

A two-accent model of Japanese word prosody*

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In generative phonology, it has been commonly assumed since McCawley (1968) that a Japanese word has either one accent or no accent (the ‘one-accent model’). Some problems for the model are discussed, both cross-linguistically and within Japanese itself. To solve the problems, I propose an alternative model, according to which a Japanese word has either one or two accents (the ‘two-accent model’). The new proposal yields a more consistent treatment of metrical prominence and of the relation between stress and tone in different languages, such as English, Chinese, and Japanese.

1. The standard view: the one-accent model

According to McCawley (1968), words in Tokyo Japanese (hereafter Japanese) have the tonal patterns in (1), where H is a high tone and L is a low tone. When the initial syllable is long, L-H can be realized as H-H, although I shall not discuss this case. The patterns in (1) can be analyzed if we assume that some words have a lexically accented vowel and some do not. The accented vowel is shown in boldface and with an apostrophe in (2), and the accented tone with an apostrophe. Let us call this kind of accent analysis the standard view.

(1)	Tonal patterns		
	kageboosi	H-L-L-L-L	‘shadow’
	tamago	L-H-L	‘egg’
	yamazakura	L-H-H-L-L	‘wild cherry’
	murasakiiro	L-H-H-H-H-H	‘purple’

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- (2) Words with one accent:
 ka'geboosi H'-L-L-L-L 'shadow'
 tama'go L-H'-L 'egg'
 yamaza'kura L-H-H'-L-L 'wild cherry'
 Words with no accent:
 murasakiiro L-H-H-H-H-H 'purple'

The pitch patterns can be related to the accent (or the lack of it) by rules in various ways. In (3) I show the rules proposed by McCawley (1968: 174). The rules are illustrated in (4) with the words in (1).

- (3) Tone rules:
 a. Assign H to every mora
 b. Change H to L for all moras after the accent
 c. Change the first mora to L if the second mora is H

- (4) Rule (3a)
 ka'geboosi H'-H-H-H-H 'shadow'
 tama'go H-H'-H 'egg'
 yamaza'kura H-H-H'-H-H 'wild cherry'
 murasakiiro H-H-H-H-H-H 'purple'
 Rules (3b)
 ka'geboosi H'-L-L-L-L 'shadow'
 tama'go H-H'-L 'egg'
 yamaza'kura H-H-H'-L-L 'wild cherry'
 murasakiiro H-H-H-H-H-H 'purple'
 Rule (3c)
 ka'geboosi H'-L-L-L-L 'shadow'
 tama'go L-H'-L 'egg'
 yamaza'kura L-H-H'-L-L 'wild cherry'
 murasakiiro L-H-H-H-H-H 'purple'

The assumption that some Japanese words have an accent and some do not is shared by many analyses (e.g. Poser 1984, Vance 1987, Pierrehumbert and Beckman 1988, Haraguchi 1991, Kubozono 1993), although they may use different rules for tonal assignment. For example, following Selkirk (1984), Pierrehumbert and Beckman (1988) propose that Japanese has a hierarchy of prosodic categories shown in (5).

- (5) Prosodic hierarchy in Japanese (Pierrehumbert and Beckman 1988)
 Utterance
 Intermediate phrase
 Accentual phrase
 Word
 Syllable
 Mora

In addition, Pierrehumbert and Beckman assume that tones can be assigned to any prosodic category; those assigned above the syllable or mora level appear as boundary tones. Their tone rules are shown in (6) and illustrated in (7), where % indicates a boundary tone.

- (6) Tone rules (Pierrehumbert and Beckman 1988: 13)
- a. Assign HL to the accent of a ‘word’, where H is linked to the accented mora
 - b. For each ‘accentual phrase’, assign a pre-boundary tone H% and a post-boundary tone L%
 - c. For each ‘utterance’, assign a pre-boundary tone L%
 - d. For a question ‘utterance’, assign a post-boundary tone H%
 - e. If the first two moras are unaccented, link a pre-boundary H% to the second mora and a pre-boundary L% to the first mora
 - f. If the accent is on the second mora, link a pre-boundary L% to the first mora

- (7) Examples of single words

Accented:

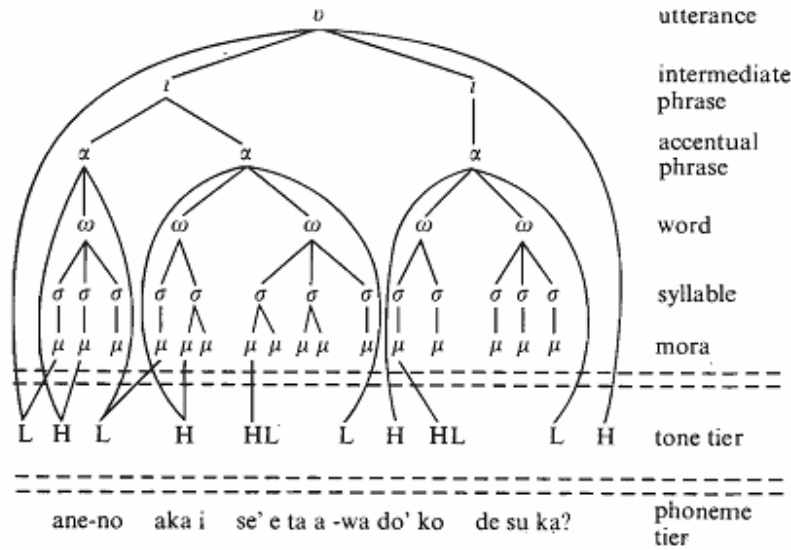
ka’geboosi	tama’go	yamaza’kura
	/ \	/ /
L%H%HL L%	L%H%HL L%	L%H%HL L%
‘shadow’	‘egg’	‘wild cherry’

Unaccented:

murasakiiro
/ \
L%H% L%
‘purple’

An important property of the representation in (7) is that not all vowels are linked to a tone, despite previous claims that every vowel must be linked to a tone (Goldsmith 1976). Pierrehumbert and Beckman refer to this property as ‘tonal underspecification’, which I think is correct. It can also be seen that, as in (3), LH is assigned to the beginning of a word and HL is assigned to the accent. On the other hand, some tones remain unlinked to vowels, such as L% and H% in ‘shadow’ and H% in ‘egg’. Pierrehumbert and Beckman’s analysis includes phonetic interpretations of toneless vowels and vowelless tones. A graphic representation of a question utterance is shown in (8), from Pierrehumbert and Beckman (1988: 21).

(8) Analysis of ‘Where is big sister’s red sweater?’



In summary, while current analyses differ in tonal assignment rules, they share the assumption that some Japanese words have an accent and some do not.

2. Problems for the one-accent model

There are three problems with the one-accent model. The first two are related to metrical structure. The third is related to tonal assignment.

The first problem concerns the issue of unaccented words in Japanese. In Tokyo Japanese, 50% of the words have no accent (Yokoyama 1979). In contrast, all content words (nouns, verbs, adjectives, and adverbs) in English have stress. The difference is not a problem if accent is entirely different from stress. However, many linguists believe that accent and stress are different realizations of the same thing, namely, phonological prominence (e.g. Beckman 1986, Pierrehumbert and Beckman 1988, Hayes 1995, and Kager 1995). Indeed, there is an important similarity between stress in English and accent in Japanese: in both languages, a special tonal unit, or ‘pitch accent’, is assigned to a stressed or accented syllable (Lieberman 1975, Pierrehumbert 1980, Goldsmith 1981, and Pierrehumbert and Beckman 1988).

It has been proposed that stress or accent serves ‘culminative’ and ‘delimitative’ functions, in that it can indicate how many words there are and where the boundaries are (Trubetzkoy 1939, Hyman 1977, Hayes 1995). If so, there ought to be one stress or accent per content word. The lack of accent in many content words in Japanese, therefore, requires an explanation.

Hayes (1995: 24) suggests that the domain of culminativity may vary in different languages. For example, stress is culminative at the word level in English but at the phrase level in French. But Japanese remains a problem: If accent is culminative at the word level, why are half of the words unaccented? If accent is not culminative at the word level, why are half of the words accented?

It can be noted that every content word in Japanese has a tonal pattern, whether accented or not. Accordingly, Pierrehumbert and Beckman (1988) suggest that it is tone,

rather than stress, that serves the culminative and delimitative functions. Still, a difference between English and Japanese remains, namely, phonological prominence is assigned lexically in English but not, or not fully, in Japanese.

It can also be noted that, in the analysis of Pierrehumbert and Beckman (1988), a Japanese word is always accented when spoken alone. This is because a pitch accent is assigned at the ‘accentual phrase’ level and at the ‘utterance’ level (where the pitch accents at these levels are realized as boundary tones). Consider the representation in (9), where ‘x’ indicates an accent and ‘.’ indicates the lack of it.

(9)	‘Accented’ word	‘Unaccented’ word	
	x	x	Utterance
	.	.	Intermediate phrase
	x	x	Accentual phrase
	.	.	Word
	x	.	Syllable/mora
	yamaza’kura	murasakiiro	
	‘wild cherry’	‘purple’	

When a word is spoken alone, it is at the same time a ‘word’, an ‘accentual phrase’, an ‘intermediate phrase’, and an ‘utterance’. Even if it does have an accented syllable or mora, it will get accent at the ‘accentual phrase’ level and the ‘utterance’ level. However, according to Hayes (1995), the representations in (9) are ill formed. The reason is that there is an important metrical requirement called the ‘Continuous Column Constraint’, by which a word cannot be assigned stress (or accent) at a higher level unless it has stress (or accent) at lower levels. On this view, to revive the metrical structures in (9), we should add accent marks at the word level and the ‘intermediate phrase’ level for ‘wild cherry’. For ‘purple’, we should add accent marks at the ‘word’ level and the ‘intermediate phrase’ level, as well as to an appropriate syllable. But if a syllable accent is added to ‘purple’, shouldn’t the word also receive the tones HL? In summary, if Hayes is correct about metrical theory, there is a problem in the representation of accent in Pierrehumbert and Beckman’s analysis.

A second problem concerns a contradiction between two prominence rules for Japanese compounds. The first rule is called the ‘branching constraint’ on ‘accent phrase formation’ (APF) by Kubozono (1993), shown in (10), where brackets indicate syntactic boundaries and parentheses indicate domains of accentual phrases.

- (10) The branching constraint on accent phrase formation (APF)
- [A B] → (AB)
 - [[A B] C] → (ABC)
 - [A [B C]] → (A)(BC)

An accentual phrase is a unit that has either one accent or no accent, similar to a word. Therefore, it is easily identifiable in Japanese. Examples of accent phrase formation are shown in (11).

Examples of the compound accent rule are shown in (15), where accents are indicated in boldface.

- (15) ‘Compound accent rule’ in Japanese:
sha’kai + **se**’edo → shakai-**se**’edo
 society-system
 ‘social system’
 kyooiku + seesaku → kyooiku-**se**’esaku
 education-policy
 ‘educational policy’
a’Npo + jooyaku → aNpo-**jo**’oyaku
 security treaty
 ‘security treaty’

In ‘social system’, the first word loses its original accent. In ‘educational policy’, the second word gains an accent, although it does not have one originally. In ‘security treaty’, the first word loses its original accent and the second word gains an accent. The contradiction between the ‘compound accent rule’ (CAR) and ‘accent phrase formation’ (APF) is highlighted in (16).

- (16) Contradiction between APF (left-prominent) and CAR (left-prominent):

	x .		
	[A B]		APF
[sha’kai + se’edo] →	(shakai- se ’edo)		
‘social system’	(A B)		CAR
	. x		
	x . .		
	[[A B] C]		APF
[[sha’kai shu’gi] ko’kka] →	(shakai-shugi- ko ’kka)		
‘social principle nation’	(A B C)		CAR
	. . x		
	x x .		
	[A [B C]]		APF
[ni’chibee [a’Npo jooyaku]] →	(ni’chibee)(aNpo- jo ’oyaku)		
‘Japan-US Security Treaty’	(A)(B C)		CAR
	x . x		

It can be seen that in ‘Japan-US Security Treaty’, CAR does not work quite well: if CAR is based on right-headed stress assignment, in [A [B C]], A should not have stress (see the mirror-image example [[A B] C] for the left-headed rule APF, where C has no stress).

A third problem of the one-accent model concerns tonal assignment. Consider the analysis of Pierrehumbert and Beckman (1988) again, shown in (7) and repeated in (17).

(17) Tonal assignment in Pierrehumbert and Beckman (1988)

Accented:

ka'geboosi	tama'go	yamaza'kura
	/ \	/ /
L%H%HL L%	L%H%HL L%	L%H%HL L%
'shadow'	'egg'	'wild cherry'

Unaccented:

murasakiiro
/ \
L%H% L%
'purple'

Since HL can only be assigned to the accent, the initial LH must be introduced in other ways. Pierrehumbert and Beckman suggest that they are introduced as boundary tones through accents at higher prosodic levels, i.e., at the 'accentual phrase' and the 'utterance' levels. Because the higher accents should be assigned consistently, such boundary tones are always present, even though there is no vowel to link to. For example, in 'shadow' the initial L% and H% are unrealized. In addition, in 'egg' the H% sandwiched between two linked tones is also unrealized.

There are two further problems with the Pierrehumbert-Beckman analysis. First, in feature theory tone is an articulatory feature and should therefore be realized on a sound, as all other features are. However, in the Pierrehumbert-Beckman analysis tones can be linked to abstract prosodic units, such as 'accentual phrase' and 'utterance'. The discrepancy between the Pierrehumbert-Beckman analysis and feature theory, therefore, requires an explanation. Second, boundary tones are supposed to be dependent on either syntax (e.g. word boundary vs. phrase boundary) or semantics (e.g. question sentence vs. declarative sentence). However, as I shall discuss below, in some Japanese dialects, Pierrehumbert and Beckman must assign boundary tones that are lexically specified.

In summary, if accent and stress are both manifestations of metrical prominence, as many linguists assume, then the lack of accent in Japanese content words requires an explanation. In addition, in Japanese compounds, there is a contradiction in the 'accent phrase formation' rule (left-prominent) and the 'compound accent rule' (right-prominent). Finally, in the Pierrehumbert-Beckman analysis, there is a fair amount of redundancy in tonal assignment, as well as a question of whether tones can be born by abstract prosodic units, in addition to individual sounds.

3. A new proposal: the two-accent model

To solve the problems with the standard model of Japanese accent, I propose a new model, according to which a Japanese word can have either one or two accents. I shall call it the 'two-accent model', described in (18).

- (18) The two-accent model:
- a. A Japanese (content) word has at least one and at most two accents.
 - b. When there are two accents, the initial one falls on the first syllable and is associated with L'H; the second accent can fall on any syllable two or more moras away and is associated with H'L.
 - c. When there is one accent, either L'H (initial) or H'L (any syllable) can occur.
 - d. Foot-Binarity: Two accents cannot fall on adjacent moras.

A comparison of the one-accent model and the two-accent model is schematically shown in (19), where m is a mora, and exemplified in (20). For visual clarity, I use an apostrophe to indicate a mora or vowel with the traditional accent and underline to indicate a mora or vowel with the new accent. I also use an apostrophe to indicate a tone linked to an accented mora or vowel and 0 to indicate lack of tone.

(19)		One-accent model	Two-accent model
	m' mmmm	H' -L-L-L-L	H' -L-0-0-0
	mm' mmm	L- H' -L-L-L	0- H' -L-0-0
	mmm' mm	L-H- H' -L-L	L' -H- H' -L-0
	mmmm' m	L-H-H- H' -L	L' -H-0- H' -L
	mmmmm'	L-H-H-H- H'	L' -H-0-0- H' (L)
	mmmm	L-H-H-H-H	L' -H-0-0-0

(20)		One-accent model	Two-accent model
	ka'geboosi 'shadow'	H' -L-L-L-L	H' -L-0-0-0
	tama'go 'egg'	L- H' -L	0- H' -L
	y <u>a</u> maza'kura 'wild cherry'	L-H- H' -L-L	L' -H- H' -L-0
	m <u>u</u> rasakiro 'purple'	L-H-H-H-H-H	L' -H-0-0-0-0

Because of Foot Binarity, the initial syllable in 'egg' is unaccented. Like Pierrehumbert and Beckman (1988), I assume that not all vowels need to be linked with a tone, and so there is no tone spreading. Indeed, it can be seen that the toneless vowels are all unstressed, and this is a familiar effect, namely, unstressed syllables tend to be toneless. For example, in Chinese, syllables lose their underlying tones when they lose stress (Duanmu 1999, 2000).

It can be seen that the location of the initial accent is predictable, that is, always on the first mora. This is probably why the one-accent model does not mention it. In other words, the one-accent model offers no evidence against an initial accent; rather, the model is based on economy of underlying representation, namely, we only need to specify one accent lexically. But predictable accent (or stress) is still an accent (or stress) and it should be recognized. For example, if a language has predicable initial stress, or predictable penultimate stress, it does have stress, and this fact should be recognized in

the analysis. I shall now show how the present model solves the problems for the one-accent model.

3.1. Word accent

In the two-accent analysis, every content word in Japanese has at least one accent (or stress). In this regard, Japanese accent works the same way as English stress. In addition, there is no problem for ‘unaccented’ words to receive stress at higher levels, because in the two-accent model such words are already stressed.

3.2. Compound prominence rules

In the one-accent model, the first word of a compound loses its accent and the second word either keeps its accent or gains one. This appears to be a right-prominence effect, which contradicts the left-prominence effect in the ‘accent phrase formation’ rule.

In the two-accent analysis, there is no loss of accent from the first word. Instead, there is a possible accent adjustment in order to conform to the canonical pattern of word accent. Consider the examples in (21).

(21)	Compound accent rule		
		One-accent model	Two-accent model
	Underlying	sha’kai + se’edo	sha’kai + se’edo
	Surface	shakai-se’edo ‘social system’	sha’kai-se’edo
	Underlying	kyooiku + seesaku	kyo’oiku + se’esaku
	Surface	kyooiku-se’esaku ‘educational policy’	kyo’oiku-se’esaku
	Underlying	a’Npo + jooyaku	a’Npo + jo’oyaku
	Surface	aNpo-jo’oyaku ‘security treaty’	a’Npo-jo’oyaku

In the two-accent analysis, there is no accent deletion from the first word; instead, it always has an accent, in agreement with the fact that it carries compound stress. What appears to be accent deletion in the one-accent model, as seen in ‘security treaty’, is a change from a HL accent to a LH accent. This is the result of the fact that, like a word, an ‘accent phrase’ has at most two accents, where the first must be LH.

Similarly, there is no accent gain in the second word, because it always has an accent. What appears to be the gaining of an accent on the second word, as seen in ‘educational policy’ and ‘security treaty’, is a change from LH to HL. The again is because the second accent in a word or accent phrase must be HL.

In summary, in the two-accent model, the compound accent rule is compatible with left-prominence, and there is no conflict between the compound accent rule and the accent phrase formation rule.

3.3. Tonal assignment

I suggested earlier that the Pierrehumbert-Beckman analysis of tonal assignment is rather complicated. In the two accent model, a simpler tonal assignment can be

achieved. The comparison is shown in (22) and (23).

(22)	PB model	Two-accent model	
	ka'geboosi	ka'geboosi	'shadow'
	L%H%HL L%	H' L	
	tama'go	tama'go	'egg'
	/ \		
	L%H%HL L%	H' L	
	yamaza'kura	ya'maza'kura	'wild cherry'
	/ /		
	L%H%HL L%	L' H H' L	
	murasakiiro	mu'rasakiiro	'purple'
	/ \		
	L%H%L%	L' H	
(23)	Properties	PB	Two-accent
	Tonal underspecification	yes	yes
	Pre-boundary tones	yes	no
	Final-boundary tone	yes	no
	Unlinked boundary tones	yes	no
	Unaccented words	yes	no

While both models assume that tones do not need to be specified for every vowel, they differ in several ways. In the two-accent model, both L'H and H'L can be introduced by word accent. Therefore, there is no need to introduce L'H as boundary tones via higher accent. This is not to say that boundary tones are not needed. For example, a boundary H is clearly needed for a question utterance. Rather, the point is that, once we have two accents, we can introduce L'H by word accent, instead of higher level accents. In addition, L'H is introduced only when an initial accent is present, and therefore there are no excess tones. In contrast, in the PB model, boundary tones are introduced by accents at higher levels; and therefore they are always there, even when relevant vowels are already linked to other tones.

4. Further issues

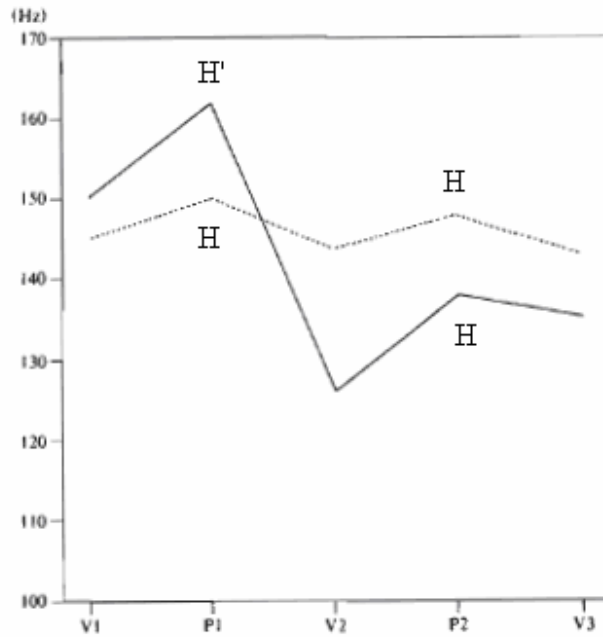
Besides solving the three problems discussed above, the two-accent model can account for a number of other effects in Japanese prosody. I discuss a few here.

4.1. Accentual boost

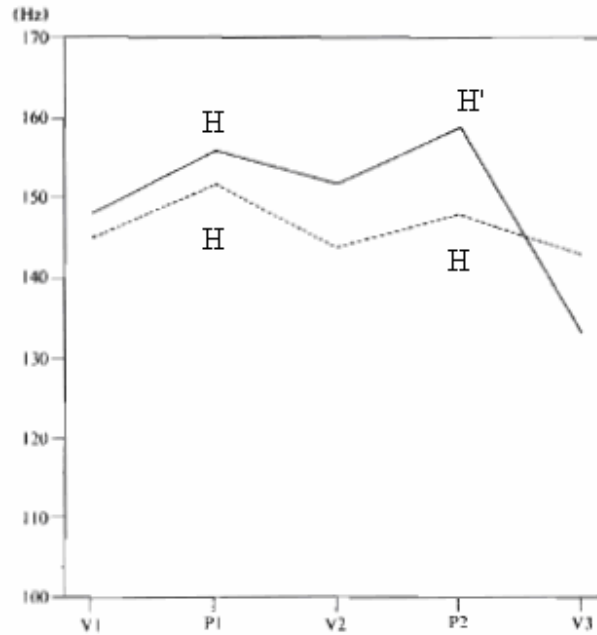
It has been observed in Japanese that an accented syllable (in the one-accent model) has a higher pitch level than the H tone on other syllables (Poser 1984). Kubozono (1993) refers to this effect as 'accentual boost'. For example, uma'i 'tasty' has

an accented H' on the second syllable, whereas *amai* 'sweet' has an unaccented H on the second syllable. The accentual boost effect shows that the H in *uma'i* has a higher pitch value than the H in *amai*. Two examples are shown in (24), from Kubozono (1993: 269-270), where '-A' is an unaccented word and '+A' an accented word. The lines show pitch values at the peaks and valleys of the words. For visual clarity, I have added the accented H' and the unaccented H at relevant locations.

- (24) Accentual boost (Kubozono 1993: 269-270)
 a. Solid line: +A-A (*uma'i yamaimo* 'a tasty yam') vs.
 Dotted line: -A-A (*amai yamaimo* 'a sweet yam')



- b. Solid line: -A+A (*amai nomi'mono* 'a sweet drink') vs.
 Dotted line: -A-A (*amai yamaimo* 'a sweet yam')



In (24a), the accent on *uma'i* 'tasty' raises its peak pitch value, compared with the lower peak value of the unaccented word *amai* 'sweet'. Similarly, in (24b), the accent on *nomi'mono* 'drink' raises its peak pitch value, compared with the lower peak value of the unaccented word *yamaimo* 'yam'.

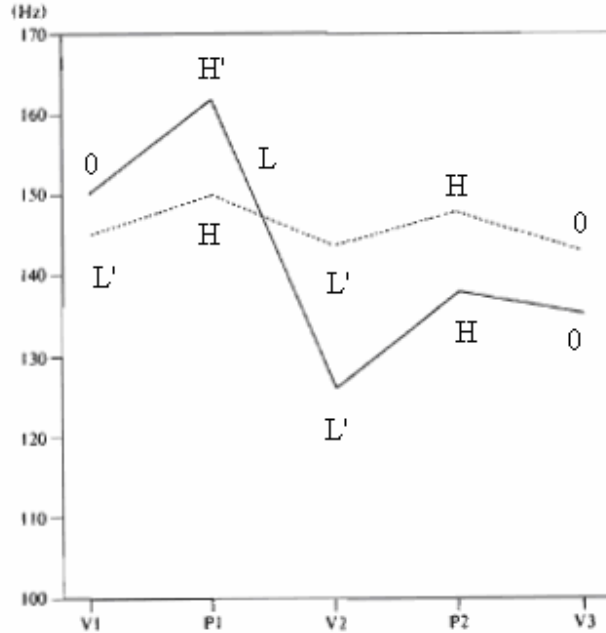
The accentual boost effect shows that an accent is like a stress in that it has greater prominence and shows a higher pitch level. However, it also raises a question for the two-accent analysis. In particular, in the two accent model, every word has an accent. Therefore, why should a traditional accent have a higher peak pitch value than the new initial accent (in the two-accent model)? The answer is that in the traditional accent H'L, the accent is on H. In contrast, in the new initial accent L'H, the accent is on L. What we need to do, therefore, is to propose the pitch interpretation rules in (25), where 0 is the lack of a tone feature.

- (25) Pitch interpretation rules
- a. An accented H' has a higher pitch value than an unaccented H.
 - b. An accented L' has a lower pitch value than 0 or an unaccented L.

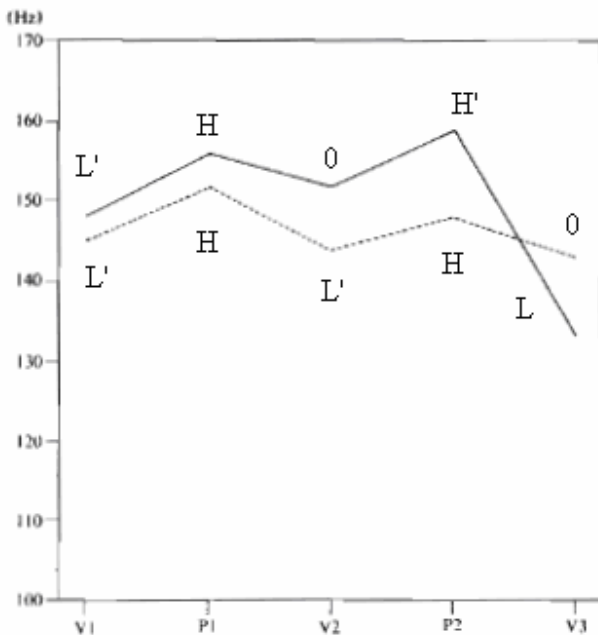
Both rules are phonetically natural, in the sense that features on an accented or stressed sound are usually pronounced more fully than those on unaccented sounds. Given the pitch interpretation rules, we can now reexamine the pitch contours in (24) in a new light, as shown in (26).

(26) Interpreting accentual boost

- a. Solid line: +A-A (*uma'i yamaimo* 'a tasty yam') vs.
 Dotted line: -A-A (*amai yamaimo* 'a sweet yam')



- b. Solid line: -A+A (*amai nomi'mono* 'a sweet drink') vs.
 Dotted line: -A-A (*amai yamaimo* 'a sweet yam')



It can be seen that the predictions of the two-accent model match the pitch contours quite well. In addition, the term 'accentual boost' is essentially correct, too, provided we do not interpret 'boost' to be a higher pitch value, but a greater value in the direction of the accented feature.

4.2. Weight-stress effect

If accent in Japanese is metrically like stress in English, we expect there to be metrical effects, such as the presence of foot structure or sensitivity to syllable weight. Evidence for foot structure in Japanese has been discussed in Poser (1990). In this section I discuss some weight-stress effects.

Syllabic weight refers to whether a syllable is heavy (where the rhyme is VV or VC) or light (where the rhyme is V). Kubozono (2003) observes that Japanese shows a number of cases of adjustment in syllable weight, whereby a heavy syllable (H) is shortened or a light syllable (L) is lengthened, in order to produce HL and HH patterns. The weight adjustment cases are listed in (27), where *Zuzya-go* is a language game. Some examples are shown in (28) and (29), from Kubozono (2003). Syllable boundaries are indicated by ‘.’, according to Kubozono (2003). Accent marks are provided by Miki Obata (p.c.), according to the one-accent model.

(27) Syllable weight adjustment in Japanese (Kubozono 2003: 118)

Sporadic lengthening/shortening:

HH → HL

LL → HL

LH → HH

Loanword truncation:

LH → LL

HH → HL

Motherese:

LL → HL

L → HL

LH → HL

H → HH

Zuzya-go formation:

HH → HL

LL → HL

L → HL

H → HL

LH → HL

Emphatic mimetics:

LL → HL

(28) Loanword truncation

LH → LL ro.kee.shon → ro’.ke ‘location’

HH → HL roo.tee.shon → ro’o.te ‘rotation’

(29)	Motherese		ADULT	BABY	
		L → HL	ha	hap.pa	'leaf'
		LL → HL	ma.ma'	ma'm.ma	'food/eat'
			da.ku'	da'k.ko	'holding up'
			ne.ne'	ne'n.ne	'sleep'
		LH → HL	hau'	ha'i.hai	'crawl'
		LH → HL	o.bu'u	o'm.bu	'piggyback ride'

The data show that the shift in syllable weight generally corresponds to a shift in the location of the accent. In the output forms, the initial syllable is accented but the second is not. It is well known in stress languages that there is a relation between stress and syllable weight, in that stressed syllables tend to be heavy and unstressed syllables tend to be light. The same relation can explain why there is a preference for a heavy initial syllable and a light second syllable in the Japanese cases. In other words, the weight adjustment effects provide further evidence that accent in Japanese is similar to stress in other languages.

It is also interesting to note that in hap.pa 'leaf', the first syllable has no accent in the one-accent model. Therefore, it is unexpected why the first syllable is heavy. In the two-accent model, happa does have an accent on the first syllable, and so it is expected that the first syllable is heavy.

4.3. Other Japanese dialects

In a survey of Japanese dialects, Uwano (1999) shows a wide range of tonal patterns in Japanese words. However, the variation can be generalized in two ways, which I state in (30).

- (30) Variation in word tones in Japanese dialects:
- a. Variation in the word-initial tonal contour
 - b. Variation in the 'accented' tonal contour

For example, in Tokyo Japanese, the initial contour is predictably LH and the accented contour is predictably HL. In other dialects, however, either the initial contour or the accented contour may be unpredictable and has to be specified in the lexicon.

It is interesting to examine Osaka Japanese in this regard. In Osaka Japanese, a word may contain pitch fall (HL) or not. In the traditional one-accent model, HL can be attributed to the word accent, while other words are thought to be unaccented. Some examples are shown in (31).

- (31) Tone patterns in Osaka Japanese
- | | | |
|--------------------------|------------|----------------|
| Accented (with HL): | | |
| u'guisu | H'-L-L-L | 'lark' |
| yamaza'kura | H-H-H'-L-L | 'wild cherry' |
| nokogi'ri | L-L-H'-L | 'file' |
| Unaccented (without HL): | | |
| tsukemono | L-L-L-H | 'pickles' |
| tsukemono-ga | L-L-L-L-H | 'pickles, nom' |
| niwatori | H-H-H-H | 'chicken' |
| niwatori-ga | H-H-H-H-H | 'chicken, nom' |

In the two-accent model, a word can have up to two accents. When both accents occur, the first falls on the initial mora and the second occurs two or more moras to the right. The tonal assignment can be described by the rules in (32).

- (32) Tonal assignment in the two-accent model:
- Assign lexically specified H' or L' to the first accent
 - Assign H'L to the second accent
 - L' must be followed by H

The tonal assignment rules are illustrated in (33) with the words in (31), where '0' indicates an unspecified tone. For comparison the full-tone representation (Full rep.) is also given.

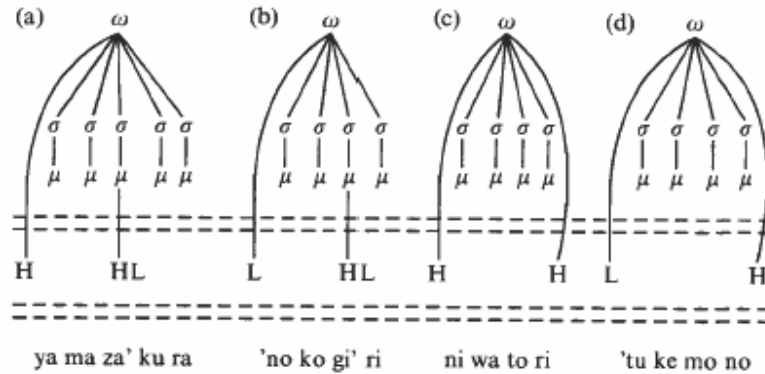
- | | | |
|---------------|------------|------------------------------|
| (33) | Full rep. | Two-accent model |
| u'guisu | H'-L-L-L | H' -L-0-0 |
| ya'maza'kura | H-H-H'-L-L | H' -0- H' -L-0 |
| no'kogi'ri | L-L-H'-L | L' -0- H' -L |
| tsu'kemono | L-L-L-H | L' -0-0-H |
| tsu'kemono-ga | L-L-L-L-H | L' -0-0-0-H |
| ni'watori | H-H-H-H | H' -0-0-0 |
| ni'watori-ga | H-H-H-H-H | H' -0-0-0-0 |

Next consider the tonal assignment in the Pierrehumbert-Beckman analysis, which is shown in (34), where % indicates a boundary tone. As discussed earlier, a boundary tone is the realization of an accent assigned at a higher prosodic level (that is, above the syllable or mora). In the case of Osaka Japanese, the boundary tones come from an accent assigned to the word level (even if the word has no accented syllable or mora).

- (34) Tonal assignment in Pierrehumbert and Beckman (1988):
- Assign H'L to the accented mora
 - Assign a lexically specified pre-boundary H% or L%
 - For 'unaccented' words, assign a post-boundary tone H%

The rules in (34) is illustrated graphically in (35), from Pierrehumbert and Beckman (1988: 229).

(35) Illustration of tonal assignment in Pierrehumbert and Beckman (1988)



As in their analysis of Tokyo Japanese, Pierrehumbert and Beckman assume that some words in Osaka Japanese have an accent and some have none. Since the accent can only introduce HL, additional tone features have to be introduced as boundary tones, via the assignment of a higher accent at the word level. This is shown in (36).

(36)	'Accented' word	'Unaccented' word	
	x	x	Word accent
	x	.	Syllable/mora accent
	nokog <i>i</i> 'ri	niwatori	
	'file'	'chicken'	

It can be seen that, as discussed earlier, the metrical representation for 'chicken' is ill formed, because it contains a higher accent without there being a lower accent (a violation of the 'Continuous Column Constraint' of Hayes 1995). In contrast, in the two-accent model every word has at least one accent and some have two. Therefore, the accents can introduce enough tones, without the need for boundary tones. It should also be noted that the use of boundary tones can create tonal ambiguity and unlinked tones. This happens when the traditional 'accent' is on the initial syllable. Consider the example in (37).

(37)	Unlinked tones and tonal ambiguity	
	u'guisu 'lark'	u'guisu 'lark'
	H%H'L	L%H'L

Because the word has initial accent, the pre-boundary tone remains unlinked, because there is no vowel available. In addition, because an unlinked tone is not heard, we do not know whether it is H% or L%.

There are questions about the use of boundary tones in Osaka Japanese. First,

boundary tone assignment is usually based on syntax (e.g. indicating different kinds of boundaries) or semantics (e.g. indicating a question vs. a declarative sentence). However, in Osaka Japanese, the choice for the initial boundary tone (H% or L%) must be lexically specified. In addition, the post-boundary tone H% has to be made sensitive to whether the word has an accent, although it is not part of that accent. Finally, the traditional H...H pattern is represented as H%...H%, as given in (35c), although there does not seem to be clear evidence for the final H%. For example, H-H-H-H is represented as H-0-0-H in the Pierrehumbert-Beckman analysis but H-0-0-0 in the two-accent analysis. Since the pitch contour of such word seems to decline gradually, without a final rise (Pierrehumbert and Beckman 1988: 217), H-0-0-0 seems to be a better representation.

In (38) I summarize the comparison of the Pierrehumbert-Beckman analysis (PB) and the two-accent analysis.

(38)		PB	Two-accent
	Tonal underspecification	yes	yes
	Unaccented words	yes	no
	Initial boundary tone	yes	no
	Final boundary tone	yes	no
	Unlinked tones	yes	no
	Final H% for 'H-words'	yes	no
	Tonal ambiguity	yes	no

Both analyses assume tonal underspecification, in that some moras are unspecified for tone. In addition, in both analyses the initial H or L before the accented HL is unpredictable and must be lexically specified. However, in other respects the two models differ, and when they do the two-accent model seems to be simpler.

5. Concluding remarks

I have discussed several problems with a traditional view of Japanese accent, according to which a word has either one accent or no accent. To solve the problems, I have proposed a new analysis, according to which a Japanese word has either one or two accents. The second accent is the same as the traditional accent. The first accent is always on the first syllable, provided there is no accent on the following mora. Following a standard view on the relation between stress and tone, each accented syllable can be assigned a lexically specified tone pattern. Because some words have two accents, additional tones can be assigned to them in order to create the correct pitch contours of words, without the use of boundary tones or abstract accents at higher prosodic levels.

The new proposal offers a simpler analysis of tonal assignment in Japanese. It also resolves a contradiction between 'accent phrase formation' in Japanese, which shows left prominence, and the 'compound accent rule' in Japanese, which seems to show right prominence. In the two-accent analysis, both 'accent phrase formation' and 'compound accent rule' are left prominent. Finally, the new analysis yields a more consistent theory of metrical structure, compound stress, and the relation between stress and tone in different languages, such as English, Chinese, and Japanese.

References

- Beckman, Mary E. 1986. *Stress and Non-stress Accent*. Dordrecht: Foris.
- Duanmu, San. 1999. "Metrical structure and tone: evidence from Mandarin and Shanghai." *Journal of East Asian Linguistics* 8(1), 1–38.
- Duanmu, San. 2000. *The Phonology of Standard Chinese*. Oxford: Oxford University Press.
- Goldsmith, John. 1976. *Autosegmental Phonology*. Doctoral dissertation, MIT, Cambridge, Massachusetts. Reproduced by the Indiana University Linguistics Club, Bloomington, Indiana.
- Goldsmith, John. 1981. "English as a tone language." In *Phonology in the 1980's*, Didier L. Goyvaerts (ed.), pp. 287–308. Ghent, Belgium: E. Story-Scientia.
- Haraguchi, Shosuke. 1991. *A theory of Stress and Accent*. Dordrecht: Foris.
- Hayes, Bruce. 1995. *Metrical Stress Theory: Principles and case studies*. Chicago: University of Chicago Press.
- Hyman, Larry. 1977. "On the nature of linguistic stress." In *Studies in Stress and Accent*, Larry Hyman (ed.), pp. 37–82. *Southern California Occasional Papers in Linguistics* 4. Los Angeles: Department of Linguistics, University of Southern California.
- Kager, René. 1995. "The metrical theory of word stress." In *The Handbook of Phonological Theory*, John Goldsmith (ed.), pp. 367–402. Cambridge, MA: Blackwell.
- Kubozono, Haruo. 1993. *The Organization of Japanese Prosody*. Tokyo: Kurosio Publishing.
- Kubozono, Haruo. 2003. "The syllable as a unit of prosodic organization in Japanese." In *The Syllable in Optimality Theory*, Caroline Féry and Ruben van de Vijver (eds.), pp. 99–122. Cambridge: Cambridge University Press.
- Liberman, Mark. 1975. *The Intonational System of English*. Doctoral dissertation, MIT, Cambridge, Massachusetts.
- McCawley, James D. 1968. *The Phonological Component of a Grammar of Japanese*. The Hague: Mouton.
- Pierrehumbert, Janet. 1980. *The Phonetics and Phonology of English Intonation*. Doctoral dissertation, MIT, Cambridge, Massachusetts.
- Pierrehumbert, Janet, and Mary Beckman. 1988. *Japanese Tone Structure*. Cambridge, Massachusetts: MIT Press.
- Poser, William. 1984. *The Phonetics and Phonology of Tone and Intonation in Japanese*. Doctoral dissertation, MIT, Cambridge, Massachusetts.
- Poser, William. 1990. "Evidence for foot structure in Japanese." *Language* 66, 78–105.
- Selkirk, Elisabeth. 1984. *Phonology and Syntax: The Relation Between Sound and Structure*, Cambridge, Massachusetts: MIT Press.
- Trubetzkoy, Nikolai Sergeevich. 1939. *Principles of Phonology*. Translated from German by Christiane A. M. Baltaxe in 1969. Berkeley: University of California Press.
- Uwano, Zendo. 1999. "Classification of Japanese accent systems." In *Proceedings of the Symposium "Cross-Linguistic Studies of Tonal Phenomena, Tonogenesis, Typology, and Related Topics"*, Shigeki Kaji (ed.), pp. 151–178. Tokyo: Institute for the Study of Languages and Cultures of Asia and Africa, Tokyo University of Foreign Studies.
- Vance, Timothy J. 1987. *An Introduction to Japanese Phonology*. Albany, N.Y.: State University of New York Press.
- Yokoyama, Shoichi. 1979. "zisyō midasigo no akusento no seikaku ni tuite" [On the nature of the accent of dictionary-listed words]. *Nihon Onkyoogakkai Kooen Ronbunshyuu*. The Acoustical Society of Japan.