Strategic processing and predictive inference generation in L2 reading

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Abstract

Predictive inference is the anticipation of the likely consequences of events described in a text. This study investigated predictive inference generation during second language (L2) reading, with a focus on the effects of strategy instructions. In this experiment, Japanese university students read several short narrative passages designed to elicit predictive inferences under instructions either to understand the passage or to anticipate the outcome of the events described. Each passage was followed by a lexical-decision probe word that was related to the expected inference. In addition, a cued recall task was conducted after reading all the passages. Analysis of lexical decision times revealed that inferences were generated during reading only when instructions encouraged predictions. Furthermore, the facilitation effect of instructions was prominent among higher L2 proficiency readers. The results of the recall task showed that readers' comprehension of explicit text information was not impaired by focusing attention on implicit predictive information.

Keywords: reading process, inference generation, predictive inference, strategic processing, narrative texts, Japanese EFL learners

Reading a text requires several cognitive abilities such as memory, problem solving, and making *inferences*. In text reading, inferences are defined as processes through which (a) readers' relevant background knowledge is activated, and (b) a subset of implicit text information is encoded in the text representation (Graesser & Kreuz, 1993; Graesser, Singer, & Trabasso, 1994). During the past three decades, readers' inferential processing has received attention from numerous researchers in psycholinguistics and from educators as well. This is because inference generation plays a significant role in reading comprehension by establishing textual coherence or embellishing what is explicitly stated in the text.

As inference generation is of critical importance in reading, the ability to make appropriate inferences about a text is often contained in syllabi. Moreover, it is measured in formal language tests for both first (L1) and second (L2) language reading. Chikalanga (1992) further suggested that L2 teachers should know what types of inferences can be produced in reading, and proposed taxonomies of inferences for teaching and assessing L2 reading.

Thus far, only a few empirical studies have examined whether L2 learners generate inferences during reading and what types of inferences they make. Consequently, this study was carried out

to explore inference generation in L2 reading with a specific focus on *predictive inferences*. The next section describes the theoretical framework and experimental evidence pertaining to the fundamental notion of predictive inferences.

Theoretical Framework and Experimental Evidence for Predictive Inferences

There are several types of inferences that can be produced in text reading (see Chikalanga, 1992; Graesser et al., 1994; Mckoon & Ratcliff, 1992), such as inferences about causal antecedents of described events, or referential words. For example, when reading the sentences *The spy threw the report into the fire. The ashes floated up* (Singer & Ferreira, 1983), readers infer that the burning report is the causal antecedent of the event described in the second sentence. Likewise, when reading the noun phrase *the criminal*, readers infer that it refers to the same person introduced earlier in the story as the burglar (McKoon & Ratcliff, 1980). Previous studies have established two major theories of inference generation during reading: the minimalist hypothesis (McKoon & Ratcliff, 1992) and constructionist theory (Graesser et al., 1994). The main difference between these two theories concerns expectations about the type of inference generation required to establish global textual coherence; the constructionist model suggests that inferences to establish global coherence can be drawn during the course of comprehension, whereas the minimalist hypothesis suggests that these inferences cannot be drawn (see Graesser et al., 1994, for discussion).

Of the group of possible inferences that may occur during reading, however, many previous studies have focused on predictive inference, which is the anticipation of the likely outcome of an event described in a narrative text. For example, consider the following sentences:

1. Brad had no money but he just had to buy something special for a present for his wife's birthday. In the accessories department, he saw an expensive ruby ring sitting in a display. Seeing no salespeople or customers around, he quietly made his way closer to the display and opened his bag. (adapted from Klin, Murray, Levine, & Guzmán, 1999)

After reading these sentences, readers are likely to predict that the outcome of the event is that Brad stole the ring in the display. Another example of predictive inference is presented below:

2. Steven had been married for years. Today, he was angry with his wife because she had left home without washing the dirty dishes in the kitchen sink. His resentment had been building up. No longer able to control himself, he threw a delicate glass vase against the wall. (adapted from Klin, Guzmán, & Levine, 1999)

Most readers would predict that the breaking up of the vase is a highly probable consequence of the event described in these sentences. As demonstrated in these examples, predictive inference generation is the activation of likely outcomes of described events during reading.

Researchers have claimed that readers benefit from generating predictive inferences. For example, drawing predictive inferences during reading eases processing of the subsequent context, promotes construction of situation models (the ideal form of mental representation), and

encourages active engagement with the text (Allbritton, 2004; Fincher-Kiefer, 1993; Linderholm, 2002). Furthermore, making predictions while reading is often regarded as an effective comprehension strategy (e.g., Carrell, 1989; Palincsar & Brown, 1984). Day and Park (2005) suggested that asking students what might happen next in a described situation helps them become more interactive readers.

According to the two theories by minimalist and by constructionist theory, predictive inferences are typically unlikely to be drawn on-line (i.e., during the course of reading). However, both theories suggest that the likelihood of inference generation should increase under certain conditions. Consistent with these theories, experimental evidence has shown that predictive inference generation during L1 reading is affected by several factors such as the degree to which the text constrains a possible inference (i.e., contextual constraint) (e.g., Cook, Limber, & O'Brien, 2001; Klin, Guzmán, et al., 1999), whether or not the inferences are related to narrative characters' goals or motivation (e.g., Klin, Murray, et al., 1999), the reading purpose or strategy (e.g., Allbritton, 2004; Calvo, Castillo, & Schmalhofer, 2006), the readers' working memory (WM) capacity (e.g., Linderholm, 2002), and their reading ability (e.g., Murray & Burke, 2003).

Most past studies analyzed lexical decision or naming times for a target word that represented the inference concepts (e.g., *steal* or *break* for the example sentences above), which were collected immediately after reading. If readers activate inference concepts on-line, correct responses to these target words should be facilitated because lexical access will be primed by inference activation. Therefore, correct response times to target words should be shorter for contexts that induce predictive inferences such as the above examples (i.e., predictive contexts), than for contexts that are unlikely to elicit inferences (i.e., control or neutral contexts).

Of several possible factors affecting predictive inference generation, many researchers have focused on the effects of contextual constraint. Specifically, they demonstrated that predictive inferences are more likely to be drawn during reading when the context strongly constrains the possible inferences than when it weakly constrains them (e.g., Cook et al., 2001; Klin, Guzmán, et al., 1999). The two examples quoted above draw strongly predictive inferences, which could point to a single and specific outcome. In contrast, readers are less likely to generate target inferences when reading about a plastic vase being thrown against a wall than a delicate glass vase (as in Example 2), because the context predicts two outcomes (i.e., the vase will or will not break); that is, inference is weakly constrained by the context (Casteel, 2007; Klin, Guzmán, et al., 1999).

In addition, several studies have suggested that predictive inferences are more likely to be generated when they are related to narrative characters' goals or motivation (Klin, Guzmán, et al., 1999; Klin, Murray, et al., 1999). The expected inference in Example 1 (i.e., stealing the ring) is not only a possible outcome of the described event, but also the motivation or cause of the described character's actions (i.e., approaching the display and opening his bag). In other words, the inference explains why the character performed the intentional actions described in the passage. Thus, this inference is necessary to maintain the local coherence of the text, which is called a *motivational inference*.[1] In contrast, the expected inference in Example 2 (i.e., the breaking up of the vase) is purely the result of the event described in the passage, and is less related to the character's goals or motivation. This kind of predictive inference—called a

consequence inference—only serves to embellish the passage; it is not necessary to preserve the local coherence of the text. Klin and colleagues (Klin, Guzmán, et al., 1999; Klin, Murray, et al., 1999) demonstrated that consequence inferences are only generated when they are strongly constrained by context, whereas motivational inferences are generated regardless of the strength of contextual constraint. In sum, predictive inferences are classified into two subcategories, motivational and consequence, and evidence has shown that readers are more likely to generate motivational inferences than consequence inferences.

Other studies have investigated the effects of strategic processing on predictive inference generation during reading (e.g., Allbritton, 2004; Magliano, Trabasso, & Graesser, 1999; van den Broek, Lorch, Linderholm & Gustafson, 2001). Strategic processing refers to readers' actions aimed at accomplishing a specific task and/or reading goal. These studies often involve a pre-reading instructional set to encourage strategic processing. For example, in Magliano et al. (1999), participants were instructed to read passages for explanation, prediction, association, or understanding. The analysis of think-aloud protocols during reading demonstrated that participants strategically controlled the inferences they generated according to instructions. Specifically, the participants produced more predictive inferences in the prediction condition than in the understanding condition. In addition, van den Broek et al.'s (2001) analysis of think-aloud protocols revealed that participants made more predictive inferences when reading passages for study versus entertainment. Furthermore, Allbritton (2004) investigated the strategic production of predictive inferences using a lexical decision task and manipulating the post-reading task. In this study, readers provided evidence of predictive inference generation when they were asked to write a sentence that continued the story, but not when asked to answer a literal comprehension question about the story. In short, previous studies suggested that predictive inference generation during reading can be facilitated by explicit instructions and/or tasks encouraging readers to strategically process the text.

Researchers have also identified reader variables related to predictive inference generation. For instance, Murray and Burke (2003) demonstrated that skilled readers had shorter naming latencies for inference-related words for a predictive context than for a control context, but less-skilled readers did not. This suggests that reading ability affects the likelihood of on-line predictive inference generation. In another study, Linderholm (2002) found that readers with high WM capacity were more likely to generate predictive inferences than were those with low WM capacity.

As reviewed above, a substantial number of L1 studies have been conducted, and the results of these studies suggested that several factors (e.g., contextual constraint, subtypes of inferences, strategic processing, and reading skills) affect predictive inference generation during reading. In contrast, predictive inference generation in L2 reading has only been examined in a limited number of studies. The following section provides a detailed review of these studies.

Predictive Inference Generation in L2 Reading

Horiba (1996) and Yoshida (2003) investigated what types of inferences are produced during L2 reading using a think-aloud methodology. They found that L2 readers make several types of

inferences, including predictive inferences, during reading. In addition, these studies revealed that the frequency of predictive inference generation was influenced by readers' L2 proficiency. Horiba (1996) reported that L2-Advanced readers (native English speakers learning Japanese) produced predictive inferences as frequently as L1 readers (native Japanese speakers), but L2-Intermediate readers were less likely to produce them. This study attributed the limited production of predictive inferences among L2-Intermediate readers to the fact that these readers needed to allocate more cognitive resources to lower level reading processes such as word recognition and syntactic analysis. As a result, L2-Intermediate readers did not have sufficient cognitive resources to engage in higher level processing such as inference generation. Similarly, Yoshida (2003) reported that Japanese university English-as-a-foreign-language (EFL) students with high L2 proficiency more frequently produced elaborative inferences (including predictive inferences) than did those with low L2 proficiency.

However, both Horiba (1996) and Yoshida (2003) focused on the generation of several types of inferences during reading, and did not closely examine predictive inferences. Consequently, Nahatame (2013a) conducted an experiment with Japanese university EFL students that used a word recognition task to directly investigate predictive inference generation during L2 reading. This study manipulated experimental passages in terms of subtypes of inferences (motivational vs. consequence) and contextual constraint (strong vs. weak). Analysis of recognition times for inference-related words suggested that participants were most likely to generate predictive inferences when the inferences were motivational and strongly constrained by the context. In contrast, regardless of the strength of the contextual constraint, there was no evidence of predictive inference generation with consequence inferences. In a subsequent investigation using a lexical decision task, Nahatame (2013b) confirmed a higher likelihood of inference generation when motivational inferences were strongly constrained by the context. Together, Nahatame's (2013a, 2013b) studies revealed that text characteristics (i.e., subtypes of inferences and contextual constraint) affect the likelihood of predictive inference generation during L2 reading.

Nevertheless, it should be noted that participants in Nahatame's (2013a) study were instructed simply to read the passages for accurate comprehension. Therefore, it is possible that L2 readers are more likely to generate predictive inferences on-line when they are explicitly instructed to predict what will happen next. To examine this possibility, it is necessary to investigate the effects of strategy or task instructions on predictive inference generation during L2 reading. Horiba (2000, Experiment 2) provided significant insight into this point. In this study, L1 and L2 readers (Japanese as a first and second language) were told to read passages either freely (i.e., read normally) or for coherence (i.e., read to pay attention to how the current sentence relates to prior and incoming text). Participants' think-aloud responses indicated that L1 readers in the read-for-coherence condition generated more backward and forward (i.e., predictive) inferences than those in the read-freely condition. In contrast, there were no significant differences for L2 readers in the pattern of text processing between the two reading conditions. Although qualitative analysis suggested that L2 readers tried to alter text processing according to instructions, large amounts of their cognitive resources were allocated to lower level processing, regardless of instruction type. Horiba attributed this result to L2 readers' limited language proficiency, wherein the demands of lower level processing inhibited them from strategically altering their higher level processing mode.

In a more recent study, Horiba (2013) compared the effects of three different task instructions on Japanese university EFL students' text processing. Participants were told to (a) pay attention to words and expressions in the text, (b) visualize described events, or (c) compare the author's views with their own. Consistent with Horiba (2000, Experiment 2), analysis of think-aloud data suggested that although readers tried to allocate resources to various levels of processing according as instructed, the effect of task instructions on text processing was limited. This study further suggested that the relationship between task instruction types and these effects on text processing were likely moderated by readers' L2 proficiency and general comprehension skill.

In sum, Horiba's (2000, 2013) previous findings suggested that the effects of strategy or task instructions on text processing are smaller in L2 compared to L1 reading, due to L2 readers' limited language proficiency. However, there has been only a limited number of studies on the effects of these instructions on L2 text processing. It is also important to note that Horiba (2013) asserted that L2 readers may show more distinct text processing following provision of instructions if they are given more specific instructions or an additional behavioral task (e.g., answering questions). Therefore, further investigation is required to better understand the effects of strategy or task instructions on L2 text processing. In particular, as previously assessed in L1 research, it is necessary to conduct L2 research that examines the relationship between a particular type of instruction (e.g., instructions to anticipate what will happen next in the text) and a specific reading process (e.g., on-line predictive inference generation).

Purpose, Hypothesis, and Research Questions

The primary purpose of this study is to determine whether predictive inferences are strategically generated during L2 reading following instructions aimed at active predicting. Of the two subcategories of predictive inferences, consequence inferences, rather than motivational inferences, were tested. To clearly examine the effects of strategy instructions on inference processing, this study focused on inferences that L2 readers are less likely to draw during normal reading (Nahatame, 2013a).

The main variable in this study was orienting instructions: in the *non-orienting condition* participants were asked simply to understand the passages, whereas in the *strategic orienting condition* they were instructed to actively anticipate likely outcomes of the described events in each passage. As noted by Horiba (2013), L2 readers may alter their text processing more distinctively depending on instruction type if they are asked to perform an additional behavioral task. Therefore, to confirm that participants in the strategic orienting condition engaged in intended text processing, they were also asked to write a sentence that would continue the story after reading each passage (Allbritton, 2004).

Although previous L1 studies have revealed that predictive inference generation is facilitated by explicit instructions to predict what would happen next (Allbritton, 2004; Magliano et al., 1999), the relationship between inference generation and these instructions does not seem to be straightforward in L2 reading. Based on Horiba's (2000, 2013) findings, it is possible that the effect of strategy instructions on predictive inference generation during L2 reading will be small. Alternatively, the magnitude of the effect may differ according to readers' L2 proficiency level,

such that high-proficiency readers will be more affected by strategy instructions. Thus, this study included readers' L2 proficiency level as a critical reader-related variable.

Some L2 studies have also suggested that the effects of strategy or task instructions are not clearly observed in reading outcomes (e.g., text comprehension assessed by written recall tasks) (Horiba, 2013; Yoshida, 2012). Similarly, previous L1 studies have found that strategy instructions for predictive inferences do not affect comprehension of explicit text information, as assessed by written recall (Magliano et al., 1999) or yes–no comprehension tests (Calvo et al., 2006). However, few studies have examined the effect of strategy instructions for predictive inferences on L2 readers' explicit text comprehension. Therefore, this is another area that requires exploration.

Given that L2 readers were less likely to generate consequence inferences in the absence of specific strategy instructions (Nahatame, 2013a), it is hypothesized that there would be no evidence of on-line inference generation in the non-orienting condition. The primary focus of this study is whether predictive inferences would be generated on-line in the strategic orienting condition among L2 readers. The second focus is the effect of strategic processing on L2 readers' explicit text comprehension after reading. The third focus is the relationship between readers' L2 proficiency levels and the effect of strategy instructions. Thus, one hypothesis (H) and three research questions (RQs) were addressed in this study as follows:

H: L2 readers do not automatically generate predictive inferences during reading when instructed simply to read a passage for comprehension.

RQ1:   Do L2 readers strategically generate predictive inferences during reading when instructed to anticipate likely outcomes of described events?

RQ2:   Does the strategic processing aimed at predictive inferences affect L2 readers' explicit text comprehension after reading?

RQ3:   Does readers' L2 proficiency level affect the impact of strategy instructions on predictive inference generation during reading and that on explicit text comprehension after reading?

In this study, inference generation during reading was primarily assessed with a lexical decision task on inference-related probe words. Furthermore, explicit comprehension after reading was measured with a written recall task. The lexical decision task is one of the most frequently used tools to measure predictive inference activation in reading (e.g., Allbritton, 2004; Campion & Rossi, 2001; Virtue, van den Broek, & Linderholm, 2006). The main advantage of this task is that it permits an on-line measure of inference concept activation—that is, it can arguably tap into the text representations participants construct during reading, which is distinguished from more reflective processes that occur after reading. In addition, compared to the recognition process, lexical decisions are less likely to be affected by context checking because participants have no apparent reasons to compare lexical decision probes to the texts (Allbritton, 2004). In this study, sentence reading times were also analyzed to confirm the effects of strategy instructions on text processing.

Method

Participants

The participants were 40 Japanese undergraduate and graduate students (21 female and 19 male; aged 18–28 years, *M* = 20.55, *SD* =2.00). All participants had studied English as a foreign language for more than six years as part of formal Japanese education and they were assumed to have intermediate-level English proficiency. Before beginning the experiment, participants received an explanation of the experimental procedures and provided written informed consent.

Two participants' data were excluded from the data set because of failure to follow instructions. Additionally, data from one participant were eliminated because the inference activation scores (see Results section) showed extreme outliers in the box plot. Therefore, the analyses were based on data from 37 participants.

Materials

Thirty-two short narrative texts written in English were adopted from several previous studies (Klin, Guzmán, et al., 1999; Motyka Joss, 2010; Virtue et al., 2006) as experimental passages. These included 16 *inference* texts and 16 *neutral* texts. Each text consisted of four sentences. As these texts had been designed for L1 readers, sentence structures were simplified and low-frequency words were replaced with high-frequency synonyms. Most of the texts were derived from those used in Nahatame's (2013a) study.

The inference texts were designed to elicit specific predictions for the outcomes of described events. The context strongly constrained the target inferences, which were less related to characters' goals or motivation. The neutral texts also consisted of four sentences and were similar in length to the inference texts. However, neutral texts described different topics and were unlikely to induce target inferences. The neutral texts were used to provide a baseline measure of inference activation. Table 1 provides a sample of the experimental passages (see also Appendix), and Table 2 provides descriptive statistics for the passages. Twelve filler texts were also used to balance responses in the lexical decision task. The filler texts were similar in length to the experimental texts, but did not elicit any specific inferences.

Table 1. *Sample Experimental Passages, Target Words, and Comprehension Questions*

Inference Text
Steven and his wife had been married for 10 years. Today, Steven was angry with his wife because she had left home without washing the dirty dishes in the kitchen sink. He tried to cool down, but felt his anger rising. No longer able to control himself, he threw a delicate glass vase against the wall. Target word: *break* Question: Had Steven and his wife been married for many years? (YES)

Neutral Text
The person directly next to Steven handed him an answer sheet. Soon, this hard chemistry class would be over. Steven nervously read over his notes one last time. He repeated the chemical sequences aloud to himself. Target word: *break* Question: Did Steven read over his chemistry class notes? (YES)

Table 2. *Number of Words and the Readability of the Experimental Passages*

	M	SD	Max	Min	FKGL	FRE
Inference	50.94	9.16	67	32	5.38	79.68
Neutral	41.19	6.02	53	31	4.73	79.11

Note. FKGL = Mean Flesch-Kincaid Grade Level; FRE = Mean Flesch Reading Ease.

Predictive inference generation is beneficial to readers, but there is a risk of generating inferences that are inconsistent with the subsequent context. This can be problematic because correcting text comprehension may be cognitively demanding (Fincher-Kiefer, 1993). Therefore, to confirm that EFL readers would understand the meaning of the text and generate correct (target) inferences, the present study used inference passages that included simple words and sentences. The context also strongly constrained interpretation to one possible inference.

Each text was paired with a corresponding target word for the lexical decision task (adapted from the same prior studies that the passages were adapted from). Target words for inference and neutral texts were action verbs that represented the predictive inference concept suggested by the inference text (e.g., *break*). All target words paired with the filler texts were pseudowords. Pseudowords were created by rearranging the letters of real words so that they remained pronounceable (e.g., *clak, dal*).

Obtaining reliable priming effects of L2 lexical decisions requires a minimum level of L2 proficiency among participants because lexical decisions "rely on the participants' ability to access and process lexical representations in an automatic manner, with a reasonable degree of accuracy" (Elgort, 2011, p. 371). Studies have identified word-related factors that affect L2 lexical decisions, such as word length, frequency, and familiarity (de Groot, Borgwaldt, Bros & van den Eijnden, 2002; Yokokawa, 2006). Thus, only highly frequent and familiar words were used as lexical decision probes for experimental passages so that intermediate-level learners would have little difficulty accessing and processing them. All target words for experimental passages were three to six letters in length, appeared in the most frequent 2000-word level (Levels 1 and 2) in the JACET List of 8000 Basic Words (JACET Committee of Basic Words Revision, 2003), and had high familiarity ratings on Yokokawa's (2006) 7-point scale. Table 3 shows descriptive statistics for lexical decision probes. These factors (i.e., word length, frequency and familiarity) were counterbalanced across four presentation lists, and there were no significant differences between lists (all Fs < 1).

Table 3. *Length, Frequency, and Familiarity of Lexical Decision Probes for Experimental Passages*

	M	SD	Max	Min
Number of letters	4.31	0.79	6	3
Frequency (JACET 8000 Level)	1.38	0.50	2	1
Familiarity (on a 7-point scale from Yokokawa, 2006)	5.49	0.71	6.36	3.96

In addition to the target words, a simple yes–no comprehension question was constructed for each passage to ensure that participants engaged in text reading (see Table 1 for an example). As in related previous studies, these questions concerned an explicitly stated piece of information.

The experimental texts and orienting conditions were counterbalanced across four presentation

lists using a Latin square. Each presentation list included 16 experimental and 12 filler texts. This ensured that each participant read an equal number of experimental passages in each text type and condition, and that no participant received the same passage twice.

Finally, an English reading proficiency test was created based on retired copies of the reading subsection of The EIKEN Test (constructed by the Society for Testing English Proficiency, Japan). The proficiency test included five passages that were each paired with three to five multiple-choice questions, for a total of 20 items.

Procedure

In the experiment, participants were tested individually and sessions lasted approximately 75 minutes. The English proficiency test (30 minutes) was completed before the main experimental session.

The main session of the experiment was computer-based and administered using SuperLab 4.5 software. Participants were randomly assigned to one of four presentation lists. First, they read general instructions about the experiment on the computer screen. The instructions informed participants that the session consisted of two phases, and that in each phase they would read short narrative passages in English and make a series of yes or no responses to target words. They were also informed that at the end of each phase, they would be asked to recall the content of some of the passages. Participants completed three practice items before each phase following the same procedure used in the experimental session.

Phase 1 was conducted following the general instructions. At the beginning of this phase, participants were instructed to read passages so that they could correctly answer yes–no comprehension questions presented after each passage.

Each trial began with the word *Ready?* presented in the center of the computer screen. When ready to begin the trial, participants pushed the *Yes* button on the Response Pad (RB-730) before the first sentence of the passage appeared. Participants read the passage sentence by sentence at their own pace. Pushing the Yes button removed the current sentence and replaced it with the next one. Reading times for each sentence were recorded in milliseconds (ms) by SuperLab. After reading the final sentence of the passage, pressing the Yes button led to the appearance of a warning signal (XXX) for 750 ms in the center of the screen. The target word flanked by asterisks (e.g., **break**) followed the warning signal. Participants were required to determine if the target word was a word or a non-word as quickly and accurately as possible, using a pair of Yes–No buttons (i.e., lexical decision task). Accuracy and response latencies (ms) were recorded by SuperLab. After responding, another signal (???) appeared for 500 ms and was replaced by a comprehension question. Participants responded again using a pair of Yes–No buttons. After their responses, the question was erased from the screen and then immediate feedback concerning accuracy was automatically presented on the screen. This trial sequence was repeated for each of the 14 passages (eight experimental and six filler passages). Passages were presented in random order.

After reading all the passages in Phase 1, participants engaged in a cued recall task for the

inference texts they had read. Participants received a booklet that displayed the first sentences of these texts. Using the given sentences as cues, they were then asked to write down as much about the passages as possible in Japanese. Participants were allowed an unlimited amount of time to complete the recall task. After the recall task, a short break was provided before starting Phase 2.

The procedure in Phase 2 was the same as that in Phase 1, with the following exceptions. First, at the beginning of Phase 2, participants were instructed not only to read each sentence for comprehension, but also to predict what would happen next in the story (Magliano et al., 1999). Second, instead of a comprehension question (as in Phase 1), an inference question "What will happen next?" appeared on the screen following the lexical decision task (Allbritton, 2004). Participants were asked to write down their answers to the questions in Japanese on a sheet of paper. Similar to Phase 1, after reading all the passages in Phase 2, a cued recall task was completed.

In this experiment, Phase 2 always occurred after Phase 1; that is, the strategic orienting condition always followed the non-orienting condition. The purpose of this order manipulation was to avoid learning effects from the strategic orienting condition on the non-orienting condition. In other words, this manipulation prevented the carryover of strategic reading from the previous trials.

Results

L2 Reading Proficiency Test

After excluding seven low-discriminability items, the reliability of the L2 reading proficiency test was acceptable (Cronbach's α = .70). Before the main analysis, participants were classified into two proficiency groups: the higher (n = 16, M = 11.50, SD = 0.63) and the lower (n = 21, M = 7.71, SD = 2.19) according to a median split of test scores. There was a significant difference in test scores between these two groups, $t(35)$ = 6.67, p < .001, d = 2.21.

Comprehension Questions

Mean correct response rates for the comprehension questions in the non-orienting condition were quite high (note that the participants did not answer the comprehension questions in the strategic-orienting condition). Table 4 shows the mean accuracy (%) on comprehension questions for each text type and proficiency group.

Table 4. *Mean Accuracy (%) on the Comprehension Questions for Experimental Passages in the Non-orienting Condition*

	Inference		Neutral	
Proficiency	*M*	*SD*	*M*	*SD*
Higher	95.31	10.08	95.31	13.60
Lower	93.67	11.72	91.67	12.08
Total	94.38	10.92	93.24	12.70

A mixed two-way analysis of variance (ANOVA) was conducted on mean correct response rates, with text type (inference and neutral) as a within-participants variable and L2 proficiency as a between-participants variable. The results revealed no significant main effects of either text type, $F(1, 35) = 0.12$, $p = .728$, $\eta_p^2 = .00$, or L2 proficiency, $F(1, 35) = 0.93$, $p = .341$, $\eta_p^2 = .00$. There was also no significant interaction between text type and L2 proficiency, $F(1, 35) = 0.12$, $p = .728$, $\eta_p^2 = .00$.

Lexical Decision Task

Prior to analysis, lexical decision data were eliminated if participants mistakenly skipped a sentence in the passage, for fear of partial taint in accuracy and latencies. In addition, response times falling more than 2.5 *SD*s above the mean for each participant were excluded. This resulted in the exclusion of 5.24% of the dataset.

Table 5 shows mean correct response times and error rates for the lexical decision task in each condition. The error rates were quite low in each condition, and overall mean response accuracy was 96.45%.[2] *Inference activation scores* (Graesser, Wiemer-Hastings, & Wiemer-Hastings, 2001; Virtue et al., 2006) were first calculated for individuals. These scores were obtained by subtracting a participant's mean correct response time for inference texts from the mean time for neutral texts in each orienting condition. For example, if a participant's mean response time was 900 ms for the inference texts and 1000 ms for the neutral texts in the non-orienting condition, the mean inference activation score for the participant in the non-orienting condition would be 100 ms. Overall, mean activation scores were then calculated for each proficiency group and each orienting condition. Calculating these scores allowed for a direct and clear comparison of inference activation strength between conditions. If inference generation is facilitated by strategy instructions, activation scores should be higher in the strategic orienting condition than in the non-orienting condition. Figure 1 displays inference activation scores as a function of orienting condition and readers' L2 proficiency.

Table 5. *Mean Lexical Decision Times (ms) for Correct Responses (and Error Rates) by Orienting Condition, Text Type, and Proficiency Group*

	Non-orienting Reading				Strategic Orienting Reading			
	Inference		Neutral		Inference		Neutral	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Higher	872.99 (.05)	253.65	891.76 (.03)	271.52	935.42 (.00)	288.30	1049.99 (.03)	345.01
Lower	873.66 (.06)	205.15	874.56 (.08)	171.75	910.02 (.01)	240.27	917.30 (.01)	240.75
Total	873.37 (.05)	224.03	882.00 (.06)	217.21	921.00 (.01)	258.59	974.68 (.02)	293.66
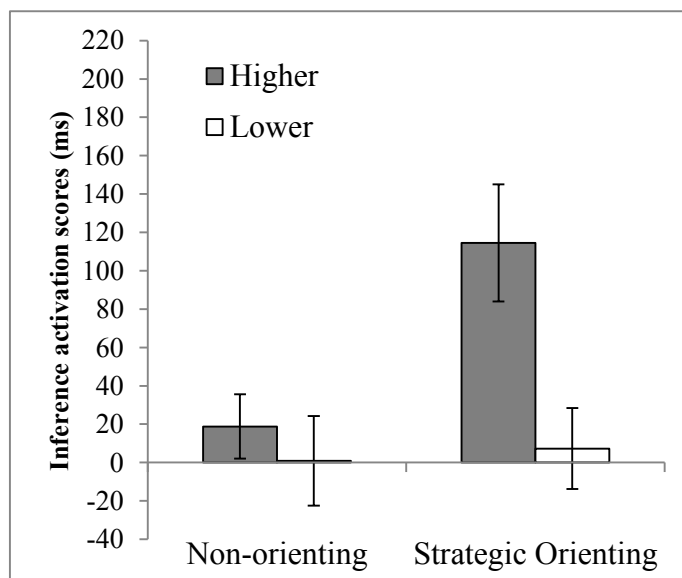
Figure 1. Inference activation scores (ms) as a function of orienting condition and L2 proficiency. Error bars represent the standard errors of the means.

A mixed two-way ANOVA was conducted with inference activation scores as the dependent variable. The independent variables were orienting condition (non-orienting and strategic orienting) as a within-participants factor, and L2 proficiency (higher and lower) as a between-participants factor. The ANOVA results revealed significant main effects of orienting condition, $F(1, 35) = 5.60$, $p = .024$, $\eta_p^2 = .14$, and proficiency, $F(1, 35) = 6.04$, $p = .019$, $\eta_p^2 = .15$. Specifically, activation scores were higher under the strategic orienting condition than under the non-orienting condition (non-orienting: $M = 8.62$, $SD = 91.33$; strategic orienting: $M = 53.68$, $SD = 119.70$). Furthermore, scores were higher for readers with higher compared with lower L2 proficiency (lower: $M = 4.09$, $SD = 97.99$; higher: $M = 66.67$, $SD = 108.40$).

Moreover, there was a significant interaction effect between orienting condition and L2 proficiency, $F(1, 35) = 4.29$, $p = .046$, $\eta_p^2 = .11$. To examine the simple main effects of orienting condition, the means for non-orienting and strategic orienting conditions were compared for each proficiency group using the Bonferroni correction. The simple main effect was significant for higher proficiency readers, $t(15) = 3.50$, $p = .003$, $d = 0.97$, such that there were higher activation scores in the strategic orienting than in the non-orienting condition (non-orienting: $M = 18.77$, $SD = 66.96$; strategic orienting: $M = 114.58$, $SD = 122.08$). This effect was not significant for lower proficiency readers (non-orienting: $M = 0.89$, $SD = 107.26$; strategic orienting: $M = 7.29$, $SD = 96.88$), $t(20) = 0.20$, $p = .840$, $d = 0.06$. Similarly, mean activation scores for higher and lower proficiency readers were compared for each orienting condition. The simple main effect of proficiency was not significant in the non-orienting condition, $t(35) = 0.56$, $p = .563$, $d = 0.16$, but was significant in the strategic orienting condition, $t(35) = 2.98$, $p = .005$, $d = 0.99$, with higher activation scores for higher than lower proficiency readers.

One-sample t tests were also conducted on mean inference activation scores for each condition and proficiency group. These tests determined scores significantly greater than zero, indicating strong inference activation (Virtue et al., 2006). The results revealed that activation scores for

higher proficiency readers were significantly greater than zero in the strategic orienting condition, and the effect size was large, $t(15) = 3.75$, $p = .002$, $d = 0.91$. However, the scores in all the other conditions were not significantly greater than zero and the effect sizes were comparatively small, non-orienting × higher: $t(15) = 1.12$, $p = .280$, $d = 0.27$; non-orienting × lower: $t(20) = 0.03$, $p = .976$, $d = 0.01$; strategic orienting × lower: $t(20) = 0.35$, $p = .734$, $d = 0.07$.

Sentence Reading Times

To better understand the effects of strategy instructions on text processing, mean reading times were calculated for each of the four text sentences. Because each text and sentence had a different number of syllables and words (e.g., inference texts contained an average of 13.13 more syllables than neutral texts), reading times were divided by the number of syllables included in each sentence. As in the analysis of lexical decision times, reading times that were 2.5 *SD*s beyond each participant's mean were removed (2.96% of the dataset). Table 6 reports mean reading times (ms) per syllable for the first to fourth sentences as a function of orienting condition, text type, and proficiency group.

Mean reading times were then analyzed in a mixed three-way multivariate analysis of variance (MANOVA). The dependent variables were first to fourth sentences, and the independent variables were text type, orienting condition, and L2 proficiency. The results indicated significant multivariate main effects of text type, $F(4, 32) = 8.64$, $p < .001$, $\eta_p^2 = .52$, and orienting condition, $F(4, 32) = 5.78$, $p = .001$, $\eta_p^2 = .42$. Any other potential main or interaction effects were neither significant nor marginally significant (all *F*s < 2).

Table 6. *Mean Sentence Reading Times (ms) per Syllable by Orienting Condition, Text Type, and Proficiency Group*

	Non-orienting Reading				Strategic Orienting Reading			
	Inference		Neutral		Inference		Neutral	
	M	SD	M	SD	M	SD	M	SD
First								
Higher	448.69	186.46	492.86	201.08	461.52	145.89	486.35	160.02
Lower	536.50	158.45	545.94	231.10	495.40	171.29	589.92	201.75
Total	498.53	174.29	522.98	217.32	480.75	159.56	545.13	189.71
Second								
Higher	405.19	124.07	459.06	132.82	375.88	123.12	454.53	142.51
Lower	476.76	142.87	502.75	161.73	502.61	206.17	535.73	221.69
Total	445.81	138.01	483.86	149.54	447.81	184.34	500.62	193.46
Third								
Higher	384.68	88.33	413.99	161.43	380.64	114.79	467.48	125.82
Lower	441.60	122.39	509.17	197.23	475.63	184.38	562.77	145.72
Total	416.99	111.31	468.01	186.43	434.55	163.26	521.57	143.82
Forth								
Higher	372.62	107.96	368.03	145.90	431.28	140.41	436.19	142.30
Lower	459.97	181.25	468.22	147.39	559.69	227.89	594.01	213.61
Total	422.20	158.22	424.90	153.20	504.16	203.04	525.76	200.17

Follow-up univariate repeated ANOVAs were conducted on reading times for each sentence to examine on what sentences the effects of text type and orienting condition were prominent. The results revealed that the main effect of text type was significant for all sentences except for the fourth, with shorter reading times for inference texts than neutral texts, $F(1, 35) = 5.40$, $p = .026$, $\eta_p^2 = .13$; $F(1, 35) = 5.98$, $p = .020$, $\eta_p^2 = .15$; $F(1, 35) = 30.81$, $p < .001$, $\eta_p^2 = .47$; $F(1, 35) = 0.72$, $p = .403$, $\eta_p^2 = .02$. More importantly, the main effect of orienting condition was significant only for the third and fourth sentences, $F(1, 35) = 8.50$, $p = .006$, $\eta_p^2 = .20$; $F(1, 35) = 22.01$, $p < .001$, $\eta_p^2 = .39$, but not for the first and second sentence, $F(1, 35) = 0.16$, $p = .900$, $\eta_p^2 = .00$; $F(1, 35) = 0.20$, $p = .658$, $\eta_p^2 = .01$. As shown in Table 6, both proficiency groups of participants took a longer time reading the third and fourth sentences in the strategic orienting condition than in the non-orienting condition. This trend was consistent between inference and neutral texts.

Written Recall

To score recall performance, two raters parsed each inference text into idea units (IUs) by following a procedure used in prior studies (Carrell, 1992; Ikeno, 1996). Each IU consisted of a single clause (main or subordinate, including adverbial and relative clauses). Inter-rater reliability was high for IU segmentation ($r = .95$) and any disagreements were resolved through discussion. The two raters then scored 30% of recall protocols separately, providing one point if participants either reproduced an IU verbatim or paraphrased it. This process resulted in 91.60% agreement. After resolving disagreements, the remaining data were scored by one rater. All recall scores were transformed into a percentage of the total number of IUs in each passage (except for the first sentence used as a retrieval cue). Mean recall production rates (%) are shown in Table 7. An arcsine transformation was also performed on the recall production rates before analysis because each text had a different number of IUs, ranging from 5 to 11.

Table 7. *Mean Recall Rates (%) by Orienting Condition and Proficiency Group*

	Non-orienting Reading		Strategic Orienting Reading	
	M	SD	M	SD
Higher	57.27 (48.80)	14.86 (11.09)	59.32 (51.18)	19.68 (14.97)
Lower	47.15 (42.47)	13.39 (11.66)	51.03 (48.48)	21.71 (12.92)
Total	50.92 (45.21)	15.45 (11.70)	55.30 (49.65)	20.79 (13.71)

Note. The values after an arcsine transformation are shown in parentheses.

A mixed two-way ANOVA was then conducted on recall performance, with orienting condition as a within-participants variable and L2 proficiency as a between-participants variable. The results revealed that the main effect of orienting condition was marginally significant, $F(1, 35) = 3.69$, $p = .063$, $\eta_p^2 = .10$, with better performance in the strategic orienting condition than in the non-orienting condition. However, the main effect of L2 proficiency was not significant, $F(1, 35) = 1.57$, $p = .218$, $\eta_p^2 = .04$. There was also no significant interaction between orienting condition and L2 proficiency, $F(1, 35) = 0.69$, $p = .411$, $\eta_p^2 = .02$.

Discussion

H: L2 readers do not automatically generate predictive inferences during reading when instructed simply to read a passage for comprehension.

The lexical decision time data did not show high inference activation scores in the non-orienting condition. Indeed, the activation scores in the non-orienting condition were not significantly above zero among either higher or lower proficiency readers. These findings support the hypothesis regarding predictive inference generation in the absence of strategy instructions. Specifically, consistent with Nahatame (2013a), the present study confirmed that when given instructions simply to read the passage for comprehension, L2 readers are less likely to generate consequence inferences on-line even though the predictability of the to-be-inferred event is high.

Mean answer rates for the comprehension questions in the non-orienting condition were above 90%. In addition, there was no significant difference in the answer rates between text types. These results support the claim that participants were able to comprehend the experimental passages, regardless of text types. Consequently, the possibility that participants did not make inferences in the non-orienting condition due to poor comprehension of text meaning was ruled out.

RQ1: Do L2 readers strategically generate predictive inferences during reading when instructed to anticipate likely outcomes of described events?

Regarding the strategic generation of predictive inferences, the results pertaining to lexical decision times revealed a significant main effect of orienting condition on inference activation scores, with higher scores in the strategic condition than in the non-orienting condition. This suggests that providing strategy instructions should facilitate predictive inference generation.

Analysis of reading time partially supports the claim that inference generation was facilitated in the strategic orienting condition. In particular, results demonstrated that participants had read the latter part of the text (especially the fourth sentence) for a significantly longer amount of time in the strategic-orienting condition than in the non-orienting condition. This finding suggests that participants altered their text processing according to instruction type by allocating increased effort toward making inferences in the latter part of the text. Additionally, the majority of sentence reading times for inference texts were shorter than that for the neutral texts. It is possible to assume, albeit extending beyond the scope of the study, that this occurred because of the effect of the high level of contextual constraint in the inference texts.

It could be argued that rather than activating predictive inferences, the high inference activation scores observed (i.e., the substantial difference in lexical decision times between inference and neutral texts) were caused by activation of inter-lexical associations as a result of reading words related to the target inferences. Certainly, the inference texts used in this experiment included more words that were semantically related to the target inference probes than did the neutral texts (e.g., *throw, delicate, glass*). However, this argument seems unlikely given that it predicts high activation scores under both non-orienting and strategic orienting conditions because the relationship between the texts and target probes does not differ between these two conditions. In this study, high activation scores were only found when readers were instructed to make predictions.

Further discussion about strategic generation of predictive inferences is described in the response

to RQ3, including the consideration of readers' L2 proficiency level.

RQ2: Does the strategic processing aimed at predictive inferences affect L2 readers' explicit text comprehension after reading?

The results of the written recall task indicated that readers were likely to recall more information from the text in the strategic orienting condition than the non-orienting condition. Therefore, it is possible that strategy instructions about anticipating the outcomes of described events enhance readers' comprehension of explicit text information.

This effect pertaining to strategy instructions was assumed to be the result of readers' active engagement in text processing. In the strategic orienting condition, readers need to process the text more actively and carefully to determine how the text should constrain the possible outcome of events. The aforementioned longer sentence reading time in the strategic orienting condition is indicative of readers' active and careful engagement with the text. Readers also answered a literal yes–no comprehension question in the non-orienting condition, whereas they wrote down a continuing sentence in the strategic orienting condition. This additional task in the strategic orienting condition might further encourage reprocessing or rehearsal of the text. Such careful and repeated processing of the text, therefore, could have strengthened readers' memory for each passage.

Calvo et al. (2006) and Magliano et al. (1999) demonstrated that strategic processing for predictive inferences had no impact on L1 readers' explicit text comprehension. Although the present study suggests positive effects of strategic processing on L2 readers' text comprehension, the results are consistent with these past studies in that strategic processing for predictive inference generation did not reduce explicit text comprehension. One might expect that strategically making predictions during reading is demanding for L2 readers, resulting in impaired comprehension because they require more cognitive effort to comprehend a text than L1 readers did. However, this study demonstrated that L2 readers' comprehension of explicit text information is not impaired when their attention is focused on generating predictive inferences during reading. Nevertheless, it should be noted that the experimental passages used in this study had relatively low WM demands. The passages were short and consisted of simple words and sentences. It is possible that these factors enabled strategic text processing with little cost to the extraction of explicit text information.

RQ3: Does readers' L2 proficiency level affect the impact of strategy instructions on predictive inference generation during reading and that on explicit text comprehension after reading?

As noted in the discussion of RQ1, results demonstrated that there was a facilitation effect of strategy instructions on predictive inference generation during reading. However, as indicated by the significant interaction effect between orienting condition and L2 proficiency on inference activation scores, the effect of strategy instructions was more prominent among higher proficiency readers than among lower proficiency readers. Furthermore, inference activation scores were significantly greater than zero only for higher proficiency readers under the strategic condition.

Horiba (2000, 2013) suggested that flexibility in controlling text processing according to task instructions is affected by readers' language proficiency. Consistently, higher proficiency readers in this study would be better than would lower proficiency readers be at controlling text processing according to instructions. In addition, Murray and Burke (2003) found that skilled L1 readers are more likely to generate predictive inferences on-line than are less skilled readers. The present study denotes similar facilitation effects of L2 reading proficiency, although these effects were enhanced by strategic orienting instructions.

As noted above, analysis of reading time suggests that both higher and lower proficiency readers altered their text processing according to instructions. Given this result, it seems more plausible to state that higher and lower proficiency readers might differ in their ability to activate a particular inference concept during reading according to instructions. Thus, less proficiency readers might possibly have failed to make inferences due to the low-level of inferential activation, even though they were aware of the instructions and their processing mode was altered to some extent.

One might wonder why higher proficiency readers tend to take more time to respond to lexical decision probes than less proficient readers do (see Table 5). Although there were no significant differences between higher and lower proficiency readers' response times in any of the four conditions (all t values < 1.5), response times seem especially slow among higher proficiency readers for the neutral texts in the strategic orienting condition. Given that the neutral texts did not induce specific predictions, this result may be attributed to the inhibition of response times caused by activating inference concepts unrelated to the target probes. Nevertheless, the results consistently suggest that proficient readers should more actively engage in inferential processing during reading than less proficient readers should when they were encouraged to do so.

In contrast to the results of lexical decision times, there was no significant interaction effect of L2 proficiency and orienting condition on recall performance. Thus, recall performance tended to be better in the strategic orienting condition than in the non-orienting condition, regardless of readers' L2 proficiency level. This is the same direction as the results pertaining to reading times for the third and fourth sentences (i.e., longer reading times in strategic orienting condition than in the non-orienting condition for both proficiency groups of participants), which supports the view that readers' active and careful engagement with the text should enhance comprehension of explicit text information. Therefore, rather than predictive inference generation itself, active processing of the text would rather be required to improve comprehension of explicit text information.

Conclusions and Implications

The results of the present study confirm and extend previous findings on inference generation during L2 reading. First, consistent with Nahatame (2013a), lexical decision data demonstrated that predictive inferences (that were not related to characters' goals or motivation) were less likely to be generated on-line during L2 reading when readers were instructed simply to read the passage for accurate comprehension (a support for Hypothesis). Second, lexical decision and sentence reading times presented the facilitation effects of strategy instructions on predictive

inference generation during L2 reading (answer to RQ1). Third, recall production analysis found that strategic processing for predictive inference generation was achieved without reducing L2 readers' comprehension of explicit text information; rather, it likely facilitated comprehension (answer to RQ2). Finally, lexical decision data indicated that the facilitation effect of strategy instructions on inference generation was much stronger among readers with higher L2 proficiency than among those with lower L2 proficiency. However, a similar interaction effect was not observed on recall performance (answer to RQ3).

As mentioned in some studies (Allbritton, 2004; Fincher-Kiefer, 1993; Linderholm, 2002), readers benefit from generating predictive inferences during text processing. For instance, predictive inference generation facilitates integration of the subsequent context into current text comprehension. However, the present study suggests that L2 readers do not always automatically generate predictive inferences during text processing. Consequently, it is recommended that L2 teachers provide pre-reading instructions and questions to direct learners' attention toward predictive inferences. This is especially important when the text implies a predictable event that is highly constrained and less related to characters' goals or motivation. That said, such instructions and questions might only be effective for on-line generation of predictive inferences in higher proficiency readers. Nevertheless, in contrast to giving an instruction to simply comprehend the passage and asking yes–no text comprehension questions, strategy instructions or questions aimed at predictive inferences will encourage both higher and lower proficiency learners' active engagement in and better comprehension of the text.

Limitations of This Study and Suggestions for Future Research

While the findings of the present study offer new insight into L2 text processing, it is important to note its limitations as well as promising directions for future research. First, the present study was limited by participant characteristics such as L2 proficiency (i.e., intermediate level) and L1 background (i.e., Japanese). In other words, it remains uncertain whether the effects of strategy instructions on predictive inference generation and explicit text comprehension differ for advanced or novice level Japanese EFL learners. The issue is important because Koda (2005) suggested that instructions focusing on higher level text processing (including making inferences) could negatively affect reading comprehension for lower proficiency L2 learners.

Second, the orienting condition was a within-participants factor because the focus of this study was on how individuals alter their reading process according to instructions. Participants always read passages in the non-orienting condition prior to the strategic orienting condition so that the strategic orienting instructions did not influence text processing in the non-orienting condition. However, it was difficult to fully rule out the influence of the preceding non-orienting condition trials on the performance in the strategic orienting condition. Thus, an additional experiment should be conducted that includes orienting condition as a between-participants factor or utilizes a control group that performs twice in the non-orienting condition.

Third, the use of a lexical decision task has both advantages (as discussed in the Purpose, Hypothesis, and Research Questions section) and potential disadvantages. For instance, some researchers have claimed that lexical decisions may still be affected by context checking

(Keenan, Potts, Golding, & Jennings, 1990). Additionally, although this study carefully controlled probe characteristics, further research is also required on whether the task adequately reflects inference activation by L2 readers, especially in light of the issue of mental translation (Kroll & Stewart, 1994). Therefore, the present findings need to be further confirmed by combining the task used in the present study with other tasks. For example, Magliano and Graesser (1991) suggested the use of a three-pronged method for investigating inference generation that includes: (a) collection of on-line response time data, (b) collection of think-aloud protocols, and (c) theories of discourse processing (see also Graesser et al., 1994).

Finally, because response time research requires as many trials as possible, the experimental passages in the present study included only short narratives. Thus, it is necessary to investigate how predictive inferences are automatically and strategically generated when reading comparatively long narrative passages such as those adopted from L2 reading textbooks. This approach will be both theoretically and pedagogically important to address in future research on L2 reading.

Acknowledgments

Notes

1. Some researchers may disagree with the inclusion of motivational inferences within the class of predictive inferences because predictive inferences are traditionally considered unnecessary to maintain the local coherence of the text (e.g., Graesser, et al., 1994). However, other researchers have investigated motivational inferences as a subtype of predictive inferences because they represent the prediction of a likely consequence of the described event (Allbritton, 2004; Klin, Murray et al., 1999; Murray & Burke, 2003). The present study adopted the latter understanding of motivational inferences.

2. A 2 (orienting condition: non-orienting, strategic orienting) × 2 (L2 proficiency: higher, lower) ANOVA was conducted on facilitation of response accuracy (i.e., differences in response accuracy between inference and neutral texts). The results showed no significant main effects of orienting condition, $F(1, 35) = 0.19$, $p = .666$, $\eta_p^2 = .01$, or L2 proficiency, $F(1, 35) = 0.02$, $p = .888$, $\eta_p^2 = .00$. The interaction between orienting condition and L2 proficiency was also not significant, $F(1, 35) = 1.78$, $p = .190$, $\eta_p^2 = .05$. It should be noted again that response error rates were quite low in each condition; thus, there was no evidence of a speed–accuracy trade–off.

References

Allbritton, D. (2004). Strategic production of predictive inferences during comprehension. *Discourse Processes*, *38*, 309–322. doi: 10.1207/ s15326950dp3803_2

Calvo, M. G., Castillo, M. D., & Schmalhofer, F. (2006). Strategic influence on the time course of predictive inferences in reading. *Memory & Cognition*, *34*, 68–77. doi: 10.3758/BF03193387

Campion, N., & Rossi, J. P. (2001). Associative and causal constraints in the process of generating predictive inferences. *Discourse Processes*, *31,* 263–291. doi: 10.1207/S15326950dp31-3_3

Carrell, P. L. (1989). Metacognitive awareness and second language reading. *The Modern Language Journal*, *73*, 121–134.

Carrell, P. L. (1992). Awareness of text structure: Effects on recall. *Language Learning*, *42*, 1–20. doi: 10.1111/j.1467-1770.1992.tb00698.x

Casteel, M. A. (2007). Contextual support and predictive inferences: What do readers generate and keep available for use? *Discourse Processes*, *44*, 51–72. doi: 10.1080/01638530701285572

Chikalanga, I. (1992). A suggested taxonomy of inferences for the reading teacher. *Reading in a Foreign Language*, *8*, 697–709.

Cook, A. E., Limber, J. E., & O'Brien, E. J. (2001). Situation-based context and the availability of predictive inferences. *Journal of Memory and Language*, *44*, 220–234. doi: 10.1006/jmla.2000.2744

Day, R., & Park, J. (2005). Developing reading comprehension questions. *Reading in a Foreign Language*, *17*, 60–73.

de Groot, A. M. B., Borgwaldt, S., Bos, M., & van den Eijnden, E. (2002). Lexical decision and word naming in bilinguals: Language effects and task effects. *Journal of Memory and Language*, *47*, 91–124. doi: 10.1006/jmla.2001.2840

Elgort, I. (2011). Deliberate learning and vocabulary acquisition in a second language. *Language Learning*, *61*, 367–413. doi: 10.1111/j.1467-9922.2010.00613.x

Fincher-Kiefer, R. (1993). The role of predictive inferences in situation model construction. *Discourse Processes*, *16*, 99–124. doi: 10.1080/01638539309544831

Graesser, A. C., & Kreuz, R. J. (1993). A theory of inference generation during text comprehension. *Discourse Processes*, *16*, 145–160. doi: 10.1080/01638539309544833

Graesser, A. C., Singer, M., & Trabasso, T. (1994). Constructing inferences during narrative text comprehension. *Psychological Review*, *101*, 371–395. doi: 10.1037/0033-295X.101.3.371

Graesser, A. C., Wiemer-Hastings, P., & Wiemer-Hastings, K. (2001). Constructing inferences and relations during text comprehension. In T. Sanders, J. Schilperoord, & W. Spooren (Eds.), *Text representation: Linguistic and psycholinguistic aspects* (pp. 249–271). Amsterdam, Netherlands: John Benjamins Publishing.

Horiba, Y. (1996). Comprehension processes in L2 reading: Language competence, textual coherence, and inferences. *Studies in Second Language Acquisition*, *18*, 433–473. doi: 10.1017/S0272263100015370

Horiba, Y. (2000). Reader control in reading: Effects of language competence, text type and task. *Discourse Processes*, *29*, 223–267. doi: 10.1207/S15326950dp2903_3

Horiba, Y. (2013). Task-induced strategic processing in L2 text comprehension. *Reading in a Foreign Language*, *25*, 98–125.

Ikeno, O. (1996). The effects of text-structure-guiding questions on comprehension of texts with varying linguistic difficulties. *JACET (The Japan Association of College English Teachers) Bulletin*, 27, 51–68.

JACET Committee of Basic Words Revision (Ed.). (2003). *JACET list of 8000 basic words*. Tokyo: JACET.

Keenan, J. M., Potts, G. R., Golding, J. M., & Jennings, T. M. (1990). Which elaborative inferences are drawn during reading? A question of methodologies. In D. A. Balota, G. B. Flores d'Arcais, & K. Rayner (Eds.), *Comprehension processes in reading* (pp. 377–402). Hillsdale, NJ: Lawrence Erlbaum Associates.

Klin, C. M., Guzmán, A. E., & Levine, W. H. (1999). Prevalence and persistence of predictive inferences. *Journal of Memory and Language, 40*, 593–604. doi: 10.1006/jmla.1998.2628

Klin, C. M., Murray, J. D., Levine, W. H., & Guzmán, A. E. (1999). Forward inferences: From activation to long-term memory. *Discourse Processes*, 27, 241–260. doi: 10.1080/01638539909545062

Koda, K. (2005). *Insights into second language reading: A cross-linguistic approach.* New York, NY: Cambridge University Press.

Kroll, J. F., & Stewart, E. (1994). Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language*, 33, 149–174. doi: 10.1006/jmla.1994.1008

Linderholm, T. (2002). Predictive inference generation as a function of working memory capacity and causal text constraints. *Discourse Processes*, 34, 259–280. doi: 10.1006/jmla.1994.1008

Magliano, J. P., & Graesser, A. C. (1991). A three-pronged method for studying inference generation in literary text. *Poetics*, 20, 193–232. doi: 10.1016/0304-422X(91)90007-C

Magliano, J. P., Trabasso, T., & Graesser, A. C. (1999). Strategic processing during comprehension. *Journal of Educational Psychology*, 91, 615–629. doi: 10.1037/0022-0663.91.4.615

McKoon, G., & Ratcliff, R. (1980). The comprehension processes and memory structures involved in anaphoric reference. *Journal of Verbal Learning and Verbal Behavior*, 19, 668–682. doi: 10.1016/S0022-5371(80)90355-2

McKoon, G., & Ratcliff, R. (1992). Inference during reading. *Psychological Review*, 99, 440–466. doi: 10.1037/0033-295X.99.3.440

Motyka Joss, L. S. (2010). *Predictive inference generation in the cerebral hemispheres: An investigation of time course and reader goals* (Doctoral dissertation). Retrieved from College of Liberal Arts & Social Sciences Theses and Dissertations (Paper 23).

Murray, J. D., & Burke, K. A. (2003). Activation and encoding of predictive inferences: The role of reading skill. *Discourse Processes*, 35, 81–102. doi: 10.1207/S15326950DP3502_1

Nahatame, S. (2013a). Predictive inference generation during Japanese EFL reading: Focusing on contextual constraint and local coherence of text. *JACET (The Japan Association of College English Teachers) Journal*, 56, 19–38.

Nahatame, S. (2013b). Cognitive demands and the process of predictive inference generation in Japanese EFL reading. *ARELE (Annual Review of English Language Education in Japan)*, 24, 173–188.

Palincsar, A. S., & Brown, A. L. (1984). Reciprocal-teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction*, 1, 117–175. doi: 10.1207/s1532690xci0102_1

Singer, M., & Ferreira, F. (1983). Inferring consequences in story comprehension. *Journal of*

Verbal Learning and Verbal Behavior, *22*, 437–448. doi: 10.1016/S0022-5371(83)90282-7

van den Broek, P., Lorch, R. F., Linderholm, T., & Gustafson, M. (2001). The effects of readers' goals on inference generation and memory for texts. *Memory & Cognition*, *29*, 1081–1087. doi: 10.3758/BF03206376

Virtue, S., van den Broek, P., & Linderholm, T. (2006). Hemispheric processing of inferences: The influence of textual constraint and working memory capacity. *Memory & Cognition*, *34*, 1341–1354. doi: 10.3758/BF03193276

Yokokawa, H. (Ed.). (2006). *Nihonjin Eigo Gakushūsha no Eitango Shinmitsudo: Moji hen* [*English word familiarity for Japanese EFL learners: Letter volume*]. Kuroshio Shuppan, Tokyo.

Yoshida, M. (2003). Working memory capacity and the use of inference in L2 reading. *JACET (The Japan Association of College English Teachers) Bulletin*, *36*, 1–17.

Yoshida, M. (2012). The interplay of processing task, text type, and proficiency in L2 reading. *Reading in a Foreign Language*, *24*, 1–29.

Appendix

Sample passages, target words, and comprehension questions used in this study

Inference Text
David and his dog were enjoying a nice, long walk on the beach. He couldn't imagine a better way to spend his summer vacation. David decided to take his shoes off and ran into the water. With his next step, he didn't notice a piece of broken glass under his foot.
Question: Was David walking on the beach with his dog? (YES)

Neutral Text
The atmosphere on the remote island was becoming tense. The survivors had a hard time getting along with each other. They didn't enjoy sharing the island. After only two days, the survivors were ready to leave.
Question: Were survivors ready to leave the island? (YES)
Target word: *cut*

Inference Text
The director and the cameraman were preparing for the next scene. They were new in Hollywood and had a lot to learn. The crew set up the cameras next to the building. The actress stood by a window on the 14th floor and suddenly fell to the ground.
Question: Had the director and cameraman worked for many years in Hollywood? (NO)

Neutral Text
The first thing Rebecca and Jessica did the day after graduation was to look for summer jobs. They wanted to find fun jobs that had fairly flexible hours. They read all of the jobs advertisements but could not find anything. So they decided to meet some friends for drinks at their favorite bar.
Question: Did Rebecca and Jessica find a summer job? (NO)
Target word: *die*

Filler Text
Maui loved to surf. His real name wasn't Maui, but that's the name he went by. He got the nickname by

spending 4 months of the year in Hawaii. Maui spent those months riding the waves.
Question: Did he get his nickname "Maui" in Hawaii? (YES)
Target word: *clak*

Filler Text
The two women greeted each other in the park. They were glad to catch up with each other. One woman had gotten married only 2 months ago. She told her friend all about her honeymoon in the French Riviera.
Question: Were the women talking at a restaurant? (NO)
Target word: *dal*

About the Author

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