

I Introduction to Japanese phonetics and phonology

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1 Goals and scope of the volume

This volume describes the basic phonetic and phonological structures of modern Japanese with main focus on the standard variety known as Tokyo Japanese. It aims to provide a comprehensive overview and descriptive generalizations of major phonetic and phonological phenomena in modern Tokyo Japanese by reviewing important studies in the fields over the past century or so. In addition, this volume also aims to give an overview of major phonological theories including, but not restricted to, traditional generative phonology, lexical phonology, prosodic morphology, intonational phonology, and the more recent Optimality Theory. It also presents summaries of interesting questions that remain unsolved in the literature.

While the entire volume is devoted to the description of modern Tokyo Japanese, some chapters refer to other major dialects and some discuss the historical aspects of the dialect to some extent. These references are intended to help the reader better understand the phonetic/phonological structures of modern Tokyo Japanese. It is recommended that one reads the Dialect and History volumes, too, if one is interested in dialects other than Tokyo Japanese and in the history of the language.

This volume consists of eighteen chapters in addition to this introductory chapter to the whole volume (Part I). The eighteen chapters are grouped into four parts from Part II to Part V, according to the nature of the phenomena they deal with. Part II consists of five chapters all of which analyze segmental properties of Japanese such as sokuon (or geminate obstruents), new consonant phonemes, vowel devoicing and diphthongs. Part III discusses morphophonological processes and phonetic/ phonological structures therein. These include various processes in mimetic, Sino-Japanese, and loanword phonology, various word-formation processes, and rendaku (or sequential voicing). Part IV deals with the prosodic structure of modern Japanese, discussing phonetic and phonological processes within and beyond the word. These include word accent, rhythm, and intonation as well as the syntax-phonology interface. Finally, Part V examines Japanese phonetics and phonology from broader perspectives in their interface with other subfields of linguistics such as historical and corpus linguistics, L1 phonology, and L2 research. All four chapters in this part attempt to reveal phonological structures of modern Japanese which would otherwise remain uncovered.

While this volume is intended to cover all major areas in the phonetics and phonology of modern Tokyo Japanese, the reader is referred to more classic or introductory books of Japanese phonetics

and phonology including, but not restricted to, Bloch (1950), Martin (1975), Kawakami (1977), Komatsu (1981), Vance (1987, 2008), Saito (1997), Kubozono (1999b) and Labrune (2012). These introductory books provide basic information and will help the reader to understand the chapters of this volume better.

In this introductory chapter, we will provide an overall introduction to the sound system of modern Tokyo Japanese, such as vowel and consonant inventories, accentual patterns, as well as a brief introduction to each topic dealt with in the subsequent chapters. Also some basic concepts/notions and terminologies that are commonly used in the volume are defined. These include notions such as the mora, the syllable, word accent, and intonation. In addition are sketched the basic organization of the lexicon of modern Japanese and its lexical categories (i.e. native, Sino-Japanese and foreign words).

2 Vowel inventory

2.1 Short vowels

As is well known, modern Tokyo Japanese has five vowel phonemes: /a/, /i/, /u/, /e/ and /o/. In this volume, these vowels are phonetically represented as [a], [i], [u], [e], and [o], respectively. The symbol [u] is used instead of [ʊ] since this vowel has almost lost lip protrusion although it is not as flat as what the IPA symbol [u] is supposed to denote. Phonologically, these five vowels can be characterized by the height of the tongue – high (/i/ and /u/), mid (/e/ and /o/) and low (/a/) – and the backness of the tongue – front (/i/ and /e/) and back (/u/, /o/ and /a/). In terms of distinctive features, the following three features suffice to differentiate between the five vowels (Kubozono 1999b). Positing these features is instrumental in formulating vowel changes such as vowel coalescence (see Kubozono Ch. 5, this volume) and in defining the patterns of vowel epenthesis in loanwords (Kubozono Ch. 8, this volume).

- (1) /i/ [+high, -low, -back]
 /u/ [+high, -low, +back]
 /e/ [-high, -low, -back]
 /o/ [-high, -low, +back]
 /a/ [-high, +low, +back]

According to UPSID (UCLA Phonological Segment Inventory Database, Maddieson 1984), a vowel system with five short vowels represents the most standard type of vowel system in world's languages: it is more common than vowel systems with four short vowels or those with six short vowels. The same database also shows that most five-vowel systems consist of /a/, /i/, /u/, /e/ and /o/. In this sense, the vowel system of modern Japanese represents the most typical vowel system.

The five vowels constituting the vowel system do not occur equally frequently in the Japanese vocabulary. According to Onishi (1937) cited in Hayashi (1982), /a/ is the vowel that occurs most frequently (by type frequency), followed by /o/, /i/, /e/, /u/ in this order.

Of the five vowels, /i/ and /u/ are phonetically ‘weak’ vowels. They are, for example, the shortest vowels in modern Japanese (Campbell 1992) and are most prone to vowel devoicing (see Fujimoto, this volume, for details). Thus, the second vowels in /a.ki/ ‘autumn’ and /a.ku/ ‘to open (intransitive)’ are often devoiced in spontaneous speech, while the second vowels in /a.ka/ ‘red’, /ta.ke/ ‘bamboo’ and /ta.ko/ ‘octopus, kite’ are not. Moreover, /i/ and /u/ are the most common epenthetic vowels in the language. In old loanwords borrowed from Chinese, i.e. Sino-Japanese (SJ) vocabulary, these vowels were inserted to avoid closed syllables, or syllables that end in a consonant. Some examples are given in (1), where old Chinese forms are given in the input and loanword forms in the output. Epenthetic vowels are enclosed in < >.

- (2) a. gak → gak<u> ‘learning’ (学)
 yak → yak<u> ‘duty’ (役)
 bat → bat<u> ‘punishment’ (罰)
 b. ek → ek<i> ‘benefit’ (益), ‘station’ (駅)
 bat → bat<i> ‘punishment’ (罰)

/i/ and /u/ are inserted in modern loanwords from English and other languages, too. This is exemplified in (2): see Ito and Mester (Ch. 9, this volume) for more details about epenthetic vowels, and Kawahara (Ch. 1, this volume) and Kawagoe (this volume) for the discussion of geminate consonants in modern loanwords.

- (3) a. back → bak.k<u>
 top → top.p<u>
 b. ink → ink<i>, ink<u>
 deck → dek.k<i>

2.2 Long vowels and diphthongs

In addition to the five short vowels, modern Tokyo Japanese has the same number of corresponding long vowels. In this volume, these long vowels are represented with a double letter in phonemic /phonological representations (/aa/, /ii/, /uu/, /ee/, and /oo/) and with a length marker in phonetic representations ([a:], [i:], [u:], [e:], [o:]). Not surprisingly, there are many minimal pairs of words that contrast in vowel length (some of which can be distinguished by word accent). Syllable boundaries are denoted by dots (.) in (4) and in the rest of this volume.

- (4) a. too ‘ten, tower’ vs. to ‘door’
 b. bii.ru ‘beer’ vs. bi.ru ‘building’
 c. ru.bii ‘ruby (jewel)’ vs. ru.bi ‘ruby, an old printing type size equal to 5 1/2 points’
 d. o.baa.san ‘grandmother, old woman’ vs. o.ba.san ‘aunt, middle-aged woman’
 e. paa.maa ‘Palmer (personal name)’ vs. paa.ma ‘permanent wave, perm’
 f. koo.mo.ri ‘bat’ vs. ko.mo.ri ‘baby-sitting’
 g. oo.ya.ma ‘Ōyama (family name)’ vs. o.ya.ma ‘Oyama (family name)’

Just as their short counterparts, long vowels do not occur equally frequently in the language but variably occur according to the type of the word. First, the main sources of long vowels in modern Japanese are loanwords from Chinese, i.e. SJ words, and recent loanwords from English and other Western languages (henceforth, 'loanwords' for short). That is, long vowels are generally rare in native words. Historically, old Japanese did not have a contrast in vowel length, and developed long vowels via sound changes, notably consonant deletion and vowel coalescence.

- (5) a. ka.wa + mo.ri → koo.mo.ri 'bat' (川守り, 蝙蝠)
 a.wa + u.mi → oo.mi 'Oomi, Shiga Prefecture' (近江)
 b. o.wo.ki.ki → oo.kii 'big'
 ko.wi → koi 'carp'

In contrast, there are many SJ morphemes with a long vowel. However, they exhibit a considerable imbalance as regards their distribution: they permit only three long vowels – /oo/, /ee/ and /uu/ – and not /aa/ or /ii/. (6) gives some compounds consisting of two Chinese morphemes/letters.

- (6) a. koo.koo 'high school' (高校)
 roo.doo 'labor' (労働)
 b. see.tee 'establishment' (制定)
 tee.see 'correction' (訂正)
 c. kuu.ki 'air' (空気)
 guu.suu 'even numbers' (偶数)

Of these three vowels, /oo/ is by far the most common in SJ morphemes, followed by /ee/ and /uu/ in this order. Both the absence of /aa/ and /ii/ and the unequal distribution of /oo/, /ee/ and /uu/ in the SJ vocabulary can be attributed primarily to their historical origins, namely, the fact that long vowels in this type of vocabulary derive largely from diphthongs via vowel coalescence. Thus, /oo/ results from the coalescence of three diphthongs, /au/, /ou/ and /eu/, whereas /ee/ developed from /ai/ and /ei/. The coalescence rule did not yield /aa/ or /ii/ from any vowel sequence (see Kubozono Ch. 5, this volume, for details).

While SJ thus displays a systemic gap in the inventory of long vowels, recent loanwords show all five long vowels because, being sensitive to vowel length, modern Japanese adopts long or tense vowels in the source languages as long vowels.¹ Some examples are given below.

- (7) kaa.do 'card'
 rii.daa 'leader, reader'
 puu.ru 'pool'
 tee.bu.ru 'table'
 koo.naa 'corner'

It is probably worth mentioning the phonetic differences between long and short vowels. As their names suggest, these two categories are differentiated from each other in terms of phonetic duration: other things being equal, long vowels are considerably longer than their short counterparts. Han (1962: 65) reports that long vowels are phonetically two to three times as long as corresponding

short vowels in the same phonological contexts. Hirata (2004) provides more recent data for both accented and unaccented words.

While duration is the primary acoustic correlate of vowel length, other phonetic factors may also play a role in the perception of long vowels as opposed to short ones. Pitch is one such factor (Kinoshita, Behne, and Arai 2002).² Since pitch changes may occur in long vowels but not in short ones in Tokyo Japanese, the presence of a pitch fall within a vowel signals that the vowel is phonologically long. This can be illustrated by the minimal pair of words in (8) which are accented on their initial syllables: Perceptually, pitch falls within the syllable /bii/ in (8a), whereas it falls between the two syllables, /bi/ and /ru/, in (8b).

- (8) a. bii.ru 'beer'
b. bi.ru 'building'

Finally, modern Japanese has some diphthongs in addition to short and long vowels. There is some dispute in the literature as to which vowel sequence constitutes a diphthong as opposed to hiatus, or vowel sequences across a syllable boundary. Phonological considerations suggest that only three vowel sequences function as diphthongs in the language, i.e. /ai/, /oi/ and /ui/ (Kubozono 2004, 2005, 2008c). The fact that all these diphthongs end in /i/ is not a coincidence since vowel sequences ending in /u/ such as /au/, /ou/, /eu/ and /iu/ underwent a historical change in native and SJ words whereby they turned into long vowels (see Kubozono Ch. 5, this volume, for a detailed analysis of diphthongs and vowel coalescence). Some examples are given below.

- (9) /kjau/ → /kjoo/ 'capital' (京)
/koukou/ → /koo.koo/ 'high school' (高校)
/teuteu/ → /tjoo.tjo(o)/ 'butterfly' (蝶々)
/riu/ → /rjuu/ 'dragon' (竜)
/iu/ → /juu/ 'to say' (言う)

3 Consonant inventory

3.1 Phonemes and allophones

The inventory of consonantal phonemes in modern Japanese is given below (adapted from Shibatani 1990: 159). See [section 8](#) below for the phonetic symbols adopted in this volume.

Table 1: Consonant system of modern Japanese

	labial	dental- alveolar	palatal	velar	glottal
plosive	p b	t d		k g	
fricative		s z			h
nasal	m	n			
liquid			r		
glide	w		j		

This system might look simpler than the consonant systems of other languages. This is not quite true, however, since Japanese has many more consonants if allophones are also considered. For example, /s/ has two allophones that are distributed in a complementary fashion in native words: [ʃ]³ appears before /i/ and [s] before other vowels. Likewise, /t/ is realized in three forms: the affricate [tʃ] before /i/, the affricate [ts] before /u/, and the dental stop [t] anywhere else. Similarly, /h/ has three allophonic forms: the palatal fricative [ç] before /i/, bilabial fricative [ɸ] before /u/, and glottal fricative [h] before any other vowel.

While these ‘allophones’ are thus in complementary distribution in the native vocabulary, many of them are not complementary in SJ words and loanwords. In SJ words, for example, [ʃ] and [s] appear in the same context: e.g. [ʃakw] ‘to serve sake’ vs. [sakw] ‘a fence’. [tʃ] and [t] are not complementary, either: e.g. [tʃa] ‘tea’ vs. [ta] ‘others’. [ç] and [h] also appear before the same vowel: [çakw] ‘hundred’ vs. [hakw] ‘beat’. Each of these consonants can be said to have established itself as an independent phoneme in the consonant system of modern Japanese.

This tendency has been accelerated recently as loanwords from English and other languages introduced new sequences of sounds into Japanese (see the discussion in Pintér, this volume, for details). For example, [t] now appears not only before [a] but before [i] and [u], too: [ti:] ‘tea’ [ti: ʃatsw] ‘T shirt’; [tu:] ‘two’, [tu:rw:zw] ‘Toulouse’. Similarly, [ts] appears before [a] as well as before [u]: e.g. [mo:tsaru] ‘Mozart’, [tsua:] ‘tour’. Moreover, [ɸ] may be combined with vowels other than [u], creating CV sequences contrasting with [ɸu]. This is shown in (10).

- (10) a. [ɸan] ‘fan’, [ɸaito] ‘fight’
 b. [ɸitto] ‘fit’, [ɸi:ringw] ‘feeling’
 c. [ɸensw] ‘fence’, [ɸe:sw] ‘face’
 d. [ɸo:rw] ‘fall’, [ɸonto] ‘font’

Recent loanwords have also ‘filled’ the native phonotactic gaps in the distribution of some consonant phonemes. For example, /w/ has been allowed to combine only with /a/ in the phonology of native and SJ words, as evidenced by the alternations such as /suwaru/ ‘to sit’ and /sueru/ ‘to set’, the latter deriving from /suweru/ historically via /w/ deletion. This situation is being changed by the introduction of some recent loanwords such as [wetto] ‘wet’, [wo:ta:] ‘water’, [wisuki:] ‘whisky’, [witto] ‘wit’, and [winta:] ‘winter’.

A similar situation can be found with [j], which combined only with back vowels (/a/, /o/ and /u/) in the traditional phonological system. This consonant can now be combined with /e/ in some

loanwords, expanding the phonological context where it can appear: e.g. [jeritsin] ‘Yeltsin (former Russian president)’ (Ito and Mester 1995).

3.2 Voice in consonants

As in many other languages, consonants in modern Japanese exhibit a contrast in voice, but not all consonants participate in this contrast. Voiceless consonants have their voiced counterparts in the system, but not vice versa. In order to understand this point, we should first note that voiced consonants fall into two groups, voiced obstruents and non-obstruents (or sonorants), of which only the first group involves a phonological contrast with voiceless consonants in modern Japanese. Thus, voiced stops ([b], [d], [g]) and fricative ([z]) contrast with voiceless ones ([p], [t], [k] and [s]). On the other hand, voiced non-obstruents ([m], [n], [r], [j] and [w]) do not have voiceless counterparts at least at the phonemic level.

In natural languages, voiceless obstruents are supposed to be unmarked as against voiced obstruents. For one thing, every language that has voiced obstruents is likely to have voiceless ones, although not vice versa. Maddieson (1984: 27) reports that “a language with only one stop series almost invariably has plain voiceless plosives.” Similarly, Yavaş (1998: 173) mentions that “the existence of the voiced obstruents implies the existence of its voiceless counterparts.” In phonological development, too, children acquire voiced obstruents only after they have acquired voiceless ones: “Children will . . . use voiceless unaspirated stops before acquiring the pattern of voicing types that is contrastive in their language” (Macken 1980: 163).

On the other hand, non-obstruents such as nasals, liquids and semivowels are typically voiced. For example, voiced nasals ([m], [n]) are unmarked as against voiceless nasals ([^hm], [^hn]) in natural languages, as can be seen from the fact that a diacritic symbol is added in the phonetic descriptions of the latter. Seen in this light, the distribution of consonants in the Japanese consonant system looks quite natural: It contains unmarked sounds (voiceless obstruents and voiced non-obstruents) in its core part, plus some marked sounds (voiced obstruents). In the traditional Japanese linguistics, the former group is called “seion” (清音), or pure sounds, whereas the latter group is called “dakuon” (濁音), or impure sounds. This grouping is summarized in [Table 2](#), where the shaded part denotes “seion”, and the others are “dakuon”.⁴

Table 2: Two-way classification of consonantal phonemes in modern Japanese

	voiceless	voiced
obstruents	p, t, k, s, h	b, d, g, z
non-obstruents	—	m, n, r, w, j

Voiced obstruents did not exist in the consonant system of old Japanese, at least in word-initial position. They developed in the language in several ways (see Vance, this volume, and Takayama, this volume, for the historical development of voiced obstruents in Japanese). One major source is SJ words, or old loanwords from Chinese, which had many voiced obstruents in morpheme-initial

positions. This can be understood by the comparison between the “on-yomi” (SJ pronunciation) and “kun-yomi” (native pronunciation) of Chinese characters.

Table 3: Comparison of on-yomi and kun-yomi

Chinese character	on-yomi	kun-yomi	Gloss
外	gai	so.to	outside
人	zin	hi.to	man
男	dan	o.to.ko	male
女	zyo	on.na	female

Another major source of voiced obstruents is the sound change known as *rendaku*, or sequential voicing, in native words. This voicing process turned voiceless obstruents into their voiced counterparts in the initial syllable of non-initial members of compounds. Some examples are given below (see Ito and Mester 2003 and Vance, this volume, for a full discussion of this process).

- (11) a. osiroi ‘powder’ + hana ‘flower’ → osiroi-bana
 ‘a tropical American flower, also known as a four-o’clock’
 b. to ‘door’ + tana ‘shelf’ → to-dana ‘closet, cupboard’
 c. hira ‘flat’ + kana ‘kana syllabary’ → hira-gana ‘hiragana syllabary’
 d. nobori ‘upward’ + saka ‘slope’ → nobori-zaka ‘uphill slope’

What is interesting about *rendaku* is that /b/ alternates with /h/ rather than /p/. This can be attributed to a change by which /p/ turned into /h/ (phonetically, [ç], [ɸ], [h]) in word-initial position in the course of the history. This historical change shows its trace in the alternation between /h/ and /p/ in the morphophonology of modern Japanese. For example, the word /hi.jo.ko/ ‘a baby bird’ can be related with the mimetic expression /pi.jo.pi.jo/ which denotes the sound produced by baby birds. Likewise, the noun /hi.ka.ri/ ‘light’ is historically related with the mimetic expression /pikari/ which describes lightening. In these words, /p/ turned into /h/ in ordinary nouns, but remained unchanged in onomatopoeic expressions.

3.3 Moraic obstruents and nasals

Among consonants in Japanese, so-called moraic obstruents and nasals are different from other consonants in many ways. These are consonantal elements that are called “sokuon” (促音) and “hatsuon” (撥音), and in the traditional literature are often represented as /Q/ and /N/, respectively. These two types of consonants are similar to each other in the following respects. First, they only occur in the coda position of the syllable. Second, as moraic consonants, they contribute to the weight of the syllable in Tokyo Japanese so that syllables containing these consonants in the coda position are counted as bimoraic as opposed to monomoraic. Third, both of them are phonetically homorganic with the following consonant: they share the place of articulation with the onset consonant of the following syllable. This is illustrated in (12) and (13), respectively, where the traditional archiphonemic symbols /Q/ and /N/ are used for the sake of description.

- (12) a. /iQ.pai/ [ippai] ‘one cup’ (一杯), /raQ.pa/ [rappa] ‘trumpet’, /taQ.paa/ [tappa:] ‘tupper’
 b. /iQ.tai/ [ittai] ‘one body’ (一体), /baQ.ta.ri/ [battari] ‘with a thud, suddenly’, /baQ.taa/ [batta:] ‘batter’
 c. /iQ.kai/ [ikkai] ‘one time’ (一回), /gaQ.ka.ri/ [gakkari] ‘with a disappointment’, /saQ.kaa/ [sakka:] ‘soccer’
- (13) a. /aN.ma/ [amma] ‘massage’, /aN.ba/ [amba] ‘pommel horse’, /raN.pu/ [rampuu] ‘lamp’
 b. /aN.na/ [anna] ‘Anna (girl’s name)’, /aN.da/ [anda] ‘a hit in baseball’, /saN.ta/ [santa] ‘Santa Clause’
 c. /maN.ga/ [manga] ‘cartoon, anime’, /taN.ka/ [tan̩ka] ‘tanka poem’, /taN.ku/ [tan̩ku] ‘tank’

In semantic terms, moraic obstruents and nasals are similar to each other in that they are often used as a kind of infix for emphasis. When used for emphasis, they are complementary with each other: moraic obstruents appear before voiceless consonants, whereas moraic nasals appear elsewhere (Kuroda 1965). This is shown in (14), where /ma/ is an emphatic prefix often combined with the moraic consonants.

- (14) a. maQ.pu.ta.tu ‘in half’ (< hu.ta.tu ‘two’)
 maQ.pi.ru.ma ‘mid-day’ (< hi.ru.ma ‘daytime’)
 maQ.ku.ro ‘deep black’ (< ku.ro ‘black’)
 maQ.si.ro ‘pure white’ (< si.ro ‘white’)
- b. maN.ma.ru ‘perfect circle’ (< ma.ru ‘circle’)
 maN.na.ka ‘the very center’ (< na.ka ‘middle, center’)
 suN.goi ‘fantastic!’ (< su.goi ‘dreadful, wonderful’)
 aN.ma.ri ‘(not) too much’ (< a.ma.ri ‘(not) very’)

While moraic obstruents and nasals are similar to each other in these respects, they differ in other ways. For one thing, moraic obstruents cannot appear in word-final position, except in some interjectives such as /aQ/ [aʔ]~[atʔ] ‘Oh, Oh dear’ and /eQ/ [eʔ]~[etʔ] ‘really?’. In fact, they form a geminate obstruent together with the onset consonant of the following syllable: e.g. [makkwuro] ‘deep black’. In contrast, moraic nasals can appear freely in word-final position: e.g. /en/ ‘yen, the Japanese currency’, /kan/ ‘tube’, /sen/ ‘line’. Phonetically, these word-final nasals are often described as nasal(ized) vowels or the like (Kuroda 1965; Kawakami 1977). Kawahara (Ch. 1, this volume) and Kawagoe (this volume) provide a more detailed description of moraic obstruents.

4 Mora and syllable

4.1 Mora versus syllable

The distinction between the mora and the syllable is crucial in Japanese phonetics and phonology. Since these two units are used in most chapters of this volume, we would like to discuss them in some detail here. In native words, they overlap in most cases. For example, /na.go.ja/ ‘Nagoya’ and /to.jo.ta/ ‘Toyota’ both consist of three syllables and three moras: each mora corresponds to a syllable. However, these two phonological units often fail to overlap in many SJ words and loanwords. The words /nip.pon/ ‘Japan’ and /zja.pan/ ‘Japan’ are both made up of two syllables, but they contain four and three moras, respectively.

The discrepancy between the mora and the syllable arises because some moras cannot constitute a syllable on their own. In other words, moras fall into two types, those that can constitute a syllable on their own and those that are always attached to another mora to form a syllable. The former is labeled as “jiritsu haku” (自立拍, independent mora), and the latter as “tokushu haku” (特殊拍, meaning ‘special mora’), “huzoku haku” (付属拍, or dependent mora) or “moora onso” (moraic phonemes) in the traditional literature (Kawakami 1977). In the more recent literature, they are also called “syllabic mora” vs. “non-syllabic mora” (Kubozono 1989, 1999a), or “head mora” vs. “non-head mora” (Ito and Mester 1993; Kubozono 2012a,b).

Those moras that cannot constitute a syllable on their own fall into four types in Tokyo Japanese: (a) the second half of long vowels, (b) the second half of diphthongs (ai, oi, ui), (c) moraic nasals, or the coda nasals, and (d) moraic obstruents, or the first half of geminate consonants. These are often represented as /R/, /J/, /N/ and /Q/ in traditional descriptions. These moras form a syllable together with their preceding moras, as shown below.

- (15)
- a.

too ‘ten, tower’, koo.to ‘coat, court’, nii.san ‘elder brother’, o.too.to ‘younger brother’, kaa.ten ‘curtain’
- b.

gai.ko.ku ‘foreign country’, kan.sai ‘Kansai area’, sai.daa ‘cider (lemonade)’
- c.

son ‘loss’, san ‘three’, ton.da ‘jump (past tense)’, ron.don ‘London’
- d.

nip.pon ‘Japan’, hat.ten ‘development’, ro.ket.to ‘rocket’, gak.koo ‘school’

The following table shows the discrepancy between mora and syllable counts in some proper names. Dots and hyphens indicate syllable and mora boundaries, respectively.

Table 4: Syllable count versus mora count

Word	Gloss	Syllable count	Mora count
toyota	Toyota	3 (to.yo.ta)	3 (to-yo-ta)
nissan	Nissan	2 (nis.san)	4 (ni-s-sa-n)
honda	Honda	2 (hon.da)	3 (ho-n-da)
kurinton	Clinton	3 (ku.rin.ton)	5 (ku-ri-n-to-n)
bussyu	Bush	2 (bus.syu)	3 (bu-s-syu)
obama	Obama	3 (o.ba.ma)	3 (o-ba-ma)

Two points must be noted about the four types of ‘special moras’ in (15). First, not all languages count these elements as ‘moraic’, or as elements contributing to syllable weight. Some languages

allow only long vowels and diphthongs in (15a,b) to count as two moras, some give a moraic status to coda nasals in (15c) as well, and others count all elements in (15) including coda obstruents in (15d) as moraic (Zec 1995). Japanese belongs to the last type of language in this classification.

What is relevant here is the existence of a hierarchy or implicational law as shown in (16), which indicates that coda obstruents can have a moraic status only in a system in which all other elements have a moraic status. It also indicates that coda nasals can count as one mora only when the second half of diphthongs and long vowels is counted as one mora (Zec 1995). Seen conversely, this hierarchy precludes the possibility of a system in which coda obstruents but not coda nasals count as one mora as well as a system where coda nasals and obstruents are moraic but the second half of diphthongs and long vowels are not.

- (16) a. System A: second half of diphthongs and long vowels
 b. System B: second half of diphthongs and long vowels__coda nasals
 c. System C: second half of diphthongs and long vowels__
 coda nasals__coda obstruents

Another point to note about (15) is that the four types of special moras do not appear equally frequently in Japanese. For example, moraic nasals occur twice as frequently as moraic obstruents if counted by type frequency (Hayashi 1982: 319). There seems to be no statistical study that compared their relative frequency with that of long vowels and diphthongs or the frequency of long vowels vs. diphthongs.

4.2 Syllable weight

As is clear from the foregoing discussion, there are two types of syllables: (i) those that are made up of one mora, i.e. a syllabic (independent) mora, and (ii) those that consist of two moras, a syllabic mora plus a non-syllabic (special) mora. (The possibility of trimoraic syllables will be discussed shortly). These two types of syllables are called 'light' (or 'short') syllables and 'heavy' (or 'long') syllables. By definition, light syllables are monomoraic and heavy syllables are bimoraic.

It is generally assumed that there was no contrast in syllable weight in Old Japanese. As long vowels, diphthongs and coda consonants developed and acquired a moraic status in the history of the language, it has become necessary to distinguish between independent and special moras, or equivalently, between light and heavy syllables. Not surprisingly, light syllables are much more common than heavy ones in modern Japanese. According to Kubozono (1985), the ratio between light and heavy syllables is about two to one (2:1).

While both monomoraic and bimoraic syllables are popular, trimoraic syllables are not. These syllables, often called 'superheavy' or 'overlong' syllables, may occur only in loanwords, while they do not generally occur in native and SJ words due to various phonotactic and morphophonological constraints to be discussed in section 6 below. Superheavy syllables will typically consist of a long vowel or diphthong followed by a coda consonant, as exemplified below.

- (17) wain 'wine', rain 'line, Rhine', taun 'town',
 su.pein 'Spain', rin.kaan 'Lincoln', gu.riin 'green'

A careful phonological analysis suggests, however, that these seemingly trimoraic syllables actually consist of two syllables rather than one. One piece of evidence to support this view comes from the accent analysis of compound nouns of which the words in (17) form the first member. The basis of the compound noun accent rule in Tokyo Japanese is to place a compound accent on the final syllable of the first member if the second member is one or two moras long. If applied to the compound nouns just mentioned, this accent rule generally places an accent on the second mora of the quasi-trimoraic syllables, suggesting that there is a syllable boundary between this mora and the preceding mora (Kubozono 1999a).⁵ In this and subsequent chapters in this volume, word accent is denoted by an apostrophe ('), which indicates the position of an abrupt pitch fall in Tokyo Japanese.⁶

- (18) rain + ka.wa → ra.i'n.ga.wa, *ra'in.ga.wa 'River Rhine'
 taun + si → ta.u'n.si, *ta'un.si 'town magazine'
 su.pein + ka.ze → su.pe.i'n.ka.ze, *su.pe'in.ka.ze 'Spanish influenza'
 rin.kaan + hai → rin.ka.a'n.hai, *rin.ka'an.hai 'Lincoln Cup'

That the quasi-trimoraic strings actually consist of two syllables can be shown more clearly if the data of Kagoshima Japanese are considered. Unlike Tokyo Japanese, this dialect is sensitive to syllable boundaries and its accent rule places a high pitch on the penultimate syllable in most loanwords as well as compound nouns whose first member is a loanword. An accent test of this dialect shows that there is a syllable boundary between the first and second moras of the three-mora strings in question (Kubozono 2004).

- (19) ta.UN.si 'town magaine'
 su.PE.in 'Spain'
 su.pe.IN.zin 'Spanish people'
 rin.ka.AN.hai 'Lincoln Cup'

The idea that superheavy syllables are disfavored and tend to be avoided in modern Japanese can further be reinforced by several other independent pieces of evidence. First, so-called pre-nasal vowel shortening (Lovins 1975) produces a bimoraic syllable out of a sequence of segments that would otherwise be borrowed as a trimoraic syllable in Japanese (Kubozono 1995a, 1999a). This is exemplified in (20), where English forms are given in the input⁷ and the loanword forms in Japanese in the output. The relevant portion is underlined.

- (20) a. [faun.dei.fən] → [fan.de:.fon] 'foundation'
 b. [keim.bridʒ] → [ken.bu.ri.dʒi] 'Cambridge'
 c. [steind glæs] → [su.ten.do.gu.ra.su] 'stained glass'
 d. [gri:n.pi:z] → [gu.rin.pi:.su] 'green peas'
 e. [kɔ:nd bi:f] → [kon.bii.ɸu] 'corned beef'

Generally speaking, [n] in the coda in English words is borrowed as a moraic nasal. Moreover, tense vowels and diphthongs in English are borrowed as long vowels and diphthongs in Japanese. One notable exception to the latter rule is the tense vowels before a nasal consonant. As the examples in (20) show, English tense vowels in this context tend to be borrowed as short vowels.

Thus, in (20d), the same tense vowel /i:/ [i:] in English turned into a short vowel in 'green' but into a long vowel in 'peas' in the word 'green peas'. The rule of pre-nasal vowel shortening permits a certain number of exceptions as shown in (17), but it is clear that this rule has a function of turning potential trimoraic syllables into bimoraic ones via vowel shortening.

Another process that has prevented Japanese from creating superheavy syllables is antigemination, whereby consonant gemination is blocked under certain environments. Consonant gemination is a popular process in the loanword phonology of Japanese that geminates voiceless obstruents in the coda position of English words as exemplified in (21) (Kawagoe and Arai 2002; Kawagoe and Takemura 2013; Kubozono, Takeyasu, and Giriko 2013; see also Kawagoe, this volume). Seen from the viewpoint of syllable weight, this process creates a sequence of heavy and light syllables in the output.

- (21) pak.ku 'pack'
kap.pu 'cup'
kat.to 'cut'
bat.to 'bat'

This process is subject to various restrictions as discussed in detail by Kawagoe (this volume). One such restriction concerns the length of the preceding vowel. Namely, the process is blocked if the vowel before the voiceless obstruent is a tense one or a diphthong in the source language. These tense vowels and diphthongs are borrowed as long vowels in Japanese and block the gemination process. Some examples are given in (22).

- (22) paa.ku, *paak.ku 'park'
kaa.pu, *kaap.pu 'carp'
kaa.to, *kaat.to 'cart'
kai.to, *kait.to 'kite'

Pre-nasal vowel shortening in (20) and antigemination in (22) may be described by phonotactic constraints that prohibit long vowels and diphthongs from occurring with the following moraic nasal or obstruent. These phonotactic constraints do not explain the general nature of the phenomena, however. What is truly crucial here is that both processes contribute to avoiding the creation of trimoraic syllables in the output, a prosodic structure that is disfavored across languages (Árnason 1980; Sherer 1994; Zec 1995). Seen in this light, it is clear that they have much in common with the syllabification fact revealed by accent phenomena in (18) and (19). All these phenomena conspire to avoid creating superheavy syllables in Japanese (see Kubozono Ch. 8, this volume, for some potential exceptions such as the native word /to'otta/ 'passed (past tense of pass)').

In sum, the syllable structure of the language can be described as (Cj)V(VC), where materials in the parentheses are optional.⁸ /V/ and /C/ in the second parentheses cannot generally co-occur with each other due to the strict constraint banning superheavy syllables.

4.3 Mora's roles

The roles of moras in Japanese phonetics and phonology have been widely discussed in the literature: see the series of work by Kubozono (Kubozono 1985, 1989, 1999a) and Otake (Otake et al. 1993), for example (see also Otake, this volume, for a full summary). In order to argue for the relevance of this prosodic unit, it is necessary to demonstrate that one and the same phenomenon can be better generalized by the mora than by the syllable. Specifically, it must be shown that bimoraic syllables, i.e. heavy syllables, behave similarly to a sequence of two monomoraic syllables, i.e. (light + light) sequence, and differently from monomoraic monosyllables.

The most famous role of the mora is probably its role as a counting unit in the meter of traditional poems such as tanka, haiku and senryū (Bekku 1977; Homma 1984). Tanka poems, literally meaning ‘short poem’, for example, consist of five lines of which the first and three lines are made up of five moras and the remaining lines, seven moras (5-7-5-7-7). Haiku and senryū are shorter versions consisting of three lines of which the first and third lines are made up of five moras (5-7-5). To take one example from Kobayashi Issa’s famous poetry, the second line of the haiku below has seven units by mora count, but six units by syllable count: the word /is.sa/ ‘Issa, the composer’s name’ is disyllabic and trimoraic (hyphens indicate mora boundaries).

(23)	ya-se-ga-e-ru	‘a skinny frog!’
	ma-ke-ru-na i-s-sa	‘don’t give up. Issa’
	ko-re-ni-a-ri	‘is here’

Likewise, the following senryū composed by an elementary school child consists of five, seven and five units by mora count, but three, five and four units by syllable count. This example as well as Issa’s haiku above show that it is the mora and not the syllable that is used to define the meter of Japanese poetry.

(24)	ni-ho-n-zyu-u	‘all over Japan’
	a-t-ti ko-t-ti-de	‘here and there’
	ta-ma-go-t-ti	‘(everyone has) a tamagotchi toy’

The mora’s role has been discussed in the description of speech rhythm, too. Thus, the concept of “mora timing” comes from the idea that the mora is a timing unit that repeats itself isochronously in natural speech. This idea has been discussed in much detail in the literature, sometimes supported and sometimes refuted (or doubted) by experimental evidence (see Warner and Arai 2001 for a summary). It is certainly true that moras in Japanese do not have equal phonetic durations since they vary durations considerably due to segmental, prosodic and other factors. However, it is also true that word durations can be more or less predicted in the language by the number of moras contained in the word (Port, Dalby, and O’Dell 1987).

The mora has been used in the description of phonological phenomena, too, where the concept of “mora counting” is widely known, particularly in the analyses of word accent (McCawley 1968). This concept is based upon the idea that the position of word accent is determined by counting the number of moras in the word; in other words, the mora is used as a unit to measure phonological distances in the computation of word accent. For example, loanwords are supposed to be subject to the antepenultimate mora rule that places the accent on the third mora from the end (McCawley 1968): e.g. /su.to’.re.su/ ‘stress’, /su.to’.roo/ ‘straw’, /ku.ri.su’.ma.su/ ‘Christmas’. The mora-counting

principle applies to many other accent rules of Tokyo Japanese, which prompted McCawley (1978) to define the dialect as a 'mora-counting' language.

The mora plays a crucial role as a counting unit in other phonological processes, too. For example, it is known that *rendaku* is often constrained by the phonological length of the first member of compound nouns.⁹ Thus, the noun /hon/ 'book' undergoes this voicing process if it is attached to a three-mora or longer noun, as in (25a), but generally not if the preceding element is either monomoraic or bimoraic, as in (25b) (Ohno 2000).

- (25) a. man.ga + hon → man.ga-bon 'a comic book'
 mi.do.ri + hon → mi.do.ri-bon 'green book'
 et.ti + hon → et.ti-bon 'an erotic book'
- b. a.ka + hon → a.ka-hon 'red book, a textbook for entrance exams'
 e.ro + hon → ero-hon 'an erotic book'
 e + hon → e-hon 'a picture book'

Morphological processes are also sensitive to the mora. For example, compound truncation generally combines the initial two moras of the two elements of the compound noun (Ito and Mester 2003; Kubozono 1999a,b).

- (26) a. ki.mu.ra ta.ku.ya → ki.mu-ta.ku 'Kimura Takuya, a famous singer/actor'
 b. po.ket.to mon.su.taa → po.ke-mon 'pocket monster, or Pokémon'
 c. han.gaa su.to.rai.ki → han-su.to 'hunger strike'
 d. han.bun don.ta.ku → han.don 'half, Zontag; a half day off'

We have seen that the mora is an indispensable unit in a wide range of phenomena of Japanese, phonetic, phonological and morphological. What is important in considering the roles of the mora in these processes is that the same generalizations cannot be made on the basis of the syllable. More specifically, one must demonstrate that heavy syllables behave differently from light syllables yet similarly to a sequence of two light syllables. To take one example from (25), a crucial case is the contrastive *rendaku* behaviors of /et.ti/ and /e.ro/, which share morphological, semantic and syllable structures but differ in the number of moras involved: /et.ti/ has three moras and patterns with other three-mora nouns like /mi.do.ri/ 'green', whereas /e.ro/ consists of two moras and does not trigger *rendaku* similar to other bimoraic nouns.

Similarly, the outputs of the truncation process described in (26) are all made up of four moras which vary in the composition of syllables: four light syllables in (26a), two light syllables followed by a heavy syllable in (26b), a heavy syllable followed by two light syllables in (26c), and two heavy syllables in (26d). The uniformity of the output forms cannot be captured if their phonological length is measured by the syllable.

The roles of the mora in (26) and other phonological processes have led to the notion of 'bimoraic foot', which assumes that a sequence of two moras forms a prosodic unit above the mora in the prosodic hierarchy. This unit was first posited for the description of traditional poems (Bekku 1977), while it has been shown to be indispensable for the description of many linguistic phenomena, too. The pioneering work in the latter field is Poser (1990), whose analysis has been extended to various

linguistic phenomena: loanword accent (Katayama 1998; Shinohara 2000), compound accent (Kubozono 1995b, 1997; Kubozono, Ito, and Mester 1997), compound truncation (Ito and Mester 2003) and the formation of *zuuzya-go* (*zuuja-go*), a jazz musicians' secret language (Tateishi 1989; Ito, Kitagawa, and Mester 1996). It is also instrumental in explaining why monomoraic outputs are disfavored and tend to be lengthened in phrases. Vowel lengthening in monomoraic nouns is illustrated below (Ito 1990; Mori 2002).

- (27) a. /go/ 'five' → [go:] as in /goo.i.ti.goo zi.ken/ '5.15 incident'
 b. /ni/ 'two' → [ni:] as in /nii.nii.ro.ku zi.ken/ '2.26 incident'
 c. /ne/ → [ne:] 'the year of the Rat (in the Chinese zodiac)'

4.4 Syllable's roles

While various arguments can be found in the literature in favor of the mora, relatively little has been discussed about the relevance of the syllable in Japanese. This can be attributed in large part to the traditional typology by Trubetzkoy (1958) and Kindaichi (1967), who claimed that the syllable and the mora cannot coexist in a single prosodic unit. They classified languages into two types: "mora" (or mora-based) languages like Tokyo Japanese and "syllable" (syllable-based) languages like English. A similar idea can be found in Sibata's (1962) classification of Japanese dialects into "mora dialects" and "syllabeme dialects".

This rigid dichotomy has been challenged in the past few decades. On the one hand, it has been demonstrated that the distinction between light and heavy syllables plays a pivotal role in the phonology of English and many other languages for, for example, computing stress patterns and explaining compensatory lengthening (see Hayes 1989, 1995). Since the idea of syllable weight hinges upon the notion of mora, these analyses have integrated the mora as a basic unit in the description of what was formerly described as syllable(-based) languages.

On the other hand, the syllable has been recognized as a relevant phonological unit in the description of mora languages. In Tokyo Japanese, the syllable plays somewhat subsidiary roles, but there are many phenomena in which the bimoraic monosyllables pattern with monomoraic monosyllables and not with bimoraic disyllabic words. In loanword accentuation, for example, the accent falls on the fourth mora from the end of the word if the antepenultimate mora is a special mora, or the second mora of a heavy syllable.

- (28) ro'n.don, *ron'.don 'London'
 wa.si'n.ton, *wa.sin'.ton 'Washington'
 sa'i.daa, *sai'.daa 'cider, or lemonade'

What is crucial here is the fact the accent apparently 'shifts' one mora to the left, and not one mora to the right. This indicates that the accent is placed on the first mora of the heavy syllable if its second mora is the designated as an accent position by accent rules. This led McCawley (1968) to propose the following accent rule for loanwords, which actually accounts for the accentuation of accented native and SJ words, too (Kubozono 2006, 2008a,b, 2011, 2013).¹⁰ Since the syllable is the

unit bearing the accent in Tokyo Japanese, it is labeled as a ‘mora-counting, syllable language’ (McCawley 1978).

(29) Accent falls on the syllable containing the antepenultimate mora.

Some accent rules are sensitive to both the mora and the syllable in measuring phonological length. A good example is the rule responsible for the accentuation of personal names whose second member is /ta.roo/ ‘Taro’ (Kubozono 1999a,b). These names exhibit three accent patterns depending on the phonological length of the first member: (i) the unaccented pattern if the first member is monosyllabic, (ii) a pattern with an accent on the last syllable of the first member if the first member is disyllabic and bimoraic, and (iii) a pattern with an accent on the initial syllable of /ta.roo/ if the first member is longer than two moras. These three patterns are illustrated below. Of these, the third pattern represents the general accent pattern of compound nouns with a three-mora second member, e.g. /ti.ka.ra-si’.go.to/ ‘power, work; heavy labor’, /bii.ti-ba’.ree/ ‘beach, volleyball; beach volleyball’.

- (30) a. ko-ta.roo ‘Ko-taro’
 kin-ta.roo ‘Kin-taro’
 koo-ta.roo ‘Koo-taro’
 b. mo.mo’-ta.roo ‘Momo-taro’
 a.ma’-ta.roo ‘Ama-taro’
 i.ti’-ta.roo
 c. ti.ka.ra-ta’.roo ‘Chikara-taro’
 ka.ree-ta’.roo ‘Curry-taro’
 u.ru.to.ra.man-ta’.roo ‘Ultra-man Taro’

The boundary between (30a) and (30b) is defined by the number of syllables in the first member, i.e. monosyllabic vs. disyllabic, whereas the boundary between (30b) and (30c) is determined by the number of moras, i.e. bimoraic vs. trimoraic. It is interesting that one and the same rule employs the two prosodic units to produce different accent patterns.

The syllable plays an indispensable role in other accent rules, too (Kubozono 1999a,b). Four-mora loanwords, for example, tend to be unaccented, i.e. lack an abrupt pitch fall in the phonetic output, if they end in a sequence of two light syllables: e.g. /kon.so.me/ ‘consommé’, /mo.na.ri.za/ ‘Mona Lisa’, /ai.o.wa/ ‘Iowa’, /a.ri.zo.na/ ‘Arizona’, /mo.su.ku.wa/ ‘Moscow’ (Kubozono 1996). On the other hand, four-mora loanwords of other syllable structures disfavor the unaccented pattern: e.g. /pa.re’e. do/ ‘parade’, /o.re’n.zi/ ‘orange’, /o.ha’i.o/ ‘Ohio’, /ro’n.don/ ‘London’, /su.to’.roo/ ‘straw’. [Table 5](#) shows the extent to which the accentuation of four-mora loanwords depends on their syllable composition (Kubozono 1996, 1999a,b, 2006): ‘L’ and ‘H’ stand for light and heavy syllables, respectively. That accent patterns vary greatly within four-mora words can be accounted for if and only if they are analyzed in terms of the syllable.

Table 5: The ratios of unaccented words in four-mora loanwords as a function of syllable structure

Syllable composition	LLLL	HLL	LHL	LLH	HH
Ratio of unaccentedness	54%	45%	24%	19%	7%
Example (unaccented)	a.ri.zo.na 'Arizona'	mai.na.su 'minus'	be.ran.da 'veranda'	pe.ri.kan 'pelican'	ai.ron 'iron'
Example (accented)	to.ra'.bu.ru 'trouble'	ma'i.ru.do 'mild'	bu.ra'n.ko 'swing'	su.to'.roo 'straw'	na'i.ron 'nylon'

Looking beyond word accent, the syllable has been shown to be indispensable for the description of many morphological processes, too. In the truncation of loanwords, for example, not only monomoraic forms but also bimoraic forms consisting of one syllable are banned (Ito 1990).¹¹ In other words, bimoraic forms are acceptable if they consist of two syllables, e.g. /su.to/ 'strike', but not if they consist of one syllable, as the following examples show. The fact that bimoraic words display contrastive behaviors depending on their syllabic composition indicates that the syllable plays a critical role.

- (31) roo.tee.syon → roo.te, *roo 'rotation'
 paa.ma.nen.to (wee.bu) → paa.ma, *paa 'permanent wave'
 pan.fu.ret.to → pan.fu, *pan 'pamphlet'
 don.ki.hoo.te → don.ki, *don 'Don Quijote Group, a Japanese chain store'

Moreover, three-mora outputs consisting of a light syllable followed by a heavy syllable are also illicit. This contrasts with other types of trimoraic outputs that are well-formed. (32) compares these ill-formed and well-formed outputs.

- (32) a. ro.kee.syon → ro.ke, *ro.kee 'location'
 de.mon.su.to.ree.syon → de.mo, *de.mon 'demonstration'
 b. te.re.bi.zyon → te.re.bi 'TV'
 pan.fu.ret.to → pan.fu 'pamphlet'
 paa.ma.nen.to (wee.bu) → paa.ma 'permanent wave'

The tendency to avoid creating light-heavy disyllables is observed in a wide range of phenomena in Japanese including baby talk words, zuuzya-go formation and historical changes (Kubozono 2000, 2003). Overall, the syllable as well as the mora plays a pivotal role in formulating many linguistic phenomena in Japanese. In this sense, Japanese presents compelling evidence that the two prosodic units are not mutually exclusive in a single prosodic system.

5 Accent and intonation

5.1 Terminologies

Several chapters in this volume discuss word accent either as a main topic (Kawahara Ch. 11) or as a secondary topic in relation to the main subject of the chapter (Fujimoto Ch. 4; Nasu Ch. 6; Ito and Mester Ch. 7; Kubozono Ch. 8; Ito and Mester Ch. 9; Igarashi Ch. 13; Ishihara Ch. 14). This section summarizes some basic concepts and ideas that are commonly assumed in these chapters.

The word “accent” is often used ambiguously in the literature of Japanese phonetics and phonology. On the one hand, “accent” refers to the overall prosodic pattern, or accentuation, of the word: “accent” is used in this sense in such expressions as the ‘accent of nouns’, the ‘accent of Tokyo Japanese’, and the ‘phonetics/ phonology of Japanese accent’. On the other hand, the same word is also used to refer to the phonological prominence assigned to a particular position of the word, or “akusento-kaku” (accent kernel) in the more traditional terminologies (Hattori 1973; Uwano 1997, 2012). In Tokyo Japanese, this refers to an abrupt pitch drop in words like /i'.no.ti/ ‘life’ and /ko.ko'.ro/ ‘heart’. Words with such a phonological/ phonetic feature are called “accented” words as opposed to “unaccented” words like /ne.zu.mi/ ‘mouse’.

These two meanings of the term are often used in one and the same article or book. One finds, for example, that words are classified into “accented” and “unaccented” words in an article entitled ‘the accent of Tokyo Japanese’. A similar ambiguity can be found in the literature of English word accent, where the word “stress” is used in two ways: “Stress” in the ‘stress system of English’ refers to the overall prominence pattern of the word, whereas “stress” in the sentence ‘the stress is on the initial syllable’ refers to the phonological prominence given to a particular syllable of the word.

The term “accent” is used in the two senses in this volume, too, but we will try to disambiguate the two meanings as much as possible. We will, for example, use the terms “accent pattern” and “accentuation” if we mean the overall prominence pattern defined at the word level.

5.2 Accent system and representations

The word accent of Japanese is often called ‘pitch accent’ as opposed to ‘stress accent’ (Trubetzkoy 1958; Beckman 1986). This is based on the fact that word-level phonological prominence is signaled primarily by pitch (F0, or fundamental frequency) rather than other phonetic parameters such as duration, intensity and vowel quality.

Tokyo Japanese is generally considered to have a multiple-pattern system (“takei-akusento”, 多型アクセント) for nouns and a two-pattern system (“nikei-akusento”, 二型アクセント) for verbs and adjectives (Uwano 1999). This means that the number of accent patterns increases in nouns as the word becomes phonologically longer, whereas verbs and adjectives have only two accent patterns no matter how long they may be. Specifically, nouns obey the (n+1) rule whereby monosyllabic, disyllabic and trisyllabic nouns have two, three, and four accent patterns, respectively. These are illustrated in (33)–(35), where /ga/ (nominative particle) is attached. For the sake of description, high-pitched moras are denoted by capital letters.

- (33) a. hi'-ga (HI-ga) 'fire'
 b. hi-ga (hi-GA) 'sun, sunshine'
- (34) a. a'.me-ga (Ame-ga) 'rain'
 ha'.na-ga (HA.na-ga) 'Hana, a girl's name'
 b. ha.na'-ga (haNA-ga) 'flower'
 c. a.me-ga (aME-GA) 'candy'
 ha.na-ga (haNA-GA) 'nose'
- (35) a. i'.no.ti-ga (I.no.ti-ga) 'life'
 b. ko.ko'.ro-ga (ko.KO.ro-ga) 'heart'
 c. o.to.ko'-ga (o.TO.KO-ga) 'man'
 d. ne.zu.mi-ga (ne.ZU.MI-GA) 'mouse'

As shown in (33)–(35), the number of accent patterns is greater than the number of syllables by one. This is because of the unaccented pattern, or the pattern that does not involve a pitch drop even if a particle is attached to the noun.¹² In other words, nouns in Tokyo Japanese contrast not only in the position of the pitch accent but also in its presence or absence.

While an abrupt pitch drop is thus the primary acoustic correlate of the word accent in Tokyo Japanese, a pitch rise is a redundant feature. Namely, the position of pitch rise is fully predictable in this system: pitch rises in word-initial position unless the initial syllable is accented or, alternatively, the initial two moras must differ in pitch height (Haraguchi 1977). As noted by Kawakami (1961), Uwano (1977, 2012) and Pierrehumbert and Beckman (1988), however, the word-initial pitch rise is not a property of the word per se, but a property of the phrase. This can be seen in a phrase consisting of an unaccented adjective and a noun, where the word-initial pitch rise in the noun disappears. The phrase /ko.no ko.ko'.ro/ 'this heart', for example, does not show a pitch rise in the initial syllable of /ko.ko'.ro/ (unless this noun is emphasized for some reason): /koNO KOKOro/. This suggests that it is only the position of pitch fall that is marked or stored in the lexicon.

The relationship between the word and its accent pattern is basically arbitrary, so that it is difficult to predict which word takes which accent pattern. Naturally, there are many segmentally homophonous pairs of words that can be distinguished by word accent. Two points must be noted here. First, most minimal pairs of words that are distinguished by word accent involve a contrast in accentedness; that is, one word is accented and the other, unaccented. In contrast, minimal pairs of words that are distinguished by the position of accent are relatively few: e.g. /ha'na/ 'Hana' vs. /ha.na'/ 'flower'. This suggests that the presence or absence of word accent is primary, while its position is only secondary. This analysis is compatible with several facts to be mentioned shortly below.

Second, while there are many pairs of segmentally homophonous words that are distinguished by word accent, there are also many pairs that cannot be distinguished by word accent. These words are homophonous in the strict sense of the term. Some examples are given below.

- (36) ku'.mo 'spider', 'cloud'
ko'o.sya 'the latter case', 'school building', 'public corporation',
'a tactful person'
su.ro'o 'throw', 'slow'

Surprisingly, this type of absolute homophones outnumbers homophones that can be distinguished by word accent: according to the statistical work by Sibata and Shibata (1990), only 14% of segmental homophones in Tokyo Japanese are distinguished by word accent, while the remaining 86% are completely homophonous. This suggests that the distinctive function is not the primary function of word accent in this dialect.

It is worth adding a few points about the (n+1) rule here. First, the permitted accent patterns do not occur equally frequently. On the contrary, only two patterns are very productive. In the case of three-mora nouns in (35), the pattern with an accent on the antepenultimate mora in (35a) and the unaccented pattern in (35d) are productive, while the other patterns – those with an accent on the penultimate or final mora – are much less productive. This can be seen clearly from the data in [Table 6](#).

Table 6: Accent patterns and their frequencies in three-mora nouns (Kubozono 2006: 15)

Accent pattern	Antepenultimate accent	Penultimate accent	Final accent	Unaccented
Frequency	42%	4%	2%	52%

Second, the discrepancy between the productive and unproductive patterns becomes more prominent as the word becomes longer. In fact, the (n+1) rule is no longer valid for five-mora or longer nouns. A majority of long loanwords, for example, have an accent on their antepenultimate mora unless they are unaccented. This is basically true of native and SJ words, too. Most native and SJ words are morphologically complex, i.e. compound nouns, if they are longer than four moras, and are hence subject to compound accent rules. Nevertheless, the compound accent rules for nouns produce only two major patterns, those with a compound accent on the third or fourth mora from the end of the word, and those that are unaccented. Homophonous pairs show this.

- (37) a.ki.ta'-ken 'Akita Prefecture' vs. a.ki.ta-ken 'Akita Dog'
si.ke'n-kan 'examiner' vs. si.ken-kan 'test tube'
i.wa.te'-san 'Mt. Iwate' vs. i.wa.te-san 'made in Iwate, produce of Iwate'

The fact that only two accent patterns are productive in Tokyo Japanese has led Kubozono (2008a, b) to propose that nouns in this dialect basically constitute a two-pattern system with a certain number of lexical exceptions, or words whose accent position is particularly marked in the lexicon. Under this analysis, nouns in this dialect contrast primarily in the presence or absence of word accent, and not in its position, just like verbs and adjectives described in (38). This is compatible with the idea mentioned above, that presence or absence is the primary feature of word accent, whereas position is only secondary.

- (38) a. accented verbs and adjectives
 na'.ru 'to be completed', ha.re'.ru 'to clear up', a.tu'-i 'hot', a.o'-i 'blue'
 b. unaccented verbs and adjectives
 na.ru 'to ring', ha.re.ru 'to become swollen', a.tu-i 'thick', a.ka-i 'red'

5.3 Accent rules

We have seen that loanwords and relatively long native and SJ words exhibit a limited number of accent patterns albeit the (n+1) rule. This suggests that the accentuation of Tokyo Japanese is rule-governed to a large extent. In the literature, in fact, one finds a number of accent rules, including the rule for loanwords, a set of accent rules for compound nouns, and the accent rule for verbs and adjectives (Akinaga 1985, 2001). Endeavors have been made in the past few decades to 'refine' these rules (see Kawahara Ch. 11, this volume, for a full discussion).

Scholars have attempted to generalize the various accent rules. To take one example, the loanword accent rule formulated in (29) has been shown to account for the accentuation of most accented native and SJ words, too (Kubozono 2006). Native and SJ words differ from loanwords in the abundance of unaccented words, but if we focus on accented words, they do not essentially differ from loanwords. In other words, the loanword accent rule is not a rule specifically for loanwords, but is a general rule for accented nouns in Tokyo Japanese.

The accent rules for compound nouns have also been generalized to a considerable extent. It was long believed that compound nouns fall into two groups depending on their accentual behaviors: those with a short (monomoraic or bimoraic) second member and those with a long (trimoraic or longer) second member (Akinaga 1985; McCawley 1968; Poser 1990; Uwano 1997). In this analysis, the first group of compound nouns was further classified into three subgroups according to their accent patterns: (i) those that attract a compound accent on the final syllable of the first member, e.g. /a.ba.re'-u.ma/ 'spirited horse', (ii) those with a compound accent on the initial syllable of the second member, e.g. /pe.ru.sja-ne'.ko/ 'Persian cat', and (iii) those that are unaccented, e.g. /ne.zu.mi-i.ro/ 'rat, color; grey'. On the other hand, compound nouns with a long second member were classified into two groups: (iv) those with a compound accent on the initial syllable of the second member, e.g. /too.kjoo-da'i.ga.ku/ 'Tokyo University', and (v) those that keep the lexical accent of the second member, e.g. /ja.ma.to-na.de'.si.ko/ 'Japanese woman'. This means that five major accent patterns or rules were put forward for compound nouns in Tokyo Japanese.

Kubozono (1995b, 1997) challenged this traditional analysis and proposed that the seemingly different accent patterns can be generalized. The key to this new analysis is to differentiate rule-governed patterns from lexically-marked patterns. In the case under consideration, the pattern in (iii) must be removed from the scope of accent computation since the unaccented pattern is due to the deaccenting effect of a certain number of morphemes that must be specified as such in the lexicon. Once this lexically-marked pattern is removed, all other compound accent patterns can more or less be generalized in an output-oriented OT analysis – they can be accounted for as the result of interactions between several general constraints, notably 'nonfinality' (don't put an accent at the

end of the word), ‘edgemostness’ (put an accent maximally towards the end of the word) and ‘Max-accent’ (preserve the original accent of the second member).

The accent patterns of compound nouns can be generalized not only with each other but with morphologically simplex (accented) nouns, too (Kubozono 2002, 2008a,b). Furthermore, they can also be generalized with the accent pattern of accented verbs and adjectives, and also with the famous accent rule of Latin (Kubozono 2006, 2008a,b, 2011). The key to this new generalization is to separate the unaccented pattern clearly from accented patterns.

The efforts to generalize seemingly different accent patterns are closely linked to those to clarify the extent to which the patterns are predictable. In the case of trimoraic nouns in (35), (35a) and (35d) are much more productive than the other two patterns, as already mentioned. If we focus on the accented patterns, we can derive the accent pattern in (35a) by rule – actually by the same rule that governs loanwords – while attributing the other accented patterns to lexical exceptions. Again, the crucial point of this analysis is to differentiate rule-governed patterns from lexically-marked ones.

One might argue against this analysis that it is still impossible to explain why /i’noti/ ‘life’ in (34a) belongs to the rule-governed group, while /koko’ro/ ‘heart’ and /otoko’/ ‘man’ belong to the lexically-marked group. This is basically true, but it does not entail that the three patterns must be treated in the same way. To take one parallel example from the verb morphology of English, it is difficult to explain, at least in the synchronic grammar, why ‘go’ and ‘run’ take irregular verbal forms (go-went-gone, run-ran-run), while ‘visit’ and ‘walk’ are regular verbs (visit-visited-visited, walk-walked-walked). Yet, few people would argue against the standard analysis whereby the former verbs should be treated differently from the latter verbs: the past and perfect forms are marked in the lexicon for the former verbs but are derived by rule for the latter verbs. In the same way, while it is difficult to explain why /i’noti/ but not /koko’ro/ and /otoko’/ has an accent on the antepenultimate mora, it is nevertheless reasonable to assume that one of the accent patterns is derived by rule, while the other patterns are lexically marked.

It is worth mentioning here that serious attempts have been made to account for the distribution of unaccented words. In the case of native and SJ words, it is difficult to explain why words like /nezumi/ ‘mouse’ in (35d) take this accent pattern. However, analyses of loanwords and compound words have clarified the phonological conditions on this accented pattern (Kubozono, 1996, 2010; Kubozono, Ito, and Mester 1997; Giriko 2009). For example, it is now clear that loanwords tend to take the unaccented pattern if they are four moras long and involve a sequence of two light syllables in word-final position (see [Table 3](#) above). If further developed, this approach to the unaccented pattern might be able to define the linguistic conditions under which this peculiar accent pattern occurs in the Japanese vocabulary as a whole, which has been a long-standing mystery in Japanese phonology.

Finally, the attempts to generalize various accent rules are mingled with the approaches to discovering the general principles underlying the accent rules. Take the antepenultimate rule in (29), for example. As mentioned above, this rule has been shown to account for the accentuation of most accented nouns in Tokyo Japanese. It has also been demonstrated that it is crucially similar to the famous accent rule of Latin (Kubozono 1996, 2008a,b, 2011). However, it is also assumed in more theoretical analyses (Katayama 1998; Shinohara 2000) that the antepenultimate effect is an

epiphenomenon that results from the interaction of several independent, general principles. These theoretical analyses provide us with the ground where we can discuss Japanese accent from cross-linguistic and typological perspectives.

5.4 Accent and intonation

Word accent remains largely intact in the sentence level in Tokyo Japanese. Thus, the distinction between accented and unaccented words remains intact when they are embedded in sentences. In this sense, word accent is basically independent of sentence-level prosody. Yet, it is closely related with sentence intonation in several ways. One of the most important phenomena in this area is so-called downstep (or catathesis) by which pitch range is lowered after an accented word/phrase. In other words, one and the same word is realized at a lower pitch level if it is preceded by a lexically accented phrase than if it is preceded by a lexically unaccented one (Poser 1984; Pierrehumbert and Beckman 1988; Kubozono 1988).

- (39) a. u'mai nomi'mono 'tasty drink'
 amai nomi'mono 'sweet drink'
- b. u'mai ame 'tasty candy'
 amai ame 'sweet candy'
- c. na'oko-no eri'maki 'Naoko's muffler'
 naomi-no eri'maki 'Naomi's muffler'

In the pair of sentences in (39a), the second phrase /nomi'mono/ is realized considerably lower if preceded by the accented phrase /u'mai/ than if preceded by the unaccented phrase /amai/. Similarly, the unaccented phrase /ame/ in (39b) has considerably lower pitch values if it follows the accented phrase than if it follows the unaccented one. Overall, the accentedness of the first phrase affects the pitch of the following phrases significantly. This and other issues pertaining to word accent and intonation will be discussed in detail by Igarashi (Ch. 13) and Ishihara (Ch. 14).

6 Word types and word structure

6.1 Lexical strata

To understand the phonetic and phonological structures of Japanese, it is vital to understand the organization of its lexicon, or the lexical strata. Specifically, it is important to know that different types of words have different structures and often exhibit different phonological patterns/behaviors. Words in Japanese are generally classified into three groups: (i) native words, (ii) Sino-Japanese (SJ) words, and (iii) loanwords. The third group usually refers to loanwords that have been borrowed from English and other language in the past few centuries. About 84% of loanwords in modern Japanese come from English (Sibata 1994). Some linguists add mimetic words as a fourth group (Ito and Mester 1999, 2008; Nasu 1999): see Nasu (this volume) for a full analysis of this type of words.

The three types of words show many linguistic differences. In terms of orthography, SJ words and loanwords are generally written in Chinese characters and katakana letters, respectively. Some loanwords, especially acronyms, are written in English alphabets, too: e.g. ANA ‘All-Nippon Airways’. Native words, in contrast, are written either in hiragana letters or in Chinese characters (or the combination of the two): e.g. 学ぶ or まなぶ for the verb /manabu/ ‘to learn’.

In addition to the differences in orthography, the three types of words in Japanese exhibit different linguistic structures and patterns. As for vowels, for example, not many native words have a long vowel or diphthong. Many SJ words and loanwords have a long vowel or diphthong, but long vowels in SJ words are restricted to /oo/, /ee/ and /uu/, as noted above. Loanwords have all five long vowels since tense vowels in English are generally adapted as long vowels in Japanese (see (7) above).

As for consonants, /p/ occurs quite commonly in loanwords but not in native words. This is due to the historical changes whereby /p/ turned into other sounds – [h] in word-initial position and [w] in medial position – in the course of the history. In native and SJ words, in fact, /p/ is found only as a geminate consonant in word-medial positions. This is clearly shown by the morphophonemic alternation between /h/ in word-initial position and /p/ in medial position: e.g. /hjoo/ ‘table, chart’ vs. /happjoo/ ‘presentation’, /hi.ru.ma/ ‘daytime’ vs. /mappi.ru.ma/ ‘midday’.

6.2 Phonological length

The three types of words differ in phonological length, too. As for the size of morphemes, SJ morphemes are the shortest: they are one or two moras long by mora count and one or two syllables long by syllable count. These length restrictions reflect the fact that morphemes in Chinese are basically monosyllables, some of which become disyllabic via vowel epenthesis (see (2) above). Not many SJ morphemes are used as independent words in Japanese.¹³ Rather, two morphemes are usually combined to form a ‘word’ in the language: e.g. /gaku-mon/ ‘learning, to ask; learning, science’.

Native morphemes can be longer than SJ morphemes, but they do not usually exceed three moras. Seen conversely, most four-mora or longer native words are compounds, at least etymologically. Thus, the noun /mi.zu.u.mi/ ‘lake’ consists of two morphemes, /mizu/ ‘water’ and /umi/ ‘sea’. The same is true of the four-mora verb, /nu.ka.zu.ku/ ‘to prostrate oneself’, where /nuka/ ‘forehead’ and /tuku/ ‘to push, to prick’ are combined. In comparison, loanwords can be quite long. They are minimally bimoraic, e.g. /ba.su/ ‘bus’ and /pin/ ‘pin’,¹⁴ but can be many moras long. For example, /kon.pjuu.taa/ ‘computer’ is a monomorpheme in Japanese that consists of six moras.

It is probably worth adding here that four-mora length is the most popular length of words in the Japanese vocabulary. In Yokoyama’s (1979) data, cited in Hayashi (1982), four-mora words account for 49% of all the words listed in Sanseido’s dictionary (Shinmeikai Kokugo Jiten), followed by three-mora words (30%) and five-mora words (9%) (Table 7).

Table 7: Frequency of Japanese words as a function of their length (based on Yokoyama 1979)

No. of moras	1	2	3	4	5	6	7	8~
No. of words	282	3,785	16,095	26,559	4,859	1,858	471	278
%	0.5	7.0	29.7	49.0	9.0	3.4	0.9	0.5

Similar statistics were reported by Hayashi (1957), who looked at about 47,000 words listed in the 1951 version of the NHK Accent Dictionary.

Table 8: Frequency of Japanese words as a function of their length (Hayashi 1957)

No. of moras	1	2	3	4	5	6	7	8~
%	0.3	4.8	22.7	38.8	17.7	11.0	3.3	1.5

6.3 Accent

The three types of words often display different phonological patterns. One of the most remarkable differences in word accent can be found in the frequency of the unaccented accent pattern. This pattern is very popular in native and SJ words. According to Kubozono (2006), it accounts for about 71% and 51% of trimoraic native and SJ words, respectively. In contrast, the same accent pattern is relatively rare in loanwords: it accounts for only 10% of loanwords as a whole (Sibata 1994) and 7% of trimoraic loanwords (Kubozono 2006). The huge difference between native/SJ words and loanwords with respect to the popularity of the unaccented word has been a matter of debate in Japanese phonology. In loanword phonology, in fact, it has been a mystery why loanwords behave so differently from the other two types of words and, more specifically, where the loanword accent rule in (29) comes from (Sibata 1994; Shinohara 2000; Kubozono 2006).

Apart from this, the accent patterns of nouns have much to do with their phonological length. For example, the unaccented pattern is most common in four-mora words in all three types of words. It remains a mystery why words of this phonological length favor the unaccented pattern (Ito and Mester, forthcoming).

6.4 Rendaku

The three types of words behave quite differently in the phonological process of rendaku, too. Rendaku is a process converting voiceless obstruents into voiced ones at the beginning of the second elements of compounds: see Vance (this volume) for a full discussion. This process is very productive in compound words whose second member is a native morpheme. In contrast, it occurs infrequently in SJ words and almost never in loanwords. Take the homophonous words, /kai/ 'shell' and /kai/ 'party', the first of which is a native morpheme and the second is a SJ morpheme. Rendaku readily applies to the first, as in (40a), but not to the second, as in (40b).

- (40) a. sakura + kai → sakura-gai 'cherry shell'
 nimai + kai → nimai-gai 'bivalve'
 hora + kai → hora-gai 'trumpet shell'
- b. owakare + kai → owakare-kai 'farewell party'
 doosoo + kai → doosoo-kai 'class reunion'
 kangei + kai → kangei-kai 'welcome party'

Similarly, rendaku fails to apply to loanwords, as can be seen from the comparison of /ka.me.ra/ 'camera' (loanword) and /ka.me/ 'turtle' (native word).

- (41) a. de.zi.ta.ru + ka.me.ra → de.zi.ta.ru-ka.me.ra 'digital camera'
 tu.kai.su.te + ka.me.ra → tu.kai.su.te-ka.me.ra 'disposable camera'
- b. u.mi + ka.me → u.mi-ga.me 'sea turtle'
 zoo + ka.me → zoo-ga.me 'elephant tortoise'

7 Broader perspectives

In the foregoing discussion, we have described the basic phonetic and phonological structures of modern Tokyo Japanese and defined basic concepts and notions that are often used in this volume. In passing, we have also referred to the chapters in Parts II–IV. In the last part (Part V) of the volume, we have four chapters that look at Japanese phonetics and phonology from broader perspectives, in the interface with other subfields of linguistics such as historical and corpus linguistics, L1 phonology acquisition, and L2 research. These four chapters are briefly summarized below.

7.1 Historical phonology

Historical studies of the Japanese language provide rich resources that are significant and useful for understanding the structure of modern Japanese. The Japanese language is attested back to the eighth century with a large amount of written records and dialectal information, although historical linguistic research faces many challenges. The extensive literature on Japanese historical phonology is not well known to linguists except for specialists in the history of Japanese. This chapter (Chapter 15) reviews the results and the points of controversy that have emerged from studies in the last few decades with main focus on the question of what historical studies reveal about the structure of modern Japanese.

7.2 Corpus-based phonetics

Chapter 16 examines how corpus-based quantitative studies can contribute to the better understanding of the phonetic/phonological structure of modern Japanese. After a retrospective survey of the history of speech corpus development and corpus-based analyses in the fields of phonetics and speech processing, we will describe the Corpus of Spontaneous Japanese (CSJ), which is the most representative speech corpus of the present-day spoken Japanese with respect to the corpus size, richness of annotation, and the degree of dissemination to the research communities. We will then consider several cases showing how CSJ can be applied to the quantitative study of speech processing and phonetics of spontaneous speech. We will conclude the chapter with some prospective discussions of the coming development of corpus-based phonetics in Japan and the world.

7.3 L1 Phonology: phonological development

Chapter 17 has two purposes. First, it presents an overview of descriptive findings on the phonological acquisition of Japanese as a native language. Drawing on classic as well as more recent developmental work, the chapter will exemplify how children exposed to Japanese acquire various aspects of its phonology, including segmental contrasts, durational contrasts, alternations, morphophonemic processes, word segmentation and pitch phonology. Second, it discusses the implications of these findings for our understanding of the phonological structure of Japanese and general phonological theory as well as models of phonological development. The chapter concludes with suggestions for future directions of investigation.

7.4 L2 Phonetics and phonology

Chapter 18 introduces research in phonetic and phonological aspects of Japanese as learned by non-native speakers of Japanese, and contextualizes it in a broader field of second language (L2) speech acquisition. The first two sections introduce extant research in elements of Japanese speech sounds that are difficult for learners to produce and perceive, e.g., phonemic length contrasts of vowels and consonants, pitch accent, and other segmental contrasts. The next section introduces extant theories of L2 speech acquisition, in which various factors predict degrees of success in L2 acquisition, and reviews studies exploring different types of training and multi-modal learning methods to enable learners to acquire difficult L2 speech sounds. The final section discusses areas of L2 Japanese that need investigations in the future.

8 Phonetic symbols

8.1 IPA symbols

Before concluding this introductory chapter, we give a guide to the phonetic and phonemic symbols that are used in this volume. As for phonetic representations, we broadly follow IPA for phonetic symbols. The following shows the phonemic and phonetic representations for sounds that are often symbolized in different ways in different books/articles. These representations are used in all chapters of this volume unless otherwise stated in the chapter.

(42)	/u/	[ɯ]
	/si/	[ʃi]
	/ti/	[tʃi]
	/tu/	[tsɯ]
	/hi/	[çi]
	/hu/	[ɸɯ]
	/ra/	[ra]
	/ja/	[ja]

There are some sound sequences that are observed only in loanwords. These are represented with the IPA symbols closest to them: e.g. [ti] in [pa:ti:] 'party'.

8.2 Long vowels and coda consonants

Long vowels are represented in various ways in the literature. In this volume, we chose to double the same symbol for phonemic representations, e.g. /kookoo/ ‘high school’, avoiding the archiphonemic representation (/koR/ or /koH/) as much as possible. Long vowels are shown with a length marker in phonetic representations: e.g. [ko:ko:] ‘high school’.

Nasals and obstruents in the coda position are often called moraic nasals and obstruents, respectively, in Japanese phonology. Coda nasals are shown with the symbol /n/ instead of the archiphonemic /N/ in phonemic representation. In phonetic accounts, they are represented as [m], [n] or [ŋ], so that they reflect the actual place of articulation involved. Coda obstruents are written with double consonants in both phonemic and phonetic representations: e.g. /kitte/ [kitte] ‘postal stamp’. Here, too, the archiphonemic symbol /Q/ (e.g. /kiQ.te/ ‘postal stamp’) is avoided as much as possible.

8.3 Accent and syllable boundaries

Word accent has been represented in many ways in the literature. What is relevant in the phonological description of word accent in Tokyo Japanese is the position of pitch accent (or accent kernel, “akusento-kaku”), or the position where an abrupt pitch fall occurs. This position is marked by an apostrophe (') rather than a diacritic like (*) or an accent mark on the vowel, e.g. /i/. Thus, /tookjoo-daigaku/ ‘Tokyo University’ is represented as /tookjoo-da'igaku/.

Unaccented words are often shown with no accent mark, but /⁰/ is added to the end of the word if it is necessary to show its lack of accent explicitly: e.g. /daigaku⁰/ ‘university’.

Dots (.) indicate syllable boundaries. This symbol is used wherever necessary: e.g. /dai.ga.ku/ ‘university’. Hyphens (-) are often used to denote mora boundaries in the discussion of moraic structure: e.g. /da-i-ga-ku/. They are also used to show morpheme boundaries in compounds.

8.4 Other terminologies

If more than one terminology or expression is used in the literature, one of them is consistently used here to give uniformity to the whole volume. This includes the following terms/expressions: those in the parentheses are not used in this volume.

- (43) moras (vs. morae)
- downstep (vs. catathesis)
- major phrase (vs. intermediate phrase)
- minor phrase (vs. accentual phrase)

8.5 Romanization

Romanization of Japanese words can be a source of confusion. In order to achieve a consistency, this volume – and the entire handbook series – follows the style sheet of Gengo Kenkyu, the journal of the Linguistic Society of Japan. Its basic rule is to use kunrei-shiki for linguistic samples and Hebon-shiki for references. Details can be found at the following website (Japanese and English, respectively): <http://www3.nacos.com/ljs/modules/documents/LSJpapers/j-gkstyle2010.pdf>

<http://www3.nacos.com/lsj/modules/documents/LSJpapers/j-gkstyle2010e.pdf>

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