

Suprasegmentals and Global Foreign Accent of EFL Learners

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Ikuyo Kaneko
International Christian University
Timothy J. Riney
International Christian University

The initial purpose of this study was to investigate the relationship between suprasegmentals and global foreign accent in the speech of Japanese EFL learners. Measured, using Kay Elemetrics software, were stress and intonation two times (T1 and T2), separated by an interval of 42 months, produced by eleven Japanese EFL speakers during their freshmen year and senior year of college; five age-matched native English speakers served as the control group. The unexpected finding was that the control group manifest great variation in their suprasegmental productions, leaving no clear standard by which to measure and compare to the Japanese EFL speakers. One implication of this finding is that native speaker suprasegmental performance may involve much more variance than is suggested in idealized prescriptive and pedagogical grammars.

日本人英語学習者の発話における超文節音素（プロソディ）と包括的外国語アクセントとの関連を分析するため、生成実験を行った。日本人英語学習者11名の大学1年時と大学4年時に録音を行い（よって第1回と第2回の録音の間には42ヶ月の間隔がある）、音声資料に関して、各文のストレスとイントネーションを測定した。測定にはKay Elemetrics社製の音声分析ソフトウェアを用いた。統制群

として、米国人母語話者5名(大学生)を用意した。測定の結果、5人の米国人母語話者の超文節音素はかなり異なり、統一した特徴は見られなかった。この予期せぬ結果により、英語母語話者の超文節音素という比較基準がはっきりとしないため、本研究の目的である日本人英語学習者の超文節音素との比較検討、包括的外国語アクセントとの関連の分析は出来なかった。この結果から、英語母語話者の超文節音素には幅広い個人差が見られ、その構造は規範文法や実際に教育現場で教授されている文法に示されているものよりもはるかに複雑であると考えられる。

In the field of pronunciation teaching, there has been a major debate over the past 15 years about whether EFL teachers should put emphasis on teaching segmentals or suprasegmentals (e.g., Celce-Murcia, Brinton, & Goodwin, 1997). There has been little empirical research, however, that contributes to our knowledge of how segmentals and suprasegmentals develop over time and to what extent segmentals and suprasegmentals contribute to global foreign accent, intelligibility, and comprehensibility.

The original intention of this study was to examine how suprasegmentals and global foreign accent are related in the speech of Japanese EFL learners. The term “global foreign accent” refers to the degree to which a second language speaker’s productions are perceived to differ from those of a native speaker. The research reported here follows the study of Anderson-Hsieh, Johnson, and Koehler (1992) that investigated

the relationship between impressionistic judgments of global nonnative English pronunciation and selected areas of pronunciation in speakers from 11 language backgrounds. Dividing pronunciation into three categories (prosody, syllable structure, and segmentals), they found that “the prosodic variable proved to have the strongest effect” (p. 530). They also called for more research in this area because an understanding of “the phonological factors that weigh most heavily in native speaker reactions to nonnative speech should be helpful in establishing valid priorities for teaching pronunciation to second language learners” (p. 549).

This research also follows that of Riney and Flege (1998), Riney and Takagi (1999), and Riney, Takada, and Ota (2000), all of whom investigated the relationship over time between global and discrete measures of foreign accent among the same group of 11 Japanese EFL speakers. Riney and Flege (1998), using perceptual software, examined the relationship between global foreign accent and liquid identifiability and accuracy. Riney and Takagi (1999) used acoustic measurements of L1 Japanese EFL speakers and found a positive correlation between global foreign accent and voice onset time. Riney, Takada, and Ota (2000), using native Japanese speaker perceptual judgments, found a significant correlation between global foreign accent and the substitution of the Japanese flap for the English liquids, /l/ and /r/. The study that we report here

examined speech samples from the same 11 speakers involved in the three studies above, but our focus here is on a different area: suprasegmentals and their relationship to global foreign accent.

Method

The 11 Japanese EFL speakers (8 females, 3 males) participating in this study were students at International Christian University (ICU) in Tokyo. In addition to the 11 Japanese speakers, 5 age-matched Americans who were native speakers of English (3 females, 2 males) served as the control group. (For a fuller description of these 16 speakers, see Riney and Flege, 1998.) For the experiment in Riney and Flege (1998), the 16 speakers read speech materials including five sentences at two times (T1 and T2). At T1 (June, 1992), the speakers were college freshmen aged 18-20 years. At T2, (fall, 1995) they were college seniors. There was a 42-month interval between T1 and T2. The five sentences are below:

1. A large group of students graduates each spring.
2. I heard that splendid speech you made last night.
3. Someone's trying to turn my friends against me.
4. They answered correctly and the instructor thanked them.
5. I request that all books be removed from the desks.

The global foreign accent scores to be used for the study that we describe here were derived from Riney and Flege (1998). Five Americans (different from the five above) served as listeners and blind-rated each of the 16 speaker's sentences and judged them on a scale ranging from "1," meaning strong foreign accent to "9," meaning no foreign accent. The details of this rating procedure are provided in Riney and Flege (1998).

What is original in our current study is first our focus on and the attempt to measure suprasegmentals, and second our intention to relate those measurements to degree of global foreign accent. For suprasegmentals, we examined both stress and intonation. Regarding stress, we selected a 2-syllable word from each sentence above: (S1: *student*, S2: *splendid*, S3: *against*, S4: *answered*, S5: *removed*). In each case, according to prescriptive dictionaries of English, one syllable is to receive more stress than the other syllable. For stress, based on Ladefoged (1993), we considered three measurable components: pitch, length, and loudness. We expected the native speaker control group to pronounce the prescribed stressed syllable with more stress than the unstressed or less stressed syllable. We also assumed that this difference in stress could be assessed or measured in one or more of three ways: pitch (measured by frequency in hertz), length of syllable (measured in milliseconds), and energy or loudness (measured in decibels). We paid the most attention to pitch because according

to Bolinger (1986), pitch plays a more central role in signaling stress than do length and loudness.

Regarding a different suprasegmental, sentence intonation, we intended to assess the placement of the tonic syllable in each sentence. According to Ladefoged (1993), in each intonation pattern, there is usually one syllable that stands out and carries the major pitch change. We examined the intonation contour of all the sentences spoken by the five American speakers in an attempt to determine the tonic syllable. We expected that most of the native English speakers would choose the same syllable as the tonic syllable and that this would give us a standard to which we could compare the Japanese speakers and measure the degree of approximation to the native speaker norm.

Riney and Flege (1998) had previously digitized all the productions and put each sentence into a separate speech file. Again, what is original in our study is that we acoustically analyzed the suprasegmentals in these files. For this we used “Multi-Speech” and “Real-Time Pitch” software produced by Kay Elemetrics.

Results and Discussion

Table 1 shows the measurements for pitch of the stressed and unstressed syllables of the five two-syllable words for all 16 speakers. Speakers A through K are Japanese EFL speakers while Speakers L through P are native English speakers. We expected that native English speakers

would produce the prescribed stressed syllable with higher pitch and the unstressed or less stressed syllable with lower pitch. However, we did not find this to be the case: The native English control group sometimes applied higher pitch to one syllable, sometimes higher pitch to the other, and sometimes almost the same pitch to both syllables. We also expected the English control group generally to utter the stressed syllable with greater length than the unstressed syllable but we did not find this to be the case either. The control group’s productions varied. Sometimes one syllable was longer; sometimes the other was; and sometimes the two syllables were about the same. Similarly, we expected the stressed syllable to be louder but we found that sometimes one syllable had more loudness, sometimes the other did, and sometimes the two were about the same. For all three components of stress—pitch, length, and loudness—no clear pattern emerged.

For this paper we acoustically measured pitch only, the results of which are in Table 1. We did not measure length and loudness in part because, according to Bolinger (1986), pitch is the key factor and in part because after viewing a large number of files randomly across speakers, it was our impression that there would be no difference between the stressed and unstressed syllables along the dimensions of length and loudness.

A second suprasegmental feature that we attempted to assess involved what is called the tonic syllable, the

syllable carrying the greatest pitch change. Although we anticipated some variation here, we nonetheless expected that most, if not all, native speakers of English in reading the sentences would choose the same word for the tonic syllable. However, as things turned out, these native speakers varied greatly in their choice. In Sentence 2, for example, the tonic syllable was “heard” for one speaker but “speech” for another speaker, and “you” for a third speaker. If the native English speakers had read the sentences with similar intonation patterns, as we naively expected, they would have provided us with the norm or standard that we needed in order to assess the speech of the Japanese EFL speakers. However, because the English control group provided no clear standard, we had no basis for assessing the tonic syllables of the Japanese EFL speakers.

File Name	Rec. Time	(Unit: Hz)														
		Sentence 1			Sentence 2			Sentence 3			Sentence 4			Sentence 5		
		stu	dent	Range	splen	did	Range	a	gaust	Range	an	svered	Range	re	moved	Range
A	T1	225.97	195.22	30.75	257.33	251.52	5.81	210.32	238.19	27.87	257.74	254.28	3.46	203.86	221.85	17.99
A	T2	218.91	199.86	19.05	237.25	238.96	-1.71	193.23	212.50	19.27	220.50	221.70	-1.20	182.91	199.68	16.77
B	T1	226.03	216.53	9.50	230.46	233.66	-3.20	150.34	225.20	74.86	242.42	235.31	7.11	219.18	226.08	6.90
B	T2	216.11	197.23	18.88	222.49	238.66	-16.17	175.50	198.58	23.08	219.84	232.06	-32.22	194.13	207.40	13.27
C	T1	243.36	220.66	22.70	243.10	237.45	5.65	202.47	205.53	3.06	227.00	234.44	-7.44	239.07	235.66	-3.41
C	T2	212.11	193.89	18.22	240.63	239.91	0.72	171.48	201.57	30.09	236.47	233.31	3.16	200.79	210.50	9.71
D	T1	213.49	213.85	-0.36	240.12	247.03	-6.91	185.86	198.03	12.17	223.62	248.04	-24.42	191.40	209.93	18.53
D	T2	217.52	203.80	13.72	233.96	235.43	-1.47	197.12	200.10	2.98	210.71	158.33	52.38	190.63	205.54	14.91
E	T1	223.67	241.17	-17.50	229.18	240.49	-11.31	165.59	218.96	53.37	233.00	219.78	13.22	193.57	226.98	33.41
E	T2	222.81	218.27	4.54	264.14	208.98	-24.84	179.15	208.86	29.71	286.41	209.75	-5.34	190.64	231.67	41.03
F	T1	120.69	111.59	9.10	133.31	119.43	13.88	97.35	100.80	3.45	127.80	146.21	-18.41	137.70	111.50	-26.20
F	T2	143.31	113.71	29.60	138.71	149.08	-10.37	121.82	108.27	-13.55	139.50	155.53	-16.03	107.56	123.35	15.79
G	T1	206.97	204.30	2.67	210.17	213.31	-3.14	166.65	198.83	32.18	217.45	215.12	2.33	182.65	207.21	24.56
G	T2	191.93	190.96	0.97	201.25	198.47	2.78	183.57	181.49	-2.08	205.59	196.68	8.91	180.25	190.69	10.44
H	T1	253.64	199.52	54.12	243.32	262.88	-19.56	200.21	232.24	32.03	253.20	268.29	-15.09	207.45	237.39	30.94
H	T2	236.96	210.99	25.97	242.33	249.59	-7.26	204.67	208.71	4.04	238.82	238.49	-0.35	200.86	236.41	35.55
I	T1	153.09	112.29	40.80	140.06	125.65	14.41	118.43	115.61	-2.82	125.35	146.71	-21.36	111.03	125.04	14.01
I	T2	148.55	116.38	32.17	132.85	133.95	-1.10	161.94	73.01	-88.93	135.52	143.38	-7.86	111.07	128.34	17.27
J	T1	232.17	219.76	12.41	240.88	222.74	18.14	198.28	212.52	14.24	224.72	244.73	-20.01	209.06	219.35	10.29
J	T2	207.41	203.39	4.02	219.25	213.94	5.31	182.05	198.46	16.41	216.89	224.69	-7.80	199.25	202.20	2.95
K	T1	198.25	191.00	7.25	231.38	217.74	13.64	169.20	186.37	17.17	220.89	217.13	3.76	189.19	201.62	12.43
K	T2	206.01	179.28	26.73	221.18	203.21	17.97	169.84	172.00	2.16	178.59	228.34	-49.75	174.38	197.64	23.26
ARG.	T1	208.85	193.26	15.59	218.12	215.63	2.49	169.34	193.84	24.51	213.93	220.91	-6.99	189.47	202.10	12.63
ARG.	T2	201.97	184.34	17.62	214.00	217.29	-3.29	176.56	178.50	1.94	208.08	214.75	-6.67	175.68	193.95	18.27
Grand	ARG.	205.41	188.80	16.61	216.06	216.46	-0.40	172.95	186.17	13.22	211.00	217.83	-6.83	182.57	198.02	15.45
L	T1	240.13	233.78	6.35	263.17	262.96	0.21	213.95	226.68	-12.73	247.91	209.06	38.85	227.92	227.07	-0.85
L	T2	189.29	226.98	-37.69	255.75	237.21	18.54	221.26	227.38	6.12	252.80	288.46	-35.66	230.89	231.18	0.29
M	T1	200.43	173.22	27.21	192.18	208.49	-16.31	148.55	144.19	-4.36	207.88	232.52	-24.64	166.36	167.87	1.51
M	T2	182.50	164.21	18.29	195.97	177.39	18.58	154.41	198.70	-44.29	205.27	224.20	-18.93	175.25	170.13	-5.12
N	T1	108.68	139.29	-30.61	109.22	129.77	-20.55	91.78	94.64	2.86	118.94	127.07	-8.13	94.00	100.26	6.26
N	T2	184.47	96.44	88.03	122.93	198.06	-75.13	177.58	97.13	-80.45	127.06	157.19	-30.13	92.55	100.76	8.21
O	T1	122.14	110.79	11.35	120.98	118.77	2.21	x	124.31	x	115.23	245.36	-130.13	96.41	104.85	8.44
O	T2	172.00	102.07	69.93	118.90	113.89	5.01	111.67	118.05	6.38	132.97	118.97	14.00	91.36	96.60	5.24
P	T1	233.93	230.05	3.88	234.82	263.11	-28.29	195.86	235.47	39.61	268.93	275.79	-6.86	212.51	205.19	-7.32
P	T2	251.35	240.28	11.07	264.75	274.79	-10.04	207.41	210.31	2.90	260.86	283.07	-22.21	213.60	216.84	3.24
ARG.	T1	190.74	179.32	11.42	197.57	199.96	-2.39	173.06	167.04	-4.29	194.76	214.19	-19.43	167.15	177.68	10.53
ARG.	T2	202.82	175.87	26.95	204.37	205.68	-1.30	172.79	179.85	7.05	202.55	217.04	-14.50	172.04	181.77	9.73
Grand	ARG.	196.78	177.59	19.18	200.97	202.82	-1.85	172.93	173.45	0.52	198.66	215.62	-16.96	169.60	179.72	10.13

Table 1: A comparison of the pitch (mean frequency) of the stressed and unstressed syllables of two-syllable words

The clearest difference between the native speakers and Japanese EFL speakers involved a dimension that we did not originally intend to measure: mean sentence length (measured in milliseconds). Table 2 shows the average length of all the sentences spoken by Japanese and Americans at T1 and T2. In case of Japanese speakers, almost of all the sentences became a little shorter at T2 (S1: 3.25, S2: 3.26, S3: 3.08, S4: 3.82, S5: 3.71) than at T1 (S1: 3.41, S2: 3.46, S3: 3.07, S4: 3.85, S5: 3.74). A much more striking difference, however, was between the Japanese speakers and the native English speakers (S1: 2.6 at T1 & 2.59 at T2, S2: 2.86 at T1 & 2.97 at T2, S3: 2.67 at T1 & 2.64 at T2, S4: 3.22 at T1 & 3.25 at T2, S5: 3.2 at T1 & 3.24 at T2). For the reading task, all speakers were told to read the sentences at their own pace, and it is not really surprising that the second language speakers were slower than the native speakers. One possible question of interest, however, is “Did those Japanese speakers who had better accents also read faster?” If they did, then that might be an interesting finding, but we did not find this to be the case. Riney and Flege (1998) found that three of the 11 Japanese speakers significantly improved their accent from T1 to T2. Of those, we found that one produced Sentence 1 with almost the same length at T1 and T2, and one other participant produced Sentence 1 longer at T2 than T1. These findings do not suggest any relationship between global foreign accent and length or speed of the reading.

Table 2: *Average length of sentences*

(Unit: msec)						
Speaker	Rec. Time	Sentence 1	Sentence 2	Sentence 3	Sentence 4	Sentence 5
Jpn.	T1	3.41	3.46	3.07	3.85	3.74
	T2	3.25	3.26	3.08	3.82	3.71
Amr.	T1	2.6	2.86	2.67	3.22	3.2
	T2	2.59	2.97	2.64	3.25	3.24

Conclusion

The study was designed to measure suprasegmentals and to examine the relationship between suprasegmentals and global foreign accent among Japanese EFL speakers. It used a native English control group with the intention of establishing a standard by which to measure the suprasegmentals of Japanese EFL speakers. In one measure of suprasegmentals, stress in two-syllable words, contrary to our expectation, the control group produced no differences between the stressed and unstressed syllable, based on acoustic measures of syllable length, pitch, and loudness.

In another measure of suprasegmentals, we examined the speakers' choice of the tonic syllable in the intonation of five sentences that were read. We expected that all or most control group speakers would have the same tonic syllable but they did not, and for this reason we again had no measure or standard by which we could measure the degree of approximation of the suprasegmentals of the Japanese EFL speakers. In both cases, for word stress and for tonic syllables, we were

left with no definite norm from the control group. As a result, we were unfortunately not in a position to move on to second stage of our project, to examine the relationship between suprasegmentals and global foreign accent (the latter derived from Riney and Flege, 1998). We had expected, and still believe, that those speakers with better suprasegmentals had better global accents, but we have no evidence from this study to support that.

We can think of several possible reasons that we did not get the findings that we expected from our control group. One is that our measurements were somehow

flawed (but we did them carefully and do not believe this to be the case). A second possible reason is that the acoustics measurements of syllable length, pitch, and loudness do not capture what native speakers of a language perceive when they hear a stressed syllable in a word or a tonic syllable in a sentence intonation pattern. A third possibility is that the representation of English pronunciation in textbooks is perhaps more idealized than it should be and does not reflect the amount of variation that actually occurs in speech performance.

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