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Factors Affecting Listening Comprehension Ability of Japanese Learners of English

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Abstract

This study aimed to examine factors that might affect listening comprehension ability of Japanese learners of English. The factors were vocabulary/grammar, reading comprehension, articulation speeds for Japanese and English words, English repeatability (i.e., the ability to repeat verbal input in English), auditory short-term memory, reading rate, and reading efficiency. The present study investigated these factors for the first-year students at a Japanese senior high school and made an attempt to explore exactly how they affected listening comprehension ability of Japanese learners. The results showed that listening comprehension of learners with good short-term memory was significantly better than that of learners with poor short-term memory in cases where their vocabulary/grammar and reading test scores were within the same level. A significant correlation was also observed between the articulation speed for English words and English repeatability, and between English repeatability and listening comprehension ability.

1. Introduction

Japanese learners of English as a foreign language often find it more difficult to listen to English than to read it. In listening, information is conveyed by a stream of speech sounds, whereas, in reading, by a string of letters. Spoken language is very different from written language in that written letters remain unchanged, but speech sounds gradually decay over time. As Rubin (1995) states, listening is considered to be demanding since learners must retain information in short-term memory at the same time as they are trying to understand the information. From the viewpoint of the phonological loop of working memory proposed by Baddeley (1974, 1986), the capacity of the phonological loop (which is equivalent to the auditory short-term memory span in the earlier concept of short-term memory) is not limited by a fixed number of verbal items, but rather by how much a listener can repeat in approximately 2 seconds.

More simply, the size of memory span is dependent on (subvocal) rehearsal speed (Baddeley et al., 1975; Schweickert & Boruff, 1986). It is clear that short-term memory, which depends on rehearsal speed, and listening comprehension are closely related to each other.

In the process of understanding information, learners need vocabulary and grammar as their prior declarative knowledge in long-term memory whether texts are written or spoken. Procedural knowledge is needed not only in listening but also in reading. Needless to say, many similarities exist between listening comprehension and reading comprehension.

For the reasons mentioned above, the present study attempted to investigate how Japanese learners' listening comprehension ability was influenced by other factors. The study mainly focused on short-term memory, articulation speed, and the relationship between reading and listening while paying attention to learners' written test scores. The factors were vocabulary/grammar, reading comprehension, Japanese/English articulation speed, English repeatability, auditory short-term memory, reading rate, and reading efficiency.

2. Research Questions

1. Does auditory short-term memory measured by digit memory span affect listening comprehension ability of Japanese learners of English in cases where their vocabulary/grammar and reading test scores were within the same level?
2. Does reading rate affect the listening comprehension ability of Japanese learners of English in cases where their vocabulary/grammar and reading test scores were within the same level?
3. What relationships are there between articulation speed for English words and English repeatability and, in turn, between English repeatability and listening comprehension ability?

3. Method

3.1. Participants

A total of 232 EFL students took part in this study. They were first-year students at a senior high school in Okayama, with their ages ranging from 15 to 16.

3.2. Instruments

(1) Listening Comprehension

The participants' listening comprehension was measured with the listening section (100 points for 12 items in 15 minutes) of the Basic Assessment of Communicative English (BACE) (Association for English Language Proficiency Assessment = ELPA). BACE was originally designed for first-year senior high school students and is considered a reliable and valid assessment of English proficiency because it was developed based on Item Response Theory as are TOEIC and TOEFL. The first edition of BACE 2006 was used in this study.

(2) Vocabulary/Grammar

The participants' lexical and grammatical knowledge were measured in terms of their scores in the vocabulary and grammar section (100 points for 16 items in 10 minutes) of BACE.

(3) Reading Comprehension

The participants' reading comprehension was assessed on the basis of their scores in the reading section (100 points for 12 items in 20 minutes) of BACE.

(4) Japanese/English Articulation Speed

The articulation speeds of Japanese and English words were respectively measured as the number of Japanese moras and English syllables read aloud in 2 seconds, following Tamai (2005). It has been shown that short-term memory (i.e, the capacity of the phonological loop) is dependent on how much a listener can articulate in about 2 seconds (Baddeley et al., 1975; Schweickert & Boruff, 1986). The aim of this measure is to examine how English articulation speed affects English repeatability. The participants read aloud 40 Japanese words containing 219 moras and 40 familiar English words consisting of 93 syllables as fast as they could. Articulation speeds were calculated as follows: Japanese articulation speed = 219 (moras in 40 words) / time for reading 40 words (sec.) x 2.0; English articulation speed = 93 (syllables in 40 words) / time for reading 40 words (sec.) x 2.0. All difficult English words used for measuring articulation speed were rephrased so that all participants should know them.

(5) English Repeatability

In the repeatability test, following Shibukawa (2001), the participants listened to English sentences and were required to orally repeat what they heard immediately after each sentence. All difficult words and phrases occurring in the sentences were rephrased so that all participants should know them. The participants' responses were all tape-recorded. Sentence length was gradually increased from 4 syllables to 16 syllables and three sentences were prepared for each syllable number. Each participant's sentence memory span was determined by the longest sentence he/she could remember, based on whether the participant could recall at least two sentences out of three correctly from that syllable group.

(6) Auditory Short-term Memory

In measuring digit memory span, the participants were presented with a sequence of 4 to 9 Japanese digits and required to recall and write down the numbers in the same order as they heard. A participant's digit memory span was defined as the sequence length at which the participant is correct half the time. The digit memory span provides a useful indication of the capacity of an individual's phonological loop (Baddeley et al., 1998).

(7) Reading Rate and Reading Efficiency

The reading rate was calculated from the number of words that each participant could silently read in one minute (wpm). Two passages were constructed by modifying the passages used in past STEP third grade examinations. One was 121-words long at Flesch-Kincaid Grade level 6.1 and the other was 123-words long at Flesch-Kincaid Grade level 6.2. The participants were given the following direction: Read the passage at your own pace trying to understand it and measure your silent reading time individually with a stopwatch; After recording your reading time, answer 4 comprehension questions about the passage without rereading it. Based on the recorded reading time and comprehension scores, the rates and indexes were calculated and the means of the two-time measurements were the participants' reading rates and reading efficiency indexes respectively. Reading efficiency index, defined as the reading rate at which each participant could somewhat understand a passage, was calculated by multiplying each participant's reading rate by his or her rate of correct answers in the comprehension questions about the passage. Since the number of comprehension questions was four, the formula for the index was: (wpm) x (correct answers) / 4.

4. Results and Discussion

4.1. Descriptive Statistics

Table 1 shows the descriptive statistics of listening comprehension and other factors. The minimum, maximum, mean (scores) and standard deviations of each factor are listed.

Table 1 Descriptive statistics of listening comprehension and other factors (N=232)

	Min	Max	Mean	SD
1. Listening Test	24	89	59.19	11.47
2. Vocabulary/Grammar Test	10	90	60.51	10.18
3. Reading Test	0	100	51.56	20.70
4. Written Test*	34	174	112.07	27.50
5. Japanese Articulation Speed	10.3	31.3	19.65	3.69
6. English Articulation Speed	2.0	10.2	6.57	1.46
7. English Repeatability	4	11	7.02	1.67
8. Digit Memory Span	4	9	6.25	1.07
9. Reading Rate	35	171	72.15	20.49
10. Reading Efficiency Index	26	150	63.54	19.06

*Scores for the Written Test are the summation of the scores for the Vocabulary/Grammar Test and Reading Test.

4.2. Correlations

Pearson product-moment correlation coefficients were calculated between listening comprehension and other factors.

Table 2 Correlation matrix between listening comprehension and other factors

	1	2	3	4	5	6	7	8	9	10
1.LT	1.000	.211**	.281**	.290**	.104	.093	.281**	.130*	.067	.162*
2.VGT		1.000	.532**	.770**	.142*	.245**	.280**	.099	.148*	.289**
3.RT			1.000	.950**	.188**	.338**	.389**	.150*	.220**	.352**
4.WT				1.000	.194**	.345**	.397**	.150*	.220**	.372**
5.JAS					1.000	.590**	.180**	.167*	.116	.185**
6.EAS						1.000	.312**	.134*	.339**	.377**
7.ER							1.000	.349**	.207**	.273**
8.DMS								1.000	-.048	.053
9.RR									1.000	.842**
10.REI										1.000

**p<.01 *p<.05

Notes: 1.LT=Listening Test 2.VGT=Vocabulary/Grammar Test 3.RT=Reading Test
4.WT=Written Test (i.e., VGT+RT) 5.JAS=Japanese Articulation Speed
6.EAS=English Articulation Speed 7.ER=English Repeatability
8.DMS=Digit Memory Span 9.RR= Reading Rate 10.REI=Reading Efficiency Index

Table 2 shows that listening comprehension had significantly high correlation with vocabulary/grammar (r =.211, p<.01), reading comprehension (r =.281, p<.01), written test (r =.290, p<.01), English repeatability (r =.281, p<.01) and with auditory short-term memory (r =.130, p<.05), reading efficiency (r =.162, p<.05). The result showed that factors such as vocabulary/grammar, reading comprehension, and repeatability may affect listening comprehension ability of EFL learners. Moreover, short-term memory and reading efficiency, though their correlations are not very high, might affect listening comprehension ability.

4.3. Research Question (1)

The first research question asked how short-term memory span measured by digit memory affected listening comprehension ability in cases where students' vocabulary/grammar and reading test scores were within the same level. In order to investigate the question, two groups were prepared, based on their digit memory span test and written test scores. The learners who were able to repeat 8 to 9 digits correctly with their written test scores ranging from 91 to 135 were classified as the upper group (N=20). Those whose digit memory ranged from 4 to 5 and whose test scores were between 93 and 132 were classified as the lower group (N=28). Only students

whose English scores for the written test were within the same range while their short-term memory spans were different, fell under the scope of this analysis. We were mainly interested in exploring how learners' auditory short-term memory affects listening comprehension ability when scores for written tests were within the same level.

Table 3 Descriptive statistics of written test and listening test scores for upper group and lower group based on short-term memory

		Written Test				Listening Test			
	N	Min	Max	Mean	SD	Min	Max	Mean	SD
Upper Group	20	91	135	115.20	11.68	45	89	63.25	9.58
Lower Group	28	93	132	110.86	11.65	32	78	56.21	10.15

Table 3 shows the descriptive statistics of the written test and listening test scores for both the upper and lower group based on their short-term memory span. In order to check whether their written test performance was within the same level or not, comparisons were made of the scores of their written tests. No significant difference was found between them ($F(1, 46)=1.55$, ns) and therefore their vocabulary/grammar and reading comprehension level were considered to be similar. A one-way factorial ANOVA revealed that there was a significant difference in the means of listening tests between two groups ($F(1, 46)=5.63$, $p<.05$). It seems that short-term memory measured by digit memory significantly affects Japanese learners' listening comprehension ability under circumstances in which learners' written scores are within the same level. Call (1985) found that sheer digit memory was less important than comprehension sentence memory. However, it was confirmed that short-term memory — measured by digit memory, which is equivalent to the capacity of the phonological loop — was strongly related to listening comprehension ability (Dunkel et al., 1989, Takeno, 2004).

Baddeley et al. (1998) note "The digit span measure provides a useful indication of the capacity of an individual's phonological loop (p.159)." The capacity of the phonological loop depends on how much a listener can pronounce in approximately 2 seconds (Baddeley et al., 1975; Schweickert & Boruff, 1986). The following account will probably explain the result of this study. Learners in upper group can subvocally rehearse faster and rehearse longer speech sound sequences within 2 seconds than can lower group learners. Learners' memory span is largely affected by their rehearsal speed, which in turn affects listening comprehension. Many studies have proposed the following three points: (1) "the primary function of the phonological loop is the processing of the novel speech input" (Baddeley et al., 1998: 170); (2) the phonological loop seems to provide "a back-up process" by repeating the novel speech input (Baddeley, 1999: 55); (3) verbal repetition of unfamiliar sound patterns in the phonological loop promotes long-term learning. The phonological loop plays a crucial role when novel speech input is comprehended and especially when it is given a foreign language. It is quite reasonable to

hypothesize that auditory short-term memory span, i.e., the capacity of the phonological loop, affects listening comprehension ability.

4.4. Research Question (2)

By choosing students whose written test scores were within the same level, the second research question considered the relationship between reading rate and listening comprehension ability. To achieve this aim, two groups were prepared, based on their reading rate and written test scores. The learners who were able to read 88 to 145 wpm with their written test scores ranging from 92 to 132 were classified as the upper group (N=20). Those whose reading rate was from 35 to 51 wpm with their test scores from 93 to 131 were classified as the lower group (N=20). Only students whose English scores for the written test were within the same range, while their reading rates were different, were targeted on this analysis, because our interest was mainly in exploring how learners' reading rates affect the listening comprehension ability when their scores for written tests were within the same level.

Table 4 Descriptive statistics of written test and listening test scores for upper group and lower group based on reading rate

		Written Test				Listening Test			
	N	Min	Max	Mean	SD	Min	Max	Mean	SD
Upper	20	93	132	113.15	9.40	32	89	60.00	14.04
Lower	20	93	131	110.20	11.84	39	78	58.50	11.17

Table 4 shows the descriptive statistics of the written test and listening test scores for the upper and lower groups based on their reading rate. In order to check whether their written test performances were within the same level or not, comparisons were made of the scores of their written tests. No significant difference was found between them ($F(1, 38)=0.72$, ns) and therefore their vocabulary/grammar and reading comprehension levels were considered to be of the same quality. A one-way factorial ANOVA showed that there was no significant difference in the means of listening tests between two groups ($F(1, 38)=0.13$, ns).

An upper group (N=20) and lower group (N=20) for reading efficiency were also prepared, based on student reading efficiency index and written test scores. Their written test scores ranged from 93 to 131 as in the former analysis. A one-way factorial ANOVA revealed that there was no significant difference in the means of listening tests between the two groups ($F(1, 38)=2.01$, ns), though a significant difference was found between them in the means of the written test ($F(1, 38)=8.01$, $p<.01$). This is reasonable because there is a relatively high correlation between the written test and reading efficiency index ($r=.372$, $p<.01$), as seen in Table 2.

The result obtained in this study is that reading rate or reading efficiency does not affect listening comprehension. One reason is that the participants were required to read a passage at

their own pace trying to understand it. Some learners may be able to read a passage faster and understand it if they are asked to read as swiftly as possible. Another reason is that listening rates were not taken into consideration because listening rates were not modified. It is also possible that reading rate or reading efficiency index may not affect listening comprehension in cases where vocabulary/grammar and reading comprehension performances are within the same level.

Hirai (1999) investigated the relationship between listening and reading rates of Japanese EFL learners and found that those students who had higher English proficiency were able to read more swiftly and comprehended faster speeches. In this study, as shown in Table 2, significant differences were found between the written test and listening comprehension ($r = .290$, $p < .01$), the written test and reading rate ($r = .220$, $p < .01$), and between the written test and reading efficiency index ($r = .372$, $p < .01$). When all the participants were divided into two groups based on their scores for written tests, ANOVAs revealed that significant differences were observed in the mean scores of the reading rate ($F(1, 230) = 10.52$, $p < .01$) and reading efficiency index ($F(1, 230) = 27.81$, $p < .01$). This result is congruous with the result obtained in Hirai (1999) that those students who have higher English proficiency are able to read faster, though measurements used in the respective studies were different.

4.5. Research Question (3)

Table 2 shows that a significant correlation was observed between articulation speed of English words and English repeatability ($r = .312$, $p < .01$). A significant correlation was also found between English repeatability and listening comprehension ability ($r = .281$, $p < .01$). On the other hand, no correlation was found between English articulation speed and listening comprehension ($r = .093$, ns). In this study, the articulation speed of English words was measured as the number of syllables read aloud in 2 seconds. The average number of syllables was 6.57. On the other hand, in the repeatability test, the participants were presented with English sentences ranging from 4 to 16 syllables and were asked to orally repeat what they heard immediately after each sentence. Since the average number of syllables was 7.02, it is surmised that learners could articulate 7.02 syllables in about 2 seconds with the capacity of the phonological loop and with the help of their prior declarative knowledge in long-term memory. Tauroza & Allison (1990) estimated standard rates of speech and noted that the average number of syllables per minute is 230-280, which is 7.67-9.33 syllables per 2 seconds. These figures showed that the number of syllables Japanese learners could articulate in 2 seconds or the number of syllables they could repeat with the limited capacity of the phonological loop is not good enough.

A significant relationship between English repeatability and listening comprehension ability was discovered in this study. It can be said that learners with high repeatability for English sentences are able to rehearse faster, and this high rehearsal speed in turn enables them to rehearse longer aural speech input before its echoic trace decays. This result is consistent with the idea

that the capacity of the phonological loop has a time constraint, which is determined by rehearsal speed. To summarize, learners' English repeatability, the ability to repeat English utterances fast and accurately, is considered to be a determinant factor in predicting their listening comprehension ability.

5. Implications for Pedagogy and Further Research

The results concerning the research question (1) indicate that short-term memory is one of the factors that affects listening comprehension. It can be said that auditory short-term memory, the capacity of the phonological loop, is largely affected by the learner's rehearsal speed. Practice in repeating English input quickly and accurately should be given in English instruction. Futatsuya & Kaneshige (2000) examined the relationship between rehearsal speed and listening comprehension by using a repetition task and found articulation speed and recognition accuracy are the two determining factors that help predict their aural comprehension ability fairly accurately. They also found that listening comprehension is improved by intensive practice in accelerating rehearsal speeds up to normal speed with phonological accuracy. Tamai (2005) examined the effect of shadowing practice on listening ability. He found that shadowing does not necessarily work on the reinforcement of declarative knowledge of English such as vocabulary and grammar but rather works strongly on the strategic aspect of listening. It is considered that shadowing also activates the phonological loop of working memory, and that it eventually promotes listening comprehension.

Furthermore, repetition practice with recognition accuracy — initially with short sentences then gradually longer sentences — should be given because it helps make effective use of the phonological loop and back up longer speech input.

According to the results related to the research question (2), it cannot be said that reading rate affects the listening comprehension ability of Japanese learners of English in cases where their English scores for written tests were within the same level. In this study, listening rates were not examined because listening rates were not modified. As for their reading rate, the learners were asked to read a passage at their own pace trying to understand it. However, some learners may have been able to read a passage faster and understand it if they were told to. Further study is needed to verify this point. Although no significant correlation was found between reading rate and listening comprehension ($r = .067$, ns), a significant correlation was discovered between reading efficiency index and listening comprehension ($r = .162$, $p < .05$). When all the participants were divided into two groups based on reading efficient index, a one-way factorial ANOVA showed that there was a significant difference in the means of listening tests between them ($F(1, 230) = 4.51$, $p < .05$). It is reasonable to assume that fast reading with accuracy may affect listening comprehension ability. One possible area of study in the future lies in confirming this. Moreover, students with higher written test scores were able to read faster

and more accurately. This is a very interesting result because they were simply told to read a passage at their own pace trying to understand it.

Interpretation of the results concerning research question (3) overlaps with that of research question (1). This clearly indicates that English repeatability is one of the factors that determine listening comprehension ability. Although significant correlations were found between English articulating speed and vocabulary/grammar ($r = .245$, $p < .01$) and between English articulation speed and reading comprehension ($r = .338$, $p < .01$), no significant correlation was observed between English articulating speed and listening comprehension ($r = .093$, ns). Further study is needed to answer such unresolved questions.

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