論文

The Effect of the Attentional Aspect of Language Processing on Sound Perception in L2 Repeating Compared to L2 Shadowing for Japanese EFL Learners

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1. Introduction

English-repeating training requires learners to listen to a certain amount of auditory input and then repeat it during a pause following the input. This training is similar to shadowing training, which requires learners to reproduce the model sounds almost simultaneously with the input. Both trainings require learners to reproduce model sounds, but the cognitive processes involved in shadowing and repeating are very different (Kadota, 2007). The former is an immediate online repetition task, which forces learners to focus on sounds themselves, whereas the latter is an offline task, which provides learners with sufficient time to analyze the input semantically, syntactically, and pragmatically before they reproduce the input. Shiki et al. (2013) empirically investigated the cognitive difference between shadowing and repeating by comparing type of reproduced words (i.e., content word and function word) between two trainings. The results indicated that participants who engaged in shadowing practices more successfully reproduced content words (i.e., "eleven thousand" and "Tokyo"), which are typically pronounced strongly and loudly, than did those who engaged in repeating practices. On the other hand, participants who engaged in repeating practices more successfully reproduced function words (i.e., "from" and "the"), which are typically pronounced weakly and quickly, than did those who engaged in shadowing practices. The study suggested that participants who performed shadowing rehearsed only phonologically emphasized input (i.e., content words) that they could catch under rigorously time-pressured conditions and that they had little time for additional processing (i.e., semantic, syntactic, or pragmatic processing), whereas repeating enables learners to add function words, which L2 learners find difficult to catch, when they reproduce the input as a full sentence.

As mentioned above, the main cognitive difference between shadowing and repeating is learners' attentional direction during these tasks. The former directs their attention to phonological aspects, whereas the latter directs their attention to content aspects (i.e., semantic, syntactic, or pragmatic). The repeating process includes various types of processing (i.e., semantic, syntactic, and pragmatic), such that it is difficult for

learners to identify what language aspect they should focus on during repeating tasks. This study investigates whether attentional direction to semantic, syntactic, or pragmatic aspects of language processing during repeating tasks affects repeating performance (i.e., the rates of successfully shadowed syllables (henceforth, reproduction rates)

2. Literature Review

In repeating practices, the language processing employed by learners includes syntactic, semantic, and pragmatic processing. Each instance of language processing consumes working memory resources, whose capacity is strictly limited (Just & Carpenter, 1992). Therefore, efficient processing for each aspect (i.e., semantic, syntactic, or pragmatic) is a key supporting factor of repeating performance, more so for L2 than for L1 learners, because L2 processing is more resource consuming than L1 processing (Geva & Ryan, 1993; Miyake & Friedman, 1998).

To explore the relationship between reproduction rates and the semantic, syntactic, and pragmatic aspects of language processing, participants' attentional direction should be manipulated systematically under experimental conditions. Several L2 language processing experiments have manipulated participants' attention to certain language-processing aspects according to the type of task they are assigned during reading or listening comprehension. For example, Leeser, Brandl, and Weissglass (2011) required L2 Spanish learners to read grammatically correct and incorrect sentences in a self-paced reading task and to perform a grammaticality judgment task. In addition, Hahne and Friederici (2001) measured event-related potentials when Japanese L2 learners of German were engaging in grammaticality judgment tasks after listening to German sentences in order to explore the cognitive mechanism underlying learners' attention to aspects of syntactic processing.

Following these experimental method, Nakanishi and Yokokawa (2011) manipulated participants' attention to syntactic, semantic, and pragmatic aspects by imposing semantic, grammaticality, or pragmatic judgment tasks during the reading of sentences. The study demonstrated that among these processing aspects, syntactic processing places the heaviest cognitive load on working memory resources for Japanese EFL learners. The authors created four types of reading span tests (RSTs): a standard version (RST 1), a semantically focused RST (RST 2), a syntactically focused RST (RST 3), and a pragmatically focused RST (RST 4). The main results showed that the recall scores of the syntactically focused RST (RST 3) were significantly lower than those of the other RSTs, suggesting that syntactic processing places a heavy cognitive load on working memory resources, thereby leaving few resources for storage functions while Japanese EFL learners are performing RSTs.

Nakanishi (2016) applied the framework of Nakanishi and Yokokawa (2011) to a study of shadowing in order to investigate whether attentional direction (i.e., syntactic, semantic, or pragmatic) during shadowing practices affects learners' shadowing performance (i.e., reproduction rates). The main results indicated that reproduction rates during syntactically focused shadowing do not differ significantly from those associated with other types of shadowing (i.e., prosody shadowing, semantically focused shadowing, and pragmatically focused shadowing), even though processing accuracy scores were the lowest during syntactic shadowing. The results suggested that Nakanishi's (2016) shadowing study showed that L2 learners' attentional direction to syntactic, semantic, or pragmatic aspects of language processing during shadowing does not affect shadowing reproduction rates. However, this may be the case because shadowing does not provide learners with enough time to analyze the input semantically, syntactically, or pragmatically. Therefore, the present study explores whether learners' attentional direction (i.e., semantic, syntactic, or pragmatic) during repeating tasks influences how successfully they reproduce model sounds.

3. Purpose

This study examined whether directing participants' attention to semantic, syntactic, or pragmatic processing aspects during repeating tasks influences their reproduction rates during repeating. Therefore, three research questions (RQs) were addressed:

RQ1: Do reproduction rates vary depending on the type of repeating (i.e., semantic, syntactic, or pragmatic)?

RQ2: Do processing accuracy scores vary depending on the type of repeating (i.e., semantic, syntactic, or pragmatic)?

RQ3: Do repeating performances (i.e., reproduction rates and processing accuracy scores) vary depending on learners' English proficiency?

4. Method

4.1 Participants

A total of 35 Japanese EFL undergraduate students (10 males and 25 females) participated in the study. They were recruited from one private university and one public university in Japan. Their ages ranged from 19 to 25, with an average of 20.86 years. Their proficiencies ranged from lower intermediate to advanced according to their Oxford Online Placement Test (OOPT), with scores ranging from 19 to 103 (M = 59.23). The participants were divided into two groups according to their OOPT total scores (reading score plus listening score), such that the scores were significantly different between the group with higher levels of English proficiency (N= 18, M = 74.44,

range: 58–103, S.D. = 13.156) and that with lower levels of proficiency (N= 17, M = 43.12, range: 19–56, S.D. = 12.129) ($t(33) = 7.312$, $p < .01$). The participants were drawn from the same population as in Nakanishi (2006).

4.2 Materials

Four types of repeating tasks, each including 16 sentences, were created so that the average familiarity of sentences (Yokokawa et al., 2006) and the average number of syllables per sentence were set to be statistically equal among repeating tasks 1–4 (familiarity: $F(3,63) = 1.782$, ns., syllables: $F(3,63) = 1.162$, ns., respectively). All the words within the experimental sentences used in repeating were high-familiarity words for Japanese EFL learners, each with a rating of 5.00 or more on a seven-point scale (Yokokawa et al., 2006). As these sentences constituted model speech used in repeating, these sentences were recorded by a male American native speaker of English, at a speaking rate of approximately 135 words per minute.

4.3 Procedure

All participants completed four types of repeating tasks: a standard repeating task, a semantically focused repeating task, a syntactically focused repeating task, and a pragmatically focused repeating task. Each participant was tested individually on a Windows computer using SuperLab Pro5 psychological experiment software. Each participant's repeating voice were was recorded using digital sound recorders, so that their performance could be analyzed. The order in which the four versions of the repeating tasks were administered was counterbalanced.

(1) Standard version of the repeating task

This repeating task required participants simply to repeat the sentence they heard. The repeating procedure was as follows. The fixation marker was presented for one second on a computer monitor, and the model sound was then relayed to the participants through a headset (e.g., *At the beach, the mother saw the baby boy.*). The participants were required to repeat the oral input immediately after they heard it and then to immediately press the space bar; the next sentence was then heard through the headset following the fixation mark. The participants were then asked to repeat the model sounds once more. This procedure continued until they had repeated 16 different sentences, when an instruction indicated that the session was over.

(2) Semantically focused repeating task

This repeating task aimed to direct participants' attention mainly to the semantic aspect. The Japanese-translation verification task was incorporated into the standard version of the repeating task. The repeating procedure was as follows. After the participants had repeated the experimental sentence, the Japanese equivalent of the

previous English sentence appeared on the monitor. The participants were required to press the B key if the translation was correct (e.g., *The woman had to go to the company party.* その女性は、会社のパーティに行かなければならなかった。) and N if it was incorrect (e.g., *As a young student, he was my friend.* 若い頃、私は彼のことを知らなかった。). Half of the translations were correct and half were incorrect; that is, across the entire test set, eight English sentences appeared with correct Japanese translations, and eight appeared with incorrect Japanese translations. This procedure continued until they had repeated 16 different sentences with Japanese verification tasks, when the monitor indicated the session was over.

(3) Syntactically focused repeating task

This repeating task aimed to direct participants' attention mainly to the syntactic aspect. The grammaticality judgment task was incorporated into the standard version of the repeating task. The repeating procedure was as follows. The participants were required to repeat the model speech and press the B key if the sentence was grammatical (e.g., *The company manager finally accepted her support.*) and N if it was ungrammatical (e.g., *The school meeting was changed his morning schedule.*). Half of the sentences were grammatical and half were ungrammatical, with the condition that across the entire test set, eight sentences appeared in their grammatical forms and eight in their ungrammatical forms. This procedure continued until they had repeated 16 different sentences with grammaticality judgment tasks, when the monitor indicated that the session was over.

(4) Pragmatically focused repeating task

This repeating task aimed to direct participants' attention mainly to the pragmatic aspect. The pragmatic judgment task was incorporated into the standard version of the repeating task. The repeating procedure was as follows. The participants were required to repeat the model sound and press the B key if the sentence was pragmatically plausible (e.g., *To help the sick, the girl became a nurse.*) and N if it was implausible (e.g., *We always wear many jackets in summer.*). Half of the sentences were pragmatically plausible and half were implausible, with the condition that across the entire test set, eight sentences appeared in their pragmatically plausible forms and eight in their pragmatically implausible forms. This procedure continued until they had repeated 16 different sentences with pragmatically focused judgment tasks, when the monitor indicated that the session was over.

5. Results

5.1 Descriptive statistics for repeating tasks

The following data obtained from participants' responses during the repeating practices were statistically analyzed: (1) reproduction rates, which were based on the

number of syllables produced correctly by the participants in all types of repeating tasks, and (2) processing accuracy scores (henceforth, accuracy scores), or the number of sentences correctly processed by the participants in the repeating tasks accompanied by translation verification, grammaticality judgment, and pragmatic judgment tasks (REs 2-4).

Table 1 presents the rates for successfully reproduced syllables. The total number of syllables used in the repeating tasks differed among the tasks (RE1 = 178, RE2 = 191, RE3 = 193, RE4 = 195); for ease of comparison, each reproduction rate will be graded based on a score of 100. A one-way analysis of variance (ANOVA) indicated that the differences among the tests were not significant: $F(3,139) = 2.109$, ns., partial $\eta 2 = .044$.

Table 2 illustrates the number of sentences processed accurately. The one-way ANOVA indicated that there was a significant difference among the tests: $F(2, 104) = 61.950$ ($p < .01$), partial $\eta 2 = .548$. Multiple comparisons showed that the accuracy score was significantly lower in RE3 than in RE2 and RE4 ($p < .01$) and that the accuracy rate was significantly lower in RE4 than in RE2 ($p < .01$).

These results indicate that the repeating type did not significantly affect the success with which syllables were reproduced (RQ1). However, processing accuracy scores differed according to repeating type. This was especially notable with RE3, in which participant attention was directed to the syntactic aspect, and processing accuracy was significantly the lowest (RQ2). This result—namely, that syntactic processing is more difficult and resource-consuming than other types of processing (i.e., semantic and pragmatic processing) for Japanese EFL learners—is in line with the results of Nakanishi and Yokokawa's (2011) reading study and those of Nakanishi's (2016) shadowing study.

Table 1 *Reproduction rates of repeating tasks*

	RE1	RE2	RE3	RE4
Average	73.72	73.91	67.10	70.70
Minimum	37.91	31.77	32.65	41.80
Maximum	100.00	97.40	96.43	98.41
S.D.	12.94	13.25	13.75	12.11

Note. n = 35; mark range: 0–100.

Table 2 *Accuracy scores of repeating tasks*

	RE2	RE3	RE4
Average	14.37	8.66	12.23
Minimum	8.00	4.00	8.00
Maximum	16.00	16.00	15.00
S.D.	1.90	2.63	1.90

Note. n = 35; mark range: 0–16.

5.2 Repeating performances by English proficiency

Table 3 illustrates the mean reproduction rates by participants' proficiency. A 2 (proficiency) × 4 (RE type) ANOVA revealed significant main effects of both proficiency ($F(1,139) = 33.924$, $p < .01$, partial $\eta 2 = .204$) and RE type ($F(3, 139) = 2.569$, $p = .057$, partial $\eta 2 = .055$). However, there was no significant interaction between proficiency and RE type ($F(3,139) = .046$, ns., partial $\eta 2 = .001$.).

Table 4 presents the average accuracy scores for learners with high and low proficiency. A 2 (proficiency) × 3 (RE type) ANOVA indicated significant main effects of proficiency ($F(1,104) = 7.855$, $p < .01$, partial $\eta 2 = .074$) and RE type ($F(2, 104) = 65.156$, $p < .01$, partial $\eta 2 = .568$). However, proficiency did not yield a significant interaction with RE type ($F(2,104) = .206$, ns, partial $\eta 2 = .004$).

As shown in Tables 3 and 4, high-proficiency participants reproduced significantly more syllables and processed sentences more accurately than low-proficiency participants; these results speak to RQ3.

Table 3 *Reproduction rates of repeating tasks by proficiency*

	RE1		SH2		SH3		SH4	
	High	Low	High	Low	High	Low	High	Low
Average	78.94	68.20	79.92	67.55	72.45	61.43	76.69	64.36
Minimum	62.09	37.91	60.94	31.77	52.04	32.65	59.26	41.80
Maximum	100.00	83.52	97.40	83.33	96.43	81.12	98.41	85.71
S.D.	11.09	12.73	11.06	12.63	13.14	12.34	10.29	10.79

Note. High n = 18, Low n = 17; mark range: 0–100.

Table 4 *Accuracy scores of repeating tasks by proficiency*

	RE2		RE3		RE4	
	High	Low	High	Low	High	Low
Average	15.00	13.71	9.33	7.94	12.61	11.82
Minimum	11.00	8.00	4.00	5.00	9.00	8.00
Maximum	16.00	16.00	16.00	12.00	15.00	15.00
S.D.	1.50	2.08	3.22	1.64	1.82	1.94

Note. High n = 18, low n = 17; mark range: 0–16.

5.3 Correlation analysis among task performances

Table 5 presents the correlations between OOPT scores (i.e., total score, reading section score, and listening section score) and repeating performances (i.e., reproduction rates and accuracy scores). Total English proficiency scores produced (or tended to produce) significant correlations with repeating performances, suggesting that higher-proficiency learners tend to exhibit better repeating performances; this finding is consistent with the results discussed in section 5.2.

Table 5 *Correlation among the OOPT and repeating performances*

		Total	Reading	Listening
Reproduction rates	RE1	**0.67	**0.59	**0.63
	RE2	**0.73	**0.63	**0.71
	RE3	**0.69	**0.63	**0.63
	RE4	**0.75	**0.67	**0.71
Accuracy scores	RE2	*0.50	*0.41	**0.51
	RE3	†0.31	0.23	*0.35
	RE4	*0.39	*0.35	*0.37

** $p < .01$, * $p < .05$, † $.05 < p < .01$

6. Discussion

The first goal of the present study was to explore the relationship between certain aspect of processing (i.e., semantic, syntactic, or pragmatic) to which learners' attention is directed and repeating performances (i.e., the rates of successfully reproduced syllables) using various types of RE tasks. Tables 1 and 2 indicate that the successful reproduction rates of speech input during repeating do not significantly differ in relation to the language processing types, suggesting that the aspect of language processing to which participants pay attention during repeating may not interfere with or enhance their sound perception performances. This result is consistent with Nakanishi's (2016) shadowing study.

However, when this study's repeating data and Nakanishi's (2016) shadowing data were statistically analyzed together using a 2 (task: SH/RE) × 4 (type: type 1–4) ANOVA, the main effects for both task and type were significant ($F(1,280) = 276.556$, $p < .01$, partial $\eta 2 = .504$, $F(3,280)=3.534$, $p < .05$, partial $\eta 2 = .038$, respectively), but there were no significant interactions between task and type ($F(3,280) = .818$, ns., partial $\eta 2 = .009$). Furthermore, multiple comparisons showed that the reproduction rates of type 3 were significantly lower than those of type 1 ($p < .05$) and that the reproduction rates of RE were significantly lower than those of SH ($p < .01$). This statistical analysis showed that there is a trade-off relationship between syntactic processing and reproduction rates during shadowing and repeating, suggesting that syntactic processing consumes considerable working memory resources, leaving few resources for sound perception.

In addition, it is possible that reproduction rates in repeating were significantly lower than those in shadowing because repeating is a more cognitively demanding task with respect to working memory, which consists of the phonological store and the phonological loop. The former serves to hold the phonological representations that decay over time, whereas the latter serves to refresh the representations through a rehearsal system (Baddeley, 1986). In repeating tasks, learners have to retain aural input in their phonological store and keep it active in the phonological loop during the pauses before the input is reproduced, whereas shadowing tasks force learners to immediately articulate the input overtly, such that they do not need to retain the input in the phonological store (Miyake, 2009).

The second goal of this study was to examine whether processing accuracy depends on the type of repeating (i.e., semantic, syntactic, or pragmatic). Table 6 shows that RE3 has the lowest accuracy score. RE3 places the cognitive load on syntactic processing by directing participants' attention to a grammaticality judgment task. In addition, processing accuracy in RE4 was significantly lower than in RE2. These results suggest that for Japanese EFL learners, syntactic processing is the most cognitively demanding attentional aspect, followed by pragmatic processing and then semantic processing. This result is also in line with Nakanishi's (2016) shadowing study.

Analyzing repeating and shadowing data together using a 2 (task) × 4 (type) ANOVA analysis revealed that there were significant main effects of type ($F(2,210) = 156.860$, $p <.01$, partial $\eta 2 = .606$), but neither a significant main effect of task ($F(1,210) =1.072$, ns., partial $\eta 2 = .005$) nor a significant interaction between task and type ($F(2,210) = .066$, ns., partial $\eta 2 = .001$). The multiple comparison analysis revealed that the type 3 scores were significantly lower than those of types 2 and 4 ($p < .01$), that type 4 scores were significantly lower than those of type 2 ($p < .01$), and

that RE scores were significantly lower than SH scores ($p < .01$). This two-way ANOVA analysis consistently revealed that syntactic processing places a heavier cognitive load on working memory resources than do semantic and pragmatic processing, regardless of practice type (i.e., shadowing or repeating).

The third goal of this study was to explore whether repeating performance (i.e., reproduction rates and accuracy scores) differs according to English proficiency. The results show that the higher proficiency group performed significantly better than the lower proficiency group and that there was a significant correlation between overall English proficiency scores and repeating performance.

Analyzing repeating and shadowing data together using a 2 (proficiency) × 2 (task) × 4 (type) ANOVA showed that there were significant main effects of proficiency and type ($F(1,210)=16.218$, $p < .01$, partial $\eta 2 = .076$, $F(2,210) = 165.909$, $p <. 01$, partial $\eta 2 = .626$, respectively). However, there were no significant interactions among those variances ($F(2, 210) = .534$, ns., partial $\eta 2 = .005$).

These analyses consistently show that Japanese EFL learners with higher proficiency could employ English sound perception and each type of processing very effectively.

Table 6 *Summary of this study's repeating data and Nakanishi's (2016) shadowing data*

SH/RE	Task	Main processing aspect	Reproduction rates	Accuracy scores
SH1	—	—	93.77	—
RE1			73.72	
SH2	Translation verification	Semantic	92.77	92.13
RE2			73.91	89.81
SH3	Grammaticality judgment	Syntactic	90.85	54.13
RE3			67.10	56.06
SH4	Pragmatic judgment	Pragmatic	90.00	76.44
RE4			70.70	77.31

Notes. Mark range: 0–100. *The maximum processing accuracy score for SH/RE 2, 3, and 4 is 16. However, for ease of comparison with the reproduction rate, the processing accuracy score is graded based on a score of 100.

7. Conclusion

This study explored whether repeating performance (i.e., successfully reproduced rate) depends upon Japanese EFL learners' attention to various aspects of processing (i.e., semantic, syntactic, or pragmatic) by imposing a second processing task (i.e., a translation-verification, grammaticality judgment, or pragmatic judgment task) and

whether the results are different from the shadowing results of Nakanishi's (2016) study. The main outcome demonstrated that the accuracy scores in the syntactic processing task during shadowing and repeating were the lowest. In addition, successful repetition rates declined when attention was directed toward syntactic aspects during shadowing and repeating, compared to the rates when attention was primarily directed to phonological aspects. The results suggest that the cognitive load of syntactic processing is resource consuming, leading to the bankruptcy of working memory resources needed for sound perception.

Future studies should focus on aspects of prosody (i.e., pitch, intensity, and duration) in shadowing or repeating performance and explore the relationship between learners' attentional aspects (i.e., semantic, syntactic, or pragmatic) and prosody aspects, because doing so would contribute to further investigations of cognitive processes in L2 shadowing and repeating.

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