tokyo dialect.

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Consonants

	<u>Bilabial</u>	<u>Alveolar</u>	<u>Alveolo-palatal</u>	<u>Palatal</u>	<u>Velar</u>	<u>Uvular</u>	<u>Glottal</u>
<u>Nasal</u>	<u>m</u>	<u>n</u>	(<u>ɲ</u>)		(<u>ŋ</u>)	(<u>ɴ</u>)	
<u>Stop</u>	<u>p</u> <u>b</u>	<u>t</u> <u>d</u>			<u>k</u> <u>g</u>		
<u>Affricate</u>		(<u>ts</u>) (<u>dʒ</u>)	(<u>tɕ</u>) (<u>dʑ</u>)				
<u>Fricative</u>	(<u>ɸ</u>)	<u>s</u> <u>z</u>	(<u>ɕ</u>) (<u>ʑ</u>)	(<u>ç</u>)			<u>h</u>
<u>Liquid</u>		<u>r</u>					
<u>Semivowel</u>				<u>j</u>	<u>w</u>		
<u>Special moras</u>	<u>/N/, /Q/</u>						

Notes:

- Voiceless stops /p, t, k/ are slightly aspirated: less aspirated than English stops, but more so than Spanish.^[1]
- /p/, a remnant of Old Japanese, now occurs almost always medially in compounds, typically as a result of gemination (as in 切符 *kippu*, 切腹 *seppuku* or 北方 *hoppō*) or after /N/ (as in 音符 *onpu*), and in a few older compounds as a result of the contractions of pronunciations over time (as in 河童 *kappa*). It occurs initially or medially in onomatopoeia. Some few non-onomatopoeic exceptions where it occurs initially include 風太郎 *pūtārō*, although as a personal name it's still pronounced *Fūtārō*. As *gairaigo*, loanwords of non-Middle-Chinese origin (non-Middle-Chinese Chinese borrowings such as パオズ *paozu*, ペテン *peten* as well as borrowings from non-Chinese languages such as パーティ *pāti*, etc.), enter the language, /p/ is increasingly used in transcription, initially or medially.
- /t, d, n/ are laminal denti-alveolar (that is, the blade of the tongue contacts the back of the upper teeth and the front part of the alveolar ridge) and /s, z/ are laminal alveolar. /w/ is the semivocalic equivalent of /u/, [u], with little to no rounding.
- Consonants inside parentheses are allophones of other phonemes, at least in native words. In loanwords, /ɸ, ɕ, ʑ, ts̺, dʒ̺, tɕ̺, dʑ̺/ sometimes occur phonemically, outside of the allophonic variation described below.^[2]

See below for more in-detail descriptions of allophonic variation.

- Before /i/, /s, t/ are alveolo-palatal [ɕ, tɕ̺], and /z, d/ are either neutralized as free variation between [ʑ] and [dʒ̺] or distinct as [ʑ, dʒ̺]. Before /u/, /t/ is [ts̺], and /d/ is either merged with /z/ as free variation between [z] and [dʒ̺] or always [dʒ̺] distinct from /z/. When geminated, however, /z/ is always [dʒ̺].^[3]
- /h/ is [ç] before /i/ and /j/ (🔊 listen), and [ɸ] before /u/ (🔊 listen),^[4] coarticulated with the labial compression of that vowel.
- /N/ is a syllable-final moraic nasal with variable pronunciation depending on what follows.
- Realization of the liquid phoneme /r/ varies greatly depending on environment and dialect. The prototypical and most common pronunciation is an apical tap, either alveolar [ɾ] or postalveolar [ɻ].^{[5][6][4]} Utterance-initially and after /N/, the tap is typically articulated in such

a way that the tip of the tongue is at first momentarily in light contact with the alveolar ridge before being released rapidly by airflow.^{[7][6]} This sound is described variably as a tap, a "variant of [ɾ]", "a kind of weak plosive",^[7] and "an affricate with short friction".^[4] The apical alveolar or postalveolar lateral approximant [l] is a common variant in all conditions,^[4] particularly utterance-initially^[7] and before /i, j/.^[5] According to Akamatsu (1997), utterance-initially and intervocalically (that is, except after /N/), the lateral variant is better described as a tap [ɭ] rather than an approximant.^{[7][8]} The retroflex lateral approximant [ɭ] is also found before /i, j/.^[5] In Tokyo's Shitamachi dialect, the alveolar trill [r] is a variant marked with vulgarity.^[5] Other reported variants include the alveolar approximant [ɭ],^[4] the alveolar stop [d], the retroflex flap [ɽ], the lateral fricative [ɬ],^[5] and the retroflex stop [ɖ].^[9]

Weakening

Non-coronal voiced stops /b, g/ between vowels may be weakened to fricatives, especially in fast or casual speech:

/b/ > bilabial fricative [β]: /abareru/ > [aβareru] *abareru* 暴れる 'to behave violently'

/g/ > velar fricative [ɣ]: /hage/ > [haɣe] *hage* はげ 'baldness'

However, /g/ is further complicated by its variant realization as a velar nasal [ŋ]. Standard Japanese speakers can be categorized into 3 groups (A, B, C), which will be explained below. If a speaker pronounces a given word consistently with the allophone [ŋ] (i.e. a B-speaker), that speaker will never have [ɣ] as an allophone in that same word. If a speaker varies between [ŋ] and [g] (i.e. an A-speaker) or is generally consistent in using [g] (i.e. a C-speaker), then the velar fricative [ɣ] is always another possible allophone in fast speech.

/g/ may be weakened to nasal [ŋ] when it occurs within words—this includes not only between vowels but also between a vowel and a consonant. There is a fair amount of variation between speakers, however. Vance (1987) suggests that the variation follows social class,^[10] while Akamatsu (1997) suggests that the variation follows age and geographic location.^[11] The generalized situation is as follows.

At the beginning of words

- all present-day standard Japanese speakers generally use the stop [g] at the beginning of words: /gaijuu/ > [gaiju:] *gaiyū* 外遊 'overseas trip' (but not *[ŋaiju:])

In the middle of simple words (i.e. non-compounds)

- **A.** a majority of speakers use either [ŋ] or [g] in free variation: /kagu/ > [kaŋu] or [kagu] *kagu* 家具 'furniture'
- **B.** a minority of speakers consistently use [ŋ]: /kagu/ > [kaŋu] (but not *[kagu])
- **C.** most speakers in western Japan and a smaller minority of speakers in Kantō consistently use [g]: /kagu/ > [kagu] (but not *[kaŋu])

In the middle of compound words morpheme-initially:

- B-speakers mentioned directly above consistently use [g].

So, for some speakers the following two words are a minimal pair while for others they are homophonous:

- *sengo* 千五 (せんご) 'one thousand and five' = [senɡo] for B-speakers
- *sengo* 戦後 (せんご) 'postwar' = [senŋo] for B-speakers^[12]

To summarize using the example of *hage* はげ 'baldness':

- A-speakers: /hage/ > [haŋe] or [hage] or [haɣe]
- B-speakers: /hage/ > [haŋe]
- C-speakers: /hage/ > [hage] or [haɣe]

Some phonologists posit a distinct phoneme /ŋ/, citing pairs such as [o:ɡarasɯ] 大硝子 'big sheet of glass' vs. [o:ŋarasɯ] 大烏 'big raven'.^[13]

Palatalization and affrication

The palatals /i/ and /j/ palatalize the consonants preceding them:^[4]

/m/ > palatalized [mʲ]: /umi/ > [ʍmʲi] *umi* 海 'sea'

/g/ > palatalized [gʲ]: /ɡjo:za/ > [ɡʲo:za] *gyōza* ぎょうざ 'fried dumpling'
etc.

For coronal consonants, the palatalization goes further so that alveolo-palatal consonants correspond with dental or alveolar consonants ([ta] 'field' vs. [t̚ɕa] 'tea'):^[14]

/n/ > Alveolo-palatal nasal [ɲ]: /nihoN/ > [ɲihoN] *nihon* 日本 'Japan'

/s/ > alveolo-palatal fricative [ɕ]: /sio/ > [ɕi.o] *shio* 塩 'salt'

/z/ > alveolo-palatal [d͡ʒ] or [ʒ]: /zisiN/ > [d͡ʒiɕiN] *jishin* 地震 'earthquake';
/gozju:/ > [ɡod͡ʒɯ:] ~ [ɡozɯ:] *gojū* 五十 'fifty'

/t/ > alveolo-palatal affricate [t͡ɕ]: /tiziN/ > [t͡ɕid͡ʒiN] ~ [t͡ɕiɕiN] *chijin* 知人 'acquaintance'

/i/ and /j/ also palatalize /h/ to a palatal fricative ([ç]): /hito/ > [çito] *hito* 人 ('person')

Of the allophones of /z/, the affricate [d͡ʒ] is most common, especially at the beginning of utterances and after /N/, while fricative [ʒ] may occur between vowels. Both sounds, however, are in free variation.

In the case of the /s/, /z/, and /t/, when followed by /j/, historically, the consonants were palatalized with /j/ merging into a single pronunciation. In modern Japanese, these are arguably separate phonemes, at least for the portion of the population that pronounces them distinctly in English borrowings.

/sj/ > [ɕ] (romanized as *sh*): /sjaboN/ > [ɕabon] *shabon* シャボン 'soap'

/zj/ > [d͡ʒ ~ ʒ] (romanized as *j*): /zjagaimo/ > [d͡ʒagaimo] *jagaimo* じゃがいも 'potato'

/tj/ > [t͡ɕ] (romanized as *ch*): /tja/ > [t͡ɕa] *cha* 茶 'tea'

/hj/ > [ç] (romanized as *hy*): /hjaku/ > [çakɯ] *hyaku* 百 'hundred'

The vowel /u/ also affects consonants that it follows:^[15]

/h/ > bilabial fricative [ɸ]: /huta/ > [ɸɯta] *futa* ふた 'lid'

/t/ > dental affricate [t͡s]: /tugi/ > [t͡suɡi] *tsugi* 次 'next'

Although [ɸ] and [t͡s] occur before other vowels in loanwords (e.g. [ɸaito] *faito* ファイト 'fight'; [ɸjɯ:(d)ʒoN] *fyūjon* フュージョン 'fusion'; [t͡saitoɡaisuto] *tsaitogaisuto* ツアイトガイスト 'Zeitgeist'; [eɾit͡sin] *eritsin* エリツイン 'Yeltsin'), [ɸ] and [h] are distinguished before vowels except [ɯ] (e.g. English *fork* vs. *hawk* > *fōku* [ɸo:kɯ] フォーク vs. *hōku* [ho:kɯ] ホーク). *[hɯ] is still not distinguished from [ɸɯ] (e.g. English *hood* vs. *food* > [ɸɯ:do] *fūdo* フード).^[16] Similarly, *[si] and *[(d)zi] usually do not occur even in loanwords so that English *cinema* becomes [ɕinema] *shinema* シネマ;^[17] although they may be written スイ and ズイ respectively, they are rarely found even among the most innovative speakers and do not occur phonemically.^{[18][19]}

/d, z/ neutralization

The contrast between /d/ and /z/ is neutralized before /i/ and /u/: [(d)ʒi, (d)zɯ]. By convention, it is often assumed to be /z/, though some analyze it as /d͡z/, the voiced counterpart to [t͡s]. The writing system preserves morphological distinctions, though spelling reform has eliminated historical distinctions except in cases where a mora is repeated once voiceless and once voiced, or where *rendaku* occurs in a compound word: つづく[続く] /tuduku/, いちづける[位置付ける] /itidukeru/ from [iti+tukeru]. Some dialects retain the distinctions between /zi/ and /di/ and between /zu/ and /du/, while others retain only /zu/ and /du/ but not /zi/ and /di/, or merge all four (see *Yotsugana*).

Moraic nasal

The syllable-final moraic nasal, treated as an archiphoneme /N/, undergoes a variety of assimilatory processes. It is variously:^[20]

- uvular [ŋ] at the end of utterances and in isolation. Dorsal occlusion may not always be complete.^[21]
- bilabial [m] before /p, b, m/; this pronunciation is also sometimes found at the end of utterances and in isolation. Singers are taught to pronounce all final and prevocalic instances of this sound as [m], which reflects its historical derivation.
- laminal [n] before coronals [d, t, t͡s, n]; never found utterance-finally. Apical [ɲ] is found before liquid /r/.^[22]
- alveolo-palatal [ɲ] before alveolo-palatals [t͡ɕ, d͡ʒ, ɲ].^[21]
- velar [ŋ] before /k, g/. Before palatalized consonants, it is also palatalized, as in [gẽŋ'ki].^[21]
- some sort of nasalized vowel before vowels, approximants /j, w/, liquid /r/, and fricatives [ɸ, s, ɕ, ç, h]. Depending on context and speaker, the vowel's quality may closely match that of the preceding vowel or be more constricted in articulation. It is thus broadly transcribed with [ũ], an *ad hoc* semivocalic notation undefined for the exact place of articulation.^[22] It is also found utterance-finally.^[4]

Some speakers produce [n] before /z/, pronouncing them as [nd͡z], while others produce a nasalized vowel before /z/.^[23]

These assimilations occur beyond word boundaries.

Gemination

While Japanese features consonant gemination, there are some limitations in what can be geminated. Most saliently, voiced geminates are prohibited in native Japanese words.^[24] This can be seen with suffixation that would otherwise feature voiced geminates. For example, Japanese has a suffix, |ri| that contains what Kawahara (2006) calls a "floating mora" that triggers gemination in certain cases (e.g. |tapu| + |ri| > [tappʷri] 'a lot of'). When this would otherwise lead to a geminated voiced obstruent, a moraic nasal appears instead as a sort of "partial gemination" (e.g. |zabu| + |ri| > [(d)zambʷri] 'splashing').^{[25][26]}

In the late 20th century, voiced geminates began to appear in loanwords, though they are marked and have a high tendency to devoicing. A frequent example is loanwords from English such as *bed* and *dog* that, though they end with voiced singletons in English, are geminated (with an epenthetic vowel) when borrowed into Japanese. These geminates frequently undergo devoicing to become less marked, which gives rise to variability in voicing:^[27]

doggu ドッグ → *dokku* ドック ('dog')^[28]
beddo ベッド → *betto* ベット ('bed')^[28]

The distinction is not rigorous. For example, when voiced obstruent geminates appear with another voiced obstruent they can undergo optional devoicing (e.g. *doreddo* ~ *doretto* 'dreadlocks'). Kawahara (2006) attributes this to a less reliable distinction between voiced and voiceless geminates compared to the same distinction in non-geminated consonants, noting that speakers may have difficulty distinguishing them due to the partial devoicing of voiced geminates and their resistance to the weakening process mentioned above, both of which can make them sound like voiceless geminates.^[29]

There is some dispute about how gemination fits with Japanese phonotactics. One analysis, particularly popular among Japanese scholars, posits a special "mora phoneme" (モーラ音素 *Mōra onso*) /Q/, which corresponds to the sokuon (っ).^[30] However, not all scholars agree that the use of this "moraic obstruent" is the best analysis. In those approaches that incorporate the moraic obstruent, it is said to completely assimilate to the following obstruent, resulting in a geminate (that is, double) consonant. The assimilated /Q/ remains unreleased and thus the geminates are phonetically long consonants. /Q/ does not occur before vowels or nasal consonants. This can be seen as an archiphoneme in that it has no underlying place or manner of articulation, and instead manifests as several phonetic realizations depending on context, for example:

[p̚] before [p]: /niQ.poN/ > [nip̚.pon] *nippon* 日本 'Japan'
 [s] before [s]: /kaQ.seN/ > [kas.sen] *kassen* 合戦 'battle'
 [t̚] before [t̚]: /saQ.ti/ > [sat̚.t̚i] *satchi* 察知 'inference'
 etc.

Another analysis of Japanese dispenses with /Q/. In such an approach, the words above are phonemicized as shown below:

[p̚] before [p]: /nip.poN/ > [nip̚.pon] *nippon* 日本 'Japan'
 [s] before [s]: /kas.seN/ > [kas.sen] *kassen* 合戦 'battle'
 [t̚] before [t̚]: /sat.ti/ > [sat̚.t̚i] *satchi* 察知 'inference'
 etc.

Gemination can of course also be transcribed with a length mark (e.g. [ɲipːoN]), but this notation obscures mora boundaries.

Sandhi

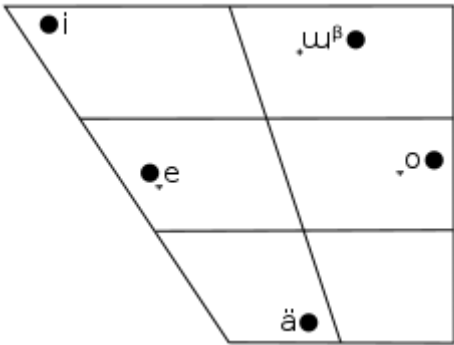
Various forms of sandhi exist; the Japanese term for sandhi generally is *ren'on* (連音), while sandhi in Japanese specifically is called *renjō* (連声). Most commonly, a terminal /N/ on one morpheme results in /n/ or /m/ being added to the start of the next morpheme, as in *tennō* (天皇, emperor), てん + おう > てんのう (ten + ō = tennō). In some cases, such as this example, the sound change is used in writing as well, and is considered the usual pronunciation. See 連声 (*in Japanese*) for further examples.

Vowels

Vowel phonemes of Japanese

	Front	Central	Back
<u>Close</u>	i		u
<u>Mid</u>	e		o
<u>Open</u>		a	

- /u/ is a close near-back vowel with the lips unrounded ([ɯ])^{[31][32]} or compressed ([ɯ^β]).^{[4][33]} When compressed, it is pronounced with the side portions of the lips in contact but with no salient protrusion. In conversational speech, compression may be weakened or completely dropped.^[33] After /s, z, t/ and palatalized consonants (/Cj/), it is centralized [ɨ].^[31]
- /e, o/ are mid [e, o].^[34]
- /a/ is central [ä].^[34]



The vowels of Standard Japanese on a vowel chart. Adapted from Okada (1999:117).

Except for /u/, the short vowels are similar to their Spanish counterparts.

Vowels have a phonemic length contrast (i.e. short vs. long). Compare contrasting pairs of words like *ojisā* /ozisaN/ 'uncle' vs. *ojiisan* /oziisaN/ 'grandfather', or *tsuki* /tuki/ 'moon' vs. *tsūki* /tuuki/ 'airflow'.

Some analyses make a distinction between a long vowel and a succession of two identical vowels, citing pairs such as 砂糖屋 *satōya* 'sugar shop' [satoːja] vs. 里親 *satooya* 'foster parent' [satooja]. They are usually identical in normal speech, but when enunciated a distinction may be made with a pause or a glottal stop inserted between two identical vowels.^[35]

Within words and phrases, Japanese allows long sequences of phonetic vowels without intervening consonants, pronounced with hiatus, although the pitch accent and slight rhythm breaks help track the timing when the vowels are identical. Sequences of two vowels within a single word are extremely common, occurring at the end of many *i*-type adjectives, for example, and having three or more vowels in sequence within a word also occurs, as in *aoi* 'blue/green'. In phrases, sequences with multiple *o* sounds are most common, due to the direct object particle を 'wo' (which comes after a word) being realized as *o* and the honorific prefix お ~ 'o', which can occur in sequence, and may follow a word itself

terminating in an *o* sound; these may be dropped in rapid speech. A fairly common construction exhibiting these is 「～をお送りします」 ... (*w*)*o o-okuri-shimasu* 'humbly send ...'. More extreme examples follow:

/ho:.o:.o.o.o:/ [ho:.o:.o.o.o:] *hōō o oō* (ほうおう お (鳳凰を追おう) 'let's chase the fenghuang'

/to:.o:.o.o.o:/ [to:.o:.o.o.o:] *tōō o oō* (とうおう おお (東欧を覆おう) 'let's cover Eastern Europe'

Devoicing

In many dialects, the close vowels /i/ and /u/ become voiceless when placed between two voiceless consonants or, unless accented, between a voiceless consonant and a pausa.^[36]

/kutu/ > [kʰʊt̚sɯ] *kutsu* 靴 'shoe'

/atu/ > [at̚sɯ] *atsu* 圧 'pressure'

/hikaN/ > [ç̥ikaN] *hikan* 悲観 'pessimism'

Generally, devoicing does not occur in a consecutive manner:^[37]

/kisitu/ > [kiç̥it̚sɯ] *kishitsu* 気質 'temperament'

/kusikumo/ > [kʰuç̥ik̚ɯmo] *kushikumo* 奇しくも 'strangely'

This devoicing is not restricted to only fast speech, though consecutive voicing may occur in fast speech.^[38]

To a lesser extent, /o, a/ may be devoiced with the further requirement that there be two or more adjacent moras containing the same phoneme:^[36]

/kokoro/ > [k̚okoɾo] *kokoro* 心 'heart'

/haka/ > [h̚aka] *haka* 墓 'grave'

The common sentence-ending copula *desu* and polite suffix *masu* are typically pronounced [des̚ɯ] and [mas̚ɯ].^[39]

Japanese speakers are usually not even aware of the difference of the voiced and devoiced pair. On the other hand, gender roles play a part in prolonging the terminal vowel: it is regarded as effeminate to prolong, particularly the terminal /u/ as in *arimasu*. Some nonstandard varieties of Japanese can be recognized by their hyper-devoicing, while in some Western dialects and some registers of formal speech, every vowel is voiced.

Nasalization

Japanese vowels are slightly nasalized when adjacent to nasals /m, n/. Before the moraic nasal /N/, vowels are heavily nasalized:

/seesaN/ > [se:s̚ãN] *seisan* 生産 'production'

Glottal stop insertion

At the beginning and end of utterances, Japanese vowels may be preceded and followed by a glottal stop [ʔ], respectively. This is demonstrated below with the following words (as pronounced in isolation):

/eN/ > [eN] ~ [ʔeN]: *en* 円 'yen'

/kisi/ > [kiʔiʔ]: *kishi* 岸 'shore'

/u/ > [uʔ ~ ʔuʔ]: *u* 鵜 'cormorant'

When an utterance-final word is uttered with emphasis, this glottal stop is plainly audible, and is often indicated in the writing system with a small letter *tsu* (っ) called a sokuon. This is also found in interjections like あっ and えっ. These words are likely to be romanized as ⟨a'⟩ and ⟨e'⟩, or rarely as ⟨at⟩ and ⟨et⟩.

Phonotactics

Phonotactically legal phoneme sequences, each counting as one mora

	/-a/	/-i/	/-u/	/-e/	/-o/	/-ja/	/-ju/	/-jo/
/Ø-/	/a/	/i/	/u/ [ʷ]	/e/	/o/	/ja/	/ju/ [jʷ]	/jo/
/k-/	/ka/	/ki/ [kʲi]	/ku/ [kʷ]	/ke/	/ko/	/kja/ [kʲa]	/kju/ [kʲɨ]	/kjo/ [kʲo]
/g-/	/ga/	/gi/ [ɡʲi]	/gu/ [ɡʷ]	/ge/	/go/	/gja/ [ɡʲa]	/gju/ [ɡʲɨ]	/gjo/ [ɡʲo]
/s-/	/sa/	/si/ [ɕi]	/su/ [sʰ]	/se/	/so/	/sja/ [ɕa]	/sju/ [ɕɨ]	/sjo/ [ɕo]
/z-/	/za/ [(d)za]	/zi/ [(d)ʒi]	/zu/ [(d)ʒʰ]	/ze/ [(d)ze]	/zo/ [(d)zo]	/zja/ [(d)ʒa]	/zju/ [(d)ʒɨ]	/zjo/ [(d)ʒo]
/t-/	/ta/	/ti/ [t͡ɕi]	/tu/ [t͡sʰ]	/te/	/to/	/tja/ [t͡ɕa]	/tju/ [t͡ɕɨ]	/tjo/ [t͡ɕo]
/d-/	/da/	(/di/) [(d)ʒi]	(/du/) [(d)ʒʰ]	/de/	/do/	(/dja/) [(d)ʒa]	(/dju/) [(d)ʒɨ]	(/djo/) [(d)ʒo]
/n-/	/na/	/ni/ [ɲi]	/nu/ [nʷ]	/ne/	/no/	/nja/ [ɲa]	/nju/ [ɲɨ]	/njo/ [ɲo]
/h-/	/ha/	/hi/ [ç̞i]	/hu/ [ϕʷ]	/he/	/ho/	/hja/ [ça]	/hju/ [ç̞ɨ]	/hjo/ [ço]
/b-/	/ba/	/bi/ [bʲi]	/bu/ [bʷ]	/be/	/bo/	/bjɑ/ [bʲa]	/bjʊ/ [bʲɨ]	/bjo/ [bʲo]
/p-/	/pa/	/pi/ [pʲi]	/pu/ [pʷ]	/pe/	/po/	/pjɑ/ [pʲa]	/pjʊ/ [pʲɨ]	/pjo/ [pʲo]
/m-/	/ma/	/mi/ [mʲi]	/mu/ [mʷ]	/me/	/mo/	/mjɑ/ [mʲa]	/mjʊ/ [mʲɨ]	/mjo/ [mʲo]
/r-/	/ra/ [ɾa]	/ri/ [ɾʲi]	/ru/ [ɾʷ]	/re/ [ɾe]	/ro/ [ɾo]	/rja/ [ɾʲa]	/rju/ [ɾʲɨ]	/rjo/ [ɾʲo]
/w-/	/wa/ [w̥a]							
Marginal combinations mostly found in Western loans ^[40]								
[ɕ-]				[ɕe]				
[(d)ʒ-]				[(d)ʒe]				
[t-]		[tʲi]	[tʷ]				[tʲɨ]	
[t͡ɕ-]				[t͡ɕe]				
[ts̺-]	[ts̺a]	[ts̺ʲi]		[ts̺e]	[ts̺o]			
[d-]		[dʲi]	[dʷ]				[dʲɨ]	
[ϕ-]	[ϕa]	[ϕʲi]		[ϕe]	[ϕo]		[ϕɨ]	
[j-]				[je]				
[w̥-]		[w̥ɨ]		[w̥e]	[w̥o]			
Special moras								
/N-/	/N/ [N, m, n, ŋ, ŋ̟, ŋ̠]							
/N-C/	/Q/ (geminate the following consonant)							

/N/	/R/ [:]
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Japanese words have traditionally been analysed as composed of moras; a distinct concept from that of syllables.^{[41][42]} Each mora occupies one rhythmic unit, i.e. it is perceived to have the same time value.^[43] A mora may be "regular" consisting of just a vowel (V) or a consonant and a vowel (CV), or may be one of two "special" moras, /N/ and /Q/. A glide /j/ may precede the vowel in "regular" moras (CjV). Some analyses posit a third "special" mora, /R/, the second part of a long vowel (a chroneme).^{[44][45]} In this table, the period represents a mora break, rather than the conventional syllable break.

Mora type	Example	Japanese	Moras per word
V	/o/	o 尾 'tail'	1-mora word
jV	/jo/	yo 世 'world'	1-mora word
CV	/ko/	ko 子 'child'	1-mora word
CjV	/kjo/ ¹	kyo 巨 'hugeness'	1-mora word
R	/R/ in /kjo.R/ or /kjo.o/	kyō 今日 'today'	2-mora word
N	/N/ in /ko.N/	kon 紺 'deep blue'	2-mora word
Q	/Q/ in /ko.Q.ko/ or /ko.k.ko/	kokko 国庫 'national treasury'	3-mora word

^{^1} Traditionally, moras were divided into plain and palatal sets, the latter of which entail palatalization of the consonant element.^[46]

/N/ is restricted from occurring word-initially, and /Q/ is found only word-medially.^[47] Vowels may be long, and the voiceless consonants /p, t, k, s, n/ may be geminate (doubled).^[48] In the analysis with archiphonemes, geminate consonants are the realization of the sequences /Nn/, /Nm/ and sequences of /Q/ followed by a voiceless obstruent, though some words are written with geminate voiced obstruents. In the analysis without archiphonemes, geminate clusters are simply two identical consonants, one after the other.

In English, stressed syllables in a word are pronounced louder, longer, and with higher pitch, while unstressed syllables are relatively shorter in duration. Japanese is often considered a mora-timed language, as each mora tends to be of the same length,^[49] though not strictly: geminate consonants and moras with devoiced vowels may be shorter than other moras.^[50] Factors such as pitch have negligible influence on mora length.^[51]

Accent

Standard Japanese has a distinctive pitch accent system: a word can have one of its moras bearing an accent or not. An accented mora is pronounced with a relatively high tone and is followed by a drop in pitch. The various Japanese dialects have different accent patterns, and some exhibit more complex tonic systems.

Sound change

As an agglutinative language, Japanese has generally very regular pronunciation, with much simpler morphophonology than a fusional language would. Nevertheless, there are a number of prominent sound change phenomena, primarily in morpheme combination and in conjugation of verbs and adjectives. Phonemic changes are generally reflected in the spelling, while those that are not either indicate informal or dialectal speech which further simplify pronunciation.

Sandhi

Rendaku

In Japanese, sandhi is prominently exhibited in rendaku – consonant mutation of the initial consonant of a morpheme from unvoiced to voiced in some contexts when it occurs in the middle of a word. This phonetic difference is reflected in the spelling via the addition of dakuten, as in *ka, ga* (か / が). In cases where this combines with the yotsugana mergers, notably *ji, dzi* (じ / ぢ) and *zu, dzu* (ず / づ) in standard Japanese, the resulting spelling is morphophonemic rather than purely phonemic.

Gemination

The other common sandhi in Japanese is conversion of つ or く (*tsu, ku*), and ち or き (*chi, ki*), and rarely ふ or ひ (*fu, hi*) as a trailing consonant to a geminate consonant when not word-final – orthographically, the sokuon っ, as this occurs most often with つ. So that

- 一 (*itsu*) + 緒 (*sho*) = 一緒 (*issho*)
- 学 (*gaku*) + 校 (*kō*) = 学校 (*gakkō*)

Some long vowels derive from an earlier combination of a vowel and *fu* (see onbin). The *f* often causes gemination when it is joined with another word:

- 法 (*hafu* > *hō*) + 被 (*hi*) = 法被 (*happi*), instead of *hōhi*.
- 法 (*bofu* > *bō*) + 師 (*shi*) = 法師 (*botchi*), sometimes *bōshi*.
- 合 (*kafu* > *gō*) + 戦 (*sen*) = 合戦 (*kassen*), instead of *gōsen*
- 入 (*nifu* > *nyū*) + 声 (*shō*) = 入声 (*nisshō*), instead of *nyūshō*
- 十 (*jifu* > *jū*) + 戒 (*kai*) = 十戒 (*jikkai*) instead of *jūkai*

Most words exhibiting this change are Sino-Japanese words deriving from Middle Chinese morphemes ending in /t̚/, /k̚/ or /p̚/, which were borrowed on their own into Japanese with a prop vowel after them (e.g. 日 MC */nit̚/ > Japanese /niti/ [nit̚i]) but in compounds as assimilated to the following consonant (e.g. 日本 MC */nit̚.p̚ən/ > Japanese /niQ.poN/ [nip̚.poN]).

Renjō

Sandhi also occurs much less often in *renjō* (連声), where, most commonly, a terminal /N/ or /Q/ on one morpheme results in /n/ (or /m/ when derived from historical *m*) or /t̚/ respectively being added to the start of a following morpheme beginning with a vowel or semivowel, as in *ten + ō* → *tennō* (天皇: てん + おう → てんのう). Examples:

First syllable ending with /N/

- 銀杏 (*ginnan*): ぎん (*gin*) + あん (*an*) → ぎん**なん** (*ginnan*)
- 観音 (*kannon*): くわん (*kwan*) + おむ (*om*) → くわん**の**む (*kwannom*) → かん**の**ん (*kannon*)
- 天皇 (*tennō*): てん (*ten*) + わう (*wau*) → てん**な**う (*tennau*) → てん**の**う (*tennō*)

First syllable ending with /N/ from original /m/

- 三位 (*sanmi*): さむ (*sam*) + め (*wi*) → さむ**み** (*sammi*) → さん**み** (*sanmi*)
- 陰陽 (*onmyō*): おむ (*om*) + やう (*yau*) → おむ**み**やう (*ommyau*) → おん**み**よう (*onmyō*)

First syllable ending with /Q/

- 雪隠 (*setchin*): せつ (*setsu*) + いん (*in*) → せつ**ち**ん (*setchin*)
- 屈惑 (*kuttaku*): くつ (*kutsu*) + わく (*waku*) → くつ**た**く (*kuttaku*)

Onbin

Another prominent feature is *onbin* (音便, euphonic sound change), particularly historical sound changes.

In cases where this has occurred within a morpheme, the morpheme itself is still distinct but with a different sound, as in *hōki* (箒 (ほうき), broom), which underwent two sound changes from earlier *hahaki* (ははき) → *hauki* (はうき) (*onbin*) → *houki* (ほうき) (historical vowel change) → *hōki* (ほうき) (long vowel, sound change not reflected in kana spelling).

However, certain forms are still recognizable as irregular morphology, particularly forms that occur in basic verb conjugation, as well as some compound words.

Verb conjugation

Polite adjective forms

The polite adjective forms (used before the polite copula *gozaru* (ござる, be) and verb *zonjiru* (存じる, think, know)) exhibit a one-step or two-step sound change. Firstly, these use the continuative form, *-ku* (-く), which exhibits *onbin*, dropping the *k* as *-ku* (-く) → *-u* (-う). Secondly, the vowel may combine with the preceding vowel, according to historical sound changes; if the resulting new sound is palatalized, meaning *yu*, *yo* (ゆ、よ), this combines with the preceding consonant, yielding a palatalized syllable.

This is most prominent in certain everyday terms that derive from an *i*-adjective ending in *-ai* changing to *-ō* (*-ou*), which is because these terms are abbreviations of polite phrases ending in *gozaimasu*, sometimes with a polite *o*- prefix. The terms are also used in their full form, with notable examples being:

- *arigatō* (有難う、ありがとう, Thank you), from *arigatai* (有難い、ありがたい, (I am) grateful).
- *ohayō* (お早う、おはよう, Good morning), from *hayai* (早い、はやい, (It is) early).
- *omedetō* (お目出度う、おめでとう, Congratulations), from *medetai* (目出度い、めでたい, (It is) auspicious).

Other transforms of this type are found in polite speech, such as *oishiku* (美味しく) → *oishū* (美味しゅう) and *ōkiku* (大きく) → *ōkyū* (大きゅう).

-hito

The morpheme *hito* (人 (ひと), person) (with *rendaku -bito* (〜びと)) has changed to *uto* (うと) or *udo* (うど), respectively, in a number of compounds. This in turn often combined with a historical vowel change, resulting in a pronunciation rather different from that of the components, as in *nakōdo* (仲人 (なこうど), matchmaker) (see below). These include:

- *otōto* (弟 (おとうと), younger brother), from *otohito* (弟人 (おとひと)) → *otouto* (おとうと) → *otōto*.
- *imōto* (妹 (いもうと), younger sister), from *imohito* (妹人 (いもひと)) → *imouto* (いもうと) → *imōto*.
- *shirōto* (素人 (しろうと), novice), from *shirohito* (白人 (しろひと)) → *shirouto* (しろうと) → *shirōto*.
- *kurōto* (玄人 (くろうと), veteran), from *kurohito* (黒人 (くろひと)) → *kurouto* (くろうと) → *kurōto*.
- *nakōdo* (仲人 (なこうど), matchmaker), from *nakabito* (仲人 (なかびと)) → *nakaudo* (なかうど) → *nakoudo* (なこうど) → *nakōdo*.
- *karyūdo* (狩人 (かりゅうど), hunter), from *karibito* (狩人 (かりびと)) → *kariudo* (かりうど) → *karyuudo* (かりゅうど) → *karyūdo*.
- *shūto* (舅 (しゅうと), stepfather), from *shihito* (舅人 (しひと)) → *shiuto* (しうと) → *shuuto* (しゅうと) → *shūto*.

Fusion

In some cases morphemes have effectively fused and will not be recognizable as being composed of two separate morphemes.

See also

- [Gemination § Japanese](#)
- [Japanese grammar](#)
- [Japanese writing system](#)
- [Japanese honorifics](#)
- [Japanese language and computers](#)
- [Japanese language education](#)
- [Japanese literature](#)
- [Transcription into Japanese](#)
- [Yotsugana](#), the different distinctions of historical *zi, *di, *zu, *du in different regions of Japan
- [Okinawan Japanese](#), a variant of Standard Japanese influenced by the [Ryukyuan languages](#)
- [Japanese loanwords in Hawaii](#)

Notes

1. Riney et al. (2007).
2. Labrune (2012), p. 59.
3. Vance (2008), p. 108.
4. Okada (1999), p. 118.
5. Labrune (2012), p. 92.
6. Vance (2008), p. 89.
7. Akamatsu (1997), p. 106.
8. Akamatsu (1997) employs a different symbol, [Ĵ], for the lateral tap.
9. Arai, Warner & Greenberg (2007), p. 48.
10. Vance (1987), pp. 110–1.
11. Akamatsu (1997), p. 130.
12. Japanese academics represent [go] as ㄱ and [ŋo] as ㄱ° .
13. Shibatani (1990), p. 172.
14. Itō & Mester (1995), p. 827.
15. Itō & Mester (1995), p. 825.
16. Itō & Mester (1995), p. 826.
17. Itō & Mester (1995), p. 828.
18. Irwin (2011), p. 84.
19. Hall (2013).
20. Labrune (2012), pp. 133–4.
21. Vance (2008), p. 96.
22. Vance (2008), p. 97.
23. Akamatsu (1997).
24. Labrune (2012), p. 104.
25. Kawahara (2006), p. 550.
26. Labrune (2012:104–5) points out that the prefix [bu] has the same effect.
27. Sano 2013, pp. 245–246.
28. Sano 2013, p. 245.
29. Kawahara (2006), pp. 559, 561, 565.
30. Labrune (2012), p. 135.
31. Labrune (2012), p. 25.
32. Akamatsu (1997), p. 31.
33. Vance (2008), pp. 54–6.
34. Okada (1999), p. 117.
35. Labrune (2012), pp. 45–6.
36. Labrune (2012), pp. 34–5.
37. Tsuchida (2001), p. 225.
38. Tsuchida (2001), fn 3.
39. Seward (1992), p. 9.
40. Irwin (2011), pp. 75–6.
41. Moras are represented orthographically in katakana and hiragana – each mora, with the exception of CjV clusters, being one kana – and are referred to in Japanese as 'on' or 'onji'.

42. Verdonshot, Rinus G.; Kiyama, Sachiko; Tamaoka, Katsuo; Kinoshita, Sachiko; Heij, Wido La; Schiller, Niels O. (2011). "The functional unit of Japanese word naming: Evidence from masked priming". *Journal of Experimental Psychology: Learning, Memory, and Cognition*. **37** (6): 1458–1473. doi:10.1037/a0024491 (<https://doi.org/10.1037%2Fa0024491>). PMID 21895391 (<https://pubmed.ncbi.nlm.nih.gov/21895391>).
43. Labrune (2012), p. 143.
44. Also notated /H/, following the conventional usage of *h* for lengthened vowels in romanization.
45. Labrune (2012), pp. 143–4.
46. Itō & Mester (1995:827). In such a classification scheme, the plain counterparts of moras with a palatal glide are onsetless moras.
47. Aoyama 2001, p. 9.
48. Aoyama 2001, p. 8.
49. Aoyama 2001, pp. 1–2.
50. Aoyama 2001, p. 11.
51. Aoyama 2001, pp. 7–8.

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