研究論文

Examining the Role of Prosody Shadowing in Sentence Comprehension for Japanese EFL Learners

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1. Introduction

The process of comprehending languages involves multiple stages, such as input perception, lexical, syntactic, semantic, contextual, and pragmatic processing. Notably, syntactic processing, places the greatest cognitive burden on Japanese EFL learners. It exhausts their finite working memory (WM), which leaves limited resources available for memory retention or higher-level cognitive functions, such as inference and contextual processing (Nakanishi & Yokokawa, 2011; Nakanishi et al., 2019).

One reason for the limited automaticity in syntactic processing is that Japanese EFL learners, unlike native English speakers, cannot immediately use prosodic information during sentence comprehension (Nakamura et al., 2020). However, prosody provides the syntactic structure of utterances (Frazier et al., 2006), and sentences that offer such prosodic cues (e.g., pausing at the main clause, raising the pitch) are presumed to lighten the cognitive load on syntactic processing (Kadota, 2007; Nakamura, 2012; Yoshikawa, 2006).

English shadowing, a technique that requires learners to repeat the provided model speech immediately, is expected to help promote automatic syntactic processing. This assumption is based on two factors. First, frequent exposure to sentences with specific syntactic patterns improves the processing of sentences with the same structure, a phenomenon known as syntactic priming (first language: Bock, 1986; Pickering & Branigan, 1998, second language: Morishita et al., 2010; Sakakibara & Yokokawa, 2015). Speakers tend to unconsciously learn and repeatedly use the immediately preceding processed sentence when they create a sentence (Kadota, 2015). Second, shadowing directs learners' attention mainly to prosody aspect and updates their speech database, stored in their mental lexicon, not only at the segmental but also the prosodic level (e.g., pitch range). Some previous studies have reported improvement in Japanese EFL learners' prosody through repeated shadowing training (Hori, 2008; Mori, 2011). For example, Hori (2008) revealed that students' originally narrow pitch range became wider and closer to the pitch range of native English speakers through shadowing the same passages 15 times.

Following these studies, Nakanishi (2023) explored the effects of repeated shadowing with prosodic structures (e.g., “The farmer that the lady loved % grows a crop in the field. : % indicates a prosodic boundary) . The main finding demonstrated that repeated shadowing led to improved accuracy, reading time (RT), and solution time (ST) in the posttest compared to the pretest for all participants. Furthermore, the group with higher proficiency outperformed the group with lower proficiency in terms of accuracy and RT for processing object relative clauses. However, regarding ST, the group with lower proficiency exhibited longer ST during the pretest, although this discrepancy was not observed in the posttest. Notably, the study had limitations, such as the absence of a control group (e.g., a listening training group) to isolate the specific effects of shadowing. Additionally, the participants' proficiency levels were relatively high, even in the lower proficiency group, with most students classified at CEFR levels B1 or B2.

2. Purpose of this study

The purpose of this study was to investigate whether repeated shadowing training aids less proficient learners in processing sentences containing object relative clauses, which are identified as cognitively demanding sentences (Gibson, 1998; Grodner & Gibson, 2005; Hashimoto, 2011, 2012; Sakakibara & Yokokawa, 2015; Yokokawa et al., 2014), as compared to repeated listening training. Furthermore, the study was to explore whether shadowing is particularly beneficial for sentences that carry cognitive load, such as those containing object relative clauses, by comparing them with more syntactically simple sentences (simple transitive sentences).

3. Method

3.1 Participants

The study was conducted with 46 Japanese EFL undergraduates, consisting of 21 males and 25 females. Their language proficiency was assessed via the Oxford Online Placement Test (OOPT), resulting in scores spanning from 11 to 57 (M = 29.09). According to the Common European Framework of Reference for Languages (CEFR), the participants comprised of 10 at A1 (Beginners), 29 at A2 (Pre-Intermediate), and seven at B1 (Intermediate). The participants were split into a listening training group and a shadowing training group. No significant disparity in the average scores between these two groups was observed ($t(44) = -0.788$, ns).

3.2 Procedure

All individuals involved in the study were required to undertake pre/post evaluations (in other words, pre/post reading aloud tests) as well as either listening or

shadowing training tasks. The entire process was carried out in a Computer Assisted Language Learning (CALL) classroom. For the purpose of assessment, the voices of participants during the pre/posttests and during the listening/shadowing training were captured on a computer.

3.2.1 Pre/Posttests

Every participant was required to undertake a reading-aloud test both prior to and subsequent to the listening/shadowing training sessions. The tests included 18 total sentences, including 12 of which were target sentences (relative clause) and 6 filler sentences (see Appendix A). All words incorporated in the sentences were selected from the New JACET List of 8,000 Basic Words (Committee of Revising the JACET Basic Words, 2016). The head nouns in all experimental sentences were animate, citing Traxler et al. (2002) and Hashimoto (2012), since inanimate head nouns simplify the processing of relative clauses, thereby eliminating any influence of animacy on the complexity of processing relative clause sentences.

All the target sentences comprising a relative clause consisted of 12 words (e.g., “The mother that the baby loves washes the dishes in the kitchen."), and filler sentences containing present perfect progressive with a transitive verb consisted of 10 words (e.g., “The baby has been baking a cake in his room."). Different sentences were employed for the pretests and the posttests.

The reading-aloud test incorporated semantic judgment tasks, so half the sentences were semantically correct (e.g., " The expert that the students like teach his subject at the college."). Half were incorrect (e.g, “The climber that the artist wears drew a picture in the studio."). Participants were presented with a total of 18 sentences on paper. They were required to read each sentence aloud and declare "Maru (True) " if the sentence was semantically valid or “Batsu (False)” if it was not.

3.2.2 Listening/Shadowing Training Sessions

The listening/shadowing sessions consisted of 75 sentences of which 50 were target sentences (relative clause) and 25 were fillers (see Appendix B). Every word used in the sentences was chosen from the New JACET List of 8,000 Basic Words. Each target sentence consisted of 12 words (e.g., "The swimmer that the climber meets swims in the sea for the race."), and filler sentence contained 10 words (e.g., “The aunt has been riding a bicycle in the ocean. ").

For auditory guides, a male native American English speaker’s voice was recorded at a rate approximately 188 words per minute (articulation rate). A 0.5-second pause was placed at the appropriate syntactic boundaries (e.g., “The swimmer that the climber meets % swims in the sea for the race.” : % indicates a

prosodic boundary) using Audacity 3.2.1, a freely available sound editing software (Audacity Team, 2021). The waveforms and pitch tracks of the sentences are displayed in Figure 1.

To ensure sentence processing, printed copies of sentences were provided to the participants. Both the listening and shadowing groups received audio sentences at 10-second intervals. While the listening group listened to each sentence, the shadowing group shadowed what they heard. Subsequently, participants of both groups were asked to determine the semantic validity of the sentence, responding with either "Maru (True)" or "Batsu (False)". The training session for both groups lasted approximately 20 minutes.

Figure 1

Example of waveform and pitch contour in target sentence

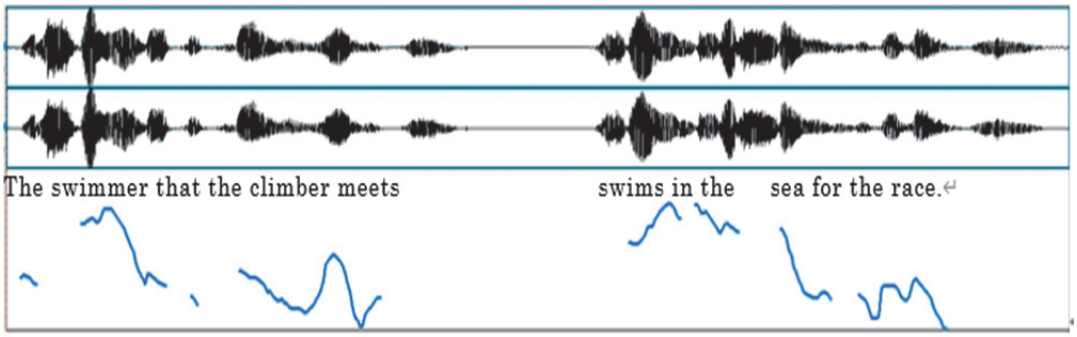
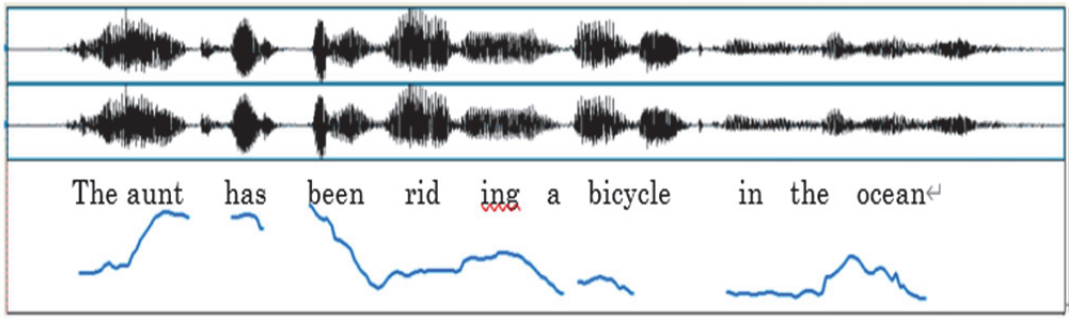


Figure 2

Example of waveform and pitch contour in filler sentence



4. Results and Discussion

4.1 Results of Pre/Posttest Performances for Target Sentence

Tables 1 and 2 provide the descriptive statistics for accuracy (Score), reading time (RT: sec.), and solution time (ST: sec.) in the reading-aloud tests for Target Sentence. Score represents the average number of correct responses in the semantic judgment task. Both RT and ST were measured employing via Audacity, with only those sentences that were accurately answered in the semantic judgment task were included in the measurement. RT indicates the time from the beginning of the sentence to the end of the sentence, and ST indicates the time from the end of reading to the beginning of answering the semantic judgment task.

To compare the effects of training, we did a two- way ANOVA analysis for training type and pre/posttest. Regarding score, the two-way ANOVA revealed no significant main effect in terms of training type ($F(1,88) = .230$, ns, partial $\eta 2 = .003$) but showed significant main effect in terms of pre/posttest ($F(1,88) = 4.167$, $p < .05$, partial $\eta 2 = .045$). The analysis indicated no significant interaction between the variables of training type and pre/ posttest at $F(1,88) = .407$, ns., partial $\eta 2 = .005$.).

As for RT, the results of the two-way ANOVA revealed no significant main effect for training type ($F(1,88) = .011$, ns, partial $\eta 2 = .000$), whereas the main effect of the pre/posttest was significant ($F(1,88) = 7.062$, $p < .01$, partial $\eta 2 = .074$). The RT revealed no significant interaction between training type and pre/posttest ($F(1,88) = .184$, ns, partial $\eta 2 = .002$).

Regarding ST, the two-way ANOVA revealed no significant difference for training type ($F(1,88) = 1.315$, ns, partial $\eta 2 = .015$). However, a significant difference exists between the pretest and posttest ($F(1,88) = 17.716$, $p < .01$, partial $\eta 2 = .168$). The analysis indicated no significant interaction between the variables of training type and pre/ posttest at $F(1,88) = .041$, ns., partial $\eta 2 = .000$).

Table 1

Descriptive statistics of the reading-aloud test data for Listening Training Group

	Score		RT		ST	
Test	Pre	Post	Pre	Post	Pre	Post
Avg.	6.62	7.14	6.75	6.17	3.37	1.94
S.D.	1.99	2.13	1.05	0.87	1.59	1.04

Table 2

Descriptive statistics of the reading-aloud test data for Shadowing Training Group

	Score		RT		ST	
Test	Pre	Post	Pre	Post	Pre	Post
Avg.	6.56	7.56	6.84	6.03	2.93	1.64
S.D.	1.71	1.29	1.76	1.06	2.20	0.98

4.2 Results of Pre/Posttest Performances for Filler Sentence

Tables 3 and 4 provide the descriptive statistics for Score, RT, ST in the reading-aloud tests for Filler Sentence.

To compare the effects of training, we did a two- way ANOVA analysis for training type and pre/posttest. Regarding score, the two-way ANOVA revealed neither significant main effect in terms of training type (F (l,88) = .147, ns, partial η2 =.002) nor pre/posttest (F (l,88) = 2.856, ns, partial η2 =.031). The analysis indicated no significant interaction between the variables of training type and pre/posttest at F (l,88) = .532, ns., partial η2 =.006).

As for RT, the results of the two-way ANOVA revealed neither significant main effect for training type (F (l,88) = .796, ns, partial η2 =.009) nor pre/posttest (F (l,88) = 3.016, ns, partial η2 =.033). The RT revealed no significant interaction between training type and pre/posttest (F (l,88) = .031, ns, partial η2 =.000).

Regarding ST, the two-way ANOVA revealed no significant difference for training type (F (l,88) = .037, ns, partial η2 =.003). However, a significant difference exists between the pretest and posttest (F (l,88) = 7.627, $p < .01$, partial η2 =.080). The analysis indicated no significant interaction between the variables of training type and pre/ posttest at F (l,88) = .176, ns., partial η2 =.002.).

Table 3

Descriptive statistics of the reading-aloud test data for Listening Training Group

	Score		RT		ST	
Test	Pre	Post	Pre	Post	Pre	Post
Avg.	4.29	4.52	4.49	4.18	2.33	1.47
S.D.	1.19	1.33	0.82	0.64	1.19	0.89

Table 4

Descriptive statistics of the reading-aloud test data for Shadowing Training Group

	Score		RT		ST	
Test	Pre	Post	Pre	Post	Pre	Post
Avg.	4.20	4.80	4.31	4.06	2.07	1.43
S.D.	1.04	1.19	0.83	0.76	1.88	0.87

5. Discussion

The first goal of the present study was to explore whether the repeated shadowing training can benefit lower-proficiency learners in comprehending object relative clauses, which are known to be cognitively strenuous for Japanese English learners, relative to repetitive listening training.

Tables 1 and 2 show that both the shadowing and listening groups experienced improvements in processing object relative clauses. Notably, not only did the processing accuracy of these clauses increase, but the reading and comprehension times for them also sped up.

There are two main reasons for the observation of this training effect in the listening group. One is that repeated encounters with the target sentence resulted in syntactic priming, facilitating the processing of that specific sentence structure. The occurrence of syntactic priming is reported to be apparent not only in language production but also in language comprehension. According to findings by Noppeney and Price (2004), a succession of sentences bearing similar syntactic structures leads to a reduction in the time required to process subsequent sentences. The other reason is that the speech involving object relative clauses used in both listening and shadowing group provided sufficient prosodic cues (including pauses and pitch rises at syntactic boundaries), which served to promote comprehension in both the shadowing and listening groups. As Nakamura et al. (2015) noted, in contrast to English native speakers, Japanese EFL learners often struggle to utilize prosodic cues effectively in syntactic construction. This problem is particularly noticeable among less proficient learners (Nakanishi, 2021a). However, through repeated exposure to sentences in which prosodic and syntactic information coincide, they may gradually acquire the ability to utilize prosodic cues in the construction of sentences.

The second purpose of this study was to examine whether shadowing proves to be especially valuable when processing sentences carrying significant cognitive load, such as containing object relative clauses, by comparing them to sentences with simpler syntactic structures (i.e., simple transitive sentences).

As Tables 3 and 4 show, the training effect was not as apparent in sentences with low cognitive load as in sentences with high cognitive load. Specifically, when comparing pre- and post-training, only ST was significantly faster, but no significant differences were found in score and RT. In previous investigations into prosody and syntactic processing in first languages, syntactically ambiguous sentences (e.g., "Whenever the guard checks the door % it's locked") are frequently employed as experimental sentences (Speer et al., 1996; Snedeker & Trueswell, 2003). Extending this line of research to second language learners, Nakanishi (2021b) revealed that more proficient learners were less reliant on prosodic cues in comprehending syntactically simple sentences as compared to their usage in understanding syntactically complex sentences. Therefore, it is suggested that prosodic cues can be more effectively utilized in the interpretation of syntactically complex sentences.

5. Conclusion and Further study

The findings from this study suggest that learner's syntactic processing can be enhanced through repetitive processing of sentences where prosodic and syntactic boundaries align, regardless of whether the approach is shadowing or listening. It also appears that this training method may be more successful when dealing with sentences of a higher syntactic complexity.

Subsequent exploration will involve comparing prosodic attributes of learners' speech during the pre- and post-training assessments across both shadowing and listening approaches. One of the observed benefits of shadowing is the enhancement of prosodic features like pitch in learners' English expressions (Mori, 2011). Acoustic analysis will be used to determine whether shadowing enables learners to assign prosodic information that clarifies syntactic boundaries when they speak syntactically complex sentences.

Acknowledgment

This study was partially supported by JSPS Grant-in-Aid for Scientific Research (C), (PI: Hiroshi Nakanishi, No. 23K00786).

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Appendix A

Sample Target Sentences for Pre/Post-Reading-Aloud Test

Target Sentences

The fighter that the lady loves won the matches in the ring.

The owner that the drivers drank checked the cars on the street.

Filler Sentences

The leader has been eating the team in the park.

The driver has been driving his car on the road.

Appendix B

Sample Target Sentences for Listening/ Shadowing Training

Target Sentences

The swimmer that the singer ate sings a song on the spot.

The author that the readers loved writes a book in his style.

Filler Sentences

The writer has been writing the play for the actors.

The mother has been cooking her children for a meal.