

# Focus Realization in Japanese English and Korean English Intonation

MOTOKO UEYAMA & SUN-AH JUN  
*University of California, Los Angeles*

## **1. Introduction**

In earlier work on intonation, not much attention has been paid to the interaction between first (L1) and second (L2) language intonation. At the same time, most previous works on second language acquisition have concentrated on the segmental level (for reviews, see Leather and James 1991; Flege 1987, 1995). Furthermore, only a few studies on the acquisition of L2 intonation have been based on instrumental evidence (Greek French & Swedish French, Gårding 1981; Japanese English, Todaka 1990; Greek English, Argyres 1996), and these studies did not consider how the phonology and phonetics of L2 intonation interact with those of L1 intonation, but only concentrated on the phonetic description of tonal shapes. Todaka (1990) compared Japanese speakers' English intonation with native English intonation adopting Pierrehumbert's (1980) model of English intonation. However, he did not compare the intonation contours in terms of the phonological components of intonation. Rather, he described the intonation contour as a holistic pattern. For example, he showed that while pitch for English speakers rose gradually after focus and remained high in an interrogative sentence, Japanese speakers lowered pitch after the focus and sustained low pitch in the same sentence type.

In this paper, we adopted the phonological model of English intonation proposed by Pierrehumbert and her colleagues (e.g. Pierrehumbert 1980, Beckman & Pierrehumbert 1986, Pierrehumbert & Beckman 1988) to compare the phonological characteristics of English intonation produced by native speakers of English with those of English intonation produced by Japanese and Korean speakers. In this model, “continuous” intonation contours are analyzed as sequences of underlying H and L tones. These tones are categorized as one of three types; pitch accents, phrasal tones, and boundary tones. The *pitch accent* is associated with the stressed syllable of the phrase, and by this association, the stressed syllable of a certain word receives pitch prominence. The *boundary tone* marks the end of an Intonational phrase. The *phrasal tone* covers the space between the last pitch accent and the boundary tone. In English, there are six types of pitch accents (H\*, L\*, H+L\*, H\*+L, L+H\*, L\*+H), two types of phrasal tones (L-, H-), and two types of boundary tones (L%, H%). In Pierrehumbert’s model, these three types of tones (pitch accent, phrasal tone, and boundary tone) are hierarchically organized so that one Intonational phrase must have at least one pitch accent, but may have more. When there is more than one pitch accent in one intermediate phrase, the last pitch accent is most prominent and is labeled as the nuclear pitch accent. This model has been applied to Korean by Jun (1993) and to Japanese by Beckman & Pierrehumbert (1986) and Pierrehumbert & Beckman (1988). Thus, we can easily identify the features of L1 intonation (Korean or Japanese) that are transferred into L2 intonation (English). This will allow us to analyze how the L2 intonation system interacts with the L1 intonation system.

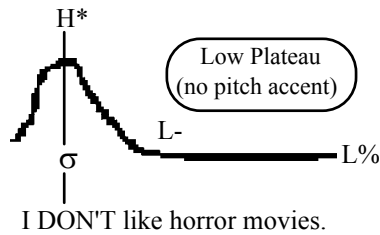
The first goal of this paper is to examine the realization of English focus produced by Tokyo Japanese speakers and Seoul Korean speakers (henceforth Japanese English and Korean English, respectively) at different proficiency levels. The second goal is to analyze the phonology (underlying tonal sequence) and phonetics (actual realization) of L2 intonation produced by learners of different proficiency levels, using Pierrehumbert’s model. We will try to answer the following questions: (1) How does the L1 intonation system affect L2 intonation patterns?; (2) Which factors characterize different proficiency levels?

In order to analyze L2 intonation produced by Korean and Japanese learners, we need to know how focus is realized in the two languages. Although the prosodic systems of Tokyo Japanese and Seoul Korean are typologically different in that Japanese has a lexical pitch accent with a H\*L tonal pattern (Pierrehumbert & Beckman 1988) while Korean has a postlexically determined accentual phrase with a LHLH or HHLH tonal pattern (Jun 1993, 1996), the realization of focus is very similar in both languages, both phonetically and phonologically. Schematics of focus realization of interrogative and declarative in English, Korean and Japanese are shown in (1).

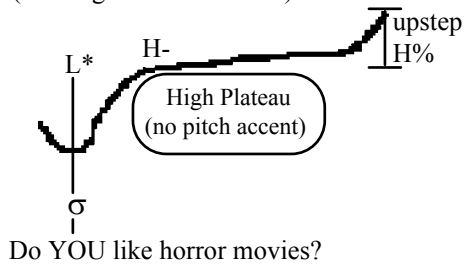
(1) Schematic contours of interrogatives and declaratives in English, Korean and Japanese

a. English

(declarative: H\* L- L%)

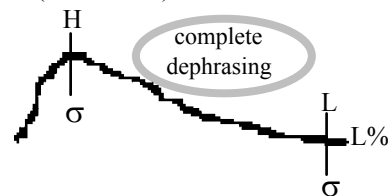


(interrogative: L\* H- H%)

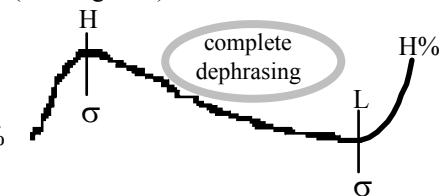


b. Korean

(declarative)

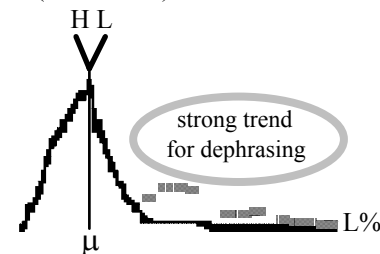


(interrogative)

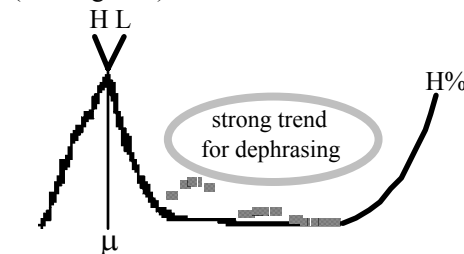


c. Japanese

(declarative)



(interrogative)



In all three languages, focus is realized by raising the pitch range and increasing amplitude, but the tonal contour of the focused phrase differs across the languages. In English, focus in interrogatives is realized as a low tone (L\*) followed by a high plateau (the sequence of H- and H%) while focus in declaratives is realized in as high tone (H\*) followed by a low plateau (the

sequence of L- and L%). In both cases, any pitch accent after focus is deaccented.

In Korean, focus is always cued by a phrase-initial H tone followed by a L tone regardless of the sentence type. The only difference between interrogatives and declaratives is in the boundary tone. The boundary tone for an interrogative utterance is high (i.e., H% or LH%, Jun & Oh 1996) while the boundary tone for a declarative utterance is low (i.e., L%, HL%, or LHL%). Similar to English, there is no phrase boundary after the focused word until the boundary tone: i.e. complete dephrasing.

In Japanese, the tonal pattern of the focused phrase is similar to that of Korean, in that tone types used for focus do not depend on the sentence types with the exception of the boundary tones: H% for an interrogative and L% for a declarative focused phrase. But, unlike in Korean, dephrasing after focus is not always complete in Japanese. Pierrehumbert & Beckman (1988, Figure 4.7) show that there are cases where dephrasing does not occur, and a H tone on the word following the focused word is realized. But they also note that dephrasing is common in a post-focus position (p.105). When an accented word is focused, all following words within the same phrase are dephrased: i.e. the phrase shows a low plateau contour after the focused word (H\*L). Maekawa (1994) shows that though post-focus dephrasing is realized as a low plateau contour, the slope of the low plateau is sharper (negatively) when the focused word is followed by an accented word than when it is followed by an unaccented word. Crucially, however, in both cases, no high tone is realized after focus.

Another difference between Japanese and Korean focus realization is the duration over which high pitch is sustained. In Korean, the focused H tone is realized on the second syllable of the accentual phrase. When the phrase-initial syllable has a H tone, high pitch is sustained over two syllables. On the other hand, in Japanese, when the focused word is unaccented and the following word is accented, the focused phrase is realized as a high tone spanning a few moras from the initial mora of the phrase up to the accented mora of the second word. Thus, compared to Korean, a high tone can be sustained longer in Japanese. Since the phrasal tone of English interrogative is a high tone covering many syllables after the focused word up to the phrase final syllable, it is interesting to see how English high plateau is realized differently by Japanese learners and Korean learners.

So far, we have discussed differences in the intonational phonology of each language. However, the phonetic realization of underlying tone sequences also differs across these languages. For example, the slope of initial f<sub>0</sub> rise in the interrogatives differs between English and Korean/Japanese. In English, after the focused word L\*, f<sub>0</sub> reaches its peak near the *end of the following word*. On the other hand, in Korean and Japanese, f<sub>0</sub> (after the phrase-initial L tone in the focused phrase) reaches its peak near the *second syllable/mora of the phrase*,

thus creating a sharper rising slope than that in English. Korean and Japanese further differ from English: a focused word initiates a new left-headed phrase in Japanese and Korean, while it delimits a right-headed phrase boundary in English (Venditti, Jun & Beckman 1996). We will however not discuss this point further in this paper since it is concerned with the phrasing differences after the focused word.

Many studies on the segmental aspect of L2 speech learning show that the phonology and phonetics of L1 interacts with L2 speech production and the degree of interaction differs depending on the degree of proficiency in L2 (e.g., Weinreich 1953; Flege & Davidian 1987; Flege 1995). Therefore, we hypothesize that the phonetics and phonology of L1 intonation will interfere with the acquisition of L2 intonation, and the degree of interference will differ depending on the degree of proficiency in L2. Under these assumptions, we will test the following hypotheses.

1. Since Korean and Japanese have dephrasing after narrow focus, English dephrasing after focus should be easy to learn. Furthermore, dephrasing should be particularly easy for Korean learners, since it is obligatory in Korean but it is only a strong tendency in Japanese.
2. Since both Korean and Japanese have no high plateau pattern but have a pattern similar to the low plateau of English declaratives, the high plateau pattern should be more difficult to learn than the low plateau pattern.
3. Since Japanese speakers sustain high pitch across word boundary while Korean speakers do not, the high plateau should be easier to learn for Japanese learners than for Korean learners.
4. Since in interrogatives in both Korean and Japanese pitch rises up to the peak with a sharper slope than English does, the initial rise of interrogative focus should be sharper in non-native speech than in native speech.

## **2. Experiment**

### **2.1. Subjects**

Two native speakers of American English participated as the control group, and three Japanese learners of English and four Korean learners of English formed the experimental groups. All the speakers were females in their 20s or early 30s. To find a developmental path in L2 intonation acquisition, we compared different proficiency levels within each experimental group. For the native Japanese speakers of English, we tested one advanced, one intermediate, and one beginning learner. For the Korean, two speakers were categorized as intermediate, two as beginning learners. Table 1 shows the description of each

learner with respect to the number of years of residence in the United States and their age of arrival in the States.

Table 1. Description of each learner with respect to years of residence in the States and their age of arrival:

<b>Speakers</b>	<b>Years of Residence</b>	<b>Age of Arrival</b>
Japanese Advanced	5 years	16
Japanese Intermediate	5 years	20
Japanese Beginning	0 year	0
Korean Intermediate 1	6 years	18
Korean Intermediate 2	5 years	26
Korean Beginning 1	2 months	22
Korean Beginning 2	1.5 months	29

## 2.2 Corpus

Test sentences were designed to check whether focus realization differs between declaratives and interrogatives and whether the location of focus influences its realization in either type of sentences. We constructed two data sets. In Set 1 the length of a noun phrase varied from three words to six words while the location of focus was kept constant at the beginning of a sentence. In Set 2 the location of focus varied while the sentence length was kept constant. The sentences of Set 1 are reported in (2); those of Set 2 are reported in (3).

### (2) Sentence Set 1

#### Interrogative

1. Do **you** want my grandma's marmalade?
2. Do **you** want my grandma's orange marmalade?
3. Do **you** want my grandma's Mandarin-orange marmalade?
4. Do **you** want my grandma's homemade Mandarin-orange marmalade?

#### Declarative

1. I **don't** want your grandma's marmalade.
2. I **don't** want my grandma's orange marmalade.
3. I **don't** want my grandma's Mandarin-orange marmalade.
4. I **don't** want my grandma's homemade Mandarin-orange marmalade.

### (3) Sentence Set 2

#### Interrogative

1. Is this yellow **potato** a source of vitamins?
2. Is this yellow potato a **source** of vitamins?
3. Is this yellow potato a source of **vitamins**?

### Declarative

1. This yellow **potato** is a source of vitamins.
2. This yellow potato is a **source** of vitamins.
3. This yellow potato is a source of **vitamins**.

The words in bold are focused. To trigger focus in each sentence in Set 1, a monologue was designed for each interrogative sentence, and a dialogue was designed for each declarative sentence. For Set 2, focus was triggered by putting a phrase in parenthesis right before each sentence. For example, the phrase “(not an apple, but)” was given for the sentence with focus on *potato*.

### **2.3 Procedure**

The sentences in each set were randomized and foil sentences were inserted pseudo-randomly so that each sequence of target sentences was separated by a foil sentence. The entire list was repeated six times by each subject. Subjects' utterances were recorded in a sound booth. The speech data were digitized and the pitch contours (fundamental frequency (=f0) tracks) were analyzed using Entropic's Xwaves+ software.

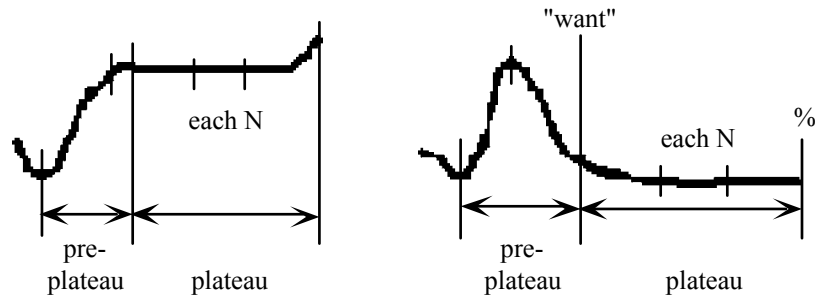
### **2.4 Measurements**

For the phonological description of L2 English intonation, the type of pitch accents and phrase boundaries occurring in each utterance was labeled adopting the framework described in Beckman & Pierrehumbert (1986). In addition, the number of pitch accents and phrase boundaries after the pitch accent on the focused word and before the boundary tone was counted. For the phonetic analysis of L2 intonation, f0 and the absolute time point at several points in each utterance were collected using Xwaves+ software. Each utterance was divided into two parts, *pre-plateau* and *plateau*, with reference to the center of the vowel in the verb, “need” or “want”, as shown in (4).

#### (4) Schematics of measurement points

a. Interrogative

b. Declarative



These verbs were taken as reference points since they coincide with the beginning of a plateau following the H\* or L\* nuclear pitch accent of the focused word. Within the pre-plateau region, the lowest f0 and the highest f0 were measured together with their corresponding time values. Within the plateau region, the f0 and time value of the highest f0 point of each noun as well as the f0 and time value of the utterance-final point were measured.

### 3. Results and Discussion

#### 3.1 Phonology of L2 English Intonation

Since dephrasing is one of the main characteristics of Japanese and Korean focus intonation, we hypothesized that dephrasing would be easy for both learners. In addition, since dephrasing is obligatory in Korean but only a strong tendency in Japanese, we expected that dephrasing would be easier for Koreans. However, the results summarized in Table 2 suggest that this is not true. In this table, the star '\*' indicates the number of pitch accents in each phrase and 'phr' refers to the number of phrase boundaries between the focused word and the boundary tone. Since there is no pitch accent after focus in English intonation, we expect that there would be only one star and no phrase boundary in each sentence. Since each sentence was repeated 6 times, native English speakers would produce a total of 6 stars and 0 phrase boundaries as shown in the table. Table cells showing the native pattern are shaded. Data for the Korean beginners and J-Adv's 3 noun data in the L-plateau context are not available.

For non-native speakers, we have found four factors which influence the degree of dephrasing. First, the degree of dephrasing differs depending on the



proficiency level of L2 learners: the more fluent the speaker is, the greater is the degree of dephrasing. J-Adv is very close to the native English speaker, but J-Int shows a higher number of pitch accents (\*) and phrase boundaries than J-Adv. J-Beg has the highest number of stars and phrase boundaries. Second, the degree of dephrasing differs depending on the length of the controlled noun phrase (NP). For all the learners, it is easier to dephrase when the number of nouns in the NP is smaller. As the length of the NP increases, the number of pitch accents and phrase boundaries increases. That is, the degree of dephrasing correlates with proficiency level and with the length of NP. This suggests that L1 dephrasing is not positively transferred to L2. Rather, there may be an independent constraint on L2 speech learning. Less advanced L2 learners may be able to parse fewer words within the same prosodic phrase. The size of the maximal phrase will increase as they become more fluent in L2.

Third, dephrasing was easier for Japanese than for Korean speakers when we compared learners at the same level of proficiency. For example, Japanese and Korean intermediate learners show a similar pattern of dephrasing for H-plateau. However, the Japanese learner shows better dephrasing than the Korean learner for L-plateau. This suggests that Japanese downstep is being positively transferred to L2 production and the lack of downstep in Korean is negatively transferred to L2 production. In Japanese, the pitch accent of an accented word following another accented word is downstepped relative to the preceding pitch accent, i.e. it is realized with a lower  $f_0$  peak relative to that of the preceding pitch accent. Dephrasing would be easier for Japanese speakers with the help of L1 downstep. Alternatively, the speakers might have produced a certain noun with a pitch accent, but due to its downstepped lower pitch level, we did not perceive it as a pitch accent. In Korean, on the other hand, phrases are marked by a phrase-final H tone without downstep. Thus it may be harder for Korean speakers to reduce pitch level, while it is easier for us to perceive the phrase boundary.

Table 2. Number of pitch accents (\*) and phrase boundaries (phr) from the focused word to the end of the utterance for Set 1. (Each cell has six tokens. J-Adv = Japanese advanced speaker, J-Int = Japanese intermediate speaker, J-Beg = Japanese beginning speaker, and K-Int = Korean intermediate speaker.)

**High plateau**

NP	English		J-Adv		J-Int		J-Beg		K-Int	
	*	phr	*	phr	*	phr	*	phr	*	phr
3 N	6	0	6	0	6	0	16	6	6	0
4 N	6	0	6	0	10	2	19	6	8	2
5 N	6	0	6	0	17	4	18	6	17	2
6 N	6	0	6	1?	22	5	19	6	20	2

**Low plateau**

NP	English		J-Adv		J-Int		J-Beg		K-Int	
	*	phr	*	phr	*	phr	*	phr	*	phr
3 N	6	0	----	----	10	2	16	6	17	2
4 N	6	0	6	0	15	3	20	9	20	3
5 N	6	0	6	0	19	6	18	6	25	6
6 N	6	0	10	3	25	7	23	7	34	5

Finally, all speakers show better dephrasing at H-plateau than at L-plateau. This could have two possible explanations: (1) the fluctuation in the higher pitch range may be more difficult than the one in the lower pitch range; (2) H-plateau is easier to learn than L-plateau because of Equivalent Classification principle (Flege 1987, 1995). This principle states that a new pattern of L2 is easier to learn than a similar but not identical pattern. For example, French /y/ is usually easier to learn for English speakers than French /i/, since French /y/ is a new sound to English speakers while French /i/ is similar but not identical to English /i/. Thus, since H-plateau is a new pattern for both Japanese and Korean learners of English, while L-plateau is similar to Korean and Japanese patterns, H-plateau may be easier to learn than L-plateau.

When the phrase after focus is shorter than three words, the difference between proficiency levels and that between H-plateau and L-plateau does not clearly emerge. Table 3 shows the number of pitch accents and phrase boundaries for Set 2 data. All the learners are better at dephrasing as the length of the phrase after focus decreases from two nouns (i.e. 'initial' condition) to zero (i.e. 'final' condition). This tendency is very similar across H-plateau and L-plateau data. For this corpus, data for the Japanese learners are not available.

Table 3. Number of pitch accents (\*) and phrase boundaries (phr) from the focused word to the end of the utterance for Set 2. (Each cell has six tokens. Eng-1 & Eng-2 = native English speakers, K-Int 1 & K-Int 2 = Korean intermediate speakers, K-Beg 1 & K-Beg 2 = Korean beginning speakers.)

**High plateau**

	Eng 1		Eng 2		K-Int 1		K-Int 2		K-Beg 1		K-Beg 2	
	*	phr	*	phr	*	phr	*	phr	*	phr	*	phr
initial	6	0	6	0	18	6	13	6	17	6	18	6
medial	6	0	6	0	12	0	7	0	12	0	12	0
final	6	0	6	0	6	0	6	0	6	0	6	0

**Low plateau**

	Eng 1		Eng 2		K-Int 1		K-Int 2		K-Beg 1		K-Beg 2	
	*	phr	*	phr	*	phr	*	phr	*	phr	*	phr
initial	6	0	6	0	17	0	16	6	18	6	18	6
medial	6	0	6	0	6	0	7	0	12	4	7	1
final	6	0	6	1	6	0	6	0	6	0	6	0

**3.2 Phonetics of L2 English Intonation**

So far, we have shown that the phonology of H-plateau (i.e. the tonal sequence of L\* H- H%) was easier to learn than that of L-plateau (i.e. the tonal sequence of H\* L- L%) by both Japanese and Korean learners of English. The next question is whether the phonetic realization of H-plateau is easier to learn than that of L-plateau. That is, is it easier to learn to sustain high rather than low pitch? The results show that L-plateau is easier to produce than H-plateau at least for advanced and intermediate speakers. Figure (5) shows the progression of f0 values produced by Native English speaker 1 starting from the verb and through each of the following nouns both in H-plateau and L-plateau utterances (3 NP is marked by a circle, 4 NP by a triangle, 5 NP by a rectangle, and 6 NP by a diamond): both the H-plateau and L-plateau are flat, and the H-plateau is even slightly rising as the length of the NP increases.

(5) Mean F0 values from the verb and through each of the following nouns both in H-plateau (left graph) and L-plateau (right graph) contexts produced by Native English speaker 1

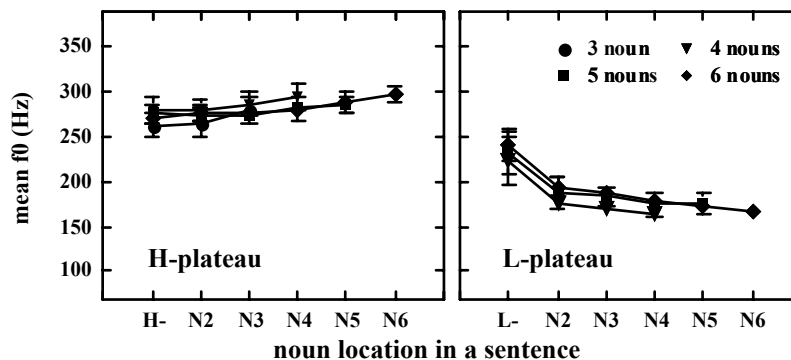
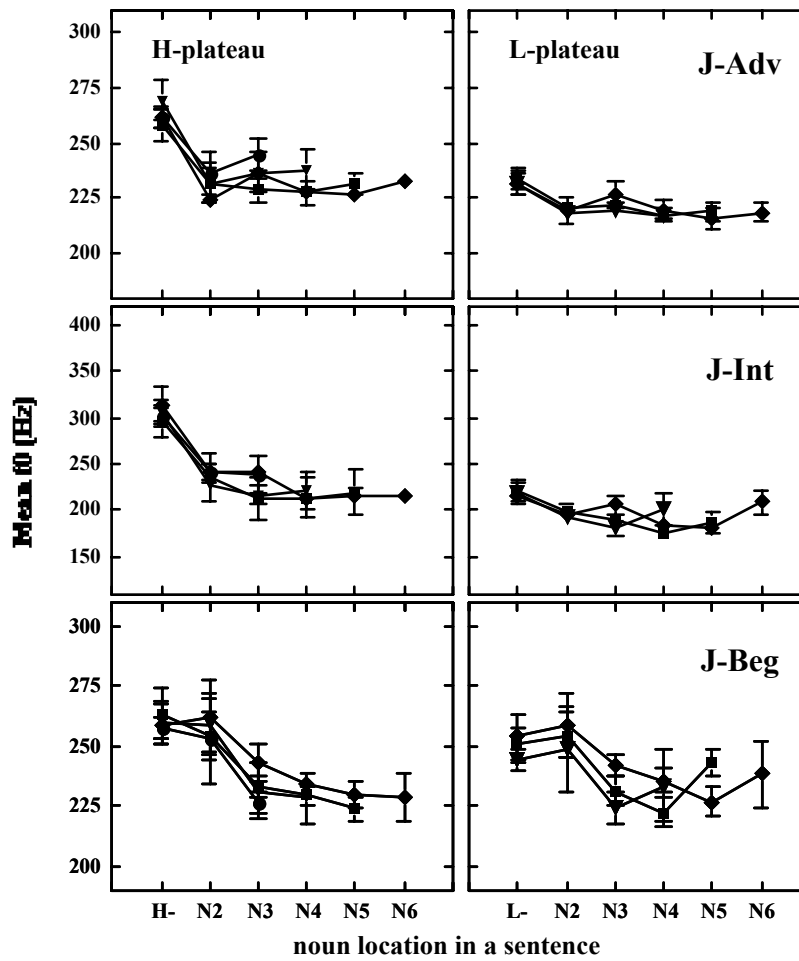


Figure (6) shows f0 values for the H-plateau and L-plateau contexts for the Japanese Advanced speaker, the Intermediate speaker and the Beginning speaker. The Japanese Advanced speaker's H-plateau is not as flat as that of the native speaker, but instead falls down after the verb. Her L-plateau, on the other hand, is similar to that of the native speakers, realized as a low flat contour, except for one peak at the second noun, *homemade*, in the six-noun-NP sequence. This suggests that her H-plateau is phonetically "less native" than her L-plateau. This is interesting since her H-plateau is phonologically closer to the native target than her L-plateau (see Table 2) since she assigns a native-like tonal sequence (L\* H- H%) for her H-plateau. This suggests that the phonology and phonetics of L2 intonation are not necessarily learned at the same pace. For this speaker, the phonology of L2 intonation is closer to native than is the phonetics. The Japanese Intermediate speaker's H-plateau is also phonetically less native than her L-plateau, while her L-plateau is phonologically less native than her H-plateau. The Japanese Beginning speaker's H-plateau are very similar to her L-plateau in terms of F0 realization: both show a wide range of pitch movement away from the plateau target. This suggests that she is not differentiating between H-plateau and L-plateau.

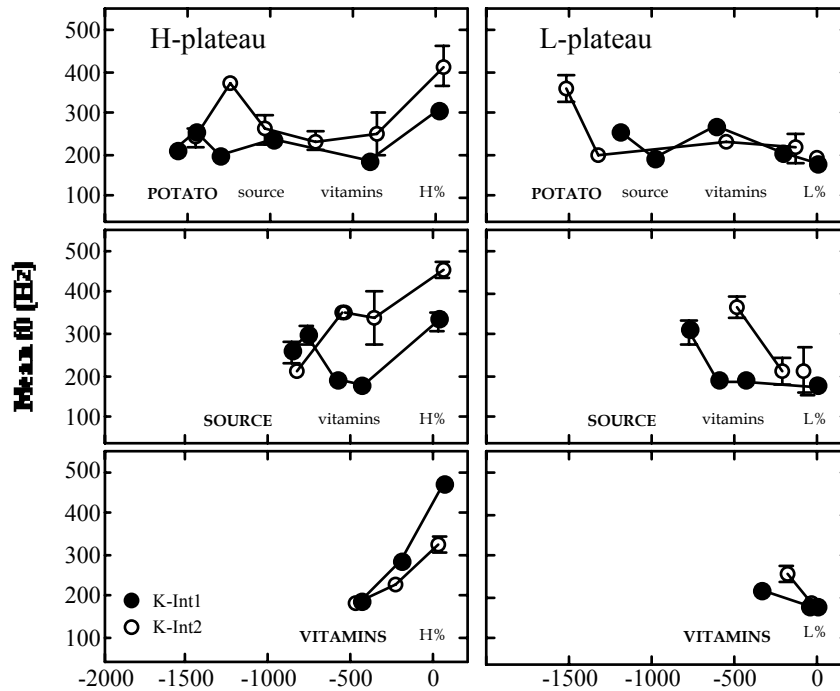
A similar tendency was found in the phonetic data of Set 2. Figures (7) and (8) show the F0 shapes of H-plateau and L-plateau produced by the Korean Intermediate learners and Korean Beginning learners, respectively. Again, when the length of the phrase following focus is shortest, i.e. in the 'final' condition, H-plateau and L-plateau produced by all non-native speakers are very similar to those of the native English speakers. When the focused word is followed by one word, both groups of speakers produce native-like f0 shapes for

L-plateau but not for H-plateau. When focus is followed by one or two words, both intermediate and beginning speakers produce flat low F0 contours before H boundary tone in the interrogatives.

(6) Mean F0 values from the verb and through each noun in H-plateau and L-plateau contexts for three Japanese speakers, advanced, intermediate and beginning level (The legend for each symbol is the same as that in (5).)



(7) Mean F0 value of the focused word, the following noun(s) and the boundary tone (also the valley before peak for H-plateau) for two Korean intermediate learners

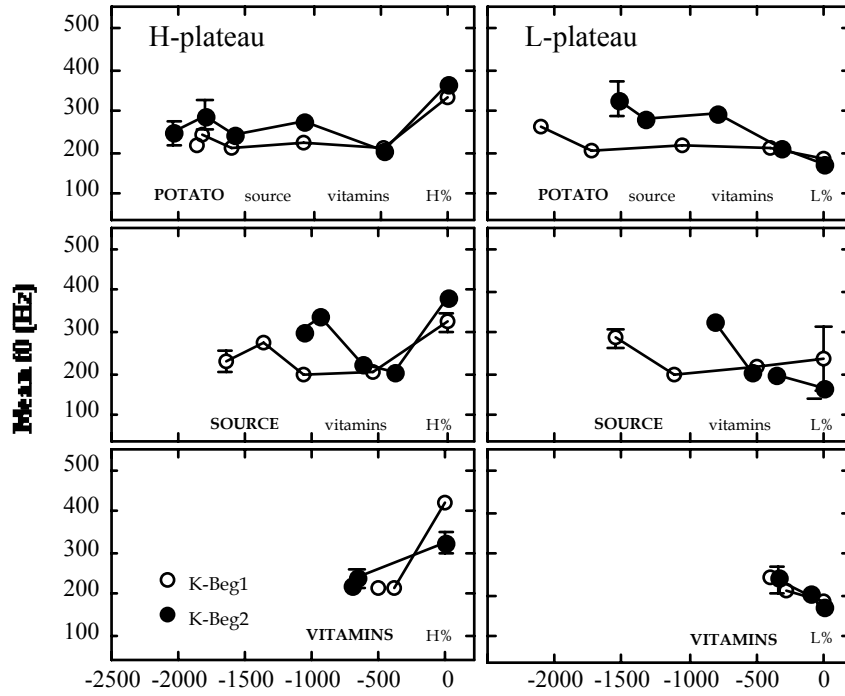


We mentioned earlier that high tones are sustained longer in Japanese than in Korean within the same focused phrase. Thus, we expected that sustaining high pitch in producing English interrogative focused utterances should be easier for Japanese speakers. The results show that there is no significant difference between the learner groups. As illustrated in Figure (9), both Korean and Japanese intermediate learners show a similar degree of pitch drifting, with a better high pitch for short NPs. The general difficulty to sustain high pitch may be due to a physical constraint against holding high pitch for a long time period.

Finally, we hypothesized that the slope of initial rise in interrogatives should be sharper for non-native speakers than for native English speakers. As shown in Figure (10), this hypothesis is tenable. The figure displays the slope of the initial rise for each speaker. Short bars symbolize shallow slopes and tall

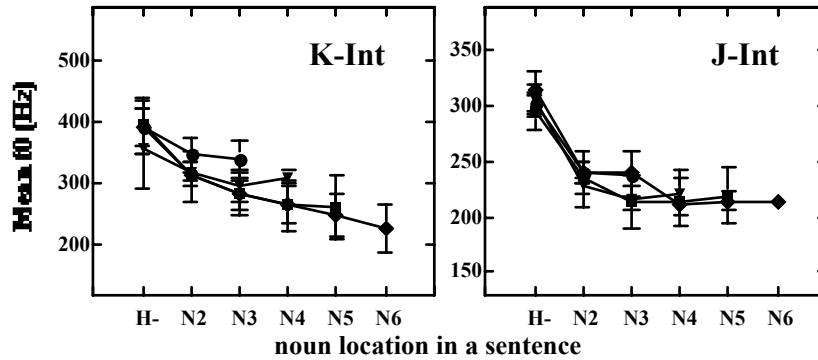
bars symbolize sharp slopes. Results of ANOVA tests show that there is a significant main effect of the group factor on the slope of the initial rise ( $F(6,158) = 125.782$ ;  $p < .0001$ ). Scheffe's posthoc test showed no significant difference among the bars with the same shade. Bars of different shades are significantly different at 0.01 level. That is, the slope of the two English native speakers is significantly shallower than that of the non-native speakers. Among the non-native speakers, the slope is significantly shallower for the advanced and intermediate speakers than for the beginning speaker. The slope of the Japanese Advanced speaker (JA) was not significantly different from that of Korean Intermediate speaker 1 (KI1) and from that of the Japanese Intermediate speaker (JI). The slope of the Japanese Intermediate speaker (JI) was not significantly shallower than that of Korean Intermediate speaker 2 (KI2). These results suggest that the sharp slope in L1 pitch rise is negatively transferred, and that the degree of negative transfer decreases as the proficiency level increases.

(8) F0 values of the focused word, the following noun(s) and the boundary tone (also the valley before peak for H-plateau) for two Korean beginning learners

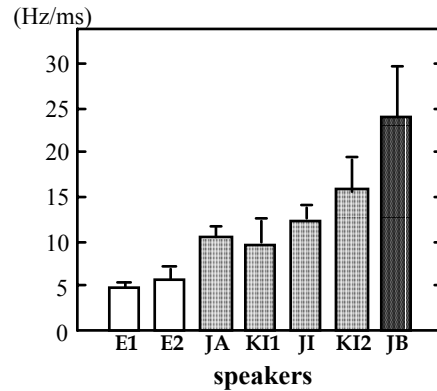




(9) Mean F0 value of H-plateau produced by Korean Intermediate speaker 2 and the Japanese Intermediate speaker (The legend for each symbol is the same as that in (5).)



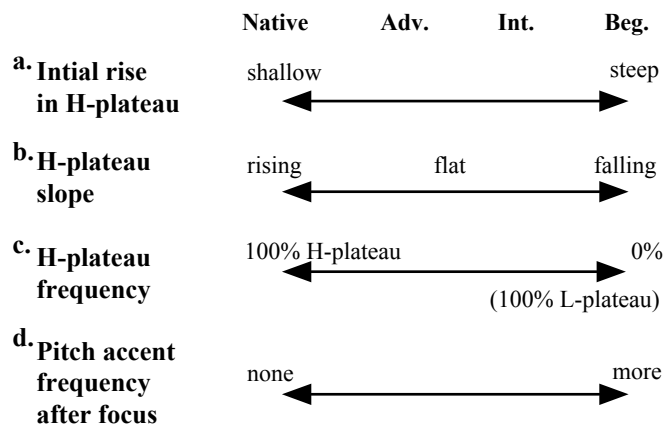
(10) Slope (Hz/ms) of initial rise in interrogative, i.e. H-plateau, by native English speakers and all non-native speakers



To sum up, we found that we can characterize different proficiency levels in the production of English focus intonation in terms of four different factors. A schematic representation of the four factors is shown in (11). First, the slope of the initial rise in H-plateau is shallower for the native speakers, and it gets steeper as the proficiency level decreases. Second, the slope of H-plateau is slightly rising for native speakers, and flat or slightly falling for advanced speakers, but strongly falling for beginning level. Third, the frequency of H-

plateau, that is, how often speakers produce H-plateau, decreases as the proficiency level decreases: native speakers always produced H-plateaus; advanced or intermediate speakers successfully produced H-plateaus approximately fifty percent of the time while beginning level speakers rarely produced H-plateaus. Finally, the number of pitch accents after focus increased as the proficiency level decreased. That is, dephrasing was more systematic in the advanced speaker than in the less advanced speakers.

(11) Four factors characterizing different proficiency levels



#### 4. Conclusion

We have shown that the L1 intonation system affects L2 intonation patterns, irrespective of the L1 source. However, not all L1 features directly shape L2 intonation. Rather, they appear to interact with universal constraints on speech production, such as the tendency to avoid dramatic fluctuations in the high pitch range, and with constraints on L2 speech learning, such as the tendency to reduce phrase sizes at the beginning stages of L2 learning. We also proposed four factors characterizing the level of L2 proficiency, based on the speakers' production of English focus intonation.

#### Acknowledgments

We would like to thank the members of the Phonetics Seminar group at UCLA, and especially Marco Baroni, Cécile Fougeron, Sean Fulop, Matt Gordon, Chai-Shune Hsu, and Patricia Keating, for their suggestions and comments. We also

would like to thank I. Park for his help with programming, and the speakers who participated in the experiments.

### References

- Argyres, Z. (1996). *The Cross-cultural Pragmatics of Intonation: the Case of Greek-English*. MA thesis, University of California, Los Angeles.
- Beckman, M. E. & J. B. Pierrehumbert. (1986). "Intonational structure in Japanese and English," *Phonology Yearbook* 3: 255-309.
- Flege, E. (1987) "The production of "new" and "similar" phones in a foreign language: evidence for the effect of equivalence classification," *Journal of Phonetics* 15:47-65
- Flege, E. (1995). "Second-language speech learning: Theory, Findings, and Problems", in W. Strange (ed.), *Speech Perception and Linguistics Experience: Theoretical and Methodological Issues in Cross-language Speech Research*. Timonium, MD: York Press.
- Flege, E. & R. Davidian (1984) "Transfer and developmental processes in adult foreign language speech production," *Applied Psycholinguistics* 5: 323-347.
- Gårding, E. (1981). Contrastive prosody: A model and its application. *Studia Linguistica* 35: 146-165.
- Jun, S.-A. (1993). *The Phonetics and Phonology of Korean Prosody*. Ph.D. dissertation, Ohio State University. [published in 1996 by Garland, N.Y.]
- Jun, S.-A. (1996) "Influence of microprosody on macroprosody: a case of phrase initial strengthening," *UCLA Working Papers in Phonetics* 92: 97-116
- Jun, S.-A. & M. Oh (1996) "A Prosodic analysis of three types of wh-phrases in Korean" *Language and Speech* 39(1):37-61.
- Maekawa, K. (1994) "Is there 'dephrasing' of the accentual phrase in Japanese?," *Ohio State University Working Papers in Linguistics: Papers from the Linguistic Laboratory* 44: 146-165.
- Pierrehumbert, J. B. (1980). *The Phonology and Phonetics of English Intonation*. Ph.D. dissertation, MIT. [published in 1987 by IULC]
- Pierrehumbert, J. B. & M. Beckman (1988) *Japanese Tone Structure*. Cambridge, MA: MIT Press.
- Todaka, Y. (1990). *An Error Analysis of Japanese Students' Intonation and Its Prosodic Analysis*. MA thesis, University of California, Los Angeles.
- Venditti, J., S-A Jun, and M. Beckman. (1996). Prosodic cues to syntactic and other linguistic structure in Japanese, Korean, and English. In J. Morgan and K. Demuth (eds.), *Signal to Syntax*. Lawrence Erlbaum Assoc., Inc.
- Weinreich, U. (1953) *Languages in Contact, Findings and Problems*. The Hague: Mouton.