ABSTRACT

This paper investigates possible Japanese L1 transfer effects in the area of English intonation. First, hypotheses regarding the possible errors were generated based upon differences in intonational structure between Japanese and English. Then, the hypotheses were tested auditorily and acoustically.

The analysis in this study reveals eight major types of errors made by Japanese speakers of English: (1) giving the same vowel length between stressed and unstressed words in an utterance; (2) using one distinct pitch shape for pitch accents: a sharp rise followed by a sharp fall; (3) using smaller pitch excursions than native English speakers; (4) no tone-spreading phenomenon in required contexts; (5) no secondary accent in multisyllalbe words in required contexts; (6) no deaccenting phenomenon in contrastive situations; (7) excessive use of boundaries in long phrases; and (8) delayed final rise for a question contour.

It is assumed that most of the above differences are due to Japanese speakers' L 1 inteference. The implications of these results are discussed.

Japanese Students'English Intonation

YUICHI TODAKA

INTRODUCTION*

A great deal of research has been carried out for both English and Japanese intonation systems (cf. Todaka, 1990 and work cited there). However, crosslinguistic research on intonational interference in the past is faced with difficulty in interpreting data (cf. De Bot 1986). Some of the causes are due to: (1) the use of different intonation systems to account for language transfer effects; (2) the analysis is based purely on acoustic or auditory judgment; (3) lack of understanding of the intonation systems being studied.

Beckman & Pierrehumbert (1986) have analyzed both the English and Japanese intonation and accent systems using the same theoretical framework, and have found similarities and differences between the two systems. Even though their analysis uses only two pitch levels (H and L tones), similar to other researchers, their tonal implementation rules make it possible to account for the intonation systems in greater depth than they have hitherto been described. Since they have comprehensive analyses of both languages in a well-developed theory, it is easier to use their analyses to predict possible L1 interference effects.

Even though they have found many similarities, there are still many differences which lead one to expect L 1 intonational interference. It is, therefore, important to test L1 interference for Japanese speakers of English. Being an English teacher for 7 years, I have noticed many intonational errors made by Japanese students, which may be related to their L1 transfer.

Fathman (1981) and Johansson (1978) (both mentioned in De Bot) examined Indochinese and Swedish ESL students' speech respectively, and found that one of the most serious errors was intonational errors.

Ohala and Gilbert (mentioned in Van Els and De Bot 1987) investigated a role of intonation in identifying the three languages (i.e., English, Japanese, and Cantonese). They had the participants only listen to the intonation of the speech by taking out all the other speech signal. They found that languages might be identified on the basis of intonation through training.

The above findings indicate the importance of the intonation, stress, and its pedagogical applications. Furthermore, intonational signals not only provide speakers' emotions, but also give turn-taking clues in conversation (Brazil, Coulthard, and Johns 1980 mentioned in Odlin 1989:119). It is, therefore, important to master how the intonational system of the second language works. The summary of the major differences in Beckman & Pierrehumbert's analyses of the two languages are as follows:

1. Japanese uses only one pitch accent, whereas English uses a variety of pitch accents, and the pitch shape for pitch accent in English is not specified for the accented lexical item[1].

2. English has a tone-spreading rule, which spreads the value of phrase accents to the right when the next value is phonetically equal or higher. The Japanese language does not have any tone-spreading rule, phonologically or phonetically.

3. The Japanese intermediate phrase is typically smaller than the English intonation phrase and

contains fewer syntactic constituents.

4. Japanese uses only pitch to mark prominent syllables, whereas English also uses duration and amplitude differences to mark prominence.

5. Both languages have catathesis, but the timing of catathesis is said to differ. In Japanese, the L tone of the accent itself is affected by catathesis, whereas in English it seems not to apply until after the second tone of the triggering pitch accent[2].

6. Each Japanese word has only one pitch accent, whereas in English it is possible to have two accents in a multi-syllable word, especially when focused or in isolation.

I have generated the following hypotheses regarding the possible L1 transfer effects of Japanese speakers of English in the area of intonation and accent, based upon the above differences introduced in Beckman & Pierrehumbert's (1986) analyses with references to Pierrehumbert's (1980) English intonation analysis and Pierrehumbert & Beckman's (1988) Japanese intonation analysis. The hypotheses are:

Hypothesis 1. Since English has a variety of pitch accent shapes to convey distinct intonational meanings, Japanese speakers may create different pitch shapes without noticing that the different melodies express different meanings.

Hypothesis 2. In the relevant cases (i.e., subject to tone-spreading), Japanese speakers will have a pitch pattern with a gradual fall between the pitch accent and the boundary tone, where English speakers will have a sustained pitch pattern.

Hypothesis 3. Japanese speakers may place boundaries between syntactic constituents in a long phrase, whereas native speakers will not.

Hypothesis 4. When a word is focused by Japanese speakers, it may have shorter duration and less of a amplitude effect than when the word is focused by native speakers of English.

Hypothesis 5. There may be timing differences of catathesis between Japanese speakers of English and native English speakers.

Hypothesis 6. When pronouncing longer multi-syllable words either in isolation or with great prominence, where English speakers place two accents, Japanese speakers may place only one.

SPEECH MATERIALS AND RECORDINGS

All the subjects were asked to read a typed list containing sentences while a recording was being made. Each sentence was designed to test one of the hypotheses mentioned above. A context for each sentence was given. The sentences and the contexts were:

Hypothetical Situation: Two speakers are talking to each other about tennis. One speaker tells the other that he/she has bought yellow tennis balls recently and asks what color balls the other has.

Sentence 1: I have orange balls.

Hypothetical Situation: One speaker repeats the sentence several times, but the addressee does not understand what is being said. Thus, the first speaker tries to clarify what he/she has said.

Sentence 2: I said recreation.

Hypothetical Situation: One speaker told the other that he/she has an examination this week and asked the other whether or not the addressee has one.

Sentence 3: Do you have an examination?.

Hypothetical Situation: Two friends are talking about cars. They are looking at the cars in front of them. One finds a nice car and tells the other how wonderful the car looks. As one praises the car, the other points to the car and tells him/her that the car is his/hers.

Sentence 4: This great big beautiful car is mine.

Hypothetical Situation: One person looks really depressed and the other asks him/her what is wrong. One tells the other that he had a bad dream.

Sentence 5: I had a bad dream.

Hypothetical Situation: Two friends have decided to make jam for their school festival. One asks the other what kinds of jam he/she has made.

Sentence 6: I made blueberry, raspberry and strawberry.

The Subjects in the experiment were asked to read the sentences in a natural way.

The fundamental frequency (F0), the acoustic correlate of pitch, was measured to compare the utterances made by Japanese subjects (Ss) and native English speakers (ESs). Since voiceless sounds have no F0 and F0 is affected substantially by segmental differences, the auditory perception of pitch was also employed in this study, with the help of a trained phonetician.

SUBJECTS

Twenty Japanese students, 10 male and 10 female, participated in the study. The subjects(Ss) were students of Kanto Gakuin University in Yokohama, Japan. They had studied English for eight to eleven years at school. None of them are English majors at the university. Four male and three female Ss had some prior English intonation lessons at either the junior high or high-school level. Most of the students had English conversation lessons once a week for one year taught by a native English speaker. In addition to the Japanese Ss, two native English speakers (American), one male and one female, provided model recordings for comparison.

METHOD

The recorded speech material was digitized and analyzed with a Kay DSP Sonagraph. Unlike previous spectrograph models, this one uses three DSP chips and a computer-style monitor for real-time display and interactive measurement. Its stored analysis setup # 6 , recommended for F0, was selected for this experiment. This setup displays both a short-time (300 Hz wideband) spectrogram and a narrowband spectrogram of the same signal, sampled at a low frequency and shown on an expanded scale. Thus, the wideband and the narrowband spectrograms can be seen simultaneously as an aid in segmentation. The expanded scale of the narrowband spectrogram gives good frequency resolution. The most significant advantage is that the F0 measurement can be extracted interactively with precise values, directly from the display on the screen. Furthermore, a whole contour with its peak values can be measured precisely.

RESULTS

For the first sentence, I have orange balls, F0 peaks were expected on the words "I" and "orange" due to contrastive stressing. In fact, the two native speakers had the same F0 contours, with pitch ranges of 111 Hz (ES1) and 163 Hz (ES2) respectively. The word "balls" was deaccented, and nuclear accent on "orange" was lower than the peak on "I" due to catathesis (see details of contour in Fig. 1a and 1c). The F0 contour for the word, orange" was exactly the same. The F0 peak occurred at the half way point and had a symmetrical shape. The actual peak occurred at the sound /r/. (see Fig. 1b).

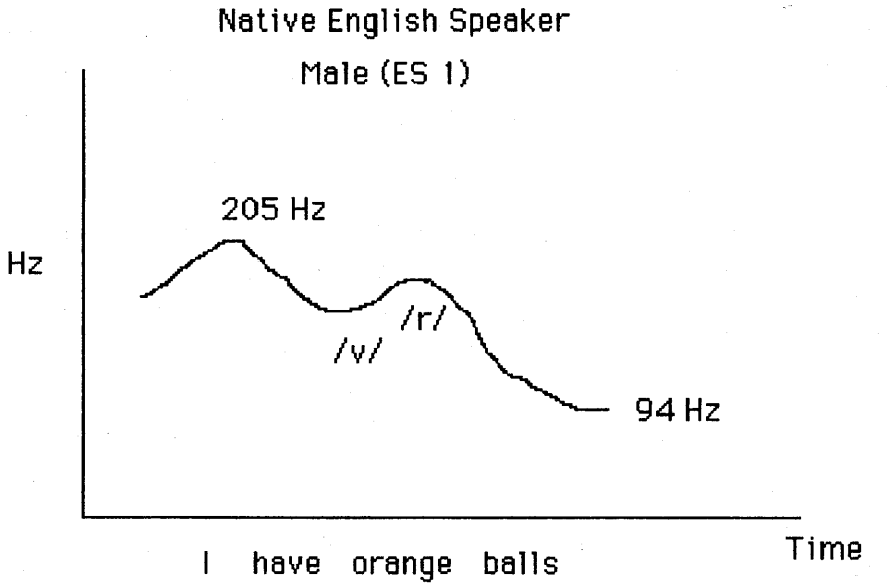


Fig.1a

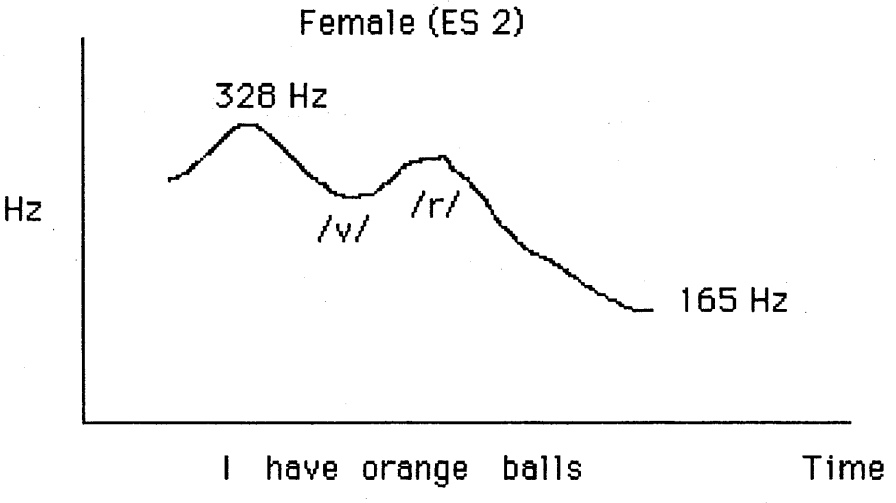


Fig.1b

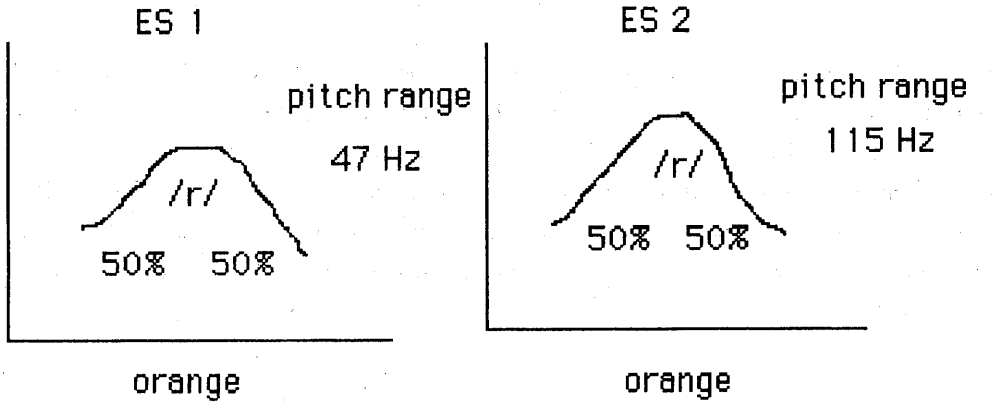
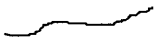
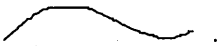


Fig.1c

All the Japanese Ss had an F0 rise at the word "I", like the ES's, but the pitch ranges, pitch shapes, and the timing were slightly different. The noticeable difference between the Japanese and the English Ss occurred on the word, "orange". Three major types of F0 contours were observed:

(1)  (2)and  (3)  . 50 % of the male and 40 % of the female Ss followed pattern 1. The F0 suddenly rose at the sound /r/ instead of gradually rising, as with the two native English Ss. 20% of the male Ss and 30% of the female Ss followed pattern 2. The F0 gradually rose until the sound /n/ when the F0 was either sustained or dropped.

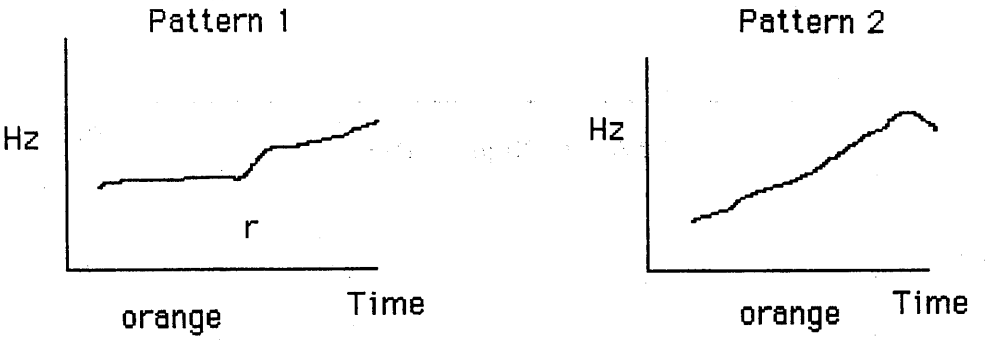


Fig. 2

Finally, 30% of both male and female Ss had the correct accent loci, but the F0 contours were different from the one the native speakers had (see Fig. 3).

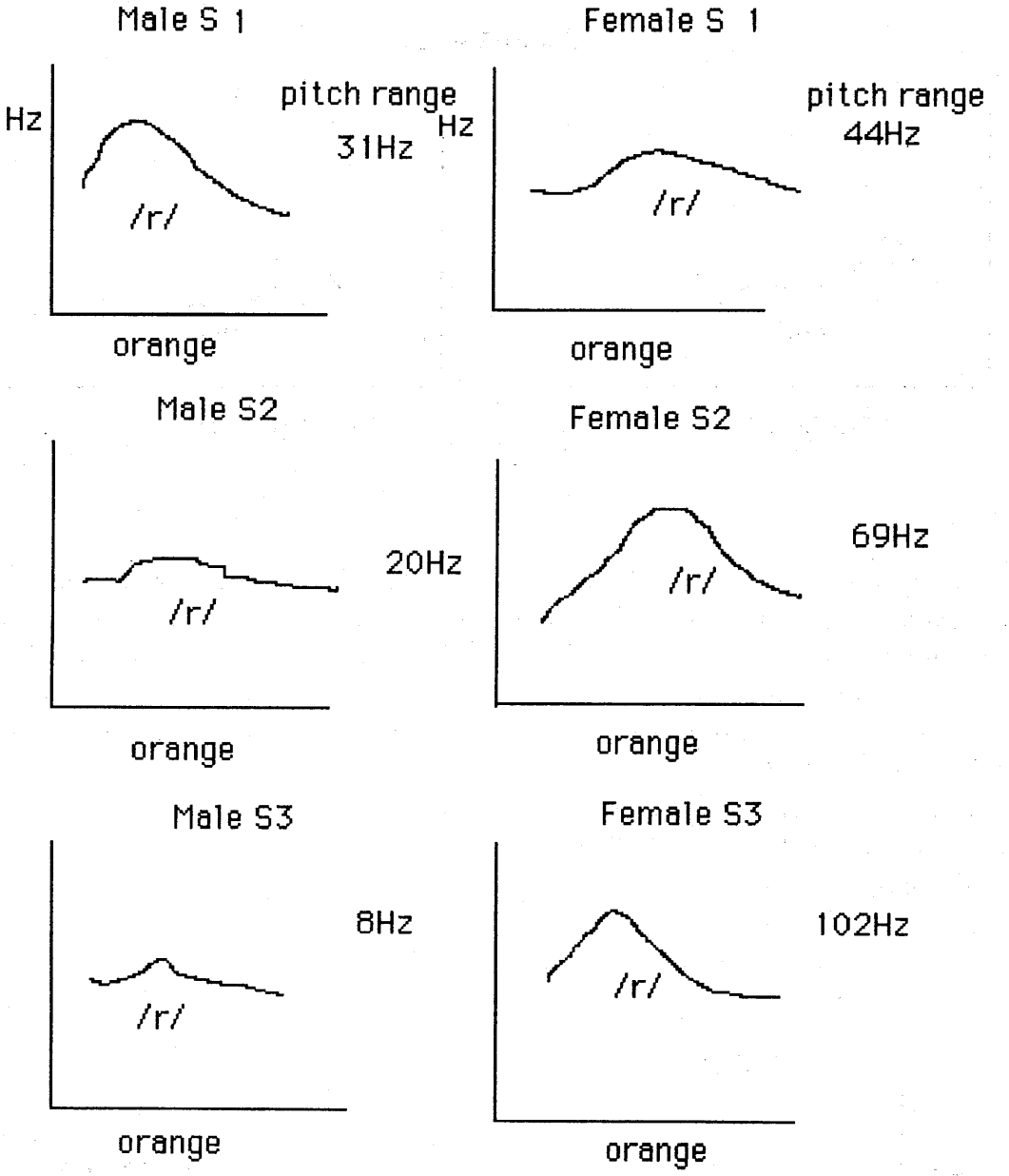


Fig. 3

These Ss either had a F0 peak close to the native English speakers with a smaller pitch excursion, or had an early F0 peak with a greater pitch excursion.

Furthermore, 80% of the male Ss and 60% of the female Ss had either a rise or sustained F0 contours at the onset and the peak of the word, "balls" (See Fig. 4). This contrasts with the ones the ESs had as seen in Fig. 1a and 1c. The ESs had a gradual fall at the word "balls".

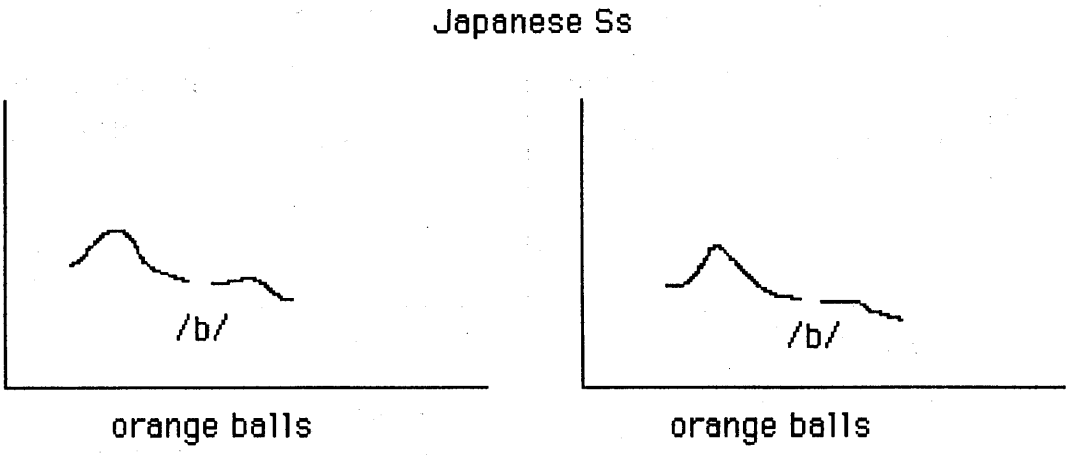


Fig. 4

Through these acoustic contours were different, the auditory perception did not reveal any intonational meaning changes associated with acoustic differences on the word "orange" (one native speaker listened to the tape). Nevertheless, one important finding auditorily and acoustically was that those Ss who had either pattern 1 or pattern 2 did not express the intended contrast meaning. Instead, they expressed something similar to an ordinary response to the question, What do you have?, with focus on "ball".

For the second sentence, I said recreation, the two ESs had two rises (i.e., one on /re/, and the other beginning at the second /ri/ and ending in /e^{I} /) as I had expected (This is a stylized, emphatic reading. see Fig. 5)

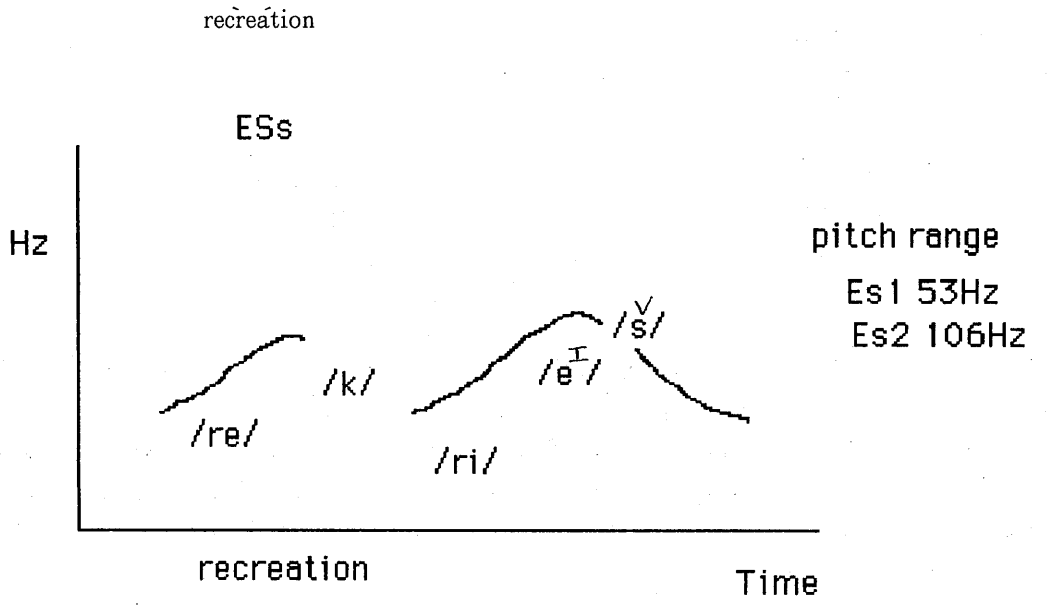


Fig. 5

In contrast, the Ss lacked a secondary peak on /re/. Only one female S had two accents in accord with the ESs (see fig. 6). The other Ss had either one (50% male and 80% female) or no accent (50% male and 10 % female Ss).

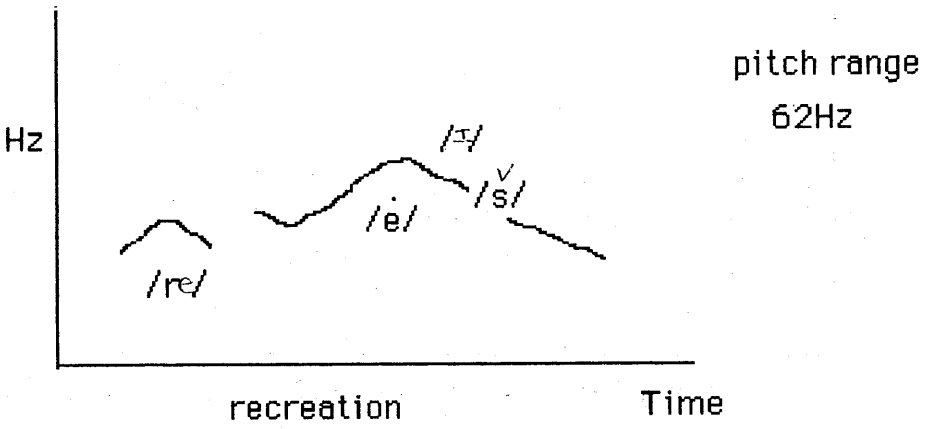


Fig. 6

The S who had two accents had a gradual rise until the nucleus of the diphthong, /e/ and a fall at the other glide vowel, /I/. Of those Ss who had one accent, all followed a similar pattern except for a straight F0 contour until /ri/ instead of a gradual rise. It is followed by a sudden rise at the nucleus of the diphthong, proceeded by a fall at the glide vowel (Fig. 7). Thus, the main peak, though in the right place, had a sharper rise and more of a fall in the accented syllable, which contrasts with the ES's.

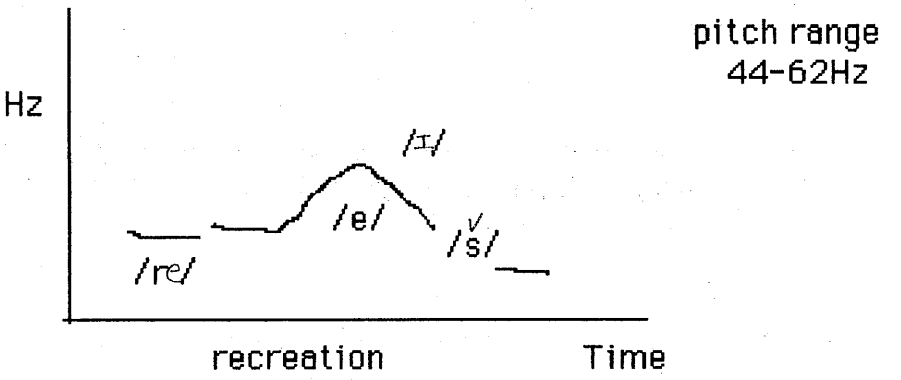


Fig. 7

Another interesting observation was that the Ss had smaller sentence and word pitch excursions than the ones the ESs had. ES1 had a sentence pitch excursion of 110 Hz, and a 53 Hz pitch excursion for the word, "recreation", whereas the ES2 had 186 Hz and 106 Hz respectively. On the other hand, Japanese male Ss had an average of 49 Hz and 22 Hz respectively, while the female Ss had an average of 106 Hz and 50 Hz respectively. None of the Ss had a greater pitch excursion than the male or the female ESs.

For the third sentence, Do you have an examination?, the ESs had a rise at the nuclear accent, "you" and the pitch was sustained until an abrupt rise at the end (Fig. 8).

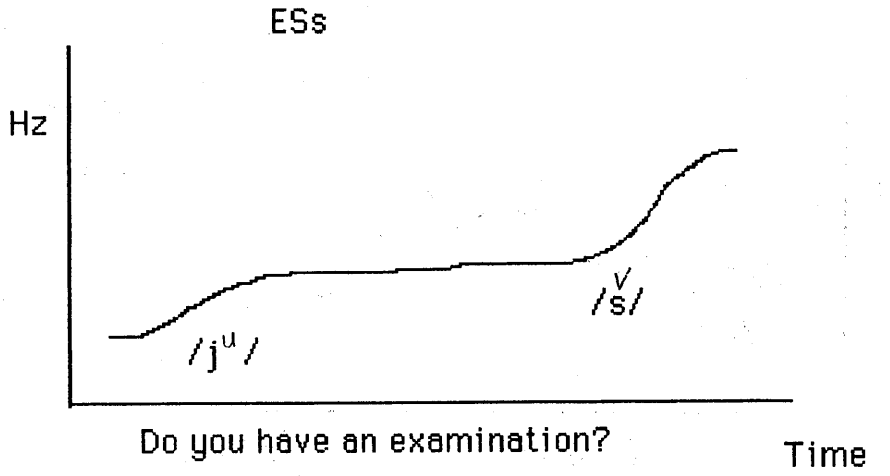


Fig. 8

In contrast, all the Japanese Ss had the following pattern:

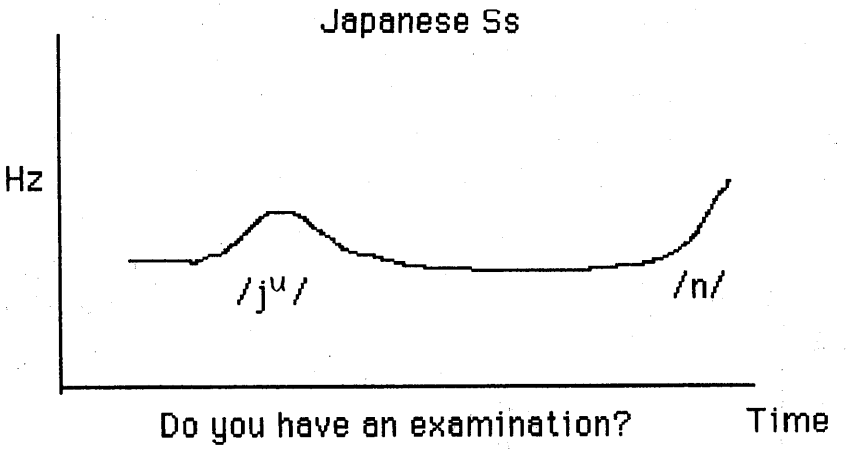


Fig. 9

The timing differences between the ESs and the Japanese Ss occur at the abrupt final rise. Of those who had the final rise, 60% of the female Ss and 30% of the male Ss did not initiate a rise until the very end. In contrast, the ESs initiated the rise with /s$^{\vee}$/ at the beginning of the syllable (see Fig. 10).

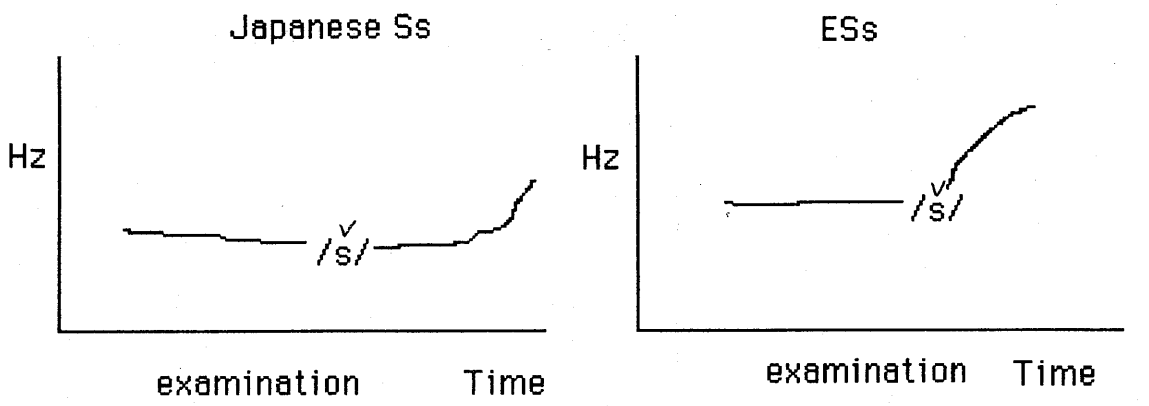


Fig. 10

Also 10% of the female Ss and 40% of the male Ss did not have an abrupt rise at the end of the utterance. Instead, they had a gradual fall as in a declarative sentence.

For the fourth sentence, This great big beautiful car is mine, the expected F0 peaks are at the words, "this' and "mine". The ESs had the expected F0 contours (see fig 11).

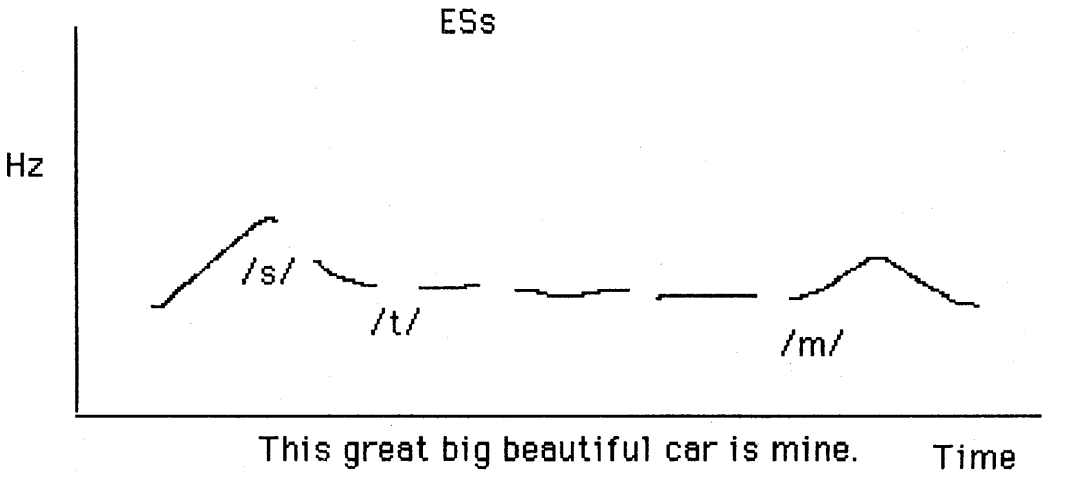
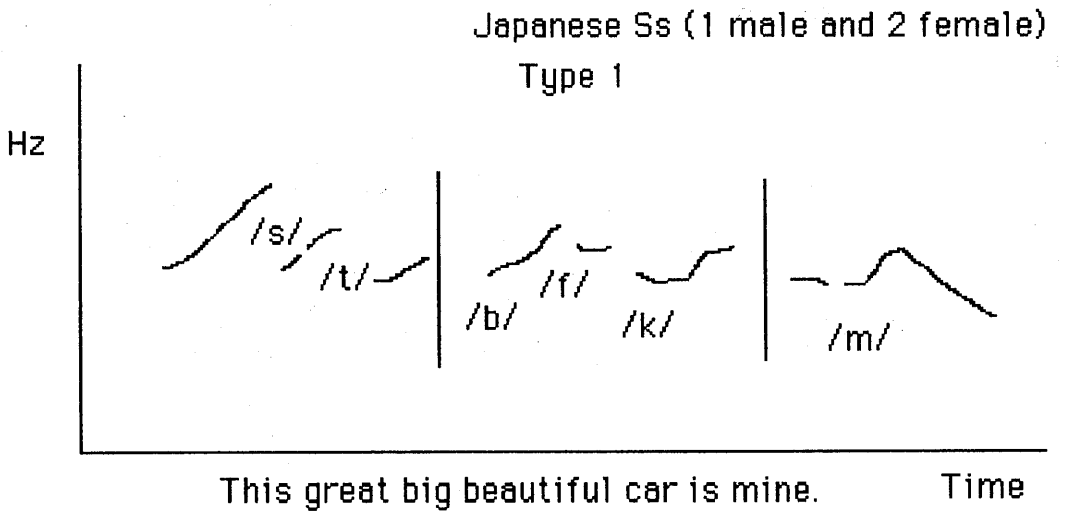
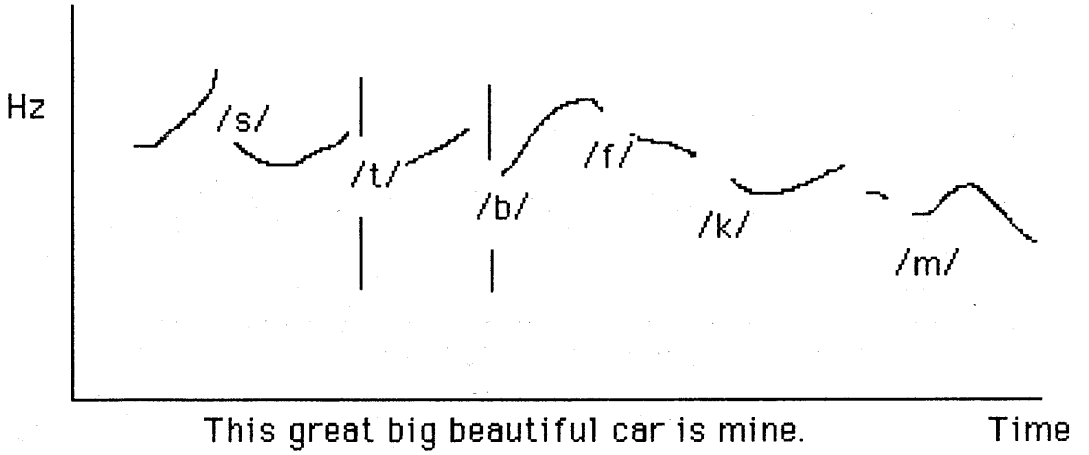


Fig. 11

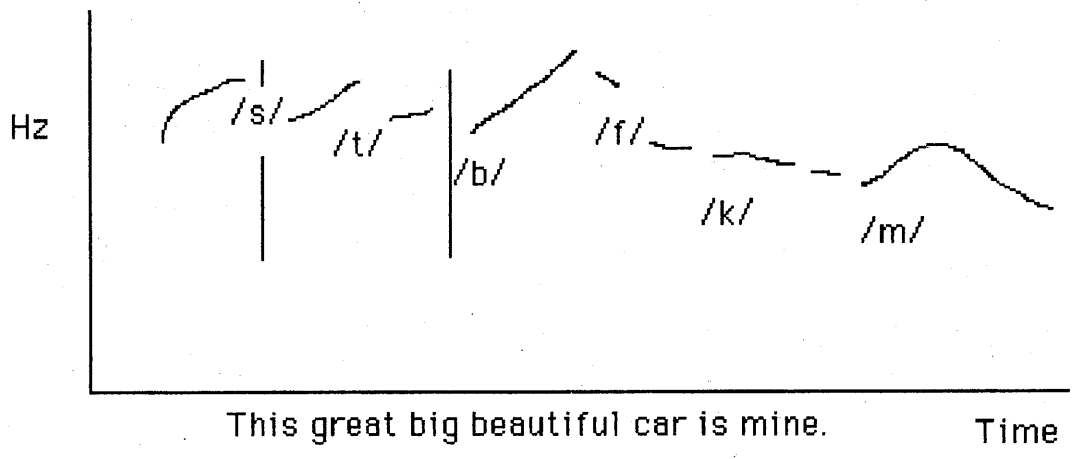
Since de-accenting occurs until the next pitch accent, the F0 contour came out flat until the word, "mine". In contrast, none of the Japanese Ss had this F0 contour. Roughly speaking, their F0 contours can be divided into five types (see fig. 12).


Japanese Ss (1 male and 2 female)
Type 1
Hz
/s/
/t/
/b/
/f/
/k/
/m/
This great big beautiful car is mine.
Time

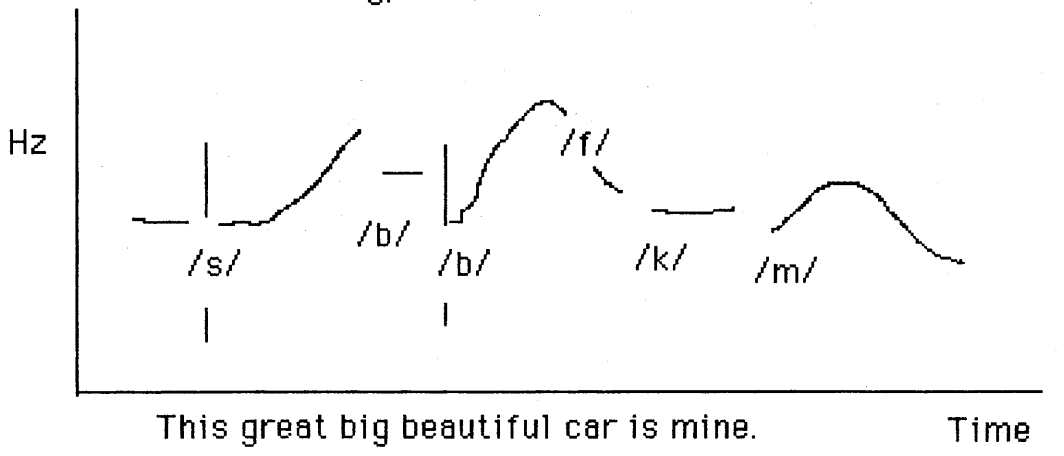
Type 2 (3 male and 5 female)



Type 3 (one female)



Type 4 (one male and one female)



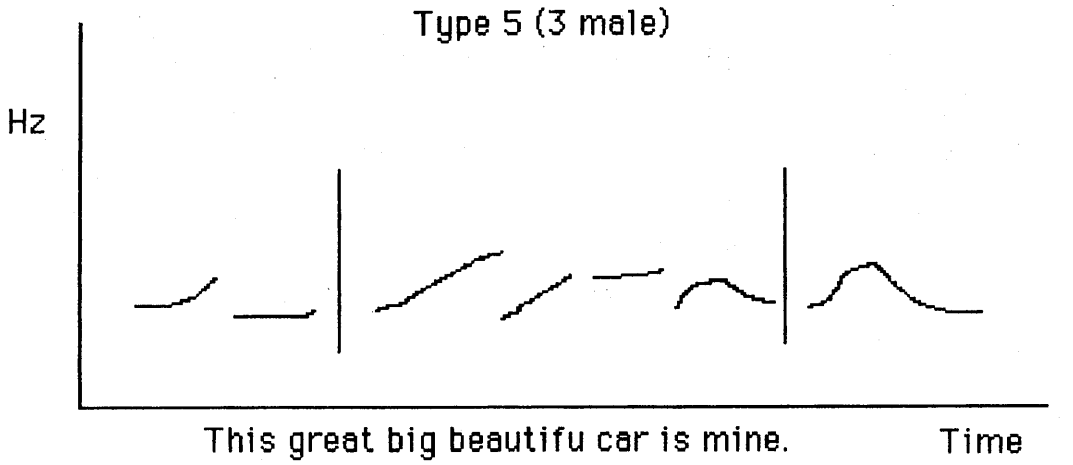


Fig. 12

The Ss placed two or three phrase boundaries before the verb (copula). Hypothesized phrases are indicated by vertical lines, and the occurrence of phrases is determined in accordance with Pierrehumbert & Beckman's (1988) discussion of phrasing in Japanese. According to Pierrehumbert & Beckman's analysis, the phrase boundaries can be determined by the F0 values of each word. For Japanese, catathesis is triggered by a pitch accent. When catathesis applies, the following F0 values are lowered. Catathesis applies within an intermediate phrase, a grouping of accentual phrases (lowest level of phrasing in Japanese). Therefore, an intermediate phrase boundary can be observed by the absence of catathesis (Beckman & Pierrehumbert 1988, p 76). Thus, an intermediate phrase boundary must have occurred between the words "great" and "beautiful" in the case of Type 1 of Fig. 11, since the accent peak on the word "beautiful" did not undergo catathesis. Auditorily, the phrase boundary was also observed. Furthermore, 33% of the Ss did not stress the word "this", and yet they still placed two or three boundaries, which can be seen in the case of Type 4 and 5.

For the fifth sentence, I had a bad dream, two noticeable differences were observed between ESs and Ss:

1. duration at the focused word, "bad".
2. pitch shape of the focused word.

Since the rate of speech differs individually, the duration of the focused word, "bad" was calculated as the ratio to the total contour.

$$D\,(\%) = DF / DT$$

DF: duration of focused word
DT: duration of total contour.

The results are as follows:

Male S	durat. (%)	Female S	durat. (%)
ES1	27	ES2	28
S1	15	S1	17
S2	18	S2	19
S3	15	S3	19
S4	14	S4	22
S5	17	S5	15
S6	18	S6	18
S7	19	S7	17
S8	16	S8	18
S9	13	S9	12
S10	18	S10	15

Fig. 13

Another interesting point regarding the duration is that the durations of the word, "had" and the word, "bad" were nearly the same with the Ss. The actual difference was about 0.02 seconds, whereas the ESs had an average difference of 0.16 seconds. This significant difference may be due to lack of vowel reduction on the word "had" with the Ss. Furthermore, 50% of the male Ss and 30% of the female Ss had longer vowel duration for the word "had" than for the word "bad".

There were also different pitch shapes on the focused word (see Fig. 14).

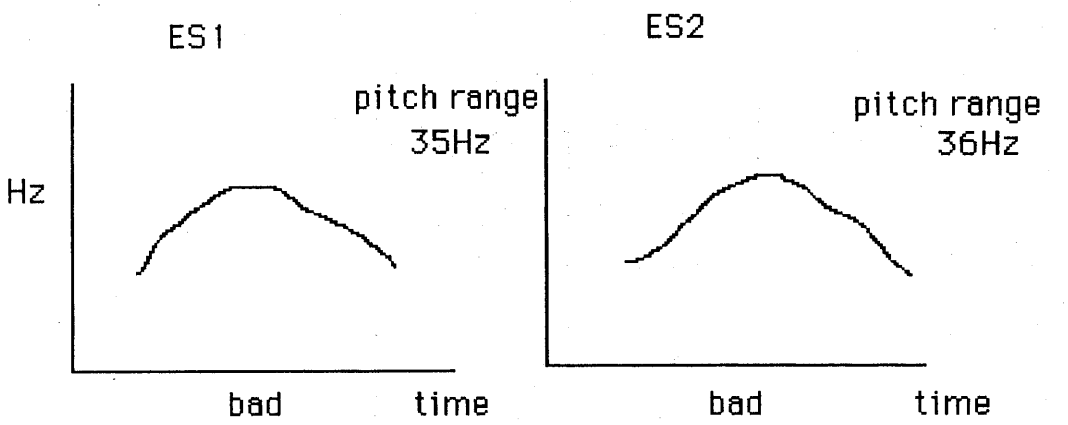


Fig. 14

In contrast, the Japanese Ss had either a gradual rise (60% male and 10% female) or a sharp rise (40% male and 90% female) at the word under focus (Fig. 15).

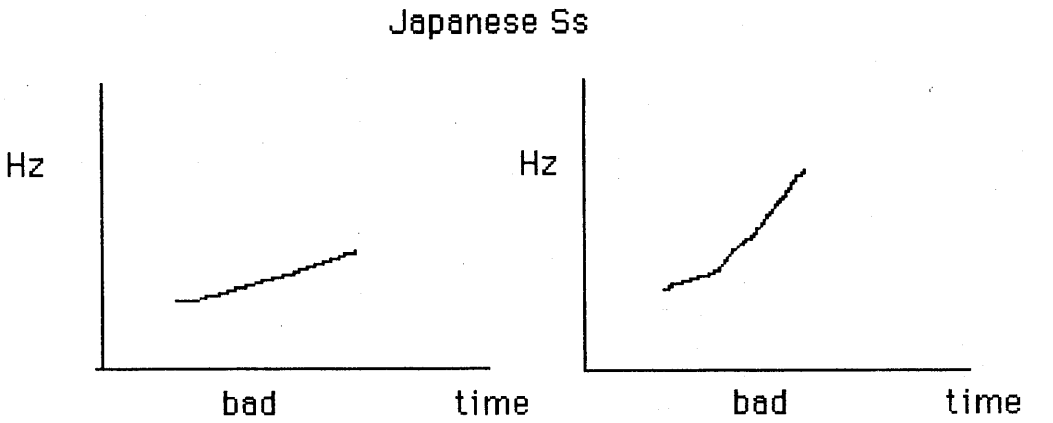


Fig. 15

One female S had a sharp rise of 200 Hz at the word "bad". The ESs had a symmetrical shape (rise + fall), but the Japanese Ss had a rise.

I had expected a difference in amplitude effect at the focused word; however, none was observed.

For the last sentence, I made blueberry, raspberry and strawberry (jams), a simple list intonation contour was expected. ES1 had rising contours on the first two series of the list and a rising-falling contour on the last, as expected. ES 2 did not have the expected rising contours. Instead, ES 2 had a straight contour on the first two series due to catathesis (see Fig. 16).

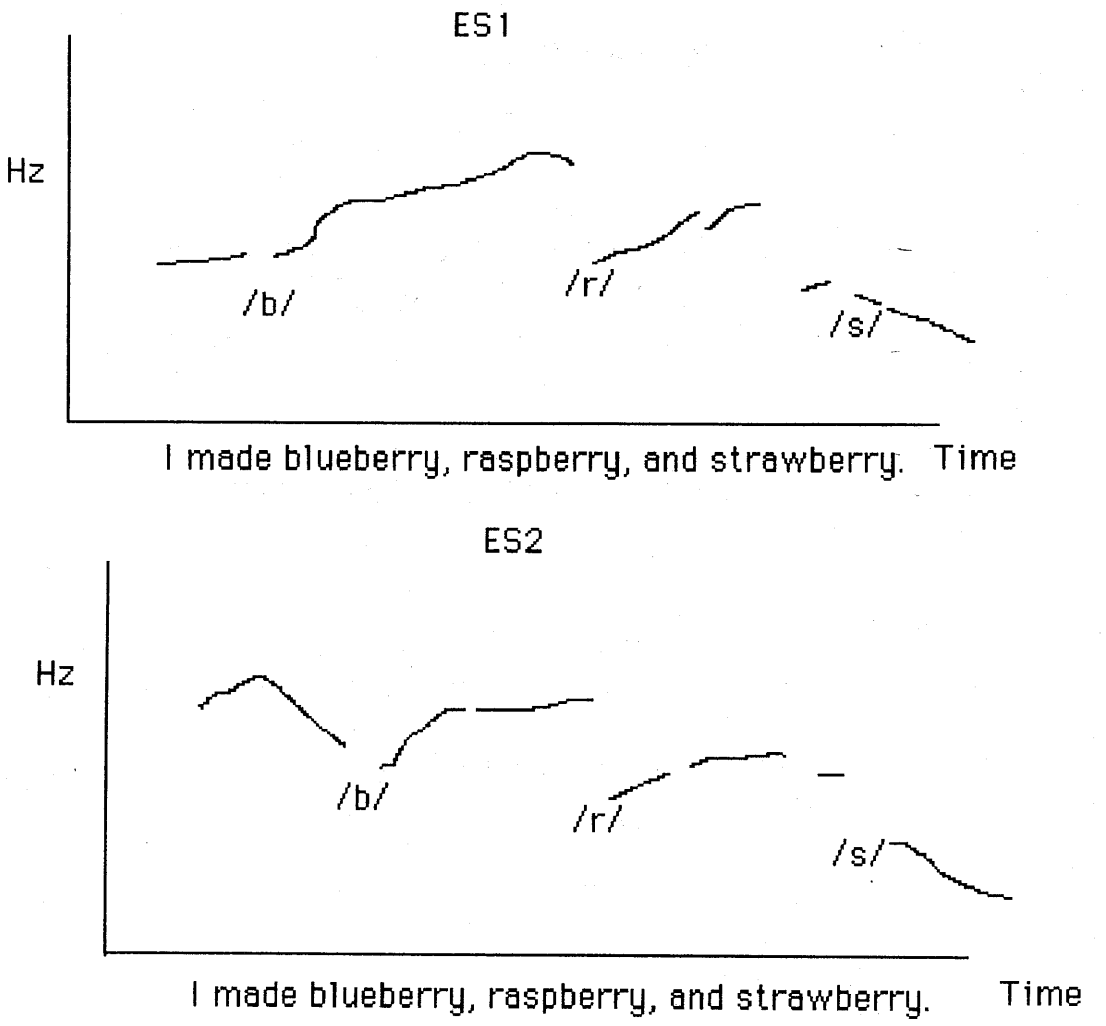


Fig. 16

Neither ES placed a phrase break in the utterance. Multiple applications of catathesis created a descending staircase like an F0 contour. With the Japanese Ss all but one female S had rising F0 contours on the first two series of the list, followed by a rising-falling contour. However, a common characteristic is shared among the Japanese Ss, which was observed previously. There was a sharp rise at nuclear accents, followed by a sharp fall, even though the degree of sharpness in rising or falling differed due to different pitch excursions for the list items (see Fig. 17).

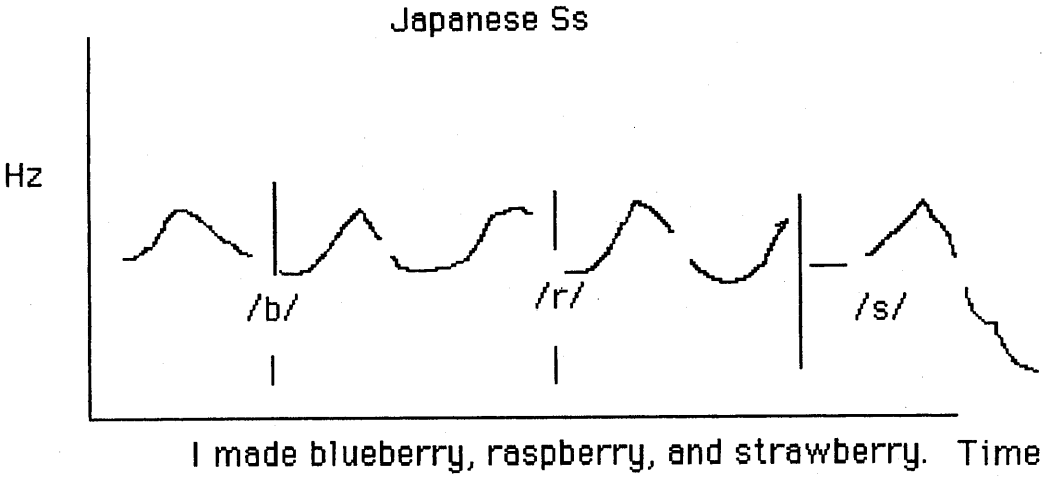


Fig. 17

The F0 contours of the Ss showed no catathesis effect, which implies that intermediate phrase boundaries occurred in-between. For this reason, possible timing differences of catathesis could not been tested in this study.

In summary, the following differences were found in this study:

Sentence 1: I have orange balls.

a) no deaccenting on the word, "balls"
b) sharp rise and fall at the nuclear accent
c) different accent locus on the word, "orange"
d) various F0 patterns
e) various pitch shapes at the pre-nuclear pitch accent

Sentence 2: I said recreation.

a) no secondary stress
b) sharp rise and fall at the main accent
c) smaller pitch excursions
d) various pitch shapes at the pitch accent

Sentence 3: Do you have an examination?

a) no tone spreading
b) timing differences at the final rise
c) sharp rise and fall at the nuclear accent

Sentence 4: This great big beautiful car is mine.

a) extra boundaries

Sentence 5: I had a bad dream.

a) lack of duration effect at the focused word
b) rising F0 contour at the focused word

Sentence 6: I made blueberry, raspberry, and strawberry.

a) extra boundaries
b) sharp rise or fall at the nuclear accent
c) various pitch shapes at the accents

DISCUSSION

The most striking differences between ESs and Ss were between the pitch shapes of the Japanese Ss and those of the ESs. The Japanese Ss in this study had created various F0 patterns. The various F0 shapes at the nuclear accent in sentence 1 (i.e., I have orange balls) illustrate this point (see Fig. 2 and 3). The tendency was also found in Sentence 2 (i.e., I said recreation) and Sentence 3 (i.e., Do you have an examination?). However, the perception of the pitch contours did not reveal any intonational meaning changes as expected. This may be due to lack of pitch excursions at the nuclear accent, especially with the cases in Fig. 2. Pattern 2 in Fig. 2 seems to have different tonal configuration than that of the ESs, but the pitch excursion was less than 60 Hz. If the pitch excursion had been markedly greater, it might have been possible to create a surprise contour. In fact, most of the Japanese Ss used much smaller excursions than the ESs used.

Using a spectrogragh, Backman (1979) analyzed the intonation of Venezuelans learning English and found the same phenomenon. Lepetit (1989) reports the similar phenomenon in his research. His Japanese speakers of French used extremely narrow pitch ranges, compared with native French speakers. Anan (1979) also confirmed this point.

Auditorily, the lack of pitch excursions seems to have made the Japanese Ss' speech sound non-nativelike or "foreign". Van Els and De Bot (1987) examined a role of the suprasegmental and segmental information in determining "foreign accent", and found that intonation (especially, pitch range variation) plays an important part in a foreign accent. This may be accounted for by the fact that the English language uses different pitch shapes to contrast different intonational meanings. Thus, it may be important to have wider pitch excursions to differentiate intonational meanings.

One distinct characteristic was found at a nuclear accent in most sentences the Japanese Ss read: a sharp rise, followed by a sharp fall. There was a tendency among the Ss to have a fall immediately after the pitch accent. In contrast, the ESs had either sustained pitch until the next syllable or had a gradual fall. This may be accounted for by their L1 influence. The Japanese language has only one pitch accent (H* + L), which consists of a sharp decline around the accented syllable (Beckman & Pierrehumbert, 1986 p. 256). The Ss therefore have applied the Japanese tonal configuration for a pitch accent in the target language. Since the English language has a variety of tonal configurations for pitch accents with appropriate use of pitch excursions, each pitch accent must be learned according to context.

Turning now to accenting of multi-syllable words, only one S assigned two accents to the word "recreation" (see Fig. 6 and 7) This confirms Hypothesis 2. Since no Japanese word can contain more than one accent, the result may have come from their L1. This also can be accounted for by L 1 interference. The word "recreation" in Japanese is analyzed as follows: /rekureeson/. The accented syllable is lengthened and an intonational fall occurs within that syllable. On the other hand, a fall does not occur until the next syllable in the case of English. However, it is difficult to explain the observed contour at the second syllable of the word. It is expected that a rise should take place at the second syllable in Japanese since a phrasal H is assigned to that syllable. However, most Ss had a rather flat contour instead of a gradual rise at the second syllable.

In sentence 3 ("Do you have an examination"), Ss did not display English-like tone-spreading (see Fig. 9). The literature on Japanese phonology has taken for granted that the Japanese tone structure includes extensive H tone-spreading. Pierrehumbert and Beckman, following Poser (1984), depart from this tradition in analyzing Japanese without tone-spreading. Thus, my result can be ascribed to L 1 interference under their analysis, which in turn provides support for the analysis. The

results in the case of Sentence 3, thus, confirm Hypothesis 3.

In sentence 1 the Japanese Ss deaccented where it should not have occurred. In English, deaccenting occurs in contrastive situations (i.e., early placement of nuclear accent due to contrast requires deaccenting of later words). Since the given context for the first sentence requires the Ss to express contrast, we would have expected the word, "Balls" to be deaccented.

Ladd (1980, p. 52) describes deaccenting as seen "in the behavior of accent placement in coordinate sentences and sentences in connected discourse." Some researchers have been concerned with the grammatical aspects of deaccenting while others have been concerned with its phonological nature. Whatever the reason given, they seem to agree that "the most obvious cases of deaccenting are those where the deaccented item occurs in the tail of a falling nuclear tone" (Ladd 1980, p. 53).

Since deaccenting did not occur with the Ss in sentence 1, their F0 contours did not express contrast (see Fig. 4). In this sentence ("I have orange balls"), the nuclear accent and the following constituent is an adjective + noun combination. In the Japanese language, Pierrehumbert & Beckman (1988) found two phrasing options in the case of utterances where the focus is on an adjective succeeded by an unfocused noun: "(1) the adjective and the noun appear as separate accentual phrases and (2) (more commonly) they are merged into a single accentual phrase" (B & P, p. 105). If that is the case, the L 1 model allows two separate phrases in the sentence 1. On the other hand, it would be unlikely to have two such phrases in English when naturally spoken. Furthermore, the Japanese phrase can have at most one pitch accent in an accentual phrase. The existence of the accent at the word "balls" confirms the possibility of two phrases. Auditorily this is apparent in a brief break between the adjective and the noun. It is difficult, however, to account for the phenomenon as L1 interference, since an accentual phrase break is not common in cases such as this one. In reviewing the Ss' F0 contours, it can be observed that most of the Ss in fact accented the last word of all of the sentences, except sentence 3. This raises the possibility that the Ss may have learned that every English word has at least one accent in isolation; however, Ss may have no knowledge of the English intonation patterns that are used for contrast. However, the Ss had the right nuclear accent in all the contexts requiring contrast. The Ss simply did not deaccent the unfocused items.

In the case of sentence 4 ("This great big beautiful car is mine."), the same phenomenon was seen as in sentence 1. The Ss did not deaccent, and phrase boundaries were found between the constituents following the nuclear accent, even though different phrase boundaries were observed (intermediate phrase boundaries). This can be explained by another L1 characteristic. Beckman & Pierrehumbert (1986, p. 287) illustrate this point with the following sentence.

kono arai | ayao-ri no obizi-ga
This rough twill obi-cloth

(taken from B & P, 1986)

Their Japanese subjects had a boundary between "twill" and "rough". They argue that an intermediate phrase in Japanese is smaller than the corresponding phrase in English. It is possible to create this boundary in English if a speaker wants to be emphatic. In ordinary natural speech, however, the break would not occur. Sugito & Fujisaki (1984, p. 325) have carried out a similar experiment and found that their Japanese subjects had more use of accent components than the native English subjects. Thus, the result in sentence 4 may be due to the differences in phrasal structures of the two languages. This finding thus confirms Hypothesis 4.

Another phenomenon observed in sentence 3 is the difference in timing at the final rise. The ESs placed an abrupt rise at the /s̆/, whereas many Ss did not place the rise until the very end (/n/). In the Japanese language, the F0 rise for a question does not occur until the very end of

the utterance; whereas in the English language the abrupt rise for a question occurs variably, depending upon the accent locus of the final word. This phenomenon may therefore be accounted for by language transfer effects.

It is worth noting that 10% of the female Ss and 40% of the male Ss used no abrupt rise, instead using a gradual fall. It is possible that the Ss confused contrastive placement of accent for "Wh-Questions" with YES-NO Questions. Whatever the reasons may be, it is important to teach the distinction to be made in intonation.

In Sentence 5 (i.e., I had a bad dream), the duration for the stressed word "bad" was shorter for the Japanese Ss than for the ESs (see Fig. 13). This fact and the fact that the Japanese Ss gave almost the same duration to the word "had" as they did to the word "bad" may be explained by the nature of the Japanese language as syllable-timed (unlike the English language which is stress-timed). This is further supported by the fact that no vowel reduction was applied (e.g., the vowel in the word "had" was not reduced to /ə/ where ESs reduced it).

Also in Sentence 5, the Japanese Ss used only a rising contour at the prominent syllable in the focused lexicon, in contrast to the ESs who used a gradual rise followed by a gradual fall. This may be the case because the Japanese language uses tonal features to mark prominent syllables. Another point regarding this sentence, is that no noticeable differences in amplitude were found. Therefore, hypothesis 5 was not confirmed in this study. Nevertheless, lack of durational effects on the focused word was found.

4.6 CONCLUSIONS

In this study, an attempt was made to test the possible L1 interference effects in the area of English intonation. One Hypothesis, 4, was partially confirmed; data was unavailable to test Hypothesis 5; Hypothesis 1 was rejected, but is amenable to revision; and three of the Hypotheses, 2, 3 and 6 were well confirmed. Overall the data indicated a lack of familiarity by Japanese students with the English intonation system. This study reveals some of the differences in the nature of rhythm and phonotactics of the two languages. We will now review them in this order to summarize the conclusions.

HYPOTHESIS 4: When a word is focused by Japanese speakers it will have shorter duration and less amplitude effect than when the word is focused by native speakers of English. Hypothesis 4 was developed to demonstrate that the Japanese language uses only tonal features of prominence to mark prominent syllables, whereas the English language has more durational/amplitude effects. In this study a difference in duration was found between the two languages. However, no difference in amplitude was found. The research supports a revised Hypothesis:

HYPOTHESIS 4a: When a word is focused by Japanese speakers it will be held for a shorter duration than when the word is focused by native English speakers.

HYPOTHESIS 5: There will be timing differences in catathesis between Japanese speakers of English and native English speakers. Hypothesis 5 was developed to demonstrate that timing will differ within the catathesis phenomenon. Within this study it was not possible to test, because the Japanese Ss placed boundaries so that there was no catathesis phenomenon.

HYPOTHESIS 1: Since the English has a variety of pitch accent shapes to convey distinct intonational meanings, Japanese speakers may create different pitch shapes without noticing that the

different melodies express different meanings. Hypothesis 1 was developed to demonstrate that, since the Japanese language has only one pitch accent, the Japanese Ss will create melodies which may not express the meaning intended. Because their pitch excursions were much smaller than those of native ESs, even though the Ss created different melodies, they failed, as expected, to create different meanings. Therefore, this study does not support Hypothesis 1. Nevertheless, it was interesting to note that one distinct characteristic could be observed with the pitch accent. There was a tendency among the Ss to have a sharp rise followed by a sharp fall, instead of a gradual fall as observed among the ESs. Therefore a new Hypothesis is proposed:

Hypothesis 7: Japanese speakers of English will create a sharp rise followed by a sharp fall at the pitch accent.

Because the Japanese Ss in this study, as well as many other studies, used smaller pitch excursions, another new Hypothesis is proposed for further study:

Hypothesis 8: Japanese speakers of English will use smaller pitch excursions than native speakers of English.

HYPOTHESIS 2: Japanese speakers will have a pitch pattern with a gradual fall between the pitch accent and the boundary tone, whereas English speakers will have a sustained pitch pattern. This Hypothesis was confirmed.

HYPOTHESIS 3: Japanese speakers may place boundaries between syntactic constituents in a long phrase, whereas native English speakers will not. This Hypothesis was confirmed.

HYPOTHESIS 6: When pronouncing longer multi-syllable words either in isolation or with great prominence, English speakers place two accents, primary and secondary accents, whereas Japanese speakers place one. This Hypothesis was confirmed.

Another hypothesis regarding Japanese L 1 effects is found in this study. In sentence 3, the Ss did not have a final rise until the very end of the utterance, whereas the ESs had the final rise at the /s̆/. Since a final rise at the very end of utterances for a question contour is a definite characteristic of the Japanese language, the following hypothesis is proposed:

Hypothesis 9: Japanese students will have an abrupt rise for a question contour at the very end, whereas English speakers will have one depending upon the accent locus of the final content word of the utterance.

The present study has tried to avoid various problems faced by the previous research by analyzing data acoustically as well as perceptually based upon a well-developed unified intonation system. However, it is still difficult to determine the errors observed in this study to come solely from L 1 interference. For instance, the Japanese Ss placed many phrase boundaries in sentence 4 (i.e., this great big beautiful car is mine) and in sentence 6 (i.e., I made blueberry, raspberry, and strawberry). Even though it is natural to place phrase boundaries in these sentences in ordinary speech in Japanese, it is difficult to interpret some of the phrase boundaries observed in the data. In other words, I had expected to see a phrase boundary between "this' and "great" or between "great" and "big" in sentence 4. However, some of the Ss placed two phrase boundaries: (1) between "great" and "big"; and (2) between "big" and "beautiful"(refer to Fig. 12: type 2). Furthermore, Japanese Ss placed three boundaries in sentence 6 (refer to Fig. 17). It is possible to place such phrase boundaries in Japanese when a speaker wants to be emphatic. Therefore, the

placing of a phrase boundary in the above sentences are understandable in terms of the differences in phrasal structures of the two languages; however, it is difficult to account for some of the overgenerated phrase boundaries to be L 1 Interference. This may have to do more with fluency of the Ss.

Similarly, there is a tendency among the Ss to have a rise immediately preceding each boundary. It is also difficult to account for this rise in terms of L 1 Interference. This has to do with Ss' misperception of the English language. In other words, they realize that English is different from Japanese, but they are not sure as to how the two languages differ. Therefore, they might have had a rise to make it distinct from Japanese. Whatever the reasons there are, further research is needed to account for the above phenomena.

De Bot (1986) gives an excellent review of the previous crosslinguistic research on intonation, and suggests that resynthesis is one of the best tools to assess and confirm one's impressions about intonational errors, since it can "manipulate one aspect while keeping others constant" (p. 117). Therefore, the present study, though implemented both acoustic and auditory judgments in the data analysis, needs further modifications in making better auditory judgments on the intonational errors observed in the study.

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1 Japanese pitch accents in their analyses gravitate to accented syllables, and "the place of the accent is lexically contrastive" (Beckman & Pierrehumbert, 1986:256). English pitch accents, on the other hand, are "produced at a rhythmically strong syllable" (p.257) and convey different intonational meanings.

2 Catathesis implies the lowering of the phonetic values of the tones to the right when preceded by the H* + L pitch accent in Japanese and the bitonal pitch accent in English.