The Effect of Task on Comprehension and Memory of L1 and L2 Text

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The study reported in this article examined the effect of task on comprehension and memory of L1 and L2 text. Eighty-four college students who were enrolled in a first-year English course read two expository passages under three different encoding conditions, read for surface forms, read for meaning, and read for critique, and later recalled the content of the texts. It was found that a significant amount of variance in recall of L2 text was accounted for by task as well as by two other factors, comprehension skill (reflected in recall of L1 text) and language proficiency (indicated in the scores for a standardized English language test), though task was not an explanatory factor for variance in recall of L1 text. These results suggest that cognitively demanding task may have a compounding effect of processing difficulty for L2 text comprehension which is also influenced by comprehension skill and language proficiency.

1. Introduction

Researchers and practitioners in the field of language learning and teaching generally acknowledge the importance of task in instruction and assessment. The cognitive demands imposed by task may influence learners' performance and thereby subsequent changes in representations of related items in their long-term memory, thus resulting in learning outcomes (Skehan, 1998; Robinson, 2001). Yet there is little research evidence available for how task factors may affect the cognitive operations in L2 use and learning in relation to the effect of learner and text factors. The present study reported later in this article is an attempt to investigate the effect of task on the cognitive processes involved in the comprehension and construction of mental representation of L1 and L2 text. More specifically, the present study is designed to directly examine how the cognitive processing demands imposed by task will influence the comprehension and representation of L2 text compared with that of L1 text. By comparing and contrasting L1 and L2 reading within the same individuals, it is believed that the effect of task will be more clearly illustrated against an interplay between linguistic processing, which is typically affected by language proficiency, and conceptual processing, which is largely related to comprehension skill.

2. Task and Construction of Mental Representation

2.1 Meaning construction and mental representation

When readers try to comprehend a text, they must be able to recognize words and understand sentences in the text. In addition, they must integrate information from different sentences as well as information activated based on relevant general knowledge and construct a coherent mental representation of the text (Coté, Goldman, & Saul, 1998; Graesser, Singer, & Trabasso, 1994; Just & Carpenter, 1992; van Dijk & Kintsch, 1983). L1 researchers generally agree that understanding of a text results in multiple levels of text representations in memory, and that these memory representations are later accessed at the time of retrieval of text memory for use in such tasks as recall and answering questions about the text. According to the influential van Dijk and Kintsch model (1983), the most superficial and short-lived memory traces represent the surface form of the discourse, that is, the exact words and syntax of sentences. The meaning of the text per se is represented as an interconnected network of ideas called the propositional text base. The construction of a propositional text base representation obviously requires that the reader recognize words and understand sentences in the text. The most enduring level of representation is referred to as the situation model (or "mental model") which represents the content or the microworld that the text is about. The construction of a situation model representation requires that the reader have access to relevant general world knowledge and fill in new propositions and relations which are not explicitly asserted in the original text.

2.2 Task and reader goal

One critical factor that affects the construction of memory representations of a text is readers' ability to monitor and control their own processing according to their comprehension goal in a given situation (Baker & Brown, 1984; Britton & Glynn, 1987; Lorch, Klusewitz, & Lorch, 1995). Reader goal is typically determined by readers' knowledge about the requirements of the task and the features of the text material as well as their ability and motivation to use the knowledge in a given context. With the limitation of cognitive resources or limited capacity working memory, readers must make good decisions on the orchestration of various cognitive processes during reading and construct a coherent text representation according to their comprehension goal.

L1 research has shown that knowledge of a particular task may significantly influence the text processing and resulting construction of mental representations. For example, Zwaan (1993, 1994) had two groups of readers process the same texts under two different conditions; one group was told to read news stories and the other group was told to read literary stories. It was revealed that those in the news stories condition constructed stronger situation-model representations than did those in the literary stories condition, whereas those in the literary stories condition constructed stronger surface structure representations than did those in the new stories condition. These findings suggest that

experienced readers have access to different processing modes for reading and that a particular processing mode can be activated when the readers choose to do even when specific textual cues are not provided.

Other research has shown that the effect of task may depend on the relationship between the processing induced by type of task and the processing invited by type of text. Einstein, McDaniel, Owen, & Coté (1990) and McDaniel, Einstein, Dunay, & Cobb (1986) compared comprehension and recall of two types of text (narrative and expository passages) under several different encoding conditions. It was found that narrative recall was aided more by elaborative processing at encoding individual items than by integrative processing, whereas expository text recall was enhanced more by integrative processing than by elaborative processing. Based on these findings, they concluded that reading and learning from a text can benefit from the difficulty imposed by the task which invites processing of the type of information that is not encoded as a result of reading the text material itself.

3. Task and Processing Constraints in L2 Reading

3.1 Task and L2 learning

In the field of L2 research and practice, it is now widely acknowledged that task is an important factor that may influence learners' performance and subsequent changes in representations of related items in their long-term memory (Robinson, 2001; Skehan, 1998). The idea that the comprehension and memory of a text can be enhanced when the task-induced processing compliments the processing invited by the text itself is particularly attractive to L2 educators and researchers. Although task is an operational necessity for various instructional and assessment activities, little is known about how a particular task may influence L2 performance and learning. The effect of task on performance and learning is certainly related to the connection between text processing and learning from text (i.e., knowledge acquisition) and the connection between text processing and literacy learning (i.e., development of language and reading proficiency). Thus, understanding of these connections are critical for improvement of research and practice of L2 learning and teaching.

Due to the limitation of cognitive resources or limited capacity working memory (Just & Carpenter, 1992), the effectiveness of a particular task is expected to be partly determined by the degree of cognitive demands imposed by the task in relation to the processing operations invited by a particular text. When the task invites processing of the type of information that is not encoded as a result of reading the text material itself, comprehension and memory of the text may be enhanced as long as the overall processing operations help construct richer and more coherent text representations. However, when the processing demands imposed by the task become excessive, some of the cognitive operations may be interfered or inhibited and a resulting memory representation of the text will be underdeveloped and less

coherent. Therefore, a careful investigation is needed in order to tease apart the effects of various factors that are likely to influence the processing operations involved in L2 reading.

3.2 Processing constraints in L2 reading

Research on L2 text comprehension has yielded two conflicting hypotheses about the role of comprehension skill and language proficiency (Alderson, 1984; Carrell, 1991). According to the linguistic threshold hypothesis, a minimum level of L2 language proficiency must be attained before readers can benefit from the application of their comprehension skill based on L1 reading experience into a L2 reading context (Clarke, 1980). According to the linguistic interdependent hypothesis, however, reading performance in L2 is largely shared with reading ability in L1, and therefore readers can make use of their general comprehension skills when reading a L2 text. There is some evidence submitted to support each of these hypotheses (Bernhardt, 2000; Durgunoglu, 1997). For example, Zwaan & Brown (1996) found that when processing stories in L1, readers constructed stronger situation model representations than when they processed stories in L2, indicating an effect of language proficiency. On the other hand, it was also found that there is an effect of comprehension skill on the construction of text base representation of L2 text. Some research studies were specifically conducted by using a within-subject design and statistically analyzing the relative contributions of comprehension skill and language proficiency to L2 reading (Bernhardt & Kamil, 1995; Bossers, 1991; Brisbois, 1995; Carrell, 1991; Lee & Schallert, 1997). These studies generally revealed that comprehension skill and language proficiency each can account for a significant portion of variance in L2 reading performance, but that a larger portion of the variance in L2 reading cannot be explained by either of these two factors (Bernhardt, 2000).

Another contributing factor to L2 reading performance may be the effect of task, which is a focus of the present research. As mentioned earlier, adult readers who have rich experiences in reading have various knowledge and strategies for processing of texts. A particular task in a given situation motivates the setting of a reader goal which further determines how the readers are engaged in certain processing operations. The overall cognitive processes may reflect the effect of task as well as the effect of other factors such as comprehension skill and language proficiency. The present research is designed to investigate the effect of task as an independent factor contributing L2 text comprehension and memory against an interplay of the effect of language proficiency and comprehension skill.

In this connection, Horiba (2000) examined and compared the text processing operations by L1 and L2 readers under differing task conditions. It was found that L1 readers' text processing is strategic and efficient according to the type of text (story and essay) and the type of task (read-freely and read-for-coherence). On the other hand, L2 readers' text processing was found to be strategic but not very efficient in

text processing especially when more cognitive demands are imposed by the text and/or the task. Interestingly, although L2 readers' verbal reports did not indicate that their processing modes differ greatly between the two encoding conditions, recall in the read-for-coherence condition was better than recall in the read-for-coherence condition and it was as good as recall by L1 readers. These findings indicate that text comprehension and memory may be influenced by both the effect of language proficiency and the effect of task. Yet the findings are only suggestive because they were obtained from a small sample of readers. In order to ascertain the effect of task on comprehension and memory of text, research needs to be conducted with a larger number of participants and a within-subjects design. Thus, the present research is designed to help fill this gap.

In the present study, the comprehension and memory of expository passages was investigated in ninety-three college students who processed the texts in two different languages, Japanese as L1 and English as L2, under three different task conditions, read for surface forms, read for meaning, and read for critique. It is assumed that quantity and quality of information included in their recall will reflect the characteristics of comprehension and representations of a text as a function of task, language proficiency, and comprehension skill. In this article, the findings about the analysis of recall at the level of propositional text base representation will be reported as baseline data for their comprehension and memory of L1 and L2 text.

4. Study

4.1 Research questions

Two research questions raised for this research are as follows:

1) Does the type of task influence the comprehension and representation of a text?
2) Does the effect of task on the comprehension and representation of a text differ between reading in L2 and reading in L1?

4.2 Design

Three independent variables are language (Japanese as L1 and English as L2), task (read for surface forms, read for meaning, and read for critique), and text topic (*street rules* and *eye contact*). Language and text topic are within-subject variables; task is a within-subject and between-subjects variable. The dependent variable is recall. The focus of recall is the readers' memory structures and functions related to the content area and structural organization of a text after reading the text. Recall is believed to display the readers' mental representations of the text as constructed, retained, and retrieved from memory.

4.3 Participants

Eighty-four individuals (19 males & 65 females; average age = 19, range = 18-21) participated in the study. They are all undergraduate students who were enrolled in a first-year English-as-a-foreign-language course at

a university in Japan. They did all the task during one of their regular English class meetings. They were paid a small fee for their participation. Originally there were ninety-three students participating in the study; the data for nine individuals who did not follow the instructions or did not complete all the tasks were excluded.

4.4 Materials

Two short expository passages, the *Street rules* text and the *Eye contact* text, were used in two different language versions: Japanese and English. They are argumentative essays written in the typical Japanese writing style called "*ki-sho-ten-ketsu* (introduction - follow-up - change - conclusion)." The English version of the *Eye contact* text is shown in Appendix A. Both language versions were published in a major Japanese newspaper. The length of the texts are relatively similar between the two passages. The *Street rules* text contains 23 sentences in the Japanese and the English version. The *Eye contact* text contains 24 sentences in the Japanese version and 21 sentences in the English version.

4.5 Procedure

First, general instructions for the experiment were orally provided to the subjects in their native language. Subjects were randomly assigned to one of the experimental conditions. Each subject processed both expository passages, one topic in Japanese as L1 and the other topic in English as L2. Each subject processed the texts under two of the three encoding task conditions. In the read for surface forms condition, subjects were told to read by paying attention to use of words and expressions. In the read for meaning condition, they were told to read by visualizing in mind the objects, people, and events that are described in the passage. In the read for critique condition, subjects were told to read by contrasting and critiquing the author's views against their own views. In each task condition, subjects were also informed that they will be later asked to answer some questions about the passages. The order of passage, language, and task, and the combination of them were counter-balanced across subjects. Each subject was given a packet containing the instructions of a first task, a first passage, the instructions of a second task, a second passage, comprehension questions, and recall task sheets. They were told to proceed at their own pace by following the instructions; they were also told not to skip any page nor go back to any previous page. All the instructions were written in the subjects' native language. The participation time was approximately 30-40 min.

4.6 Analysis

Recall protocols were analyzed propositionally. First, each of the four original texts, two passages in two language versions, was analyzed propositionally by following the procedure proposed by Bovair and Kieras (1985). According to this analysis, the *Street rules* text contains 171 propositions for Japanese and 175 propositions for English. The *eye contact* text contains 139 propositions for Japanese and 164 propositions

for English. For each text, a propositional list was created. Using this list as a template, each subject's recall protocol was analyzed and scored for the probability of recall. Two trained judges scored all the recall protocols independently. The interrater reliability was about .90; all the disagreements were resolved by another scoring one of the raters.

It is assumed that when readers have comprehended a text, their mental representation of the text will reflect the content of the original text as comprehended and encoded in memory. The propositional textbase representation is believed to indicate the readers' understanding of the meaning information explicitly provided in the text (i.e., propositions and direct links between propositions). Analyzing the proportion of propositions recalled for a text is a basic, commonly used measure of text comprehension.

In the present study, recall of L1 text is also considered an index of the reader's comprehension skill, whereas recall of L2 text is considered to indicate the reader's L2 text comprehension performance which is also influenced by his or her comprehension skill and language proficiency. The subjects' L2 language proficiency was measured independently with a standardized English language test. The test consists of reading, grammar, listening, speaking, and writing subtests. The subtest scores were all significantly correlated to each other. The total test score will be used as an index of L2 language proficiency for the data presented later in this article.

Relationship between recall scores for L1 and L2 text and L2 language proficiency scores was examined using correlational analysis. In addition, multiple and stepwise regression analyses were conducted to examine the contribution of task to the variance in recall of L1 and L2 text. In the latter case, the effect of task on recall of L2 text was analyzed against the effect of comprehension skill (reflected in recall scores for L1 text) and language proficiency (reflected in L2 proficiency test scores).

5. Results

Table 1 represents the means and the standard deviations of the probability of recall of L1 text and recall of L2 text as a function of task and topic. It was found that when processing a text in L1, the reader comprehended and recalled a greater amount of textual information than when processing it in L2. A three way analysis of variance measure was conducted to examine the effect of language, task, and topic. The results revealed that language was a significant main factor, $MS = 11079$, $F(1, 156) = 74.67$, $p < .0001$, and that the other main factors and the interactive factors were all nonsignificant.

TABLE 1
Probability of Recall of L1 and L2 Text as a Function of Task and Topic

Task	*Language & Topic*			
	L1		*L2*	
	Rules	*Eye*	*Rules*	*Eye*
Surface	.40 (.14)	.39 (.11)	.25 (.15)	.21 (.11)
Image	.40 (.15)	.40 (.10)	.27 (.11)	.21 (.09)
Critique	.33 (.13)	.38 (.13)	.21 (.12)	.17 (.09)

Table 2 represents the correlation coefficients for L2 language proficiency (based on the total score for the English language test), recall of L1 text, and recall of L2 text. It was found that recall of L2 text was significantly correlated with both L2 language proficiency and recall of L1 text. Recall of L1 text was significantly correlated with recall of L2 text but not with L2 language proficiency.

TABLE 2
Correlation Coefficients for Language Proficiency, Recall of L1 Text, and Recall of L2 Text

Variable	*L2 proficiency*	*Recall L1 text*	*Recall L2 text*
L2 proficiency	1		
Recall L1 text	.17	1	
Recall L2 text	.37 *	.41 **	1

* $p < .001$, ** $p < .0001$

Table 3 and Table 4 represent the results of regression analysis for recall of L2 text and recall of L1 text, respectively. It was assumed that recall of L1 text is a good indicator for the individual's comprehension skill whereas the score for the English language test for his L2 language proficiency. By regressing the recall scores for L2 text with the recall scores for L1 text and the scores for the L2 language proficiency test, relative and independent contributions of these factors to L2 text comprehension can be analyzed. As seen in Table 3, recall of L1 text was entered first, contributing 17% of the variance in recall of L2, which was followed by L2 language proficiency (adding 9% of the variance). Task was entered in the equation as third, contributing additional 6% of the variance in recall of L2 text In contrast, as seen in Table 4, task was not a significant contributor to the variance in recall of L1 text.

TABLE 3
Recall of L2 Text as a Function of Recall of L1 Text, Language Proficiency, Task, and Topic

Multiple regression:

df	*R*	*R-squared*	*Adj R-squared*	*Std error*	*F*	*P*
76	.58	.34	.30	9.45	9.09	.0001*

Stepwise regression:

Step	*Variable*	*R-squared*	*Std error*	*F*
Step 1	Recall L1 text	.17	10.36	15.20
Step 2	L2 proficiency	.26	9.82	13.27
Step 3 (Last)	Task	.32	9.51	11.38
(Variable not included in equation: Topic)				

TABLE 4
Recall of L1 Text as a Function of Task and Topic

Multiple regression:

df	*R*	*R-squared*	*Adj R-squared*	*Std error*	*F*	*P*
83	.13	.02	-.01	12.61	.69	.50

Beta coefficient table:

Parameter	*Value*	*Std error*	*Std value*	*t*	*P*
Intercept	40.64				
Task	1.89	1.69	.12	1.12	.26
Topic	1.07	2.75	.04	.39	.69

6. Discussion

The present study investigated the effect of task on L1 and L2 text comprehension and memory by focussing on recall that reflects the propositional text base representation of a text. The effect of task on L2 reading was also examined against an interplay between language processing, which is typically affected by language proficiency, and conceptual processing, which is likely to be influenced by comprehension skill. The findings of the present research seem to support both the linguistic threshold hypothesis and the linguistic interdependent hypothesis.

The overall analysis of recall revealed, not surprisingly, that the probability of propositional recall of a text was significantly greater when the text was processed in L1, compared with when the same text was processed in L2. Moreover, the results of correlation analysis revealed that readers' L2 language proficiency was significantly correlated to their recall of L2 text but it was not correlated to their recall of L1 text. These findings provide indirect evidence that supports the linguistic threshold hypothesis, which states that a certain level of language proficiency needs to be attained before comprehension of a text written in the language can fully benefit from comprehension skill developed

through L1 reading experience.

On the other hand, the results of the present study has also provided evidence for common ground for L1 reading and L2 reading, supporting the linguistic interdependent hypothesis. This hypothesis states that a substantial portion of reading is rather nonspecific to a particular language and therefore individuals' comprehension skill developed based on L1 reading experience is also used and reflected in their performance in L2 reading comprehension. In fact, the stepwise regression analysis of contributing factors to recall of L2 text showed that a significant amount of variance in recall of L2 text was accounted for by recall of L1 text as well as by the scores for the L2 language proficiency test. This finding clearly indicates that comprehension skill and language proficiency are both independent factors that can explain L2 text comprehension performance. This finding of the present study is an additional support to what was reported by other researchers who investigated L1 and L2 reading with other languages.

Secondly and more importantly, the present study has revealed the effect of task on comprehension and memory of L2 text by differentiating it from the effect of comprehension skill and language proficiency. Based on the analysis of contributing factors to recall of L2 text, it was found that task was a significant factor that can account for variance in recall of L2 text but not for variance in recall of L1 text. When processing a L2 text, the kind of processing demands imposed by a particular task may influence more greatly how well the content of the text is comprehended and encoded into memory representation, in contrast to when processing the same text in L1. In particular, recall of L2 text was negatively affected under the read for critique condition compared with recall under the other task conditions. On the other hand, such effect of task was not observed for recall of L1 text. Thus, task may be an additive factor that significantly influences the processing operations involved in comprehension and construction of mental representation of L2 text. In particular, the effect of task may be stronger and negative for L2 text comprehension when readers' processing operations are stretched and possibly overloaded due to the processing demands imposed by the task on top of the processing difficulty caused by limited language proficiency.

7. Conclusion

The present study has provided some evidence for the effect of task on the comprehension and memory of L2 text in contrast to L1 text. The findings of the present study suggest that task may impose processing demands independently from and additively to the effect of comprehension skill and language proficiency, influencing the processing operations and resulting memory representations of text. The study reported in this article is a part of a larger research project on L1 and L2 reading in English and Japanese. Future analysis of the collected data

will include a closer examination of recall protocols for memory representations at different levels. Such an analysis may help clarify how a particular encoding task induces certain processing operations and thereby influences the resulting comprehension of and learning from text.

Appendix

The *Eye Contact* text (The English version)

According to a newspaper report, the company selling food and drinks aboard Tokaido Shinkansen superexpress trains is switching to "quiet" sales methods. Since the superexpress line opened in 1964, sales have been conducted in the traditional *osen ni kyarameru* (rice crackers and caramels) hawking style, although the things offered for sale are different. Now that peddling style is being dropped.

Because many people would like to rest while on a train, the new quiet sales approach is welcome. Two specific sales methods have been adopted. One calls for the salesperson to try to catch the eye of each seated passenger to judge whether or not the passenger wished to buy something. The other requires the salesperson to announce the items available in a quiet voice audible only to the passengers occupying the nearest three rows of seats as the salesperson passes through a car.

What is interesting is the way the salesperson is supposed to catch the eyes of passengers. It would be discourteous to look at the eyes of a passenger too long. A short look might give the impression that salesperson is indifferent.

A variety of tests has led the company to conclude that three seconds is the limit for appropriate eye contact, according to Takao Yoshida, the firm's business manager.

This reminded me of a study carried out by American psychologists on how long eyes met during conversations. If I remember correctly, their finding was that normally the time of eye contact was less than 60% of the time a conversation lasted.

The psychologists also found that if a person looked at the eyes of another longer than that, it was under "unusual" circumstances – either they were quarreling or in love. Extremely short eye contact is also taken by experts as signaling psychological strain.

Without being conscious of doing so, one looks at the eyes of other people to surmise what goes on in their minds. But anyone trying to observe the three-second rule of the food and drink sales company is likely to find it hard to practice.

The importance of eye contact has been instilled in the members of the Japan national soccer team by its coach, Hans Ooft. Training under him in passing the ball by sending signals with the eyes has served to score goals in matches.

In our daily lives, we see two kinds of people – those who keep gazing at the eyes of the other party while the subjects of their conversation change from one to another and those who keep their eyes turned away. When a mother monkey scolds her child she looks squarely into the latter's eyes without fail, according to research on monkeys.

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