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An analysis of lexical diversity, speech rate, and pauses in public speaking by Japanese EFL learners

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Abstract

The purpose of this study was to explore lexical diversity, speech rate, and pauses in English public speaking by Japanese EFL learners. The participants were nine first-year students at a national university in Japan. The students' English proficiency was at an intermediate level on average. The speech performances were recorded, and the type-token ratio, word level, speech rate, and duration of pauses were analyzed. The results showed that less than half of the words in the speeches were different from each other (TTR = 0.43), and approximately 70% of the words in the speeches belonged to the frequent words in level 1, based on JACET 8000. Students delivered the speeches at a slow speech rate (111 words per minute), and the average duration of pauses varied among speakers. These results are expected to be useful for the improvement of teaching English public speaking to Japanese EFL learners.

1. Introduction

Speaker's fluency is characterized by lexical variables (Götz, 2013), and temporal variables, such as speech rate and pauses (Kormos & Denes, 2004). With appropriate lexical choice and lexical diversity, a moderate rate of speech with appropriate pauses is perceived as an indication of speaking fluency. Many studies have explored some of the variables related to perceived fluency (e.g. Foster & Tavakoli, 2009; Kormos & Denes, 2004; Lin & Francis, 2014). For example, Foster and Tavakoli (2009) explored L1 and L2 speakers and found that the structure or complexity of the task has an effect on L2 fluency, in terms of positioning of pausing. Foster and Tavakoli (2009) also reported that the lexical diversity among L2 speakers in an English speaking country was closer to the lexical diversity among native speakers. Lin and Francis (2014) found the relationship between temporal factors (e.g., speech rate and pauses) and listeners' judgments of acceptability and intelligibility of non-native speech.

Although the aforementioned studies shed light on lexical and temporal variables that relate to perceived L2 fluency, speech samples in those studies were limited to interviews, narrative tasks, conversation, and read speech. We were particularly interested in lexical and temporal variables in public speaking. As Fuyuno (2013) mentioned, English public speaking is widely needed in Japanese companies and organizations for globalization. In this study, we collected and analyzed speech data of English public speaking by Japanese EFL learners, focusing on lexical diversity and temporal aspects such as speech rate and pauses.

2. Method

2.1 Participants

Participants included first grade Japanese university students from one EFL classroom in a national university, that is considered one of the prestigious universities in Japan. Their English proficiency was at the intermediate level based on an essay writing test. They were not English-major students. The class sizes were medium, approximately 20 students. 19 students (9 males, 10 females) delivered a speech to approximately twenty students and to 1 native Japanese teacher, in a classroom during the thirteenth or fourteenth week. For this study, only 9 students (4 males, 5 females) were included for the following reasons. First, they all finished reading their script within the time limitation. Second, their speech was not constantly overlapped by the background noise from chairs, desks, and other objects in the classroom.

2.2 Procedure

The total number of L2 writing and speaking classes was 15 in a semester. From the ninth to the twelfth weeks, students received public speaking training, concerning script organization, speech delivery, and gestures. They wrote their own script, and prepared a speech. In the thirteenth and fourteenth weeks, each student delivered a speech to his or her classmates and teachers. The topic of the students' speech was as follows: Do you agree or disagree with the following statement? SNS (Social Networking Service) is necessary for society'. They were instructed to choose a side and give examples and reasons to support their opinion. They were also instructed to deliver the speech within four minutes with a script if necessary.

The speech performances were audio-recorded with a digital sound recorder (TEAC, DR-07), which was set to 44.1-kHz sampling and 16-bit linear quantization. The sound recorder was set on a stable place. After recording,

the digital data were stored in a database. The scripts written by the students were also stored.

2.3 Data analysis

The scripts each student wrote were analyzed in order to obtain lexical indexes, using lexical analysis software, 'Word Level Checker' (<http://someya-net.com/wlc/>). The total number of words (types) and the total number of different words (tokens) were obtained. This study explored the following lexical indexes:

1. Type-token ration (TTR)

TTR indicates lexical diversity (Richards, 1983). Following the widely used method (Götz, 2013), the type-token ratio was calculated by the total number of words (types), divided by the total number of different words (tokens). It is reasonably assumed that a speaker with high lexical diversity uses a relatively high number of different words and repeats the same words infrequently.

2. Word level

With Word Level Checker, each word in a script was ranked into eight levels (from 1 to 8), based on "JACET (Japanese Association of College English Teachers) List of 8000 Basic Words" (JACET 8000). JACET 8000 is a reliable word list based on the British National Corpus (BNC) and JACET 8000 sub-corpus, which is designed for all Japanese learners of English and has been widely used in previous English education research (Uemura & Ishikawa, 2004). An average word level index based on JACET 8000 was also obtained for each student.

In the next analysis, the author extracted silent pauses from each recording, using audio software, Praat (<http://www.fon.hum.uva.nl/praat/>) based on the following criteria: 1) Silent intervals longer than or equal to 0.1s were included, 2) sounds of breathing were considered parts of pauses, 3) if a student produced anomalous vocal signals, such as a cough, laughter, or a sneeze, silent parts before and after these anomalous vocal signals were excluded, 4) filled pauses (e.g. *er, uh, um*) (Götz, 2013) and silent parts before and after these filled pauses were excluded. This study explored the following temporal factors:

3. Speech rate

Speech rate measured in words per minute (wpm) indicates the rate at which information is produced (de Andrade, Cervone, & Sassi, 2003). The total number of words in a given speech was divided by the total amount of time in minutes.

4. The pause durations

The median duration and the maximum duration of pauses longer than 0.1 s were obtained. The pauses were divided into three categories: pause at comma/dash, pause at period/question mark, and other pause.

3. Results

Table 1 presents information regarding the numbers of words (tokens and types), the type-token ratio (TTR), and total durations of speech. The average number of tokens were 326.11 and the average number of types was 139. TTR ranged between 0.29-0.50. JM01 displayed the highest number of words (both tokens and types), but the lowest TTR (0.29). This is because the TTR depends on the text size, as Koizumi (2012) mentioned. The TTR of JF02 was the highest (0.50), which indicates the highest lexical diversity.

Table 1. Basic data on speeches

Speaker	Tokens (words)	Types (words)	Type-token ratio (TTR)	Total data duration(s)
JF02	291	147	0.50	155.82
JF04	312	142	0.45	187.53
JF05	293	141	0.48	182.25
JF09	331	136	0.41	214.90
JF10	301	126	0.41	163.08
JM01	509	151	0.29	205.25
JM03	323	139	0.43	162.23
JM10	300	136	0.45	144.21
JM13	275	133	0.48	170.26
Average	326.11	139.00	0.43	176.17

Table 2 shows the frequency of words (types) for each level (1-8) based on JACET 8000. The words, that were not included in JACET 8000 were shown in

the category 'unknown'. In total, 926 words (74.02%) were ranked at level 1, 110 words (8.79%) were ranked at level 2, and 56 words (4.48%) were ranked at level 3, and only 3 words (0.24%) were ranked at level 8. To give an example of the difficulty level of words speakers produced, 'information,' 'spread' and 'people' were included among level 1 words; 'communicate,' 'useful' and 'flood' were included among level 2 words; 'explosion,' 'scatter' and 'anxiety' included among level 3 words; 'excessively' was included among level 8 words. Table 3 shows the average word level for each speaker. The average word level was in the range of 1.15-1.37. All speakers tended to use frequent level 1 words. For example, the word level of JM13 was the lowest (1.15), which means that he used frequent words and avoided using difficult words. For example, he produced following level 1 words: 'of,' 'be,' 'people,' 'the,' 'and,' 'use,' 'that,' 'we,' 'I' and 'with,' with a minimum frequency of 5.

Table 2. Word level

Speaker	Lev1	Lev2	Lev3	Lev4	Lev5	Lev6	Lev7	Lev8	Unknown
JF02	97	16	9	5	1	1	1	0	17
	65.99%	10.88%	6.12%	3.40%	0.68%	0.68%	0.68%	0.00%	11.56%
JF04	101	20	3	4	2	2	0	0	10
	71.13%	14.08%	2.11%	2.82%	1.41%	1.41%	0.00%	0.00%	7.04%
JF05	104	9	8	4	0	0	2	0	14
	73.76%	6.38%	5.67%	2.84%	0.00%	0.00%	1.42%	0.00%	9.93%
JF09	101	15	7	1	1	1	1	0	9
	74.26%	11.03%	5.15%	0.74%	0.74%	0.74%	0.74%	0.00%	6.62%
JF10	93	12	3	4	0	0	1	1	12
	73.81%	9.52%	2.38%	3.17%	0.00%	0.00%	0.79%	0.79%	9.52%
JM01	122	10	3	2	0	2	0	2	10
	80.79%	6.62%	1.99%	1.32%	0.00%	1.32%	0.00%	1.32%	6.62%
JM03	109	11	5	2	2	1	3	0	6
	78.42%	7.91%	3.60%	1.44%	1.44%	0.72%	2.16%	0.00%	4.32%
JM10	94	14	11	1	3	0	0	0	13
	69.12%	10.29%	8.09%	0.74%	2.21%	0.00%	0.00%	0.00%	9.56%
JM13	105	3	7	3	2	0	0	0	13
	78.95%	2.26%	5.26%	2.26%	1.50%	0.00%	0.00%	0.00%	9.77%
Total	926	110	56	26	11	7	8	3	104
	74.02%	8.79%	4.48%	2.08%	0.88%	0.56%	0.64%	0.24%	8.31%

Table3. Average word level

Speaker	Average word level
JF02	1.31
JF04	1.32
JF05	1.24
JF09	1.27
JF10	1.24
JM01	1.23
JM03	1.37
JM10	1.27
JM13	1.15

Figure 1 shows speech rates in words per minute (wpm). The speech rates ranged between 92-149 wpm. The mean number of words per minute was 111. JM01 had the fastest speech rate (149 wpm), and JF09 had the slowest speech rate (92 wpm). JM01 also showed the highest number of words and the lowest TTR, which might have influenced his speech rate. It should also be noted that the word level of JM13 was the lowest, and the speech rate was less than 100 wpm, which was considerably slow compared to the other speakers.

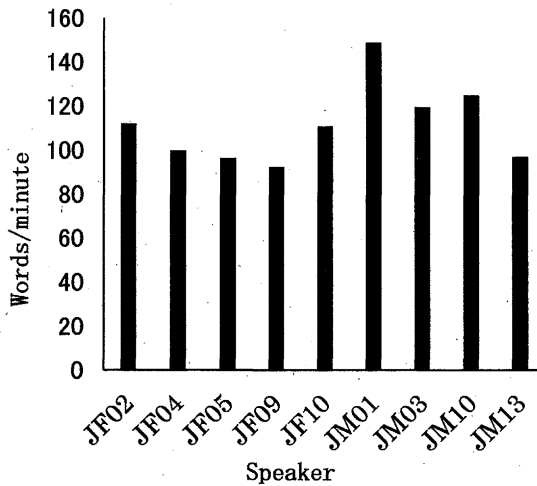


Figure 1. Speech rates in words per minute (wpm)

Figure 2 shows the distributions of the pause durations. The number of pauses was within the range of 64-89. The average number of pauses was 77. The median duration of pauses was in the range of 0.26-0.53 s, and the maximum duration of pauses varied among the speakers. For example, the maximum duration of JF09's pauses was 2.72 s, and that of JM13's was 1.17 s.

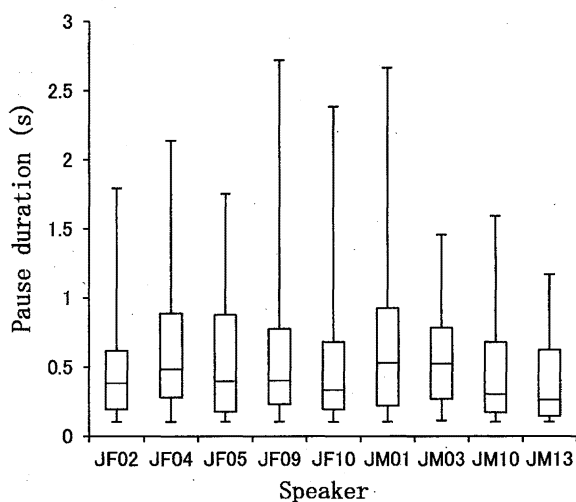


Figure 2. The distribution of pauses in time for each speaker.

The pauses were divided into three categories: pause at comma/dash, pause at period/question mark, and other pause. Table 4 presents the results of the average duration of pauses in each category for each speaker. These reveal that the average duration of pauses at period/question mark was longer than that of pauses at comma/dash and other pauses for all three speakers. We further explored the ratio of pause durations at comma/dash to those at period/question mark, and the ratio of pause durations at comma/question mark to those at others (Table 5).

Table 4. Average durations of pauses in three types

Speaker	period/question mark average duration (SD)	comma/dash average duration (SD)	others average duration (SD)
JF02	0.73 (0.36)	0.39 (0.25)	0.37 (0.34)
JF04	1.12 (0.30)	0.51 (0.23)	0.38 (0.24)
JF05	1.07 (0.32)	0.44 (0.26)	0.35 (0.37)
JF09	1.20 (0.60)	0.50 (0.31)	0.33 (0.24)
JF10	1.05 (0.54)	0.48 (0.23)	0.22 (0.10)
JM01	1.06 (0.49)	0.53 (0.27)	0.38 (0.31)
JM03	0.83 (0.31)	0.47 (0.21)	0.30 (0.19)
JM10	0.75 (0.30)	0.30 (0.14)	0.18 (0.10)
JM13	0.70 (0.24)	0.39 (0.21)	0.30 (0.25)

Table 5. The ratio of pause durations

Speaker	comma-period ratio	others-comma ratio
JF02	1: 1.87	1: 1.05
JF04	1: 2.20	1: 1.34
JF05	1: 2.43	1: 1.26
JF09	1: 2.40	1: 1.52
JF10	1: 2.19	1: 2.18
JM01	1: 2.00	1: 1.39
JM03	1: 1.77	1: 1.57
JM10	1: 2.50	1: 1.67
JM13	1: 1.79	1: 1.30

Both the comma-period ratio and the comma-others ratio varied among speakers. For JF02 and JM13, both the comma-period ratio and comma-others ratio were relatively lower than those of other speakers; those of JF10 were relatively higher. Figure 3 shows the cumulative relative frequency of the three types of pause durations for JF02 (A) and for JF10 (B). In order to compare the results of Japanese learners of English with those of native English speaker, the figure below was adapted from our previous study, which utilized the same methods (Yamashita & Fuyuno, 2015).

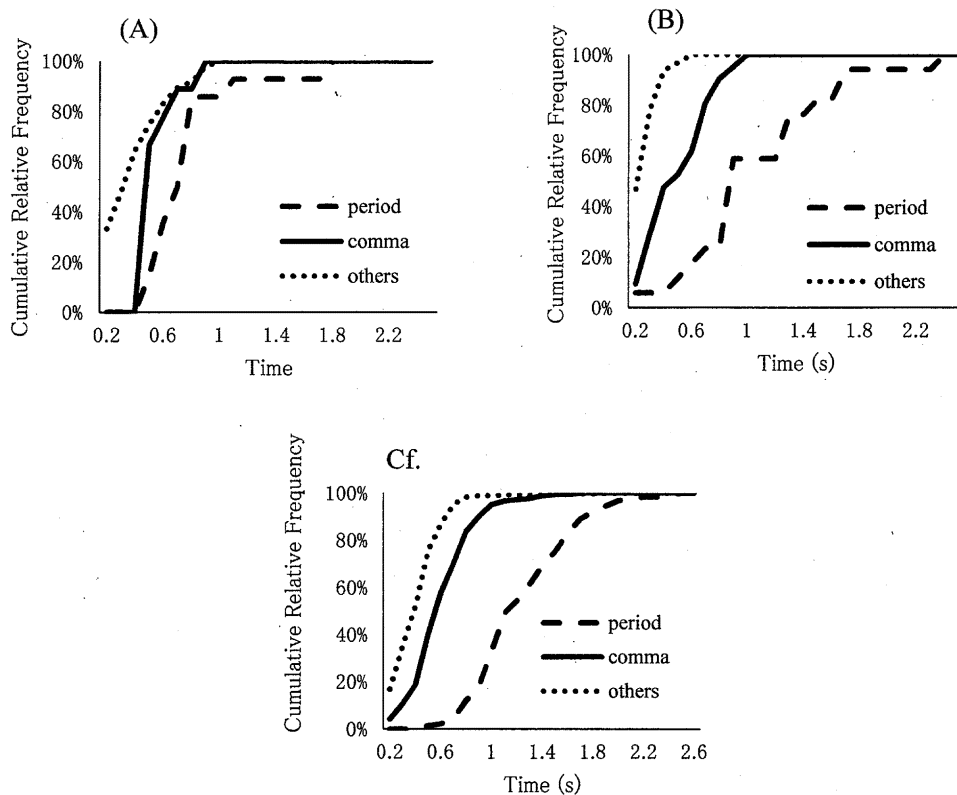


Figure 3. Cumulative relative frequency of three types of pause duration for JF02 (A) and for JF10 (B). The figure below shows those of native English speaker with relatively high speech performance, adapted from Yamashita and Fuyuno (2015).

As the figures show, the results of JF10 were similar to those of native English speaker. That is, they clearly distinguish the pause duration at periods/question marks from the one at commas/dashes, and similarly, they distinguish pause duration at commas/dashes from the one at others. It suggests that pause duration is one of the factors that determine student's speaking level.

4. Discussion

Speech data from English public speaking by Japanese EFL learners were collected and analyzed, focusing on lexical diversity, and temporal aspects, such as speech rate and pause duration. The results showed that less than half of the

words in speech were different from each other (TTR = 0.43), and approximately 70% of the words in the speeches belonged to the frequent words in level 1, based on JACET 8000. It suggests that the students tended to avoid difficult words and chose frequent words, employing repetition. As shown in Foster and Tavakoli (2009), learners' lexical diversity in speaking is significantly low, compared with that of native speakers. The average speech rate of Japanese EFL learners in this study was 111 wpm, which was slower than that of non-native speakers of English with advanced proficiency in previous studies, in which the average speech rate was 152 wpm (Fuyuno et al., 2014). With regard to pause duration, the average duration of pauses at periods/question marks was longer than that of pause at commas/dashes and other pauses for all three speakers. Some students clearly divided the pause duration at period/question mark from the one at comma/dash, and the pause duration at comma/dash from the one at others, which was similar to what was found among in native speakers in our previous study (Yamashita & Fuyuno, 2015). These results should offer useful information for the development of learning and teaching strategies to improve EFL learners' English public speaking.

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