The Process of Thematic Inference Generation in EFL Reading: Focusing on Context and Readers’ Proficiency

Yukino KIMURA
Graduate School, University of Tsukuba

Abstract

In narrative reading, readers not only understand specific information in the text but also activate thematic inferences to understand the main points or messages in whole texts. However, given that L2 or EFL learners require greater cognitive loads than L1 readers for lower-level processing such as words and sentences, it can be difficult for them to comprehend the overall meaning of the text. Moreover, the factors that affect the thematic inference process have not yet been fully examined. Therefore, the present study examines the process of thematic inference activation in EFL reading by taking into account learner and text factors. The reading time method was adopted in pilot and experimental studies to measure learners’ reading process. Japanese EFL undergraduates performed a self-paced reading task with texts that had a thematic inference target. The results of the pilot study confirmed that learners could automatically make thematic inferences during the reading process without strategic instruction. Moreover, the experimental study showed in detail the process of thematic inference activation, indicating that (a) learners activate inferences when outcome-related information in the text is presented, and (b) upper and lower proficiency readers differ in the process of thematic inference activation.

1. Introduction

1.1 What is Thematic Inference in Narrative Reading?

When people read a text, they derive meaning from it by comprehending individual words and sentences. A narrative text usually contains diverse information such as beginning, setting, action, goal, attempt, outcome, and ending (e.g., Thorndyke, 1977). However, readers need to comprehend not only explicit information in the text but also messages conveyed by the writer to comprehend the text deeply. The overall meaning, message, or point of a text is called the theme (e.g., Graesser, Pomeroy, & Craig, 2002; Graesser, Singer, & Trabasso, 1994; Kurz & Schober, 2001), and it is often implied rather than stated explicitly. Readers, therefore, need to go beyond the explicit information provided and use the context or background knowledge to generate thematic inference. For example, the following short narrative passage includes an implicit theme that expresses the message of the whole passage.
Phil was in love with his secretary and was well aware that she wanted to marry him. However, Phil was afraid of responsibility, so he kept dating others and made up excuses to delay the wedding. Finally, his secretary got fed up, began dating, and fell in love with an accountant. When Phil found out, he went to her and proposed marriage, showing her the ring he had bought. By that time, his secretary was already planning her honeymoon with the accountant. (adapted from Seifert, McKoon, Abelson, & Ratcliff, 1986)

By reading this passage, we obtain specific information that is explicitly stated, for example, “Phil was in love with his secretary and she wanted to marry him” (setting), “Phil delayed the wedding” (action), and “Finally, his secretary was planning her honeymoon with the accountant” (outcome). Additionally, we infer that the passage conveys the author’s implicit message: “it is often too late to try to prevent something after you have noticed it.”

Thematic inference is important because it contributes to the text’s (a) global coherence and (b) deeper comprehension. Thematic inference is a type of global inference, which establishes the global coherence of meaning representation in narrative texts (e.g., Graesser et al., 1994). Given that most of the information in a narrative text is usually organized around the theme, thematic inference is crucial for reading comprehension. Moreover, thematic inference is also a kind of elaborative inference, which is not necessary for local coherence of the text but enables readers to comprehend it more deeply (Graesser & Kreuz, 1993). However, regardless of its importance, second language (L2) or English as a foreign language (EFL) reading instruction mainly focus on comprehending individual words and sentences rather than understanding the theme.

1.2 Thematic Inference Activation in Narrative Reading

Previous L1 studies have argued whether thematic inferences are activated automatically or strategically. From the viewpoint of inference generation during text comprehension, automaticity of thematic inference activation can be accounted for by two well-known reading theories: the minimalist hypothesis (McKoon & Ratcliff, 1992) and the constructionist theory (Graesser et al., 1994). The former states that only a few inferences (e.g., referential, causal antecedent) are automatically activated during reading—those that are based on quickly and easily available information and those that are required for local coherence of the text being read. Thematic inferences integrate widely separated pieces of textual information into an overall network; therefore, according to this hypothesis, thematic inferences can be activated strategically (i.e., by giving strategic reading goals or instructions) but not automatically. On the other hand, the constructionist theory posits that the reader attempts to construct a meaningful situation model that is coherent at the local and global levels. According to this theory, readers can activate thematic inferences automatically during reading comprehension, because thematic inferences contribute to readers’ construction of global coherence of texts.
Some previous L1 research has empirically investigated thematic inference activation. For example, some studies have employed priming tasks in which the participants decided, as quickly as possible, whether the test item was an appropriate thematic inference word generated by the text (Long, Oppy, & Seely, 1994; Seifert et al., 1986; Till, Mross, & Kintsch, 1988). They concluded that thematic inference was not activated automatically during reading. However, Zhang and Hoosain (2005) pointed out that these studies ignored the reader’s processing time for individual words in the text; that is, if the learners had been given enough time when presented with the text and target words in the priming task, they would have automatically activated thematic inferences. Finally, they demonstrated automatic activation of thematic inferences by controlling the task condition (Zhang & Hoosain, 2005) and using a self-paced reading time method (Zhang & Hoosain, 2001).

Although few L2/EFL studies have directly focused on thematic inference generation, some have investigated the types of inferences, including thematic inference. Horiba (1996) and Yoshida (2003) used a think-aloud method in which the readers were asked to talk about what they thought was happening, including their inferences. They reported that high proficiency readers generated more elaborative inferences during reading than lower proficiency readers. Additionally, lower proficiency readers had difficulty in elaborative inference generation because of the inadequateness of their lower level processing. These results suggest that it can be difficult, even impossible, for L2/EFL readers to automatically activate thematic inference. To rectify this issue, thematic inference activation in EFL reading should be investigated.

1.3 Factors Related to the Process of Thematic Inference Activation
The studies discussed above were concerned with whether or not thematic inferences were activated during reading. However, the process of thematic inference generation has not yet been thoroughly investigated. Zwaan, Radvansky, and Whitten (2002) hypothesized that a theme is constructed in the following three steps: (a) creating a copy of the causal and motivational structure, (b) deleting the temporal and spatial framework information, and (c) eliminating all the temporal, spatial, and protagonist information that is not directly connected to the causal-motivational structure. Although this hypothesis has not been empirically tested, they claimed that readers need to not only comprehend explicit information but also select and then abstract important information in order to generate thematic inference.

Some factors affect the process of thematic inference generation: (a) reading proficiency and (b) contextual information. With regard to the former, Kimura (2012) investigated the themes Japanese EFL learners comprehend after reading narrative texts and found that while high proficiency readers can accurately identify abstract themes constructed by extracting specific information from the whole text, low proficiency readers inaccurately identify specific themes that include textual information. This result is also supported by Lehr’s (1988) L1 study, which found that poor readers only summarize the text, while good readers make generalizations about the
stories. Moreover, other studies have suggested that individual differences (i.e., reading proficiency, working memory capacity) affect both the content and time course of thematic inference. For example, Whitney, Ritchie, and Clark (1991) demonstrated that good readers can maintain local coherence while activating possible thematic inference. On the other hand, poor readers tend to focus on a sentence-to-sentence understanding and activate specific thematic inference at an early stage in reading; therefore, it is difficult for them to change their representation of the whole text during the reading process.

The other factor that appears to affect the thematic inference process is contextual information. Some previous studies have regarded a central action and its outcome in narrative texts as important components for theme comprehension (Dorfman & Brewer, 1994; Zhang & Hoosain, 2001). Dorfman and Brewer (1994) demonstrated that readers have difficulty in understanding the theme of a text when the protagonist’s central action and outcome are not consistent (i.e., when a negative action causes a positive outcome). For example, to activate thematic inference in Phil’s story (illustrated above), readers should be able to identify the consistency between the negative central action of delaying the wedding and the negative outcome of the secretary already planning her honeymoon with the accountant. Although Dorfman and Brewer did not focus on investigating the process of thematic inference, the results of their study suggest that central action- and outcome-related information also affect the process of thematic inference activation.

2. Experimental Study

2.1 Purpose and Research Questions of Present Study

The present study investigated the process by which Japanese EFL learners activate thematic inferences when reading narrative passages. In line with Zhang and Hoosain’s (2001, 2005) findings, it is hypothesized that Japanese EFL learners can activate thematic inference during reading when given sufficient time for reading passages and for inference activation. Moreover, it is expected that readers’ proficiency and context will affect the process of thematic inference activation. Research questions (RQs) of this study are as follows:

RQ1: Can Japanese EFL learners automatically activate thematic inference without strategic instruction?

RQ2: When do Japanese EFL learners activate thematic inference during reading?

RQ3: Does the process of thematic inference activation differ according to readers’ proficiency?

In the pilot study, RQ1 examined whether Japanese EFL learners can activate thematic inference automatically, as have L1 readers in previous studies (e.g., Zhang & Hoosain, 2001, 2005). In the experimental study, RQ2 and RQ3 were investigated to explain the detailed process of thematic inference activation. The former focuses on the effects of context: do Japanese EFL
learners activate thematic inference after being presented with central action- and outcome-related information in the middle and end of the text respectively? RQ3 explores the difference between high and low proficiency readers in their thematic inference activation—specifically, the process through which learners understand specific pieces of information in the text and abstract them to activate thematic inferences.

To investigate the natural process of thematic inference activation, the present study compares reading times for target sentences, in line with previous studies (e.g., Ritchey, 2011; Singer, Halldorson, Lear, & Andrusiak, 1992; Zhang & Hoosain, 2001). Although previous studies used priming tasks to measure thematic activation (Long et al., 1994; Till et al., 1988), Zhang and Hoosain (2005) claimed that readers cannot activate thematic inferences without having adequate time for reading passages and judging target items. Therefore, the reading time method, with self-paced reading reflecting the individual reading process, was adopted in this study. The reading time method is one of the common methodologies for investigating readers’ online cognitive processing during reading. Many previous studies have used reading time as a measure of inference processing. In this method, sentences containing inferred or inconsistent concepts are inserted into each text and the reading times for them are compared to measure inference activation. If participants make appropriate inferences during reading, reading times for the consistent sentences should be faster than those for the inconsistent ones. On the other hand, the inconsistent target sentences would likely require participants to reduce their reading speed as they noticed the disagreement between the inferred theme and the inconsistent one. Given that reading time reflects various factors (e.g., word recognition, processing speed) other than inference generation, the present study considers the effects of L2 reading proficiency.

2.2 Pilot Study

2.2.1 Overview of the pilot study

The pilot study investigated whether Japanese EFL learners automatically activate thematic inference without strategic instruction. Participants were 33 Japanese undergraduates. The materials were eight narrative passages by Seifert et al (1986). These passages were similar to the aforementioned story about Phil (see Appendix A). Each passage had an original title describing the theme of the passage in the form of an adage (e.g., Closing the barn door after the horse is gone, which means to act after it is too late to prevent something from happening). In this study, the participants were not presented with these titles. Instead, target sentences representing the theme of each story were created and inserted after the last sentence of the story. These target sentences were created by transforming the original titles into sentences on the basis of monolingual dictionary definitions (Longman, 2008) of the original themes. They described abstract themes and did not include specific information such as a central action and its outcomes in the text. For example, the original title Closing the barn door after the horse is gone was changed into a target sentence such as It is too late to try to prevent something after you have
noticed. In the experimental session, the condition of target sentences was set as a within-participant variable. Half the eight passages contained appropriate thematic target sentences expressing the accurate theme of the texts (i.e., Thematic) and the other half contained inconsistent target sentences expressing incorrect themes corresponding to that of another text (i.e., Error). If the participants activated thematic inference during reading, the reading time for the Error would be significantly longer than that for Thematic, because the former would require participants to slow down their reading process as they noticed the disagreement between the inferred theme and target sentence.

As mentioned earlier, reading times for these target sentences were compared in this study. In the reading section, SuperLab 4.5 was installed on a computer, and the participants read passages using Response Pad RB-730. The experimental phase followed the instruction and practice phases. Before the appearance of each passage, the signal Ready? appeared at the center of the screen and participants pushed the YES button to begin reading. They read each sentence of a sequence in a self-paced fashion and pressed the YES button to signal that they had understood each sentence. The participants were asked to carefully read each sentence for the purpose of writing down what they had understood after reading. Finally, a target sentence (Thematic/Error) for the text appeared as the last sentence of each text, and the reading time was recorded. The presence of the target sentences was counterbalanced, and the ordering of the texts was randomized. After the entire text and its target sentence was read, the target sentence reappeared on the screen following the presence of "***" for 1,000 milliseconds (ms). The participants were asked to write down what they understood about the story besides the target sentence. This comprised one trial, and the participants then proceeded with the next story.

2.2.2 Results of pilot study

A written recall task was used to ensure that students carefully read the passage without ascertaining the purpose of the study. The recall production rate was used to indicate comprehension of explicit textual information. On the basis of Ikeno (1996), experimental passages were divided into a set of idea units (IUs). This division was carried out by two raters, and the agreement between them was 91.77%. One third of recall data was randomly selected and scored by two raters separately, with 92.03% agreement. Disagreements were resolved through discussion, and the remaining data were scored by only the researcher. In scoring the recall protocols, one point was given when an IU in the passages was correctly included in the recall protocols. The mean recall production rates were 55.15% (SD = 15.52) and 55.67% (SD = 15.43) for the Thematic and Error conditions respectively. A paired t test was conducted on the recall production rate to confirm that text comprehension did not differ according to the condition of target sentences. The result showed that no significant difference existed between Theme and Error, $t(32) = -0.251$, $p = .803$, $d = 0.03$, indicating that the participants understood the texts regardless of the type of target sentence. The main focus of this study is to analyze the reading
time for target sentences; therefore the discussion of the results of the recall production rate is mentioned only briefly here.

Next, to investigate automatic activation of thematic inference, the reading time for target sentences was analyzed. The reading time of each target sentence was divided by the number of syllables it contained, because each target sentence contained different numbers of words. The mean reading times for the Thematic and Error were 591.91 ms (SD = 249.92) and 711.74 ms (SD = 273.01) respectively. A paired t test was conducted on the reading time for target sentences. The results showed a significant difference between the Theme and Error conditions, $t(32) = -2.14, p = .040, d = 0.46$. This result indicates that the reading time for Error was significantly longer than for Thematic. The results of the pilot study demonstrated that Japanese EFL learners can automatically activate, without strategic instruction, thematic inference during reading. Therefore, the following experimental study investigated in more detail the process of thematic inference activation by taking into account learner and text factors.

2.3 Method of Experimental Study
2.3.1 Participants
Participants were 69 Japanese undergraduates who were Japanese EFL learners majoring in social science, international studies, and engineering; and their English proficiency levels were intermediate to advanced. They were divided into two proficiency groups on the basis of their reading proficiency test scores (see below).

2.3.2 Materials
a. Reading Proficiency Test: To assess the participants’ English reading ability, a 24-item reading proficiency test was prepared. Passages from the pre-second, second, and pre-first grades of the STEP test (Society for Testing English Proficiency, 1997, 2009) were used.

b. Experimental Passages: The nine short narrative stories used in the pilot study were used as the experimental passages. The number of words, sentences, the Flesch-Kincaid Grade Levels (FKGL), and the original title of each text are shown in Appendix B.

As a within-subject variable, the following three types of target sentences were set: (a) General Theme, (b) Specific Theme, and (c) Error Theme. General Theme corresponded to the Thematic from the pilot study, as it described the overall message of the text without including specific information. Error Theme was the same as in the pilot study. The Specific Theme was newly added to the experimental study to examine in detail the process by which learners abstract the whole meaning of a text from specific textual information. The Specific Theme contained central action- and outcome-related information in each text. Table 1 shows examples of target sentences for Phil’s text. The Specific Theme explicitly described a central action (i.e., delaying the wedding) and an outcome (i.e., falling in love with someone else). To create target sentences
of Specific Theme, one researcher, as well as four graduate students majoring in English education, judged which idea unit in each text corresponded to central action- and outcome-related information. Finally, the number of words in each target sentence was controlled from 12 to 16. The types of target sentences were counterbalanced between texts.

Moreover, as a between-participant variable, the condition of contexts (Middle and Last) was also investigated. The participants were randomly allotted to these two contextual conditions. In the Middle condition, the target sentence was inserted immediately after the main action of each story, while in the Last condition, the target sentence was placed after the outcome, or after the last sentence of each story.

Table 1

<table>
<thead>
<tr>
<th>Examples of Target Sentences (Phil’s Text)</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>It is too late to try to prevent something after you have noticed.</td>
</tr>
<tr>
<td>Specific</td>
<td>If you delay the wedding, your lover will fall in love with someone else.</td>
</tr>
<tr>
<td>Error</td>
<td>You should not make a simple problem more difficult than it is.</td>
</tr>
</tbody>
</table>

c. Comprehension Questions: To ensure that the participants read experimental passages carefully, a comprehension question for each passage was prepared. The content of these questions did not deal with a narrative theme but with explicit information stated in the text (e.g., Did Phil buy a ring for his secretary?). These were all Yes-No questions.

2.3.3 Procedure

The participants were tested individually. First, they completed the reading proficiency test in 25 minutes and then moved on to the reading section. The procedure of reading section was almost the same as that for the pilot study, with the following exception: the participants were randomly assigned to one of the two contextual conditions (Middle and Last), and asked to read the texts for the purpose of answering comprehension questions later. As in the pilot study, SuperLab 4.5 was employed, and the participants read passages and responded to comprehension questions using Response Pad RB-730. The participants’ reading times for the target sentences and responses to the questions were recorded.

The procedure differed slightly according to the contextual conditions. The participants read each sentence within a sequence in a self-paced fashion and pressed the YES button to signal that they had understood a sentence. In the Middle condition, a target sentence was presented after the central action of each text, whereas in the Last condition, a target sentence was presented after the outcome of each text, that is, after the last sentence of each text. After reading the entire text and target sentence, one comprehension question was presented, followed by “???” appearing on the screen for 1,000 ms. The participants answered YES or NO by pressing the corresponding button.
This comprised one trial, and the participants then proceeded with the next story. This trial was repeated for nine texts.

2.3.4 Analysis

The number of words in each target sentence was different; hence, the reading time for each target sentence was divided by the number of syllables. To investigate thematic inference activation (RQ2), the mean reading time (ms/syllable) for each type of target sentence was calculated. A 3 (Theme: General, Specific, Error) × 2 (Context: Middle, Last) × 2 (Proficiency: Upper, Lower) three-way analysis of variance (ANOVA) was conducted on the mean reading time (ms/syllable). Moreover, to investigate the effects of reading proficiency on the extent to which the general and specific themes were activated (RQ3), on the basis of Richey (2011), the differences between the Error and General themes and between the Error and Specific themes were calculated respectively. The present study regards these values as the degree of thematic inference activation.

3. Results and Discussion

3.1 Reading Proficiency Test

The reliability of the reading proficiency test was deemed acceptable (Cronbach’s α = .82), and the participants were divided into two proficiency groups (Upper and Lower) on the basis of their results in this test. The number of participants and the mean scores are shown in Table 2. To confirm whether the proficiency level of the two contextual conditions was homogeneous, a 2 (Proficiency: Upper, Lower) × 2 (Context: Middle, Last) ANOVA was conducted on the reading proficiency test scores. The results indicated a significant main effect of Proficiency, F(1, 65) = 162.92, p < .001, η² = .715, whereas the main effect of Context, F(1, 65) = 0.19, p = .657, η² = .003, and the interaction between these two factors, F(1, 65) = 0.13, p = .717, η² = .002, were not statistically significant. Therefore, these results confirmed that the proficiency level was approximately equal between the two contextual conditions.

<table>
<thead>
<tr>
<th></th>
<th>Proficiency</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Upper</td>
<td>16</td>
<td>20.13</td>
<td>1.89</td>
</tr>
<tr>
<td>Middle</td>
<td>Lower</td>
<td>19</td>
<td>11.84</td>
<td>2.91</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>35</td>
<td>15.63</td>
<td>4.86</td>
</tr>
<tr>
<td></td>
<td>Upper</td>
<td>17</td>
<td>20.18</td>
<td>2.19</td>
</tr>
<tr>
<td>Last</td>
<td>Lower</td>
<td>17</td>
<td>12.35</td>
<td>3.18</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>34</td>
<td>16.26</td>
<td>4.79</td>
</tr>
</tbody>
</table>

Note. Maximum possible score is 24.
3.2 Comprehension Questions

In the present study, comprehension questions were used as an indicator of participants' comprehension of explicit textual information. The mean proportion of correct answer rate for comprehension questions was 86.63% (SD = 12.29, Min = 55.55%, Max = 100%). Therefore, it seems that the participants sufficiently comprehended the explicit information in the texts.

3.3 Reading Time for Target Sentences

In line with previous studies that employed the reading time method, reading times deviating more than 3.0 standard deviations from the mean of individual participants were excluded from analysis. The outliers constituted 6% of the data. Table 3 shows the mean reading times (ms/syllable) for target sentences.

<table>
<thead>
<tr>
<th></th>
<th>Proficiency</th>
<th>Middle</th>
<th>Last</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>General</td>
<td>Upper</td>
<td>349.13</td>
<td>143.69</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>563.16</td>
<td>205.35</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>462.44</td>
<td>207.04</td>
</tr>
<tr>
<td>Specific</td>
<td>Upper</td>
<td>407.60</td>
<td>174.18</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>492.03</td>
<td>113.52</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>542.30</td>
<td>149.19</td>
</tr>
<tr>
<td>Error</td>
<td>Upper</td>
<td>418.07</td>
<td>146.34</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>576.50</td>
<td>270.00</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>501.95</td>
<td>231.80</td>
</tr>
</tbody>
</table>

A 3 (Theme: General, Specific, Error) × 2 (Context: Middle, Last) × 2 (Proficiency: Upper, Lower) three-way ANOVA was conducted on the mean reading time. The results indicated significant main effects of the variables of Theme, F(2, 130) = 14.574, p < .001, η_p^2 = .183, and Proficiency, F(1, 65) = 9.21, p = .003, η_p^2 = .124; however, the main effect of Context was not significant, F(1, 65) = 1.07, p = .304, η_p^2 = 0.16. More importantly, the interaction between Theme and Context was significant, F(2, 130) = 5.39, p = .006, η_p^2 = .077. A post-hoc analysis showed that the simple main effect of Theme was found in the Last condition, F(2, 64) = 16.13, p < .001, η_p^2 = .335. A Bonferroni post hoc comparison shows a significantly longer reading time for Error than for General and Specific (p < .001). On the other hand, General and Specific did not differ in the mean reading time (p = .743). Moreover, the simple main effect of Context was also significant for General, F(1, 65) = 5.84, p = .019, η_p^2 = .082, and Specific, F(1, 65) = 4.68, p = .034, η_p^2 = .034, indicating that the reading time for General and Specific were significantly longer in the Middle condition than the Last one.
The significant longer reading time for Error in the Last condition suggested that the both participants of high and low proficiency levels could automatically activate thematic inference during the reading process, without strategic instructions. This result is partly consistent with those of previous L1 studies that found evidence for automatic activation of thematic inference (e.g., Zhang & Hoosain, 2001, 2005), and with the results of pilot study. The participants in this study were told to read the text for answering comprehension questions; therefore, they were not given goals of strategic reading for theme comprehension, which partially supports the automatic activation of thematic inference.

Moreover, the present study further revealed that the readers activated thematic inferences when given both central action- and outcome-related information. As L1 studies have shown (e.g., Dorfman & Brewer, 1994; Zhang & Hoosain, 2001), the consistency between a central action and its outcome is important for thematic inference also in EFL reading. When in the Middle position, the outcome of the action was not stated explicitly; therefore, the participants could not activate thematic inference, and the main effect of Theme was found only in the Last condition. This result also supports the notion that readers construct a number of interpretations about a story and draw a conclusion about the overall theme only at the story’s end (Kurz & Schober, 2001). The central action was so important in the text that it seemed relatively easy for the participants to retrieve central action-related information from their working memory when they read outcome-related information. Therefore, they could effectively connect action and outcome in the text, and this led to activation of thematic inference throughout the reading process.

3.4 Degree of Thematic Inference Activation

Both pilot and the experimental studies showed that the reading time for Error was significantly longer than General and Specific at the end of the text (see Sections 2.2.2 and 3.3). Therefore, the next analysis investigated which General and Specific themes were more strongly activated during reading process. The difference in reading times between Error-General and Error-Specific was calculated as the degree of thematic inference activation. These values are presented in Table 4. The more strongly the participants activated the thematic inference, the bigger was the difference in reading time. A 2 (Theme: General, Specific) × 2 (Context: Middle, Last) × 2 (Proficiency: Upper, Lower) three-way ANOVA was conducted on the degree of inference (ms/syllable). A significant main effect of Context, \(F(1, 65) = 7.13, p = .010, \eta_p^2 = .099\) was observed. More importantly, the results indicated an interaction of Theme × Context × Proficiency, \(F(1, 65) = 5.16, p = .026, \eta_p^2 = .074\). A post-hoc analysis subsequently showed a
simple main effect of Theme in Middle × Lower ($p = .021$). The results showed that participants in the Lower group activated the Specific theme more strongly than the General one in the Middle condition. Moreover, a simple main effect of Context in Lower × General was also found ($p < .001$), indicating that the participants in the Lower group activated the General theme more strongly in the Middle than the Last condition (see Figure 3).

Table 4

*Degree of Thematic Inference Activation (ms/syllable)*

<table>
<thead>
<tr>
<th>Proficiency</th>
<th>Middle</th>
<th>Last</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>General</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper</td>
<td>68.94</td>
<td>97.94</td>
</tr>
<tr>
<td>Lower</td>
<td>13.34</td>
<td>213.63</td>
</tr>
<tr>
<td>Total</td>
<td>39.50</td>
<td>169.30</td>
</tr>
<tr>
<td>Specific</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper</td>
<td>10.47</td>
<td>137.78</td>
</tr>
<tr>
<td>Lower</td>
<td>84.47</td>
<td>225.18</td>
</tr>
<tr>
<td>Total</td>
<td>49.65</td>
<td>190.14</td>
</tr>
</tbody>
</table>

*Figure 2.* Degree of inference activation in Upper.

*Figure 3.* Degree of inference activation in Lower.

RQ3 focuses on the effects of readers’ proficiency on the degree of general and specific thematic inference activation, that is, the process of generalization of specific information in the text. The results showed that the process of thematic inference generation differs according to readers’ proficiency. In the Upper group, general and specific themes were activated to the same degree. This result indicates that high proficiency readers extract specific information (i.e., central action, outcome) from the text and abstract them at the same time. However, the degree of inference activation was not so great in the Upper group. The reason for this appears to be that high proficiency readers cannot narrow their possible thematic inferences down to one. Unlike other types of inferences (e.g., referential inference, predictive inference), thematic inferences depend largely on readers’ interpretation (Kurz & Schober, 2001); that is, although readers draw the same conclusion about a passage, they sometimes make different thematic inferences during reading. Given that proficient readers construct a rich representation by integrating the text with their own background knowledge, their interpretation of the text can be varied, which leads to a small degree of thematic inference activation.
The readers in the Lower group activated specific thematic inference more strongly than general thematic inference in the Middle position. In addition, the degree of activation for the General theme was significantly greater in the Middle condition than in the Last one. These results showed that lower proficiency readers tend to concentrate on understanding specific textual information in the first step and then gradually abstract it. It may appear from this result that lower proficiency readers activate thematic inferences by updating their mental representation flexibility through the reading context. However, the present study set the Context condition as a between-subject factor; that is, readers were presented with the target sentences only once. Therefore, the results of this study only provide the possibility that it is difficult for lower proficiency readers to activate general thematic inference once they have strongly activated specific information in the middle of the text, because they pay more attention to sentence-by-sentence understanding and thus form conclusions about the theme early on (Whitney et al., 1991). Kimura (2012) used the same materials as the present study, with the participants performing a theme comprehension task after reading, and demonstrated that lower proficiency readers performed worse than higher proficiency readers because they activated inaccurate thematic inferences, including specific information, in the text. This result is consistent with this study’s finding that lower proficiency readers tend to persist with specific information in the text; in other words, it is difficult for them to abstract specific information from texts.

4. Conclusion

The present study investigated the process of thematic inference activation in narrative reading by using the reading time method. First, the pilot study confirmed that Japanese EFL learners can activate thematic inference automatically (RQ1), as some previous L1 reading studies have shown (e.g., Zhang & Hoosain, 2001, 2005). However, the most meaningful point in this study is focusing on the process of thematic inference activation. One major finding is that Japanese EFL readers can activate thematic inference during the reading process when presented with outcome-related information in the narrative text but not when presented with the only central action-related information (RQ2). This was found to be true for both upper and lower proficiency groups. Moreover, an analysis of the degree of inference activation indicated that the process of thematic inference activation differs according to readers’ proficiency (RQ3). High proficiency readers consistently activate both specific and general themes to the same extent during reading, indicating that the processes of selecting and abstracting important information occur simultaneously. On the other hand, low proficiency readers activate specific themes much more strongly than general ones in the middle of the text, and they activate general themes at the end of the text. This result indicates that low proficiency readers engage in understanding specific information in the text at first, and then, gradually abstract these pieces of information. Therefore, it can be predicted that if low proficiency readers spend too many cognitive resources in
understanding specific information in the text, they will not generalize them to activate thematic inferences.

Although this study concludes that Japanese EFL learners can automatically activate, without strategic instruction, thematic inferences during reading, this may have much to do with the length of the passages used in present study. The experimental passages used here were relatively short, consisting of 79.44 words on average. Therefore, readers could easily focus on central action- and outcome-related information in the story. When central action- and outcome-related information were located immediately, readers could easily connect important elements in the text to construct the overall meaning. However, given that thematic inference is a kind of global inference that is activated on the basis of global information within the text (Graesser et al., 1994), it is expected that the length of the text affects thematic inference generation. If the materials are longer texts, in which central action and outcome are distant, it will be difficult for readers to integrate these pieces of information. This can lead to difficulty in automatic thematic inference activation. Despite this limitation, the present study can be seen as a first step in investigating the process of thematic inference generation in EFL reading.

Finally, the present study’s findings have educational as well as theoretical implications. It has been revealed here that Japanese EFL learners automatically activate thematic inference when using short narrative texts. However, the process of its activation differs between upper and lower proficiency readers. In order to activate thematic inference, providing some kinds of instruction for strategic inference activation such as “read the text while considering the author’s messages” seems to be effective for both higher and lower proficiency readers. However, the present study showed the differences between upper and lower groups of L2 reading proficiency in the process of thematic inference activation. Therefore, the effects of such pre-reading instruction can differ according to the readers’ proficiency levels because given a goal before reading, readers process a text from a specific viewpoint and as a result, the reading process changes according to their reading goals. For higher proficiency readers who activate specific and general themes simultaneously during the reading process, providing strategic instruction can generate thematic inference actively without any strategic instructions, but such instruction will further facilitate their thematic inference activation. Lower proficiency readers, meanwhile, tend to activate specific themes more strongly at the first stage of reading. Previous studies have shown that it is difficult for lower proficiency readers to change their construction of representation during the reading process (Whitney et al., 1991). Therefore, giving strategic instructions will likely help lower proficiency readers to go beyond the explicit information provided and use their background knowledge to activate general thematic inferences. In reading, readers and a writer interact to construct meaning. EFL teachers should not only engage in translating each word and sentence in the text but also help readers to actively construct global coherence and facilitate deeper comprehension.
Acknowledgement

I would like to thank Professor Yuji USHIRO and my colleagues in his seminar for their helpful comments.

References


**Appendices**

**Appendix A: Examples of Experimental Passages**

*Every cloud has a silver lining*

Burt put in long hours as a night watchman. One day, a crate accidentally fell on him and broke his shoulder. Burt was in pretty bad shape. He had to spend several months at home recovering his strength. While at home, he started reading about electronics and decided to take courses by mail. By the time he was back on his feet, Burt had qualified for and found a better-paying job in an electronics repair shop. He also had more time to enjoy himself.

*Counting your chickens before they’re hatched*

Ernie was really encouraged about his interview for a security guard at the new factory in town. The interview was long, and Ernie thought he had done well. He assumed his employment as a guard was imminent. He went to the shopping mall and hunted around for a dark blue security guard uniform, and finally bought several. The next day he received a phone call from the factory personnel director saying he was not selected for a security guard position. Ernie was dismayed because he had wasted money on uniforms.

**Appendix B: Outline of Experimental Passages**

<table>
<thead>
<tr>
<th>Texts</th>
<th>Word</th>
<th>Sentence</th>
<th>FKGL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phil</td>
<td>83</td>
<td>5</td>
<td>8.7</td>
</tr>
<tr>
<td>Burt</td>
<td>84</td>
<td>7</td>
<td>5.3</td>
</tr>
<tr>
<td>Ernie</td>
<td>89</td>
<td>6</td>
<td>7.9</td>
</tr>
<tr>
<td>Karen</td>
<td>76</td>
<td>5</td>
<td>7.8</td>
</tr>
<tr>
<td>Alice</td>
<td>72</td>
<td>5</td>
<td>7.2</td>
</tr>
<tr>
<td>Bradley</td>
<td>76</td>
<td>6</td>
<td>6.1</td>
</tr>
<tr>
<td>Irving</td>
<td>78</td>
<td>4</td>
<td>6.8</td>
</tr>
<tr>
<td>Kris</td>
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</tr>
<tr>
<td>Joe</td>
<td>80</td>
<td>5</td>
<td>6.7</td>
</tr>
</tbody>
</table>

**Original Theme**

- Closing the barn door after the horse is gone
- Every cloud has a silver lining
- Counting your chickens before they’re hatched
- The pot calling the kettle “black”
- Using an elephant gun to kill a fly
- Too many cooks spoil the broth
- The cure is worse than the disease
- Cutting off your nose to spite your face
- The blind leading the blind

*Note.* FKGL were provided by Microsoft Word 2010’s readability measurement tools. The original themes were the titles of the passages in Seifert et al. (1986).