A PSYCHOLINGUISTIC IMPLICATION OF ACCENTUAL PHRASING IN JAPANESE

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1. INTRODUCTION

It is commonly recognized that in Japanese there are different types of prosodic units above the level of word: utterance (sentence), intermediate (major) phrase, and accentual (minor) phrase (McCawley 1968; Poser 1984; Pierrehumbert and Beckman 1989).

Acoustically, the utterance is characterized as the domain of declination which is about 10 Hz per second (Poser 1984). The intermediate phrase is the domain of catathesis or iterative application of pitch compression caused by an accent (Pierrehumbert and Beckman 1989). The accentual phrase is, then, the domain of an initial rise and the possible occurrence of an accent, which is an acute pitch shift from H tone to L tone.

The pitch contour in Figure 1 demonstrates these prosodic units. The whole contour is that of the utterance which consists of two intermediate phrases; *ao'i yama-ma'de* 'to the blue mountain' and *ooi'sogi-de ikima'suka* 'do you quickly go?'; of these two, the initial intermediate phrase is a good example showing that it further consists of (two) accentual phrases, the second of which is catathesized due to the accent in the preceding accentual phrase, ao'i 'blue'.
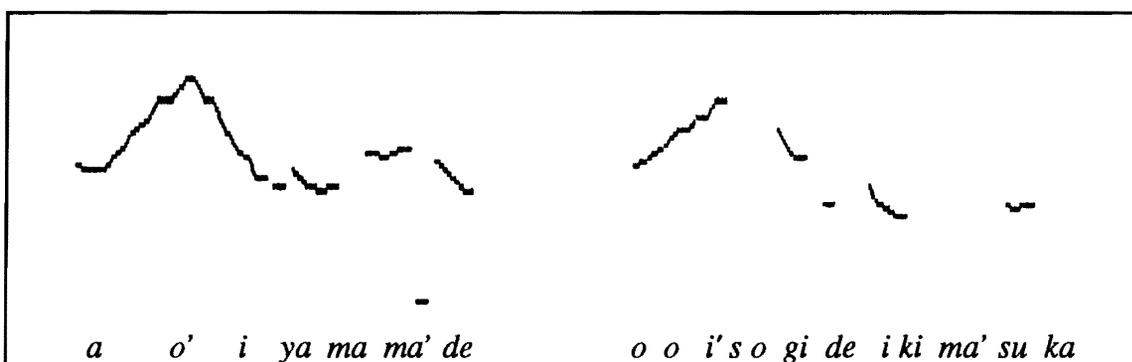

Figure 1

As part of designing a prosodic phrasing model which assists a speech-synthesis program to create natural pitch contours in Japanese (Miyamoto 1989), an acoustic experiment is conducted to investigate the conditioning factor for accentual phrasing. Our basic assumption is that, unlike intermediate phrasing, which is the complex interaction of syntactic, semantic, and extra-linguistic factors (cf. Nespor & Vogel 1986), accentual phrasing is conditioned either by the syntactic configuration or the phonological configuration of a given intermediate phrase.

Two interesting facts are found in our acoustic experiment. First, the conditioning factor for accentual phrasing is found to be the *underlying* accentual configuration of the phrase rather than the syntactic or surface accentual structure. Second, speakers are sensitive to some sort of a look-ahead mechanism in accentual phrasing.

2. ACCENTUAL BEHAVIOUR OF JAPANESE POSTPOSITIONS

Prior to reporting on the experiment on accentual phrasing, the accentual behaviour of Japanese postpositions is discussed because they play roles in accentual phrasing. In combinations of postpositions and their host nouns, many of the postpositions exhibit peculiarities in accentual behaviour. These accentual behaviour of postpositions are well documented (e.g., Hirayama 1960; NHK 1966; McCawley 1968, 1977; Higurashi 1983; Poser 1984). Table 1 provides a convenient, though not exhaustive, summary of accounts on the accentual behaviour of non-monomoraic postpositions.

Table 1
Accentual types of non-monomoraic postpositions shown in the forms with the accented host, *i'noti* "life" and the unaccented host, *miyako* "capital".

(1) *ma'de* -type [+Left-winning]: an unmarked type which obeys the left-win rule; e.g. *de'su* "copula", *yo'ri* "from", *ba'kari* "only".

    i'noti + *ma'de*   →   *i'noti-made*

    miyako + *ma'de*   →   *miyako-ma'de*

(2) *kara* -type [+Anonymity]: an unaccented counterpart of the type (1); all the monomoraic postpositions should also be included in this type.

    i'noti + *kara*   →   *i'noti-kara*

    miyako + *kara*   →   *miyako-kara*

(3) (a) *gu'rai* -type [+Deaccenting]: a marked type.

    i'noti + *gu'rai*   →   *inoti-gu'rai*

    miyako + *gu'rai*   →   *miyako-gu'rai*

  (b) *jyuu* -type [+Deaccenting]; an unaccented counterpart of the *gu'rai* type postpositions.

    i'noti + *jyuu*   →   *inoti-jyuu*

    miyako + *jyuu*   →   *miyako-jyuu*

(4) *'sika* - type [+Preaccenting (partial)]: a marked type of postposition.

    i'noti + *'sika*   →   *i'noti- sika*   (obeying the left-win rule)

    miyako + *'sika*   →   *miyako'-sika*

As listed in Table 1, postpositions may be categorized into four major types; (1) [+Left-winning] postpositions; (2) [+Anonymity] postpositions; (3) [+Deaccenting] postpositions; and (4) [+Preaccenting] postpositions. The first type, [+Left-winning] postposition is an unmarked case. Some of the non-monomoraic postpositions, such as *ma'de* "to", *de'su* "copula", or *ba'kari* "only" are classified in this type. If a [+Left-winning] postposition has any accent-conflict, i.e., when both the host and the postposition are accented, it is the host's accent which is realized, and the accented postposition loses its accent, as in *i'noti* + *ma'de* → *i'noti-made*. If there is no accent-conflict, an available accent is realized as the accent of the unit (noun + postposition), as in *miyako* + *ma'de* → *miyako-ma'de*.

The second type of postposition marked by [+Anonymity] is the unaccented counterpart of [+Left-winning] postpositions, and being a part of a host noun, they are never independent in accentuation and never cause any accent-conflicts. All the monomoraic postpositions, such as *o* "accusative", *ni* "dative", or *wa* "topic marker" should also be included in this type.

The third type of postposition is marked by the feature [+Deaccenting] and postpositions, such as, *gu'rai* "as much as", *da'ke* "only", or *jyuu* "throughout" are classified in this type. In the case of a [+Deaccenting] postposition, the accent of the host will not be realized because of the predominant power associated with the [+Deaccenting] postposition which deaccents the accent on its left, as in *i'noti + gu'rai → inoti-gu'rai*. The unaccented [+Deaccenting] postpositions, *jyuu* and *dake*, create an unaccented accentual phrase regardless of the accentuation of the host, as in *i'noti + jyuu → inoti-jyuu*; *miyako + jyuu → miyako-jyuu*.

The fourth type of postposition is marked by the feature [+Preaccenting] because the postposition of this type places an accent on the last syllable of the preceding host if the host does not have an accent (i.e., unaccented) as in *miyako + 'sika → miyako'-sika*. If the host is accented, however, *'sika* obeys the left-win rule as in *i'noti + 'sika --> i'noti-sika*.

3. EXPERIMENT ON ACCENTUAL PHRASING

3.1. Aim of Experiment

As mentioned in Introduction, the main aim in conducting an acoustic experiment is to obtain a generalization about accentual phrasing. More precisely, we would like to know whether it is a syntactic configuration or an accentual configuration which determines how an intermediate (major) phrase is parsed into accentual (minor) phrases. For example, given the phrase, *ao'i + oma'me + ma'de*, 'to the blue beans', is it possible to predict how many accentual phrases are created from the phrase? Although unlikely, will the phrase be uttered with two interphrasal boundaries, creating three accentual phrases in the phrase because there are three underlying accents? Or, more likely, will the phrase be uttered with just one interphrasal boundary (L%) which is inserted before the noun, creating only two accentual phrases, as *ao'i L% oma'me-made* because there are two surface accents? Or, will the whole phrase be realized as just one accentual phrase, having a culminative accent at the leftmost unit, *ao'i* ? Or, will it be that accentual phrasing is not conditioned by the accentual configuration, but by the syntactic configuration: modifier + noun + postposition? Of course, there ought to be variations in phrasing but also there ought to be a general trend in accentual phrasing which ought to be determined either by a phonological or syntactic condition. It is the trend and the condition of the accentual phrasing which are what we would like to elicit from the experiment

3.2. Procedure.

Table 2 is the list and the possible combinations (4 * 2 * 4 = 32) of lexical items used as stimuli in the experiments. The phrases made of the possible combinations of these lexical items are set in a carrier sentence; "····· *te-ga todokima'su* ," (I can reach out my hand for ·····) except for the possible combinations with *gu'rai*. The phrases with *gu'rai* are placed in a carrier sentence, "····· Aj- N *wa arima'sen*" as "*ao'i omame-gu'rai ao'i oma'me-wa arima'sen* ," (there are no beans which are as blue as the blue beans). It is the meaning of *gu'rai* which demands the different carrier sentence.

Table 2
A list of stimuli used in the experiments examining accentual phrasing

Modifier		Noun		Postposition	
ao'i	"blue"			*ma'de*	"to"
omoi	"heavy"	*oma'me*	"beans"	*gu'rai*	"as much as"
a'ni -no	"brother's"	*nimame*	"cooked beans"	*jyuu*	"all over"
ane -no	"sister's"			*ni*	"to"

Pierrehumbert and Beckman (1989) have found that a focused item attracts an intermediate phrase boundary immediately before the focused item. Warkentyne (1978) reports that in Japanese focus is generally placed on the "argument " which immediately precedes a (sentence final) verb. The combination of these two individual claims assures us that all the stimuli will be realized as an intermediate phrase, having an intermediate phrase boundary between the end of a stimulus phrase and the beginning of a carrier sentence which consists of an NP argument and a verb.

The stimuli are organized in the following manner. In the noun slot, there are two pairs of modifiers, each of which constrasts an accented modifier with an unaccented modifier, having similar phonemic configurations. The same with the noun slot: the accented noun, *oma'me* , is contrasted with the unaccented noun, *nimame* , in that both nouns have the same number of morae as well as similar phonemic configurations. In the postposition slot, *ma'de* represents [+Left-winning] postpositions; *gu'rai* is an accented postposition marked by the feature [+Deaccenting]; and the postposition, *jyuu* , is an unaccented [+Deaccenting] postposition. The [+Preaccenting] postposition, *'sika* , is not included in the list because its segments, /s/, devoiced /i/, and /k/ are all invisible in F_0 analysis. *Ni* represents monomoraic postpositions.

These stimuli embedded in the carrier sentences were written, in random order, on sheets of paper in Japanese. Each sentence was paired with its echo question. The data for analyses were taken only from the answers because, being old information, none of the items in the phrases in the answers should have received any narrow-focus. The total of 160 $(((4 * 2 * 4 *) * 5) = 160)$ utterances were recorded by five female subjects who were the speakers of Standard Tokyo Japanese. The subjects were requested to utter the stimuli in a well articulated manner.

Measurements were taken using MSL (Micro Speech Lab) and MSLPITCH which were IBM-PC-compatible speech analysis programs developed at the Centre for Speech Technology Research, Victoria, Canada. The recorded items were analyzed with a 10 bit, 10k/sec sampling rate.

4. RESULTS

The results of the experiment are summarized as Table 3 and Table 4. Table 3 is a summary of the phrasing of all the possible combinations with the accented noun, *oma'me* and Table 4 is a summary of the phrasing of those with the unaccented word, *nimame* . In both sets, i.e., *oma'me*-set and *nimame*-set, all the cases are divided into two groups, unmarked phrasing and marked phrasing. The markedness and unmarkedness are determined by the frequency of occurrences. In each table, there are four rows of phrase groups which differ in the modifier they take. In a group, each phrase is specified with its ending postposition. The + and - signs specify whether items in a phrase are accented (+) or unaccented (-). The reason why there are two series of + and - specifications in the unmarked phrasing case in the *oma'me*-set is that one on the left specifies a surface accentuation of a phrase and one on the right in a parenthesis specifies underlying (original) accentuation of the phrase, i.e., the accentuation prior to an application of a [+Feature] of a postposition. The *nimame*-set does not have two types of accentual specifications because surface and underlying accentual specifications are the same in a phrase in the set. A slash between symbols indicates the presence of an accentual boundary. If a phrase is realized as a single phrase without an accentual boundary, such a phrase is marked by [ ]. If there are no symbols inside [ ], it shows that a phrase is realized without a boundary and with the same accentuation as its unmarked phrasing. If a subscript is attached to the bracket, it identifies the subject who uttered the instance. The symbol Ø indicates the absence of an instance. Finally, the numeral in each case indicates the schematic F_0 contour of the phrase presented in the last section of the paper so that the reader can have visual understanding of the phrase in question.

Table 3
The results of accentual phrasing of the phrases whose head is the accented noun, *oma'me* 'beans'.

OMA'ME - Set

		Unmarked Phrasing				Marked Phrasing	
ao'i							
	A11	+/ + -	(*ma'de*)	(+ + +)	(2)	[+ - -] h/s	(9)
	A 12	+/ - +	(*gu'rai*)	(+ + +)	(3)	[ ] h	(10)
	A13	+/ - -	(*jyuu*)	(+ + -)	(4)	Ø	
	A14	+/ + -	(*ni*)	(+ + -)	(2)	[+ - -] s	(9)
omoi							
	A21	-/ + -	(*ma'de*)	(- + +)	(5)	Ø	
	A22	-/ - +	(*gu'rai*)	(- + +)	(5)	Ø	
	A23	-/ - -	(*jyuu*)	(- + -)	(7)	Ø	
	A24	-/ + -	(*ni*)	(- + -)	(5)	[ ] h/s	(9)
a'ni -no							
	A31	+/ + -	(*ma'de*)	(+ + +)	(2)	[+ - -] h	(9)
	A32	+/ - +	(*gu'rai*)	(+ + +)	(3)	[+ - -] h	(9)
	A33	+/ - -	(*jyuu*)	(+ + -)	(4)	Ø	
	A34	+/ + -	(*ni*)	(+ + -)	(2)	[+ - -] h	(9)
ane -no							
	A41	-/ + -	(*ma'de*)	(- + +)	(5)	[ ] h	(6)
	A42	-/ - +	(*gu'rai*)	(- + +)	(5)	[ ] h/s	(6)
	A43	-/ - -	(*jyuu*)	(- + -)	(7)	[ ] s	(8)
	A44	-/ + -	(*ni*)	(- + -)	(8)	[ ] h/s	(6)

Table 4
The results of accentual phrasing of the phrases whose head is the unaccented noun, nimame 'cooked beans'.

Nimame - Set

		Unmarked Phrasing			Marked Phrasing	
ao'i						
	B11	+/ - +	(*ma'de*)	(3)	[ ] h/s	(10)
	B 12	+/ - +	(*gu'rai*)	(3)	[ ] s/t	(10)
	B13	+/ - -	(*jyuu*)	(4)	[ ] h (9);	+/-/- k
	B14	+/ - -	(*ni*)	(4)	[ ] s/h	(9)
omoi						
	B21	[- - +]	(*ma'de*)	(6)	Ø	
	B22	[- - +]	(*gu'rai*)	(6)	Ø	
	B23	[- - -]	(*jyuu*)	(8)	-/-/-k	
	B24	[- - -]	(*ni*)	(8)	Ø	
a'ni -no						
	B31	+/ - +	(*ma'de*)	(3)	Ø	
	B32	+/ - +	(*gu'rai*)	(3)	[+ - -] h	(9)
	B33	+/ - -	(*jyuu*)	(4)	Ø	
	B34	+/ - -	(*ni*)	(4)	[ ] h	(9)
ane -no						
	B41	[- - +]	(*ma'de*)	(6)	Ø	
	B42	[- - +]	(*gu'rai*)	(6)	-/ - +k	(5)
	B43	[- - -]	(*jyuu*)	(7)	-/ - - k	(7)
	B44	[- - -]	(*ni*)	(8)	Ø	

For example, a part of the first, *ao'i*-group in the *oma'me*-set which is reproduced below can be read as follows:

OMA'ME - Set

	Unmarked Phrasing				Marked Phrasing	
ao'i						
A11	+/ + -	(*ma'de*)	(+ + +)	(2)	[+ - -] h/s	(9)
A13	+/ - -	(*jyuu*)	(+ + -)	(4)	Ø	

The case, A11, *ao'i* + *oma'me* + *ma'de* (+ + +) was realized, in the case of unmarked phrasing, as +/ + - , i.e., *ao'i* L% *oma'me-made* with the insertion of an accentual boundary. The schematic F0 contour of the phrase is (2) (which is listed in Figure 2). The subjects H and S, however, uttered the same phrase as [+ - -], i.e., *ao'i-omame-made* with no insertion of L% and with just one culminative accent on the left-most item, *ao'i* . The utterance is regarded as marked phrasing, and its schematic F0 contour is shown in Figure 9. Another case, A13, *ao'i* + *oma'me* + *jyuu* whose underlying accentuation is (+ + -) was realized as +/ - -; *ao'i* L% *omame-jyuu* , i.e., an intermediate phrase consisting of two accentual phrases. The schematic F0 contour of the phrase is presented in Figure 4. All five subjects showed the same phrasing pattern because its marked case has Ø, a null-sign.

Now, let us look at unmarked phrasing in the *oma'me*-set.[1] The phrases in the set have a consistent pattern of phrasing, i.e., the insertion of an interphrasal boundary between the modifier and the noun. The accentuation of the phrases seems to have no impact on the phrasing because there are the differences of all the possible combinations in accentuations. That is, if the accentuation of the postpositions are excluded from consideration, there are following accentual variations across the interphrasal boundary:

+/ +	(*ao'i* L% *oma'me-* ;	*a'ni -no* L% *oma'me-*)
+/ -	(*ao'i* L% *omame-* ;	*a'ni -no* L% *omame-*)
-/ +	(*omoi* L% *oma'me-* ;	*ane -no* L% *oma'me-*)
-/ -	(*omoi* L% *omame-* ;	*ane -no* L% *omame-*)

The above facts seem to suggest that a syntactic configuration rather than an accentual configuration determines accentual phrasing. That is, as unmarked phrasing, a phrase of "modifier + noun + postposition" is uttered as an intermediate phrase consisting of two accentual phrases with L% inserted after the modifier. So, to account for the accentual phrasing, we can posit a very simple working hypothesis; i.e., if a phrase has a syntactic configuration of modifier + noun + postposition, insert an interphrasal accentual boundary after a modifier.

Next, let us look at unmarked phrasing in the *nimame*-set in Table 4 , and test whether the above hypothesis can account for all the phrasings. In the *nimame*-set, the working hypothesis based on syntactic configuration is obviously denied because in *omoi* - and *ane -no* groups, there is no instance which has an interphrasal L%. All these phrases were realized without an accentual phrase boundary. This discounts the syntax-based hypothesis. The question is, then, how to account for the fact that it is only the phrases in the unaccented modifier (*omoi* and *ane-no*) groups in the *nimame*-set that do not have an interphrasal L%. It looks as if the accentual configurations of the phrases, too, fail to condition accentual phrasing because in the *oma'me*-set, there are the cases where L% is inserted between an unaccented modifier (-) and an unaccented noun (-), i.e., "- / - " (cases: A22, A23, A42, and A43). On the other hand, in the *nimame*-set, there is no insertion of L% in the phrases which have exactly the same accentual configuration, i.e., [- -] (cases: all the phrases in *omoi-* and *ane-no* groups). So, denying the previous syntax-based working hypothesis, it seems that accentual phrasing is arbitrary; i.e., the insertion of the interphrasal L% cannot be predicted either by a syntactic configuration or by an accentual configuration.

Importantly, however, it becomes possible to obtain a generalization on accentual phrasing once the underlying (original) accentual configuration rather than the surface pattern is taken into account. That is, in all the *underlying* accentual forms (i.e., the accentuations of the phrases prior

to the applications of the postpositional features) in the *oma'me*-set, there is at least one + either in the modifier slot or in the noun slot. It is, then, always the case that an interphrasal L% is inserted after a noun. Now, in the *nimame* -set, all the phrases in the *ao'i*- and *a'ni-no* groups have + specification in the modifier slot, and they all have an interphrasal L%. In the same *nimame*-set, however, all the phrases in the *omoi*- and *ane-no* groups which do not show any interphrasal L% have no + specification either in the modifier slot or in the noun slot. Thus, from these facts, we can deduce the following generalization: in the case of unmarked phrasing, a phrase of "modifier + noun + postposition" has an interphrasal accentual boundary after the modifier if either the modifier or the noun is underlyingly (originally) accented. This generalization accounts for the unmarked phrasing exhibited in all the data.[2]

5. PSYCOLINGUISTIC IMPLICATION

One psycholinguistic implication which comes to mind based on the results on the accentual phrasing is that there must be some sort of look-ahead mechanism in accentuation and phrasing. More precisely, there must be a look-ahead-one-item mechanism in accentuation and phrasing. Such a mechanism can be represented by a two-item-sized window cursor which moves from left to right one item at a time.[3] It is only in a (current) window cursor, that any accent-conflict between two items is resolved. Also, in the (current) window cursor, a phrasing decision is made; i.e., an accentual phrase boundary will be inserted if, in the cursor, there are two words and at least one of them is underlyingly accented (+).

What are the reasons for postulating a look-ahead-one-item mechanism for accentuation and phrasing? First, if there were no look-ahead mechanism at all, how would it be possible to account for the resolution of an accent-conflict triggered, for example, by the feature, [+Deaccenting]; e.g., (A13) *ao'i* + *oma'me* + *jyuu* → *ao'i-omame -jyuu*? To deaccent correctly *oma'me* as *omame* in the phrase, the speaker has to see the feature [+Deaccenting] before the speaker reaches the second mora of the noun, or more reasonably before the speaker starts to utter the noun. Thus, there must be some sort of look-ahead mechanism in accentuation. If, however, the speaker were able to look ahead at the accentual configurations of items up to the end of the phrase, in other words, if there were a *phrase-sized* window cursor, it would not be possible to account for the phrasing difference between, for example, (A23) *omoi -omame -jyuu* ; (- + -), -/ - - and (B23) *omoi -nimame -jyuu* ; (- - -), [- - -]. If the speaker were able to see the feature [+Deaccenting] prior to uttering the phrases, both phrases would have the same phrasing, i.e., [- - -]. That is, A23 should not have the interphrasal L% because the speaker would be able to see the feature [+Deaccenting] of the postposition prior to uttering the initial word and, thus, would treat the accentuation of the whole phrase as $\boxed{\text{- - -}}$. If this were the case, (A23) *omoi -omame -jyuu* $\boxed{\text{- - -}}$ and (B23) *omoi -nimame -jyuu* $\boxed{\text{- - -}}$ should have had the same phrasing, i.e., [- - -], according to the earlier generalization which inhibits the insertion of an interphrasal L% between two unaccented (-) words. However, the fact that A23 was realized as -/ - - whereas B23 was realized as [- - -] denies the existence of the phrase-sized window cursor; i.e., the speaker cannot look ahead to all the accentual configurations of a phrase before starting to utter it.

A look-ahead-one-item mechanism or an implementation of a two-item-sized window cursor will explain things nicely. Because there is a two-item-sized window-cursor, an interphrasal L% is inserted after the modifier in A23 but not in B23 due to the generalization that a phrase will have L% between two words if at least one of them is (underlyingly) accented:

A23   B23

| omoi (-)oma'me (+) |jyuu [+Deac] | omoi (-)nimame (-) |jyuu [+Deac]

‖   ‖

omoi L% oma'me   omoi   nimame

The next movement of the cursor enables the speaker to see the feature [+Deaccenting] and to deaccent the noun, *oma'me* , in A23:

omoi /| oma'me jyuu [+Deac] |[4]   omoi | nimame -jyuu [+Deac] |

‖   ‖

omame -jyuu   nimame -jyuu

The results, *omoi L% omame jyuu* and *omoi nimame jyuu* are exactly what we want as the unmarked phrasing for the phrases. The same argument applies to the phrasing difference exhibited between A42 and B42; and this argument is compatible with all the accentual phrasings and the realization of postpositional features shown in Table 3 and 4. We would thus like to claim that, at least in well-articulated speech involving no narrow focusing, a speaker possesses a look-ahead-one-item mechanism in accentual phrasing and in realizing the accentual feature of a postposition.

6. CONCLUSION

Based on the acoustic evidence, we have shown that (i) the conditioning factor for accentual (minor) phrasing is the underlyling accentual configuration of a given intermediate (major) phrase; (ii) an accentual phrase boundary is inserted between two words if at least one of them is underlyingly accented; and that (iii) there is a look-ahead-one-item mechanism in accentual phrasing and in realizing the accentual features of postpositions. We believe that these claims hold not only in the cases where the intermediate phrase consists of just three items, "modifier + noun + postposition", but also in the case of intermediate phrases consisting of more than a few items.

HL1
(294Hz)

HL2
(242Hz)

L%1
(222Hz)

L%2
(189Hz)

L%3
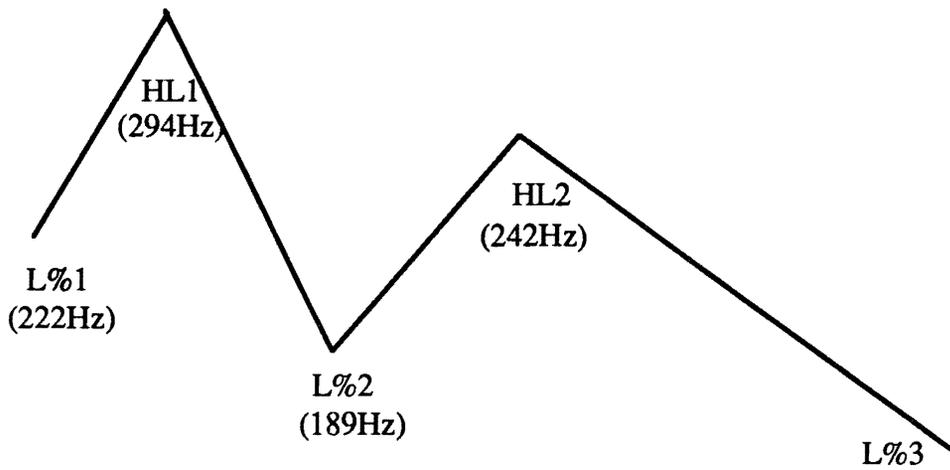
Figure 2

A schematic pitch contour of (2), +/ + - : L% HL L% HL L%. (F0 values are means of 15 tokens.)

HL1
(291Hz)

L%1
(204Hz)

Hu (216Hz)

HL2
(236Hz)

L% 2(185Hz)

L%3
(157Hz)
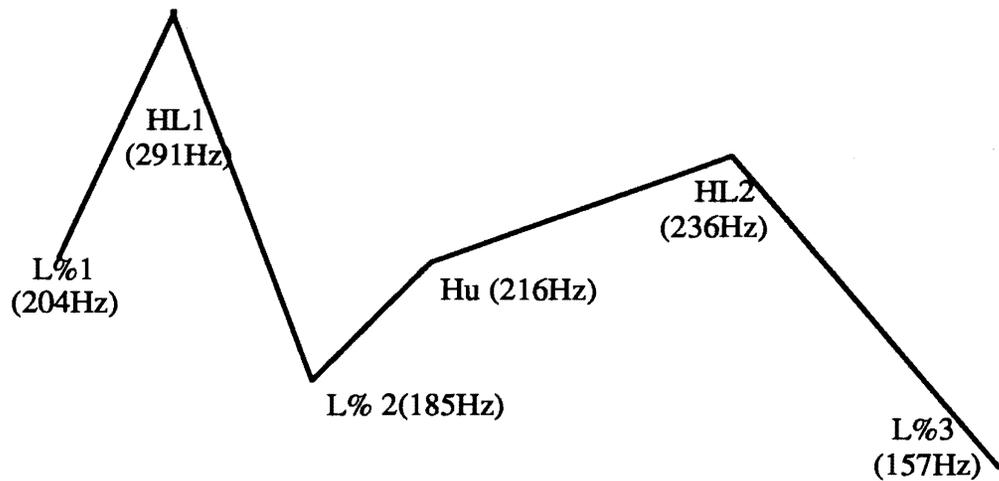
Figure 3

A schematic pitch contour of (3), +/ - + : L% HL L% H HL L%. (F0 values are means of 22 tokens.)

HL
(300Hz)

L%
(214Hz)

L% (181Hz)

H (203Hz)

H
(227Hz)

L% (202Hz)
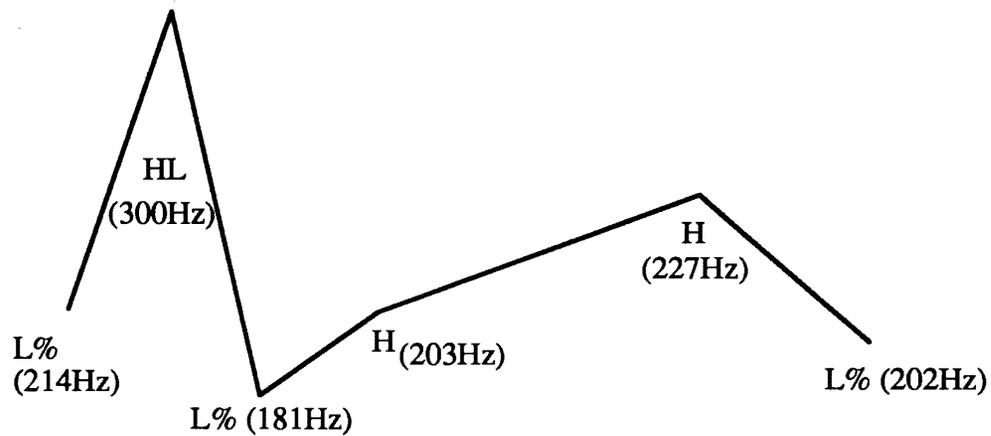
Figure 4

A schematic pitch contour of (4), +/ - - : L% HL L% H H L%. (F0 values are means of 14 tokens.)

H
(271Hz)

L%
(239Hz)

HL
(271Hz)

L% (178Hz)

· L%
(155Hz)
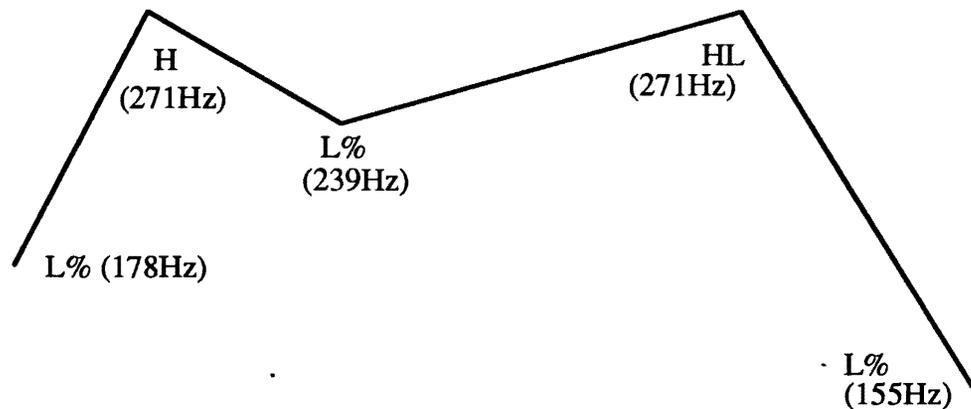
Figure 5

A schematic pitch contour of (5), -/ + - ; -/ - + : L% H L% HL L%. (F0 values are means of 23 tokens.)

10

H
(276Hz)

HL
(267Hz)

L%
(183Hz)

L%
(163Hz)
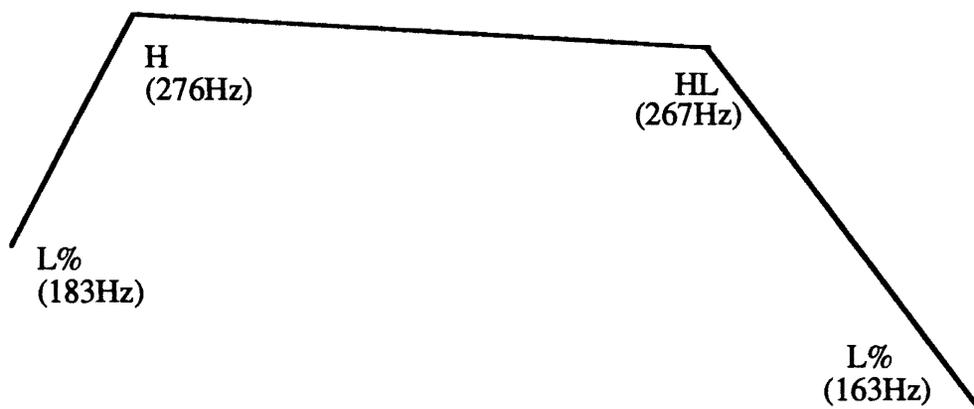
Figure 6

A schematic pitch contour of (6), [- - +] : L% H HL L%. (F0 values are means of 19 tokens.)

H
(276Hz)

H
(268Hz)

L%
(256Hz)

L%
(223Hz)

L%
(183Hz)
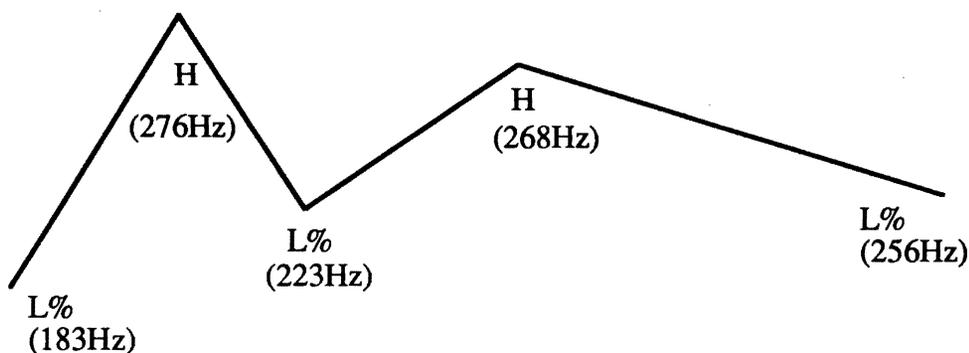
Figure 7

A schematic pitch contour of (7), -/ - - : L% H L% H L%. (F0 values are means of 3 tokens.)

H
(251Hz)

H
(233Hz)

L%
(221Hz)

L% (177Hz)

Figure 8

A schematic pitch contour of (8), [- - -] : L% H H L%. (F0 values are means of 12 tokens.)
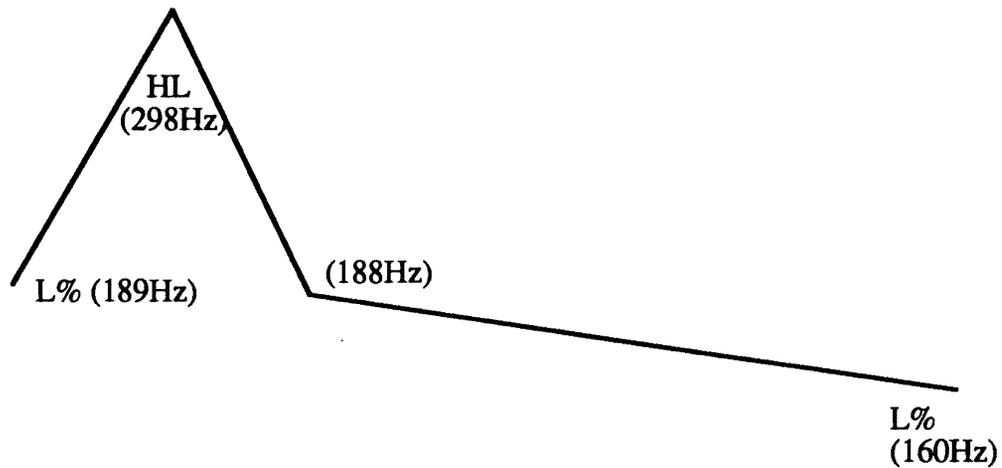
Figure 9

A schematic pitch contour of (9, marked phrasing), [+ - -] : L% HL L%. (F0 values are means of 10 tokens.)
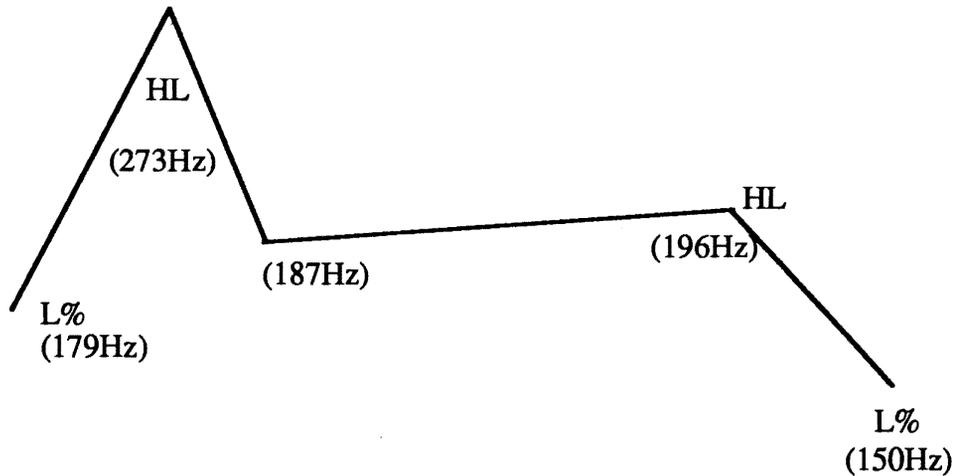
Figure 10

A schematic pitch contour of (10, marked phrasing), [+ - +]: L% HL HL L%. (F0 values are means of 4 tokens.)

NOTES

1. In this paper, we are not reporting on marked phrasing. However, roughly speaking, there are two types of marked phrasing; one caused by "culminative accentuation" and the other caused by "enunciative accentuation". Two of the subjects, S and, especially, H, constantly show the first type of marked phrasing, creating a single phrase with only one accent, whereas the subject K shows, once in a while, the second, opposite type of phrasing, inserting L% at every possible location. Typical examples of the marked phrasing caused by culminative accentuation are found in the following cases: A11, A14, A31, A32, and A34. The unmarked phrasing in these cases has either +/ + - or +/ - +, whereas the marked phrasing shows only [+ - -] which is characterized by (i) having just one culminative accent in the leftmost item and by (ii) having no interphrasal L%, realizing the whole phrase as a single accentual phrase. We performed an additional experiment

(on narrow focusing) and confirmed that this type of marked phrasing was caused by a narrow focus placed on the left-most item which deaccents any accents to its right (cf. Miyamoto 1989).

2. The maximal generalization we can obtain from the experiment may be that an accentual phrase boundary is inserted between phonological words if at least one of the phonological words is underlyingly accented, where phonological word is defined as a word coupled with or without a postposition. This generalization should be able to account for the accentual phrasing not merely of "modifier + noun + postposition" but of longer strings of words in any part of speech classifications.

3. "Item" is used as a cover term for word and postposition.

4. Because the second item in the cursor is not a word but a postposition, an accentual phrase boundary is not inserted between these two items, conforming to our generalization that an accentual phrase boundary is inserted between two *words* if one of them is underlyingly accented.

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