The role of exposure to syntactic structures and discourse-driven syntactic processing in Japanese EFL learners' text comprehension

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The role of exposure to syntactic structures and discourse-driven syntactic processing in Japanese EFL learners' text comprehension

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By

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ABSTRACT

Acquiring fluent ability to understand English texts has become increasingly important for English education in Japan due to rapid globalization caused by sophisticated communication and transportation technologies and services. Despite the importance of fluent reading ability in English, there are few EFL students who can read as fluently as L1 readers. There is a wide range of individual differences in the reading comprehension performance among Japanese EFL learners.

As text comprehension is a highly complex cognitive task, successful text processing depends on the coordinated operation of several component processes. An incremental interpretation of incoming words must be constructed before they fade away from immediate memory. Furthermore, according to Just and Carpenter (1992), the pool of processing resources is limited, so that increasing maintenance or operational demands impose constraints on the successful operation of all processes when demands exceed available resources. For L2 readers whose linguistic competence is limited compared with that of L1 readers, forming a coherent text representation is a task of considerable difficulty. Previous research has demonstrated that syntactic processing ability is a prerequisite for sentence comprehension. Thus, a disruption at syntax level may undermine text comprehension as a whole.

In this context, investigating the current state of Japanese EFL learners' text comprehension and developing methods to improve reading abilities, especially syntactic parsing abilities, could be beneficial for future English language education. This study aimed to explore the source of individual variability in text comprehension among Japanese EFL learners and examine whether repeated exposure to a syntactic structure might facilitate the syntactic processing ability and whether this facilitation leads to efficient reading comprehension. For these purposes, four experiments were conducted.

Experiment 1 was conducted to examine the effects of proficiency, working memory, and focusing task on text comprehension and reading behavior among Japanese EFL learners. This experiment consists of four sessions: a proficiency test, a reading span test, reading session 1, and reading session 2. In reading sessions 1 and 2, participants read an English text and a Japanese text on a computer screen and their eye movements were monitored and recorded by an eye tracker. In

reading session2, participants were divided into two groups, namely, a task group and a without task group. Participants in the task group were required to read the text looking for the key words (key word detection task). The results of the experiment indicate that proficiency is one of the major determinants of reading ability in English among Japanese EFL learners. There were no correlations between reading comprehension scores and reading span test scores in both English and Japanese. The plausible explanation for this result may be that working memory was not constrained because the materials used in the experiment were easy for the participants and, furthermore, participants could reread the sentences at their own pace. The results of reading session 2 demonstrated that the focusing task improved reading comprehension and reading behavior to some extent. Considering these results together, the importance of proficiency in text comprehension was confirmed.

Experiment 2 was conducted to examine whether Japanese EFL learners' syntactic processing affects their text comprehension performance. Short experimental texts containing two critical sentences that together warrant a causal inference were constructed. The second sentence of the critical sentences always contains either reduced relative clauses which is difficult to parse or less difficult unreduced relative clauses. Results from a lexical decision task conducted immediately after critical sentences suggested that readers formed the causal inferences when the syntactic structure was less difficult to parse but that inferencing was constrained when syntactic structure was more difficult. These results support the shared resource assumption (Just and Carpenter, 1992) and demonstrated that Japanese EFL learners' text comprehension depends on successful syntactic processing.

Experiment 3 was conducted to examine whether repeated exposure to a construction embedded in texts facilitates subsequent comprehension of that construction. Specifically, the role of experience in Japanese EFL readers' relative clause comprehension was investigated. Two groups, both of which were equally placed in English proficiency and working memory capacity, were formed. Participants in the Experience group repeatedly read relative clauses embedded in texts in a training session, while the Control group read the same number of texts in which no relative clauses were included. The Experience group's comprehension accuracy improved significantly, whereas that of Control group did not. Moreover, the Less Proficient group that scored below average in the pretest improved their comprehension accuracy more than did the Proficient group. Although participants read more quickly after the training session, only the Experience group was able to read

object relatives faster than subject relatives in the posttest. This study demonstrated that Japanese EFL learners' relative clause processing, especially object relative clause processing, can be facilitated by repeated exposure to relative clause structures in naturalistic discourse contexts.

It is often argued that priming is weaker in comprehension than in production. Nevertheless, robust priming effects were observed in Experiment 3. Following this result, Experiment 4 was conducted to examine whether the robust facilitative effects observed in Experiment 3 were related to discourse factors. Previous research has demonstrated that object relative clauses are used to link a new entity to the ongoing discourse. In Experiment 4, relative clause sentences were presented in isolation. The results showed no improvement in object relative clause comprehension. Accordingly, it was confirmed that discourse context plays an important role in the processing of relative clauses.

Taken together, the results of Experiments 1 and 2 demonstrated that syntactic processing ability may have considerable effects on their reading comprehension in English. The empirical results in Experiments 3 and 4 demonstrated that repeated exposure to relative clauses embedded in texts facilitated the processing of relative clauses constructions, especially of object relative clauses. These results suggest a powerful role of experience and discourse-driven syntactic processing in language comprehension. The findings of this study emphasize the importance of frequent exposure to syntactic structures in texts and discourse-driven syntactic processing to improve text comprehension.

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1. INTRODUCTION

1.1 Background

Promoting the ability to understand sentences or texts fluently in English is an important component for English education in Japan. However, there are not many students who can read as fluently as L1 readers. There is a wide range of individual differences in reading comprehension performance among Japanese English as a Foreign Language (EFL) learners.

1.1.1 Syntactic processing ability and reading comprehension

Reading is a multi-component skill that involves various processes such as word recognition, syntactic or semantic analysis, and information integration. We have to construct an incremental interpretation of incoming words before they fade away from immediate memory. The coordinated operation of such component processes is indispensable for the successful comprehension of English sentences or texts (Just & Carpenter, 1980). However, functional magnetic resonance imaging (fMRI) or event-related potentials (ERPs) investigations of language comprehension have revealed that syntactic processing ability is a necessary precondition for sentence comprehension. Local structure building takes place before lexical-semantic and thematic processes and syntactic revision and final integration (Friederici & Kotz, 2003).

Despite the importance of syntactic processing, considerable individual variability in performance on syntactic processing tasks has been observed in numerous studies (e.g., King & Just, 1991; Swets et al., 2008). As texts consist of phrases and sentences, a delay or a failure in processing information at one level is likely to have consequences for the higher-level processing that depends on that level of processing (Horiba, 1996; Rawson, 2007). A disruption at syntax level will undermine text comprehension as a whole; hence, syntactic analysis ability is crucial for fluent reading.

1.1.2 Language learning and frequency effects

Repetition has been recognized to be important in everyday language use. According to Ellis (2002), rules of language are structural regularities that emerge from learners' life-time analysis of distributional characteristics of the language input. Such analysis is greatly facilitated by

regularities in one-to-one correspondences between the co-occurring elements. Language learning and processing are closely related to input exposure and experience.

It has been argued that two brain memory systems (declarative and procedural memory) underlie language learning and language use. Ullman (2001) found that the processing of linguistic forms which is computed grammatically by procedural memory in L1, is dependent to a large extent on declarative memory in L2, especially in later L2 learning. Later learning of a language may impair the ability of the procedural memory system to learn or compute certain aspects of grammatical processing. This model predicts that the relative dependence on procedural memory for grammatical computations would increase with practice. Therefore, even older learners may show a degree of dependence on procedural memory if they have had a relatively large amount of practice or exposure because highly practiced processes become automatic. If processes are highly practiced, it becomes increasingly possible to execute them in parallel (Just & Carpenter, 1987). Considering this research, repeated exposure seems to be one of the best ways for EFL learners to become fluent readers.

1.2 Purpose of this study

Investigating the current situation of Japanese EFL learners' text comprehension and developing a better method to improve reading abilities in English could be beneficial for future English language education. Therefore, this study aims to explore the causes of insufficient text comprehension ability by Japanese EFL learners and examine whether repeated exposure to a syntactic structure will facilitate the syntactic processing ability and if this facilitation will lead to efficient reading comprehension.

1.3 Organization of this thesis

This study is organized in the following manner. The background and purpose of this study are presented in this chapter. In Chapter 2, related literature on text comprehension, working memory, structural priming and relative clause processing is reviewed. Chapter 3 presents the method of Experiment 1 which was implemented to explore the current situation of Japanese EFL learners' text comprehension, and the analyses of the results and discussion are presented. Chapter 4 contains the method, the experimental results, and the discussion of Experiment 2 which was

conducted to investigate the effect of syntactic processing on text comprehension of Japanese EFL learners. Chapter 5 provides the method, results, and discussion of Experiment 3 investigating the frequency effects on Japanese EFL learners' relative clause processing. Chapter 6 compares the results of the repeated exposure effects of relative clause sentences embedded in texts with those of relative clause sentences without discourse context. Chapter 7 discusses the results of the four experiments and demonstrates the findings. Chapter 8 presents a summary of the findings and provides suggestions for future research.

2. LITERATURE REVIEW

2.1 Text comprehension

To comprehend a text well, readers have to integrate partially assembled information and build coherence. Text is typically organized in such a way as to convey its message to readers effectively. According to the Kintsch model (e.g., Kintsch, 1998; van Dijk & Kintsch, 1983), text information is comprehended incrementally and represented in the mind on three levels: surface form, propositional textbase, and situation model. The surface structure is characterized by the exact words and phrases used. Syntactic theory provides the tools for the description and analysis of this level of representation. Surface form is generally stored until the end of the sentence and may be lost rapidly thereafter. The textbase represents the semantic content of the text and consists of elements and relations that are directly derived from the text itself. The situation model is a construction that integrates the textbase and relevant aspects of the comprehender's knowledge. It is considered to be the longest lasting component of memory trace (Kintsch et al., 1990).

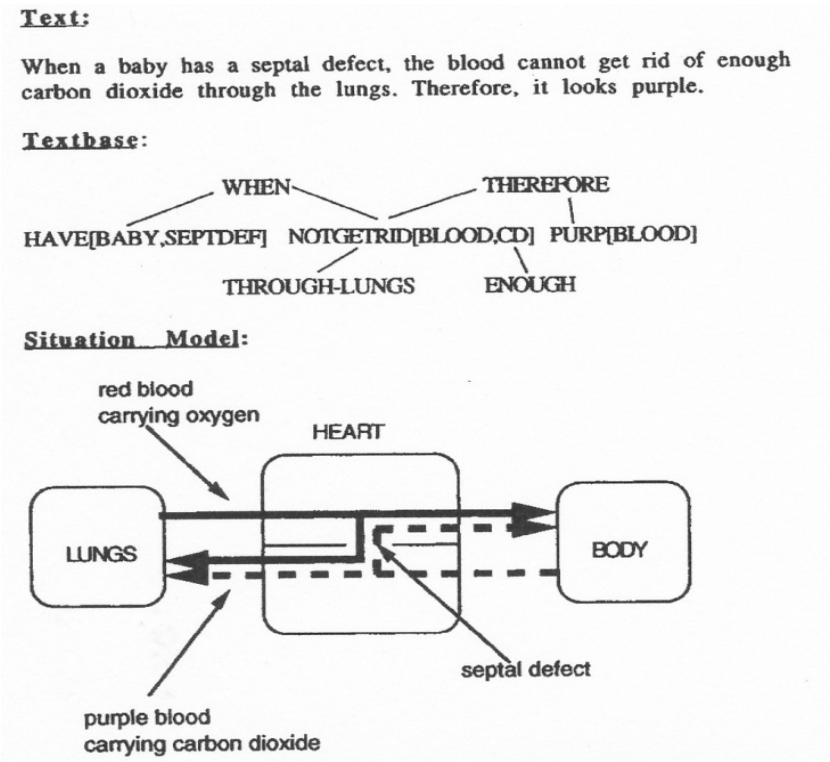


Figure 1. Illustration of the textbase and situation model (Reprinted from Kintsch et al., 1994, p.295)

The distinction between the textbase and situation model is shown in Figure 1. Figure 1 shows two sentences with their textbase and situation model. The textbase consists of three propositions linked by sentence connectives. The situation model is shown in the form of a graph based on the reader's knowledge about the circulatory system (Kintsch, 1994). The mental representation of a text that a reader constructs includes the textbase plus knowledge elaborations and knowledge-based interpretation of the text — the situation model.

The textbase and situation model have two structures: microstructure and macrostructure. The microstructure of a text consists of micropropositions and their interrelationships. The macrostructure hierarchically organizes the propositions of the microstructure. Text elements that repeatedly signal to be of local importance become important for the macrostructure. Microprocesses are concerned with the local understanding of the text that proceeds phrase by phrase and sentence by sentence with attention to the details in the text. Macroprocesses are concerned with the global understanding of how readers form an overall idea about the gist of the text (Kintsch & Yarborough, 1982). A gist of the text expressed by macrostructure is the content that matters the most for text comprehension and memory (e.g., van Dijk & Kintsch, 1983).

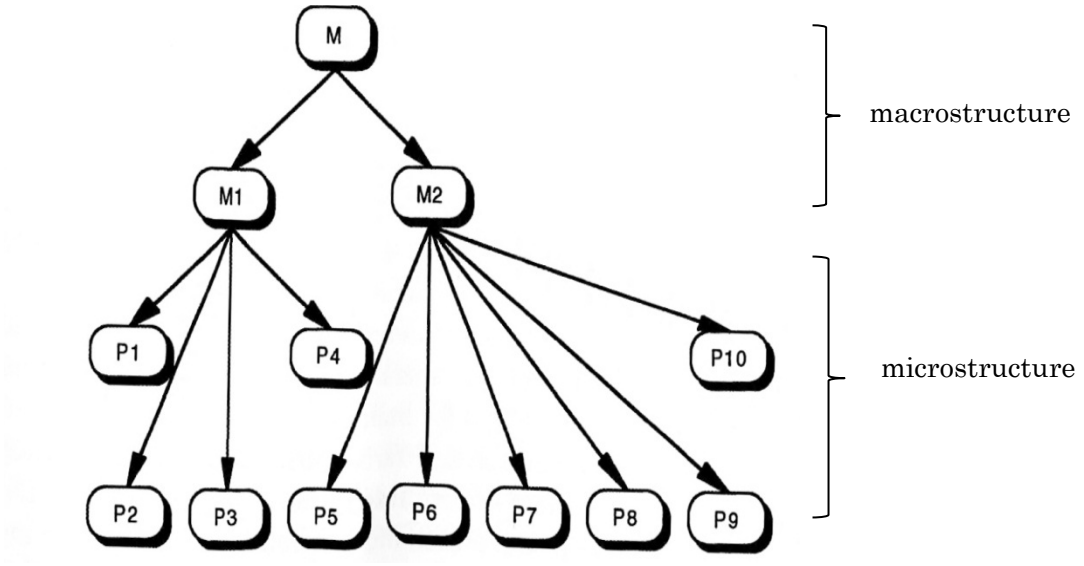


Figure 2. Macro operations resulting in a hierarchical structure (Adapted from Kintsch, 1998, p. 67)

A macrostructure must be implied by the explicit microstructure from which it is derived. Unlike micropropositions, macropropositions may not be expressed explicitly in the text. There are

many signals in the texts that enable the formation of macrostructures. Structural signals, such as titles, topic sentences, and summaries are used; moreover, syntactic and semantic signals that indicate local importance in a discourse are also used. Syntactic signals include cleft sentences, passive, the clause structure of sentences, and other foregrounding and topicalization devices. Semantic signals include topic change marker and various cues that indicate local coherence or a break that readers can use to maintain or change their current microhypothesis (Kintsch, 1998).

To form a coherent representation, readers must draw various types of information from long-term memory (Baddeley, 2000; Ericsson & Kintsch, 1995). Retrieval cues activating in working memory mediate access to these hierarchical structures which readers have generated from the previously read text and held in long-term memory. Text representation in long-term memory functions as a retrieval structure (Ericsson & Kintsch, 1995; Kintsch, 1998). Coherent representations of texts are formed by these complicated and interconnected processes.

2.2 Working memory in language comprehension

2.2.1 The role of working memory in language processing

Unlike the traditional concept of short-term memory that passively stores information, working memory is considered to be more dynamic, and is assumed to be engaged in processing and storage activities simultaneously. According to Carpenter and Just (1989), working memory plays a central role in all forms of complex thinking and its necessity in language comprehension is particularly evident; it plays a central role in storing the partial and final products of a reader's computations as they process a text. It allows the reader to mentally connect ideas that are mentioned separately in the text. Daneman and Carpenter (1980) developed the reading span test (RST). In this test, participants have to read sentences aloud while maintaining the last word of each sentence in memory. Daneman and Carpenter (1980) found a significant correlation between RST scores and reading comprehension performance.

2.2.2 A capacity theory of comprehension

As the total amount of activation available in working memory is fixed for each person, working memory resources are limited. Its two functions — storage and computation — compete for this limited capacity. In a complex task, simultaneously activated operations impose a heavier

computational burden, leaving little room for the storage function. A computationally demanding task leaves less capacity for storing information and vice versa. Thus, capacity limitations affect performance when the resource demands of the task exceed the available supply. An excessive burden on working memory creates a trade-off between computation and storage (Just & Carpenter, 1992). Researchers suggest that working memory capacity is particularly important in complex cognitive tasks (King & Just, 1991). Individual differences in complex cognitive task performance are influenced by differences in working memory capacity.

2.2.3 The relationship between L1 and L2 working memory capacity

Osaka and Osaka (1992) investigated the relationship between L1 and L2 working memory capacity among Japanese college students, using English and Japanese versions of reading span tests. They found a remarkably high correlation between L1 and L2 working memory scores. They interpreted this outcome as suggestive that working memory resources, in a large part, are shared across languages, and working memory capacity is somewhat independent of linguistic knowledge.

2.2.4 Allocation of limited processing resources in reading comprehension

2.2.4.1 Focus and reading comprehension

As our comprehension draws on limited resources, including working memory, attention, and time, we must determine what to process in detail and what to underspecify or treat in a shallow fashion (Ferreira, Bailey, & Ferrano, 2002; Sanford, 2002; Swets et al., 2008). Focus word is defined as the most important word for comprehending a sentence. To understand a sentence, the focus word must be understood, more than anything else. Cutler and Fodor (1979) demonstrated experimentally that sentence understanding is facilitated by rapid identification of focused information. They suggested that any strategy which allowed the comprehension device to find the sentence focus rapidly would presumably facilitate understanding.

Successful comprehension often requires suppressing irrelevant information. According to the structure building framework (Gernsbacher, 1990), coherent mental representations are built by enhancing the activation of relevant information while suppressing the activation of irrelevant information. Germsbacher and Faust (1991) investigated whether the cognitive mechanism of suppression underlies differences in adult comprehension skills and the results of the experiments

confirmed the effect. There were differences between skilled and less-skilled comprehenders in terms of ignoring an irrelevant stimulus. The results indicated that less-skilled readers suffer from a less efficient suppression mechanism which is important for comprehension.

To comprehend language successfully, we need to incorporate each new incoming information into an evolving mental representation of information mentioned previously in the text (van Dijk & Kintsch, 1983). Texts must be comprehended sequentially, one sentence after another; therefore, when comprehending a sentence, memory is needed to provide access to the prior text (Kintsch, 1998). Birch and Garnsey (1995) investigated the effects of focus on memory for words using written sentences and the results demonstrated that focused words were consistently better remembered. They concluded that focusing on a word increases the specificity of memory for its semantic properties, which allows readers to understand the subsequent information more readily.

Sanford (2002) argued that the material cued as foregrounded and focused is likely to be what the writer intends to be most important, and that readers devoted the most effort in processing it. Birch and Rayner (1997) conducted a research on how readers encode information that is linguistically focused by monitoring readers' eye movements. Participants had longer reading times while reading a part of the sentence that was focused. The results suggest that readers are sensitive to the manipulation of sentence focus and they encode focused information more carefully.

When it comes to discourse comprehension, important words or information are much likely to be encoded than insignificant details. According to Kintsch (1998), integration of meaning is performed whenever a new element is added to the network under construction. However, except for in the processing of short sentences, working memory will usually be loaded to capacity and must be cleared to make room for the subsequent processing. Whatever has been constructed so far is transferred to long-term memory. Consequently, except for one or two central propositions that are retained in the focus of attention due to their importance, all that has been constructed up to this point in working memory is lost from consciousness. In a normal text, however, this information is still readily retrievable because the succeeding sentence contains retrieval cues that facilitate the retrieval. If a reader constructs a good hierarchical text representation in long-term memory, the representation also facilitates the effective retrieval process. However, poor readers' textbase is not good enough to establish mental focus and cannot create sufficient constraints for deactivating irrelevant information. Therefore, poor readers are more susceptible to incomplete understanding

and misinterpretation, and they face difficulties in constructing good mental representations (Gernsbacher & Faust, 1991; Kintsch, 1998; Osaka et al., 2002). The central executive of working memory is assumed to be responsible for the allocation and coordination of the brain's attentional resources (Baddeley, 1996). The ability or strategy to flexibly control one's attention will facilitate the updating of focus, which then leads to the construction of coherent text representation. These findings suggest that focus in the sentence plays an important role in text comprehension.

Reading comprehension is a highly complex cognitive task that involves several component processes. In addition to this complexity, component processes share limited processing resources. Considering these constraints, developing reading strategies such as focusing would be beneficial for fluent reading. Simultaneously, to identify the focused information, we must acquire enough language competence to form good hierarchical text information.

2.2.4.2 Syntactic processing ability and language comprehension

Besides reading strategies, we need adequate knowledge or processing ability of English to attain fluent reading. It has been widely accepted that L2 proficiency is a vital prerequisite for effective L2 reading. According to Friederici and Kotz (2003), syntactic processing ability is most crucial to process and comprehend sentences or texts. It is the syntactic information that marks the grammatical relation between the elements in a sentence, thereby signaling "who is doing what to whom." On the basis of the results of functional magnetic resonance imaging (fMRI), event-related brain potentials (ERPs), and magnetoencephalography (MEG), they formed a brain-based model of language comprehension. This model assumes three functionally and temporally separable stages of processing: processes of local structure building take place during *phase 1*, lexical-semantic and thematic processes are engaged during *phase 2*, and processes of syntactic revision and final integration take place in *phase 3*. As shown in Figure 3, the processes of local syntactic structure building of Phase 1 functionally precede lexical-semantic processes assumed to be part of Phrase 2. Therefore, disruption at the syntactic structure building level will undermine the sentence comprehension as a whole. Consequently, successful local structure building holds the key to efficient reading comprehension.

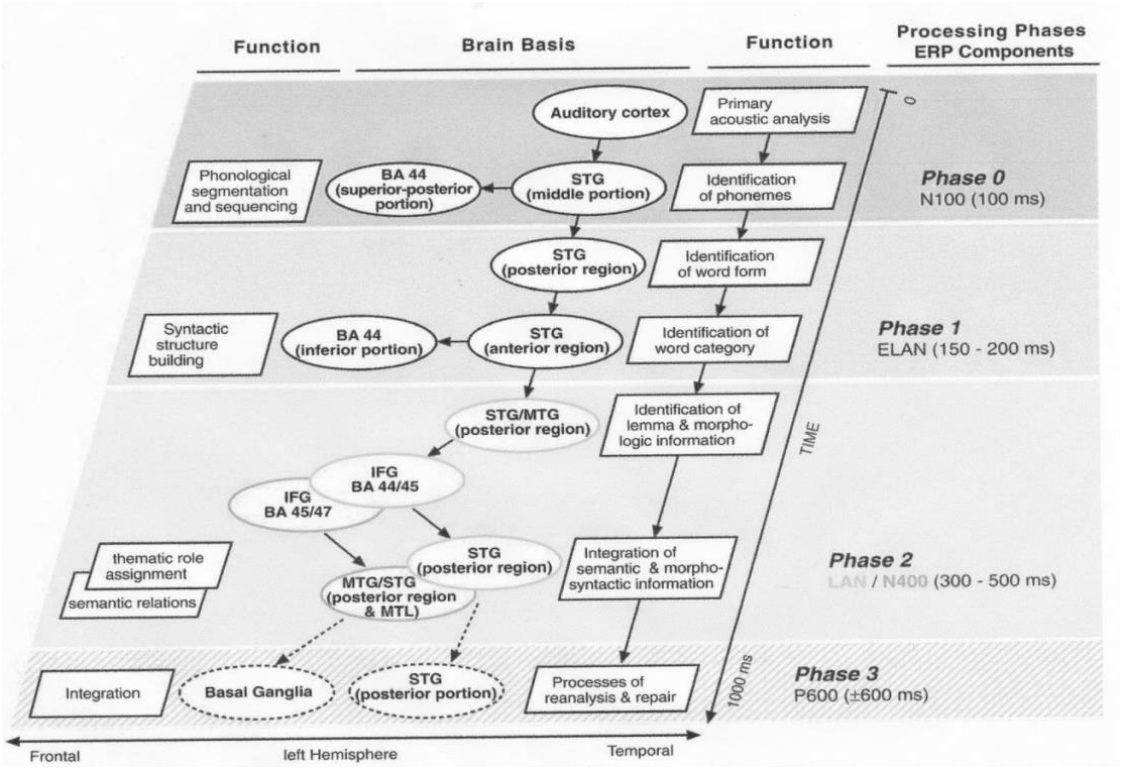


Figure 3. The syntax- and semantic-related brain regions and processing phases (Reprinted from Friederici & Kotz, 2003)

Text processing is a highly complex cognitive task and it is not merely a sequential display of sentences. Successful completion of text comprehension depends upon the coordinated operation of several component processes. Therefore, if one component process is slow or disrupted, it robs other processes not only of adequate information but of processing resources. Rawson (2007) investigated the relationship between syntactic processing and higher-level text processing. In her experiment, participants were presented with short texts containing two critical sentences that together warranted a causal inference. The syntactic structure of the second critical sentence was either an unambiguously marked relative clause sentence or a temporarily ambiguous reduced relative clause sentence. Results of a lexical decision task conducted immediately after critical sentences suggested that readers made the causal inferences when the syntactic structure was less difficult to process but that inference was constrained when the syntactic structure was more difficult and ambiguous. The result suggests that insufficient resources were left for the inference processes due to the increased demands of syntactic parsing. Therefore, acquiring sufficient

syntactic processing ability is critical for fluent reading. The results of Rawson (2007) supported the shared resource assumption and confirmed Friederici and Kotz's claim that syntactic processing ability is a necessary precondition to process and comprehend sentences or texts.

2.2.5 Frequency effects in language processing

We are sensitive to the frequencies of events in our experience. As to linguistic experience, previous studies have suggested that the types and amounts of reading and writing that people undertake lead to individual differences in reading, a result that is consistent with the important role of repetition or practice in the development of skills. For example, considerable evidences suggest that variability in readers' print exposure - the amount of text they read - is correlated with variability in their language skills, including their orthographic, phonological, and syntactic processing skill. Acheson, Wells, and MacDonald (2008) investigated the relationship between print exposure and reading skills of college students. Higher levels of print exposure were correlated with higher sentence processing abilities and superior verbal ACT, a standardized achievement test.

Moreover, increasing number of studies have shown that frequency affects the processing and acquisition of syntax. Frequent language forms influence representation and access to linguistic knowledge of constituent structure. Many previous studies have focused on the role of statistical learning and established their importance during incremental language comprehension, both in the context of ambiguity resolution and comprehension of unambiguous structure (e.g., Christiansen & MacDonald, 2009; Wells et al., 2009).

Trueswell, Tanenhaus, and Kello (1993) found that typical garden-path effects that occur for sentences such as (1a) (where "the prize" is initially interpreted as the direct object of "to accept", while it is, in fact, a part of a sentence complement) do not occur for verbs that prefer a sentence complement (e.g., "realize", in (1b)).

(1a) The man accepted the prize was not going to him.

(1b) The man realized the prize was not going to him.

These studies of sentence processing show that adults have a vast statistical knowledge about

the behavior of the lexical items of the language. They know the various cues provided by verbs. Comprehenders acquire the knowledge of relative frequencies with which particular verbs appear in different tenses, in active versus passive, and in intransitive versus transitive structures, and the typical kinds of subjects and objects that a verb takes. Previous studies have shown that sentence comprehension is affected by various distributional information including the frequency of words (Rayner & Duffy, 1986), the frequency of words in specific syntactic structures (MacDonald, Pearlmutter, & Seidenberg, 1994) as well as co-occurrence relations between verbs and specific arguments (Trueswell, Tanenhaus, & Garnsey, 1994). This knowledge can be acquired through experience with input exhibiting these distributional properties. Frequent analyses are preferred to less frequent ones. The structural regularities acquired through experience are an invaluable source of information influencing comprehension processes. Various representations in the language system can be tuned by language experience. As this tuning is long-lasting and operates unconsciously, it has been considered to be a kind of *implicit learning.*

After Trueswell, Tanenhaus, and Kello (1993), Trueswell and Kim (1998) conducted an experiment, using a fast priming technique. They found that garden-path effects for sentences like (1a) can be significantly reduced if they are primed with verbs that prefer a sentence complement above a direct object. These experiments demonstrated that frequency affects the processing and acquisition of syntax and the preference based on previous experience can be modulated by priming task. As Just and Carpenter (1992) argued, the systems supporting syntactic processing are reliant on a single pool of working memory resources. Acquiring probabilistic knowledge of the distributional regularities governing language structure can reduce the working memory load, when we process the difficult syntactic structures.

2.3 Structural priming

2.3.1 Structural priming in language processing

One of the most convincing sources of evidence that people make use of abstract syntactic representations while speaking or reading comes from the phenomenon of structural priming, which is a tendency to repeat or better process a current sentence because of its structural similarity to a previously experienced sentence (e.g., Bock, 1986; Tooley et al., 2014). When we speak or write, we tend to repeat the underlying basic structures that we recently produced or comprehended.

For example, a person who just produced a double object construction (DO; e.g., “The girl showed the teacher a picture”) is more likely to produce another DO when describing a transfer situation (e.g., “John sent Mary a letter”) than to produce a prepositional object (PO) construction describing the same event (e.g., “John sent a letter to Mary”). A person who first produced a PO sentence (e.g. “The girl showed a picture to the teacher”) is more likely to produce another PO (e.g., “John sent a letter to Mary”).

Structural priming was discovered with the classic experimental demonstration conducted by Bock (1986). Even before Bock’s experiment, it has been noted by several researchers that we tend to repeat our structural choices in our everyday conversation. The first experimental work on structural repetition was done by Levelt and Kelter (1982). They asked Dutch shopkeepers *Om hoe laat gaat uw winkel dicht?* (At what time does your shop close?) or *Hoe laat gaat uw winkel dicht?*(What time does your shop clo*s*e?). In the former case, replies tended to include the preposition, for example, *Om viif uur* (At five o’clock); in the latter case, replies tended to exclude the preposition, for example, *Viif uur* (Five o’clock). Following this study, Bock and colleagues produced some influential articles on structural priming in production (Bock, 1986; Bock, 1989; Bock & Loebell, 1990). Since the late 1990s, many researchers have shown experimentally that when two syntactic alternatives with roughly the same meaning are available to describe given pictures or to complete a sentence, speakers or writers have a tendency to use the structure they have just read or heard as a prime.

2.3.2 Structural priming in comprehension

A great deal of research has investigated structural priming in production till date. While the term structural priming in production refers to the tendency of speakers to reuse recently encountered structures, structural priming in comprehension refers to the facilitated comprehension of a structure after it has been recently processed. Recent studies have demonstrated that comprehending a sentence with a particular syntactic structure can facilitate comprehension process for subsequent sentences that have the same syntactic structure. Although structural priming that persists across unrelated intervening sentences has been commonly observed in production (Bock & Griffin, 2000), similar effects in comprehension have been relatively small in number (Tooley et al., 2014).

However, some research has shown that repeated exposure to sentences containing a novel or infrequent structure can facilitate later comprehension of sentences that have the same structure (Long & Prat, 2008; Wells et al., 2009). In Long and Prat (2008), readers were intensively exposed to sentences with main-verb/reduced-relative ambiguities. Exposure enhanced low-span readers' use of plausibility information. Furthermore, the effect of exposure generalized to sentences that were not included in the training materials. They attribute the differences in the processing of syntactically ambiguous sentences to readers' experience with these structures. Wells et al. (2009) manipulated the reading experience of L1 university students over a period of several weeks. They used relative clause sentences as the experimental stimuli, as object relative clauses were considered more demanding to comprehend because of its low-frequency word order. After the training session which manipulated the participants' reading experience, the group that received relative clause experience increased reading speed for object relatives more than for subject relatives, whereas the control group did not.

Moreover, a few studies exist on repeated exposure effects during text comprehension. Kaschak and Glenberg (2004) also found that comprehension and processing of a novel structure was facilitated after repeated exposure to examples of the structure. Although the critical structure was inserted in passages, the reading time for the critical sentence demonstrated that participants can quickly learn the novel structure. They concluded that repeated exposure to a novel structure could lead to more facile comprehension of that structure and a mechanism that supports children's language acquisition may also play a role in adult's ability to learn new structures in their native language. Further research on the effects of repeated exposure to a syntactic structure embedded in text was demonstrated in a study conducted by Rawson (2004). In series of experiments, participants were repeatedly exposed to either ambiguous or unambiguous sentences embedded in short texts. In both conditions, reading times in the target regions decreased across the trials, with more speed-up for the ambiguous sentences than the unambiguous ones. These studies for L1 readers demonstrated that repeated exposure to a given structure facilitated the subsequent processing of the same structure.

2.3.3 Mechanisms of structural priming

In a study focusing on the mechanism of such structural priming, Pickering and Branigan

(1998) suggested that structural priming effects in language production are caused by a short term residual activation mechanism. In this model, when a certain syntactic structure is recently produced, there are residual activations for that structure's combinatory nodes which represent the verb's combinatorial properties. This activation is retained for a short time at the combinatory node. As it is linked to other verbs that can take the structure specified by its combinatorial properties, this structure is more likely to be produced in subsequent utterances.

Take the verb *give*, for instance, it is used in two different constructions, *double object (DO)* and *prepositional object (PO)* constructions. *NP, NP* node is activated whenever the speaker uses *give* in DO construction and *NP, PP* node is activated whenever the speaker uses the PO construction. When a speaker produces *The teacher gives the class homework*, the word *give* activates the lemma *give*, the feature nodes for third person, singular, present tense, and so forth, and the combinatorial node *NP, NP.* Activation of these nodes as well as the links between them does not decay immediately. These nodes are therefore at an advantage in the production of a subsequent sentence due to the residual activation.

The combinatorial nodes are shared between different lemmas (e.g., *give* and *send*). Pickering and Branigan (1998) asserted that prior activation of a combinatorial node (e.g., *NP, NP*), together with a lemma node (e.g., *give*) affect its likelihood of being activated in combination with other lemma node linked to it.

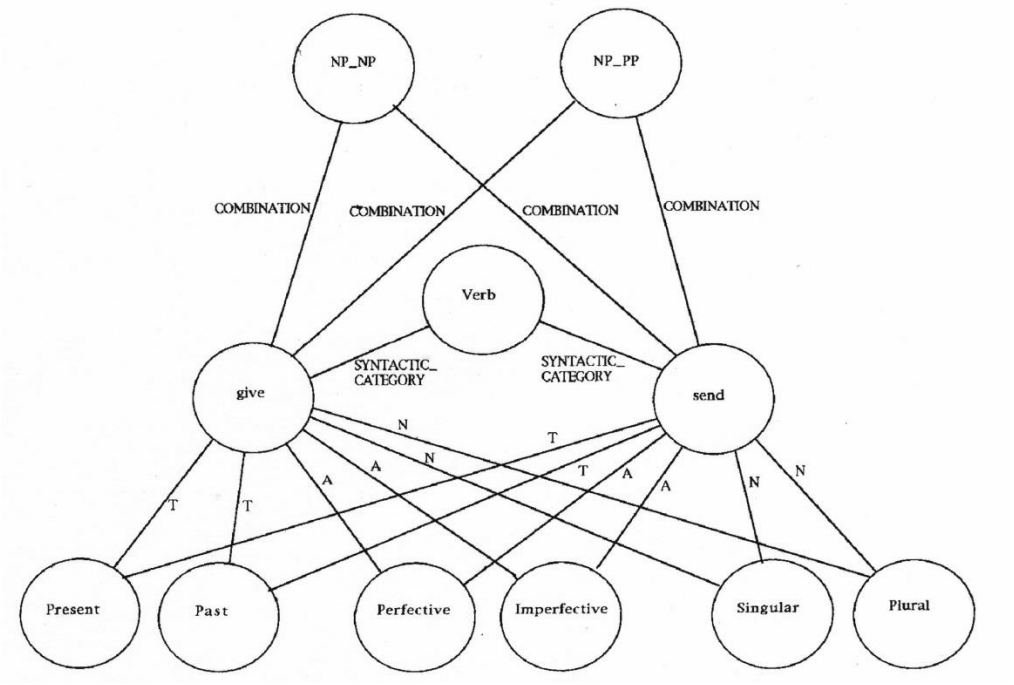


Figure 4. A partial model of the representation of syntactic information associated with verbs in the production lexicon. The labels T, A, and N refer to tense, aspect, and number, respectively. (Reprinted from Pickering and Branigan, 1998)

As these activation changes are transient, this does not explain the long-lasting priming effects, although many researchers have found that structural priming effects persist across intervening sentences (e.g., Bock & Griffin, 2000).

Other researchers have offered a different account of the mechanism producing structural priming (Bock & Griffin, 2000; Chang et al., 2006). Bock and Griffin (2000) argued that the long-lasting nature of priming, its lack of dependence on explicit memory (Bock, Loebell, & Money, 1992) and the fact that people are unconscious of the priming manipulation (Bock, 1986) support the idea that structural priming is a form of *implicit learning.* Implicit learning refers to the incidental tuning or adjustment of the tendencies of a processing system as a function of experience (Ferreira & Bock, 2006). Implicit learning has been characterized as a change in the strength of the connections in a neural network following exposure to repeated exemplars. The finding that priming can be observed even if unrelated sentences appear between the prime sentence and the target sentence means it is unlikely that priming is due to continued activation in the networks that support sentence production. They asserted that the mechanism that produces long-lasting priming

for syntax is an enhanced strength in the connections between representational units that support the use of those syntactic structures. When readers encounter linguistic expressions, one thing they must do is to determine how the syntactic structures of those linguistic expressions map onto "who did what to whom" - how the subject, verb, direct object, indirect object, and so forth in the sentence map onto the relationship among the entities, actions, and expressions (Ferreira & Bock, 2006). In other words, one must recognize that certain meaning relationships map onto certain functional elements, which map onto critical features of constituent sequences (Pickering & Ferreira, 2008). Noppeney and Price (2004) investigated syntactic priming during sentence reading by using both physiological and behavioral measures. They demonstrated that if successive sentences follow the same syntactic structure, it was less demanding for readers to assign thematic roles to the sentence arguments. It becomes easier to determine "who does what to whom" in the sentence and these mappings are acquired through experience. This learning process facilitates the procedures used to arrive at a certain syntactic analysis within the syntactic representation system. This enhanced procedural facilitation can be sustained longer. Structural priming can be a vehicle of changes in language over long stretches of time (Bock et al. 2007). Although structural priming has multifaceted effects, it seems that it partly reflects the operation of implicit learning.

So far, it is suggested that two mechanisms are at work in structural priming; a short-term priming mechanism that is lexically dependent and a long-term priming mechanism that operates on abstract syntactic structures. For a language to change, the linguistic knowledge of individual learners must change and this modified knowledge must remain stable long enough to be reproduced in others. When such changes persist, it can be considered a type of learning. From a view point of language learning, this long-term abstract structural priming is important for the facilitation of syntactic processing.

2.3.4 Inverse frequency effect

As we learn more about representations that are not well known, weakly represented syntactic knowledge is more susceptible to priming. Low-frequency structures lead to greater priming effects than higher frequency structures. This phenomenon has been observed in studies on priming and is termed *inverse frequency effect* or *inverse preference effect* (Bernolet & Hartsuiker, 2010; Fine & Jaeger, 2013; Jaeger & Snider, 2007).

In Jaeger and Snider (2007), they reanalyzed the ditransitives in the corpus of spontaneous speech containing 1108 datives with preceding primes (i.e., the previous dative in the conversation) taken from the full Switchboard corpus. In their analysis, prepositional object verbs exerted stronger priming, if they were used with verbs that are biased toward a double object dative construction. The result indicated that language users adapted their expectation based on recent input, therefore, less expected and more surprising structures prime more strongly. Bernnolet and Hartsuiker (2010) tested Jeager and Snider's result experimentally by comparing the strength of double-object dative priming (DO) and prepositional object dative priming (PO) between dative verbs with differing syntactic preferences in a syntactic priming experiment in Dutch. The syntactic preferences of the prime and target verbs were measured beforehand in the pretest. Unlike English, the majority of the datives used in the pretest were biased towards a PO-dative (78.8%), which means PO-datives are more preferred than DO-datives in Dutch. The results indicated significant priming for DO-datives and for PO-datives, however, the effect of DO-priming was substantially stronger than that of PO-priming. This result replicated the inverse preference effect and was consistent with an implicit learning account. Fine and Jeager (2013) reanalyzed data from a syntactic priming experiment (Thothathiri & Snedeker, 2008) and found that more surprising prime structures lead to stronger expectations that the same structure will be used in later sentences. They concluded that syntactic priming in comprehension is due to implicit learning (Bock & Griffin, 2000) and the implicit learning underlying syntactic priming is error-based learning (Chang et al, 2000).

According to implicit learning accounts, the process of creating structures is affected by adaptations to experience within the production system. That is, the production system learns. The inverse frequency effect arises from long-range accumulations of production and comprehension experience and subsequent learning. As object relative clauses are harder to process than subject relative clauses, priming would be a good alternative for investigating the role of experience on relative clause processing by EFL learners.

2.4 Relative clause processing

2.4.1 Sources of comprehension difficulty

It is well-established that object relatives are harder to process than subject relatives in

English. In Traxler, Morris, and Seely (2002), for instance, eye-movement monitoring experiments investigated the processing of sentences containing subject relative and object relative clauses. The result showed that sentences containing object relative clauses were more difficult to process than sentences containing subject relative clauses during the relative clause and the matrix verb. Thus the results are consistent with the pattern that is normally observed when sentences containing object relative clauses are compared to sentences containing subject relative clauses.

Many explanations have been offered for the processing of relative clauses and the related complexity effects. However, there has been little agreement about what makes object relatives harder than subject relatives. Some researchers have suggested that object relatives are harder because the sentence's meaning is more complicated in object relatives than in subject relatives in that head noun is simultaneously the object of the relative clause verb and the subject of the main clause verb, whereas the head noun has the same grammatical function for both verbs in subject relatives (Sheldon, 1974). MacWhinney (1977) claims that the difficulty of object relative clauses is due to a shift in perspective between the main clause and the relative clause. When the antecedent of the relative clause is the subject (and thus the perspective) of the main clause, there is a perspective shift in object relative clauses, but not in subject relative clauses.

Other researchers have pointed to processing difficulty as the sentence unfolds. Object relative clauses require more resources because the integrations at the embedded verb involves connecting the object-position to the filler (the establishment of *filler-gap dependencies*), which requires an integration that crosses the subject noun phrase. Gibson and colleagues (e.g., Gibson, 1998; Grodner & Gibson, 2005) emphasized the locality that affects integration costs and the working memory burden of maintaining noun phrases in memory before they can be assigned a thematic role and integrated into the structure. The word order of object relatives needs to maintain unanalyzed noun phrases longer than in subject relatives. Others have pointed out the interference effects of noun phrases. They suggested that these unintegrated noun phrases in the object relative clause must be held in memory before they are integrated into sentence, which imposes heavier demands of this sort than subject relative clauses (Gordon et al., 2001).

While many explanations for the difficulties associated with interpreting object relative clauses appeal to the demands that they make on working memory (memory-based account), there are some researchers who suggested that reading experience influences relative clause processing.

They point to variations in reading experience as a source of differences and emphasize experience over what is innate, such as working memory (experienced-based account). MacDonald and Christiansen (2002) asserted that subject relative processing would be facilitated by extensive exposure to simple transitive sentences which shared much of the S-V-O (Subject-Verb-Object) word order of subject relatives, and the amount of experience would have little effect on subject relative processing. However, they asserted that the processing of irregular object relatives is largely dependent on exposure to object relatives themselves, so that a large effect of experience can be observed for object relatives processing. This prediction was confirmed using computational simulations. Based on their research, Wells et al. (2009) conducted a study manipulating reading experiences. The results showed that the group receiving relative clause experience increased reading speeds for object relatives more than for subject relatives, whereas a control experience group did not.

2.4.2 Frequency effect on object relative clause processing

A recent series of findings demonstrated that object relatives are not always more difficult to process than subject relative clauses. Gennari and MacDonald (2008) argued that object relatives are much easier with an inanimate head noun than with an animate head noun because the animacy information is relevant to resolving ambiguities in the object relative sentences. This animacy effect matches the frequency of its configurations in several corpora: inanimate-head object relative clauses are more frequent than animate-head ones (Roland, Dick, & Elman, 2007). Reali and Christiansen (2007) conducted a corpus analysis and found that pronominal object relative clauses are significantly more frequent than pronominal subject clauses when the embedded pronoun is personal. They conducted experiments to test whether frequency of exposure influenced the processing difficulty and whether highly frequent pronominal object relatives could be processed easier. The results showed that differences in pronominal object/subject relatives processing mirrored the pattern of distribution revealed by the corpus analysis. Both of these noun properties affected relative clause processing. This distributional information obtained from repeated exposure becomes a comprehension cue and assists readers comprehend object relatives.

3. EXPERIMENT 1: The effects of focusing, proficiency, and working memory capacity on text comprehension of Japanese EFL learners: A psycholinguistic study based on eye movement data

In order to investigate the current situation of Japanese EFL learners' text comprehension, this study investigated the effects of focusing, proficiency, and working memory capacity on text comprehension of Japanese EFL learners.

3.1 Hypotheses

The following three hypotheses guided this study.

1. Proficiency is highly correlated with reading comprehension performance.
2. Reading span scores correlate with comprehension performance.
3. The keyword detection task (in which participants are required to look for the keywords of the text as they read) will serve as a retrieval cue or provide focus words, thereby improving reading comprehension performance.

3.2 Methods

3.2.1 Participants

A total of 46 Japanese undergraduate and graduate students participated in this experiment. They consist of 22 males and 24 females, and all were native Japanese speakers who had studied English for more than six years. Participants' ages ranged from 18 to 25 years. They had normal or corrected-to-normal vision.

3.2.2 Apparatus

The apparatus used in this experiment was NAC EMR-AT VOXER, an eye tracker. The eye tracker monitored the movements of the right eye of each participant. At the beginning of the experiment, the eye-tracking system was calibrated for the participant. Participants were seated 50-70 cm away from a computer screen connected with the eye tracker and read a text in a PowerPoint. Another computer was used to measure the participants' reading span scores.

3.2.3 Materials and design

An English text titled “A Cultural Difference: Being on Time” and a Japanese text titled “People of Today are Tone-Deaf” written by Takeshi Yourou were used as materials (see Appendix A and B). “People of Today are Tone-Deaf” contains 1,080 characters, and “A Cultural Difference: Being on Time” contains 438 words. With regard to the readability of the English text, the Flesch Reading Ease Test score and Flesch-Kincaid Grade Level Test score were 50.6 and 9.9, respectively. The Flesch Reading Ease Test evaluates the readability of texts on a scale of 0 to100. In this test, higher scores indicate material that is easier to read, and lower numbers mark passages that are more difficult. The result of Flesch-Kincaid Grade Level is a number that corresponds to a grade level. The score of 9.9 indicates that the text is expected to be understandable by the average student in the 9th or10th grade. The two texts in this study were selected because they are considered to be at the level of independent reading for the participants and can be understood without the use of dictionary. The titles of the texts were not displayed so as to avoid giving comprehension cues beforehand.

3.2.4 Procedure

The experiment consisted of four sessions: proficiency test, reading span test in English and Japanese, reading Session 1, and reading Session 2.

1) Proficiency test

Participants first took the Oxford Quick Placement Test, Parts 1 and 2 (paper version) to measure their English proficiency. This test assesses reading, vocabulary, and grammar. Participants were given 30 minutes to complete the test. All scores are reported on a scale of 0 to 60.

2) Reading span test

The English and Japanese versions of the reading span test (Nakanishi & Yokokawa, 2011) were administered to measure the participants’ working memory capacity. The reading span test is a memory test designed to measure both processing and storage functions during reading. In this test, sentences were presented on the computer screen. They are arranged in three sets, each of which

comprised two, three, four, or five sentences. Within a set, the sentences were not related to each other. Participants were asked to read each sentence aloud at their own pace. As soon as they finished reading a sentence orally, the next sentence was presented on the screen, and the participants continued reading aloud. After reading all the sentences in a set, the participants were asked to recall the last word of each sentence within the set for the English version and the underlined word in each sentence for the Japanese version. The order of reporting these words was based on the free recall procedure. Participants were prohibited from reporting the last target word first within each set to avoid recency effect. The reading span measure is the total number of words recalled from all the trials. The total number of the sentences was 42 in both English and in Japanese versions. Each version of the reading span test took approximately 15 minutes to complete.

3) Reading session 1

Participants were randomly divided into four groups. Groups 1 and 2 read the English text, while Groups 3 and 4 read the Japanese text. Participants read the text at their own pace. Six or seven lines of text were presented on one screen, and the participants could proceed with the text by pressing the space key. They were told not to go back to the previous slides. They were also asked to read as fast as they could as long as they could understand the contents of the text. As they read, their eye movements were monitored and recorded by the eye tracker. After reading the text, each participant was instructed to answer comprehension questions regarding the text contents in true or false (total points were 20). The answering of the comprehension questions was untimed.

4) Reading session 2

After a short interval, reading Session 2 was conducted. The materials used in this session were the same as those in Session 1. In this session, participants who read the English text in Session 1 read the Japanese text and vice versa. Group 1 read the Japanese text this time. After reading through it at their own pace once, they were instructed to reread it. Group 2 also read the Japanese text, but after the normal reading, they were instructed to reread the text looking for keywords (keyword detection task). Group 3 read the English text twice at their own pace. Group 4 also read the English text, once at their pace and again given the keyword detection task. As they

read the text, the eye tracker monitored their eye movements and collected the eye movement data. After reading the text, the participants answered comprehension questions regarding the text contents in true or false.

3.3. Results

3.3.1 The effects of proficiency on reading comprehension

The data of participants' comprehension scores were divided into two groups based on their proficiency levels. Participants whose scores were 40 or higher are referred to as the proficient group (equivalent to C2, C1, and B2 of the Common European Framework [CEF] Level), and those whose score were lower than 40 (equivalent to B1, A2, and A1 of the CEF Level) are referred to as the less proficient group.

Table 1

Mean comprehension test scores and SD of proficient readers and less proficient readers

	N	Mean	SD
Proficient reader (C2, C1, B2 level)	8	19.63	0.74
Less proficient reader (B1, A2 level)	17	18.00	1.46

The average comprehension score of the proficient group was 19.63, while the average of less proficient group was 18.00. This difference was evaluated with a *t*-test. The result was t (23) = 2.943, $p < .01$. There was a significant difference between the mean comprehension scores of the two groups. As a result, the effect of proficiency on reading comprehension was confirmed.

3.3.2 The effects of reading span on comprehension

First, descriptive statistics of the English and Japanese reading span scores were calculated. At the same time, a statistical analysis of the correlation between English and Japanese reading scores was conducted. These results are shown in Table 2 and Table 3.

Table 2

Descriptive statistics for English reading span test scores and Japanese reading span test scores

Reading span test	N	Min	Max	Mean	SD
English	46	19	41	28.22	5.53
Japanese	46	20	38	28.54	5.25

Pearson's correlation coefficient was calculated for the English and Japanese versions of the reading span test scores of 46 participants. The correlation coefficient was .608, which is statistically significant ($p < .001$), as shown below.

Table 3

Correlation between English and Japanese reading span scores

Reading span test	Japanese	English
Japanese	1	0.608
English	0.608	1

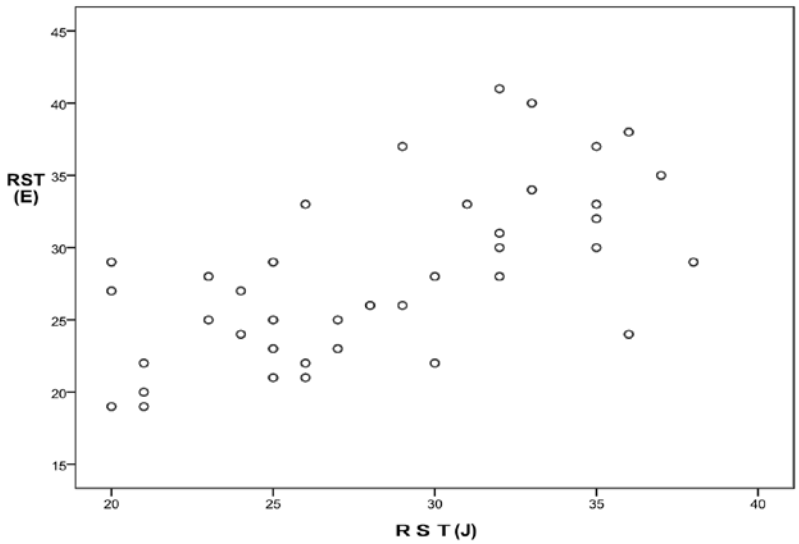


Figure 5. A scatter plot displaying the relationship between the Japanese reading span test scores and English reading span test scores

This result was quite similar to that of Osaka and Osaka (1992). It shows that there is a considerably high correlation between the two sets of reading scores. As Osaka and Osaka interpreted, this result suggests that working memory resources, in large part, are shared across languages, and working memory capacity is language independent. If an individual has a high reading span in the native language, they will be able to develop a high reading span in a second language as well (Osaka & Osaka, 1992). That is, if a reader has a lower reading span in the native language, they will have difficulty to develop a high span in the second language.

There was no correlation between English reading span scores and proficiency scores as measured by the Oxford Quick Placement Test. The correlation coefficient between English reading span scores and Oxford Quick Placement Test scores was r = -.165, n.s. Correlation coefficients between English reading span scores and comprehension scores in English and correlation coefficient between Japanese reading span test scores and comprehension scores in Japanese was r = .117, n.s., and r = -.259, n.s., respectively. Thus, there was no correlation between reading span test scores and comprehension scores in either English or Japanese versions of the test.

3.3.3 The effects of task on reading comprehension

The mean values of both English and Japanese reading comprehension scores of the task group were higher than those of the non-task group. These differences were tested with *t*-tests. The difference between the average comprehension scores in the task and non-task conditions of the English test was not statistically significant.

Table 4

Group statistics for comprehension scores in English and Japanese between task and non-task group

Group	Mean	SD
English (without task)	18.27	1.49
English (with task)	18.90	1.45
Japanese (without task)	17.77	1.48
Japanese (with task)	18.67	1.56

3.3.4 Analyses from the perspective of eye movement

3.3.4.1 The effects of proficiency on reading behavior

The cognitive processing of the text modulates the pattern of eye movements (Rayner & Pollatsek, 1989). In Eye-Mind Hypothesis (Just & Carpenter, 1980,1987), it was hypothesized that the interpretation of each word is immediate and the interpretation of the word occurs while the word is being fixated. In other words, readers can take in information at a pace that matches their internal comprehension processes. Therefore, we can use eye movement measures to infer moment-to-moment cognitive process in reading. Using computer based instruments, we can precisely see which word is being fixated and how long it is fixated.

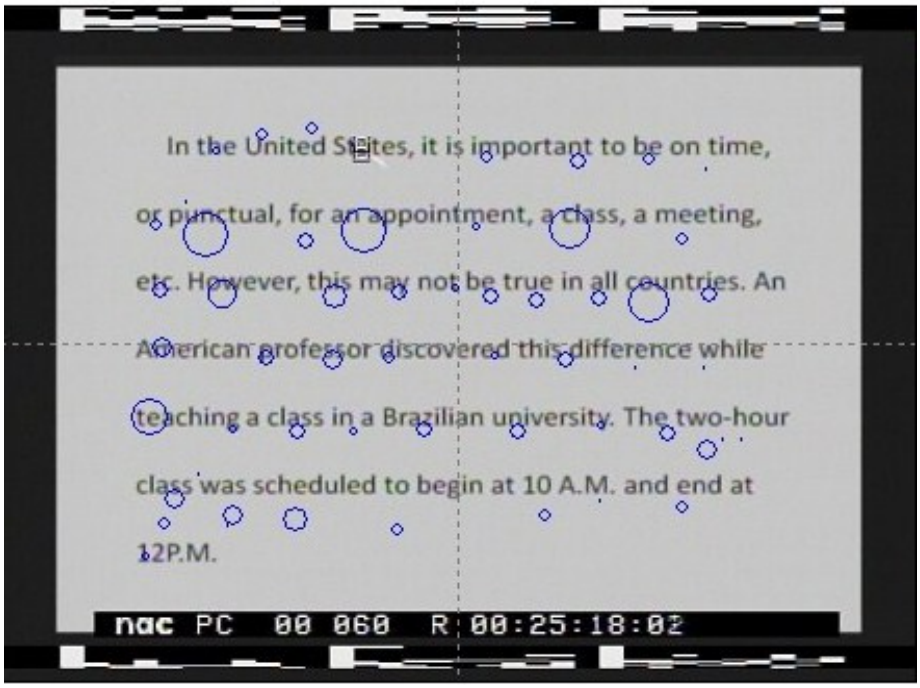


Figure 6. An eye movement protocol (proficient reader)

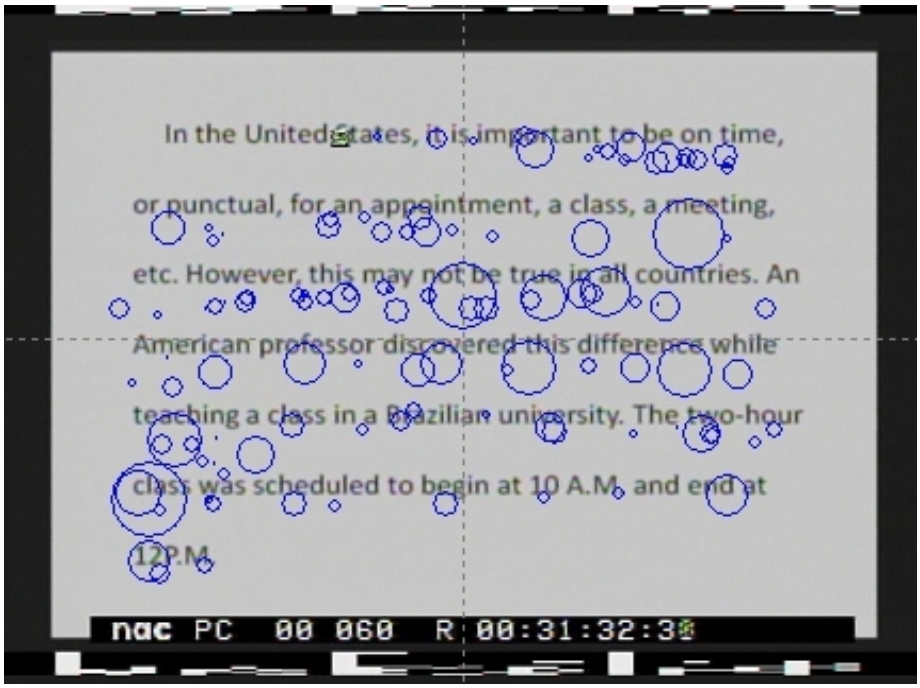


Figure 7. An eye movement protocol (less proficient reader)

Figures 6 and 7 are the eye movement protocols of a proficient reader (QPT score is 55) and a less proficient reader (QPT score is 37). The comparison between the eye movements of a proficient reader (Fig.6) and those of a less proficient reader (Fig.7) shows that the proficient reader fixated fewer words, spent less time on them, and made less regressions to earlier words. On the other hand, the less proficient reader fixated the same word or the phase repeatedly. The overlapping of circles on Figure 7 demonstrated that the reader repeated backward regressions and forward fixations, which indicates the reader's disruption in processing at lower level. The characteristics of the less proficient reader are assumed to reflect the reader's inefficiency in lower level processing, such as word recognition, lexical access, or parsing. A failure or inefficiency in processing information at one level is likely to affect higher level processes related to that lower level processing, which then leads to the incomplete representation of the text.

Another characteristic which deserves special mention is that the proficient readers in this experiment fixated keywords or discourse markers (e.g., *punctual*, *however*) without exception. This means the advanced EFL readers know the importance of coherence building and focusing, and they can make connections between ideas in the text. Proficient EFL readers utilize the reading skill or strategy which they acquired through the experience with their L1 reading. Proficient

readers can afford to allocate their capacity to coherence building owing to their efficiency in lower-level processing, whereas less proficient readers have no capacity left to take global text structure into consideration.

As Koda (2004) pointed out, less proficient readers' resources are completely taken up by lower level processing and local-information extraction. Therefore, their reading processes remain unaffected by text structure, at least until their lower level processing becomes sufficiently automated. As Figure 6 and Figure 7 show, automaticity of lower level processing is a prerequisite for efficient higher level processing.

3.3.4.2 The effects of a task on reading behavior

We can use eye movement measures to infer the moment-to-moment cognitive process of reading. The computer based instruments enabled us to precisely see which word is being fixated and how long it is fixated. In this study, mean fixation frequencies and mean total fixation durations of sentences shown above in Figures 6 and 7 were used to examine the effects of reading task on reading behavior.

Mean fixation frequencies and mean total fixation durations of the participants in the task and non-task conditions of both in English and Japanese were calculated to investigate the influence of the focusing task on their reading behavior, from the viewpoint of eye movements during reading.

Table 5

Mean fixation frequency and mean total fixation duration (in sec.) in English

	N	Fixation Frequency(1^{st})	Total Fixation Duration(1^{st})	Fixation Frequency(2^{nd})	Total Fixation Duration(2^{nd})
Reading without task	6	77.4	21.6	54.6	15.7
Reading with task	9	66.9	18.3	46.3	12.7

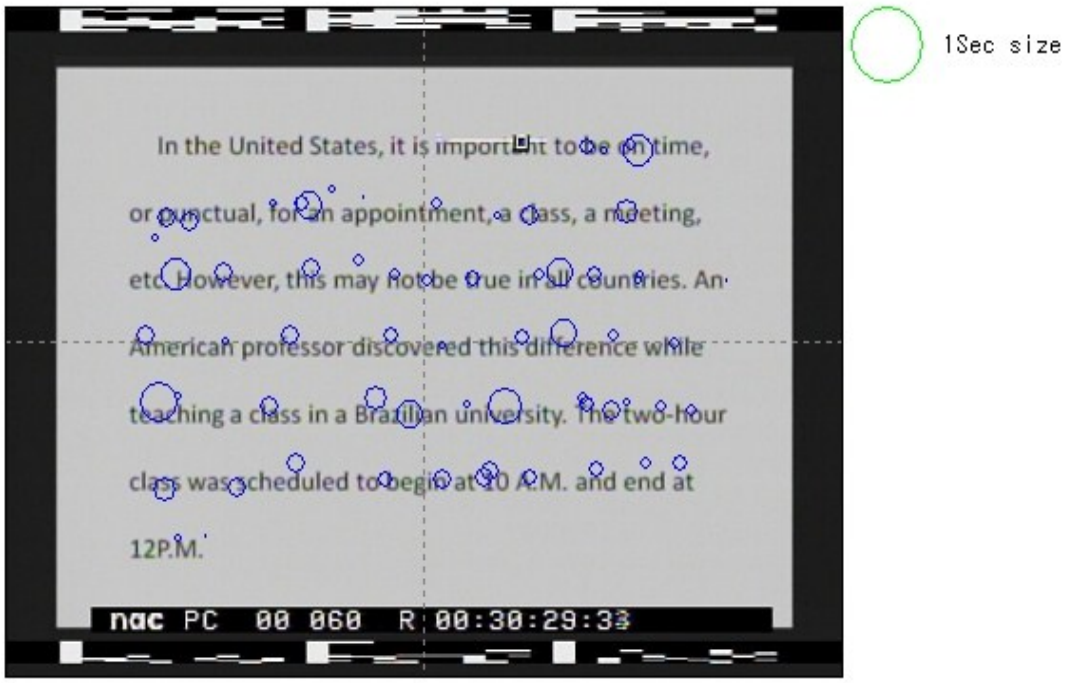
Table 6

Mean fixation frequency and mean total fixation duration (in sec.) in Japanese

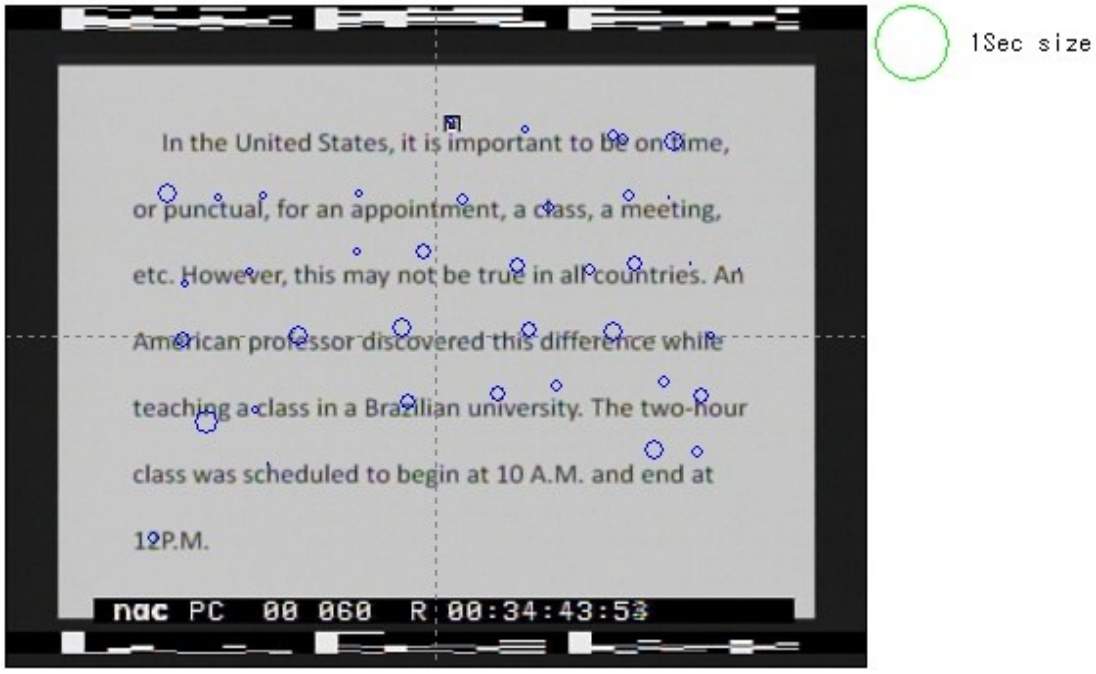
	N	Fixation Frequency(1^{st})	Total Fixation Duration(1^{st})	Fixation Frequency(2^{nd})	Total Fixation Duration(2^{nd})
Reading without task	10	63.6	15.7	33.7	8.18
Reading with task	6	64.2	15.9	33.9	8.57

Mean fixation frequencies (1st and 2nd time) and mean total fixation durations (1st and 2nd time) for the non-task condition of the Japanese text are almost identical with those of the task condition. However, mean fixation frequency of the second time reading in the task condition of the English text decreased by 30.8%, and mean total fixation duration in the second time reading decreased by 30.6%. These figures are larger than their counterparts of 29.5% and 27.3% in the non-task condition, respectively. However, the difference is not statistically significant.

According to the Eye-Mind Hypothesis (Just & Carpenter, 1980, 1987) cited earlier, the interpretation of a word occurs while the word is being fixated. In other words, fewer fixations and shorter fixation duration mean that the reader has little or no difficulty in reading the text. Considering the results of previous research, the results of this experiment show that EFL readers who were assigned a keyword detection task might have read more skillfully than those who were not given such a task. An eye-movement pattern of each reader in this experiment illustrates this difference in reading behavior between the reader in task condition and without task condition.



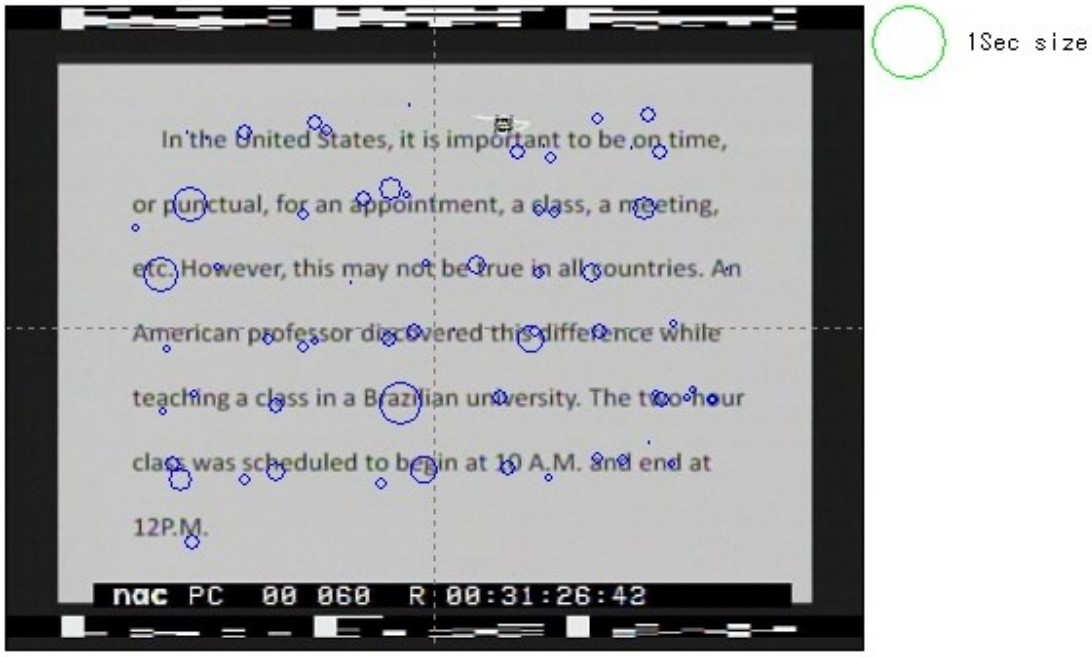
(a)



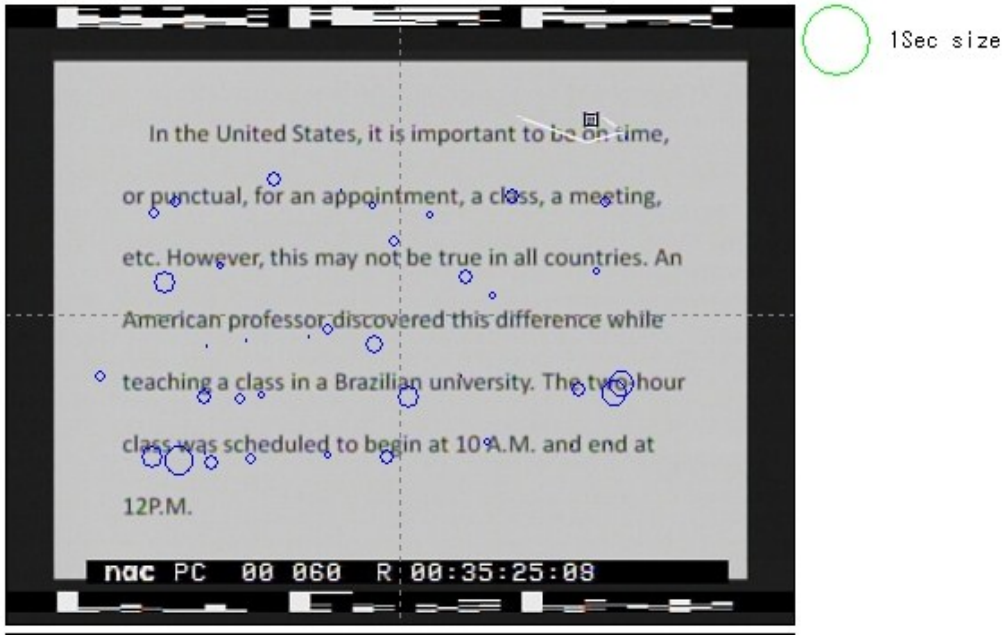
(b)

Figure 8. An eye movement protocol of a participant with task.

(a) is the protocol in the first time and (b) is the protocol in the second time



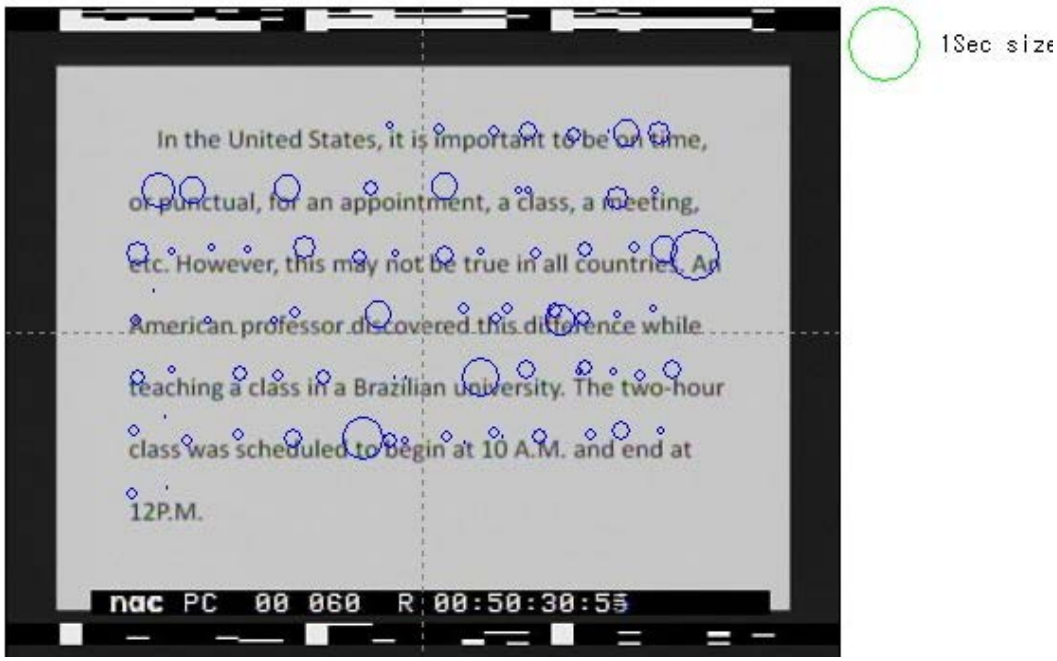
(a)



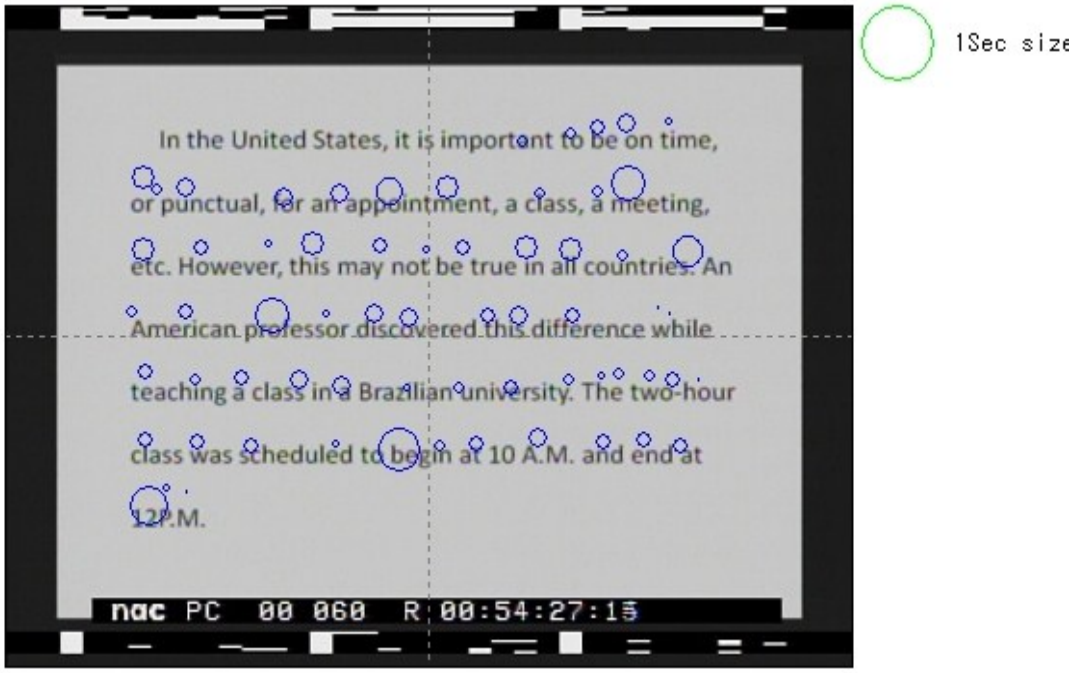
(b)

Figure 9. An eye movement protocol of a participant with task.

(a): the protocol in the first time and (b): the protocol in the second time



(a)



(b)

Figure 10. An eye movement protocol of a participant without task

(a): the protocol in the first time, (b): the protocol in the second time

An overview of eye patterns shown on the previous pages (Figures 8 to 10) illustrates the contrast of eye movements between task condition and non-task condition. The circles covering the text indicate the point of fixation and the size of the circles shows the fixation duration. Figures 8 and 9 are the eye movement protocols of participants with task. Figure 10 is the eye movements of a participant without keyword detection task.

As Figures 8 and 9 show, the fixation circle on the second time reading of the task group is smaller than the fixation circle on the first time reading. Furthermore, the number of eye fixations on the second reading is unquestionably fewer than on the first reading. The difference is striking as compared with Figure 10 which shows the eye fixation pattern of the participant without task. As the Figure 10 shows, there is no distinct difference in eye movements between the first reading and second reading.

Taking these findings into consideration, it can be assumed that the focusing task can influence reading behavior and improve reading comprehension in English.

3.4 Hypotheses Verification

Based on the results described above, the hypotheses listed in Section 3.1 will be verified.

Hypothesis 1: Proficiency is highly correlated with reading comprehension performance.

The findings in Section 3.3.1 verified Hypothesis 1. As mentioned, the difference in the comprehension scores between the comprehension of proficient readers (C2, C1, and B2 on the CEF Level) and that of less proficient readers (B1 and A2 on the CEF Level) was statistically significant, t (23) = 2.954, $p < .01$. Readers who were proficient in English comprehended better than less proficient readers, indicating that English proficiency plays an important role in reading and comprehending English texts.

Hypothesis 2: Reading span scores correlates with comprehension performance.

The results of this experiment showed that there were no significant correlations between reading span test scores and text comprehension performance both in English and in Japanese.

Hypothesis 3: The keyword detection task (in which participants are required to look for the keywords of the text as they read) will serve as a retrieval cue or provide focus words, thereby improve the reading comprehension performance.

The result of *t*-test indicated no significant difference between the comprehension scores of

reading in the task and non-task conditions in both English and Japanese. However, regarding eye fixation duration and eye fixation frequency, the behavior of the task group was better than that of non-task group in English. Mean fixation frequency in the second time reading deceased by 30.8% and mean total fixation duration in the second time reading decreased by 30.6%. These figures are larger than their counterparts of 29.5% and 27.3%, respectively, in the non-task condition. This means that the group which was given the keyword detection task behaved more like skilled readers than the group which was not assigned the task. Taking these things into consideration, reading strategies such as focusing contribute to some sort of improvement in reading behavior.

3.5 Discussion

There are not so many Japanese EFL learners who can read English texts as fluently as L1 English readers do. This experiment was conducted to investigate the current situation of Japanese EFL learners' text comprehension and to ascertain whether reading strategies such as focusing might be effective to improve reading. In this experiment, the correlation of language proficiency and reading comprehension test scores were examined. The result showed that there was a significant difference in English comprehension test scores between the high and low proficiency group. It was confirmed that L2 specific knowledge, such as vocabulary or grammatical knowledge, have considerable effects on L2 reading comprehension. Thus, we reconfirmed the importance of acquiring fundamental English competence which leads to the automaticity of lower level processing in reading English texts.

Regarding working memory, Pearson's correlation coefficient for the English and the Japanese reading span scores was calculated. There was considerably high correlation between English and Japanese reading span test scores, which is consistent with the findings reported by Osaka and Osaka (1992). This result suggested that working memory is independent of linguistic knowledge and provides a shared cognitive resource across language.

Miyake and Friedman (1998) hypothesized that working memory capacity influences one's ability to comprehend structurally complex sentences correctly and efficiently. Moreover, they suggested that working memory capacity for language may be an important component of language aptitude. However, in this study, no correlations were found between text comprehensions both in English and in Japanese and working memory. Pearson's correlation coefficient for reading span

scores and reading comprehension scores on the English and Japanese texts were r = .117, n.s., and r = -.259, n.s., respectively.

Several explanations for the lack of correlation are possible. First of all, the material used in this experiment was relatively easy for the participants, as is apparent from the good scores on the comprehension test. Furthermore, the participants could reread the sentences on the screen at their own pace, so long as they did not go back to the preceding screen. According to the Capacity Theory of Comprehension (Just & Carpenter, 1992), both processing and storage are mediated by activation, and the total amount of activation available varies among individuals. When the task demands are high enough to constrain capacity, individuals with a smaller working memory capacity are less able to perform computations quickly or store intermediate products. In other words, as far as the relationship of working memory capacity and language processing is concerned, what matters most is whether the task demands exceed their capacity or not. As participants read the relatively easy text at their own pace, it is considered that the task demands were not high enough to constrain their working memory capacity.

Secondly, there is a possibility that the participants took some kind of measures to compensate for their insufficient working memory capacity. Chujo and Nakao (2005) investigated the relationship between reading comprehension and working memory capacity using an eye tracker. Low-span readers made more forward fixations and backward regressions than high-span readers. Readers read in small chunks when their working memory was running short. Based on the results of their experiment, they concluded that readers can use a compensatory strategy to make up for the shortage of working memory capacity and minimize the reading span differences. In this connection, Linderholm and van den Broek (2002) examined the extent to which low- and high-span readers adjust cognitive processes to fit the reading purpose. Their result demonstrates that both low- and high-span readers have standards of coherence that correspond to the reading purpose and, in general, adjust processing to meet these standards. Low-span readers have some awareness of the fact that they have less resources than high-span readers and they attempt to strike a balance between more and less demanding processes in an attempt to meet reading goals (Linderholm & van den Broek, 2002). Some cognitive processes and strategies are less demanding on resources than others (Magliano, Trabasso, & Graesser, 1999), which make certain processes and strategies more attainable for readers with fewer resources. Thus, low-span readers

are more likely to engage in cognitive processes and strategies that are less demanding on resources. Taking these previous research into consideration, it is logical to assume that low span readers in this experiment made extra efforts to make up for their insufficient working memory capacity.

Finally, factors other than working memory capacity might have played a more significant role in the participants' text comprehension. An alternative approach to analyzing individual differences in language comprehension was proposed by MacDonald and Christiansen (2002). Contrary to the traditional view, they emphasized the learning side, rather than capacity limit. They contended that variations in experience or practice lead to individual differences in reading comprehension. Based on this experience-based approach, Wells et al. (2009) manipulated the reading experience of adults over a period of several weeks. They used object relative clause as the study material, because object relative clause is difficult to understand because of their low-frequency word order. The group that received relative clause experience increased reading speed for object relatives more than for subject relatives, whereas a control experience group did not. Long and Prat (2008) also investigated the relation between individual differences in working memory capacity and differences in the efficiency of syntactic parsing. In their experiments, low-span readers' use of plausibility information enhanced after receiving intensive exposure to sentences with main-verb/reduced-relative ambiguities. Moreover, the effect of exposure generalized to sentences that were not included in the training materials. They attribute the differences in processing syntactic ambiguities to readers' experience with these structures. They concluded that repeated exposure could minimize reading span differences in processing ambiguous structures. Therefore, these results supported MacDonald and Christiansen's claim that variation in reading experience is another source of individual differences. The degree of differences in processing efficiency among Japanese EFL learners is greater than that of L1 readers. The efficient and automatic processing of the experienced readers might have minimized the span differences in this experiment.

Ericsson and Kintsch (1995) shares this appreciation for the importance of experience, asserting that text comprehension is an acquired skill. During the encoding and storage of the current sentence, the relevant information from the previously read text must remain accessible. Retrieval cues to the hierarchical organization of the encoded text provide access to the information, and this skill is also acquired through experience. Given that reading is a complex skill consisting of various component processes, individual differences in text comprehension might stem from the

interaction of multiple factors, including working memory capacity, use of strategy, and experience-based language skill.

Regarding the keyword detection task, we hypothesized that learners can establish coherence of the text using keywords as retrieval cues to utilize the long-term working memory or as focus words to create good mental representation. Mean comparisons were made and a *t*-test was used to analyze the difference between mean values of comprehension scores in English and Japanese between the task group and non-task group using the data from Session 2. The mean value of the participants' comprehension score in the task condition in English and in Japanese outperformed the mean value of the non-task group, although the results of *t*-tests were not significant. Regarding the comparison of fixation frequency and fixation duration between the two groups in English, the task group's eye fixation frequencies in the second time reading decreased more than that of the non-task group. From the perspective of eye movement protocols, participants who were given the keyword detection task behaved more like skilled readers. Consolidating these findings, it can be concluded that reading strategies such as focusing might serve to improve the reading performance in English, especially in cases where readers are overloaded with capacity demand.

Eye movement protocols demonstrated that the eye movements of proficient readers show some characteristics. One feature is that proficient readers fixated fewer words, spent less time on them, and made less regression to earlier words. As Just and Carpenter (1987) states, these features indicate their competent processing during L2 reading. Another feature is their sensitivity to text structure. Although they fixated fewer words and spent less time on them than less proficient readers, they fixated on the focus words or discourse markers without exception. Both L1 reading skill and L2 language competence contribute to successful L2 reading comprehension. Nonlinguistic reading skills or knowledge acquired in L1 reading such as utilizing the knowledge of test-structure, identifying the semantic relation among propositions, inhibiting irrelevant information are not language specific. However, judging from the eye movement protocols, less proficient readers do not seem to use the reading skills effectively because of their insufficient processing resources resulting from poor language competence.

Horiba (2000) examined reader control with native and nonnative readers of Japanese. The results suggest that nonnative reader's processing is inefficient, compared with native readers' strategic reading, especially with more demanding text. If the text is too demanding, nonnative

readers whose language competence is limited would allocate much of their cognitive resources to lower level processing and, as a result, higher level processing such as the generation of inferences and the use of general knowledge association to make coherent representation would be inhibited.

The linguistic threshold hypothesis (Alderson, 1984; Clarke, 1988) states that second language reading is highly related to general linguistic knowledge, and therefore language proficiency is required before reader can achieve comprehension of a text. A lack of second language linguistic knowledge short-circuits the transfer of the native language reading skills to second language context (Clarke, 1988). EFL readers have processing strategies or knowledge of rhetorical organization which they have developed through experience with L1 reading, however, less proficient EFL readers cannot utilize such knowledge or strategy, because most of their resources are consumed by lower level processing.

Limited L2 knowledge inhibits less proficient readers from using their previously acquired L1 skills. Eye movement data support the assumption L2 proficiency is the prerequisite to efficient L2 reading and a major factor in L2 reading development.

4. EXPERIMENT 2: The effects of syntactic processing on text comprehension of Japanese EFL learners

Experiment 2 was conducted to examine whether the syntactic processing of Japanese EFL learners affects on-line text comprehension performance. The reduced relative clause was used as the experimental structure, as it has been well-established that readers face difficulties in processing the reduced relative clause. It is predicted that the processing of difficult reduced relative sentences interferes with successful text comprehension.

Text processing is a highly complex cognitive task. Successful text comprehension requires the coordinated operation of several component processes. According to Just and Carpenter's Capacity Theory of Comprehension (1992), working memory plays a central role in language comprehension. Working memory plays a critical role in storing the intermediate and final products of a reader's computations as he or she constructs and integrates ideas from the successive words of a text. Working memory is viewed as the pool of operational resources that performs computation and generates the intermediate and final products. Therefore, increasing operational demands impose constraints on the successful operation of all processes when the demands exceed the available resources.

The various cognitive processes involved in text processing are also dependent on the same limited processing resources. Among the various cognitive processes involved in language processing, syntactic processing is thought to be the core function. Friederici and Kotz (2003) investigated the brain basis of language comprehension by means of functional magnetic resonance imaging (fMRI), event-related brain potentials (ERPs), and magnetoencephalography (MEG), formulating a brain-based model of language comprehension. According to their model, there are three functionally and temporally separable phases of language processing: processes of local structure building take place in *Phase 1*; lexical-semantic and thematic processes are engaged during *Phase 2*; and processes of syntactic revision and final integration take place in *Phase 3*. The ultimate goal of language comprehension is to extract the meaning of a text or utterance, however, syntactic processing ability is a necessary precondition for sentence or text comprehension.

Thus, the increased demands of processing syntactically ambiguous sentences are predicted to interfere with the success of later processes in text comprehension, such as causal inferencing,

which is one of the highest levels of processing and is indispensable for coherence building in text comprehension. McKoon and Ratcliff (1989) assert that an inference represents an encoded (non-explicit) feature of the meaning of a text. Causal inference is a form of bridging inferences that links text ideas by the relation of cause and effect. Causal inferencing can often be performed rather quickly, without controlled processing, and outside of conscious awareness (Singer, 1994; Singer, Graesser, & Trabasso, 1994). Unlike elaborative inferences, bridging inferences are necessary for coherence building in text comprehension (Singer, 1994). Singer (1994) explains the difference between bridging inference and elaborative inference as follows.

(2a) The dentist pulled the tooth painlessly. The patient liked the new method. (explicit)

(2b) The tooth was pulled painlessly. The dentist used a new method. (bridging inference)

(2c) The tooth was pulled painlessly. The patient liked the new method. (elaborative inference)

Sequence (2a) mentions the dentist explicitly. In (2b), coherence depends on bridging inference that the dentist pulled the tooth. Sequence (2c) permits an elaborative inference about a dentist, but coherence does not depend on this inference.

Understanding a text means constructing a coherent representation of the information it contains. If readers fail to combine the information units in a text by means of coherence relations, they will not be able to fully understand the text. According to a model proposed by Kintsch and van Dijk (1978), readers compute inferences when there is a break in text coherence. Thus, when such a coherence break occurs, readers are assumed to make the text coherent by computing a bridging inference. In this way, readers attempt to maintain coherence at both local and global levels (Albrecht & O'Brien, 1994; van Dijk & Kintsch, 1983).

In order to examine whether Japanese EFL learners' increased demands of syntactic parsing interfere with their correct understanding of a text, the present experiment manipulated the difficulty of the parsing process and examined the extent to which the successful operation of inferencing was constrained. If the inference that is the higher process of text comprehension relies on successful syntactic parsing process, the manipulations influencing the resource demands of syntactic processing should affect the performance of inferencing. Specifically, in this experiment,

each critical text contained two sentences that supported a causal inference. For example, consider the following sentences.

(3) After trying some of the soup, her husband looked displeased.

The poor woman who was hurt emotionally said that she would never cook again.

One may reasonably infer that the soup was terrible and her husband's straightforward attitude with displeasure wounded her heart. A method used prevalently for evaluating whether inference has been generated on-line is to present a probe word related to the inference after the target sentence for a speeded response task. Response times for inference words are compared to those for matched control words unrelated to the target sentence. For example, immediately after the second sentence above, the inference probe word "terrible" will be presented. In the control condition, a control word unrelated to the target sentence, yet matching the inference probe word on important aspects (e.g., number of letters and syllables, frequency, or familiarity) would be presented instead (e.g., creative). Participants have to decide whether the letter string is a word or a non-word. Evidence that the inference has been made is provided if the response time to the inference probe word is faster than to the control probe word (e.g., Long, Golding, & Graesser, 1992; Millis & Graesser, 1994).

The relevant manipulation for the purpose of the present study concerns the syntactic structure of the target sentence, namely that all target sentences contained a relative clause. Two versions of each target sentence were constructed in such a way that the relative clause structure was either unambiguous or temporarily ambiguous. In the unambiguously marked condition, relative pronouns were included, while in the ambiguously marked condition, they were omitted (reduced relative clauses). Reduced relative clauses are frequently ambiguous because the same verb form is usually used for both the past tense and the participle form for most verbs in English. A fragment beginning with a noun followed by a verb that has the same form for both the past tense and the participle form will be ambiguous between the start of a main clause and the start of a relative clause.

(3a) After trying some of the soup, her husband looked displeased.

The poor woman who was hurt emotionally said that she would never cook again.

(3b) After trying some of the soup, her husband looked displeased.

The poor woman hurt emotionally said that she would never cook again.

In the example (3a), the relative clause is unambiguously marked. In the ambiguous version (3b), the marker was removed. The sentence is temporarily ambiguous at the verb "hurt" because the sentence could legally continue with "hurt" in a relative clause or with "hurt" as a main verb. Previous research has shown that upon encountering an ambiguous verb, readers typically adopt a main verb interpretation and then must reanalyze it if the subsequent content indicates that a relative clause interpretation is correct (e.g., Binder, Duffy, & Rayner, 2001; Ferreira & Clifton, 1986). The difficulty experienced by readers in such cases is often referred to as a "garden-path effect". Thus, arriving at the correct interpretation of ambiguous reduced relative clause sentences is generally more demanding than interpreting sentences with unreduced relative clauses, because the interpretation of ambiguous sentences typically requires syntactic reanalysis following initial syntactic analysis.

4.1 Prediction

The increased demands of syntactically ambiguous and difficult sentences are predicted to interfere with the success of causal inferencing. Therefore, the advantage in response times for inference probe over control probe words will be smaller after ambiguous target sentences than after unambiguous sentences.

4.2 Methods

4.2.1 Participants and design

Twenty nine undergraduate and graduate students participated in this experiment. The two within-subject variables were target sentence (ambiguous or unambiguous) and probe word (inference probe or control probe).

4.2.2 Materials

Two critical sentences that warrant a causal inference were written. Two pilot experiments were conducted to develop appropriate critical sentences and inference word pairs. This involved presenting five candidate inference words for each critical sentences to 16 pilot participants, who were asked to rate the plausibility of each inference word for the critical sentence on a five-point Likert scale from 1 (least plausible) to 5 (most plausible). For each critical sentence, the word that received the highest rating was selected as the inference probe word

A second pilot experiment comprising 14 graduate students was conducted to confirm that the inference and control probe words were suitably matched. A control word was selected that has the same number of letters and syllables with a similar word frequency and familiarity. The inference and control probe words were embedded in a list of filler words and non-words. Participants were asked to make a speeded lexical decision for each word. For correct responses, the mean response time for inference probes was 1062 ms and 1051 ms for control probes. There was no significant difference between the mean response time for inference probes and control probes (t (13) = .338, p = .741).

Each of the 16 critical sentence pairs selected from the pilot experiment was embedded in an appropriate short story context (see Appendix E). Across participants, the assignment of text to condition was counterbalanced so that each text appeared in the four conditions an equal number of times. Moreover, additional 16 filler texts of similar style and length to the critical texts were written. The filler texts were included so that not every text included a relative clause or reduced relative clause, to minimize the possibility that participants would notice what the study was about or adopt task-specific strategies. A comprehension question follows after the last sentence of the text. For the critical texts, the comprehension questions tested whether the target sentence had been parsed correctly. A sample text is presented in Table 7, along with the corresponding probe words.

Table 7

Sample text with corresponding probe words

Bob got up half an hour later than usual this morning.
He was not able to eat breakfast before work.
The restaurant (that was) recommended for a big lunch satisfied him.
#####
Inference probe word: hungry
Control probe word: stupid
He worked energetically after lunch.
Comprehension question: Bob recommended the restaurant. (No)

Note: The second and third sentences italicized here warrant a causal inference. In the third sentence, the words in brackets were included in the unambiguous version and omitted in the ambiguous versions. The ##### symbol indicates the location after which the probe word was presented.

4.2.3 Procedure

Experimental instructions and materials were presented on a computer screen. During the practice session, participants were given instructions and practiced with five sample texts. Participants were told that on each trial, a string of letters would appear on the screen and that they were to decide as quickly as possible, whether or not the letters spelled an English word or not. Participants were required to respond “Yes” or “No” by pressing the “C” or “N” key, respectively. When the letter string is a word, participants were told to press the “C” key. If the letter string does not spell a word, participants press the “N” key. Participants were instructed to make sure that they understood the story as they progressed through the sentence, but to read at their normal rate. They were told to respond as quickly and accurately as possible to the lexical decision probes when they appeared. Participants’ response and decision times were recorded.

During each experimental trial, the text was presented one sentence at a time. After reading a sentence, the participant pressed the spacebar to advance. After the second sentence of the critical sentences was read and removed from the screen, a warning signal (#####) appeared on the screen for 750 ms followed by either the inference or control probe word. After the lexical decision probe was removed from the screen, the last sentence of the text was presented. Following this, the

comprehension question was presented and participants were to respond “Yes” or “No” by pressing the “C” or “N” key, respectively. Participants were allowed to respond to the comprehension question at their own pace.

4.3 Results

Reading times for target sentences were then examined. The mean reading times (in ms) were significantly longer for ambiguous sentences (7137ms) than for unambiguous sentences (6710ms). There was a significant difference between the reading times of the ambiguous and unambiguous condition (t (28) = 2.062, $p < .05$). The result demonstrated that syntactic processing with reduced relative clauses was more demanding than the processing of unreduced relative clauses for Japanese EFL learners.

4.3.1 Response times

The mean times for correct responses to lexical decision probe words (93.75% of trials) are reported in Table 8.

Table 8

Mean response times (in ms) to lexical probe words (correct responses only)

	Inference probes	Control probes	Difference
Unambiguous clause	1264	1399	135
Ambiguous clause	1422	1449	27

A repeated measure ANOVA yielded a main effect of target sentence type (F (1, 28) = 9.665, $p < .01$) and probe word type (F (1, 28) = 5.088, $p < .05$). As predicted, the advantage in response times for inference over control probe words was smaller after ambiguous target sentences than after unambiguous sentences. There was a slight interaction between target sentence type and probe word type (F (1, 28) = 2.915, $p < .1$).

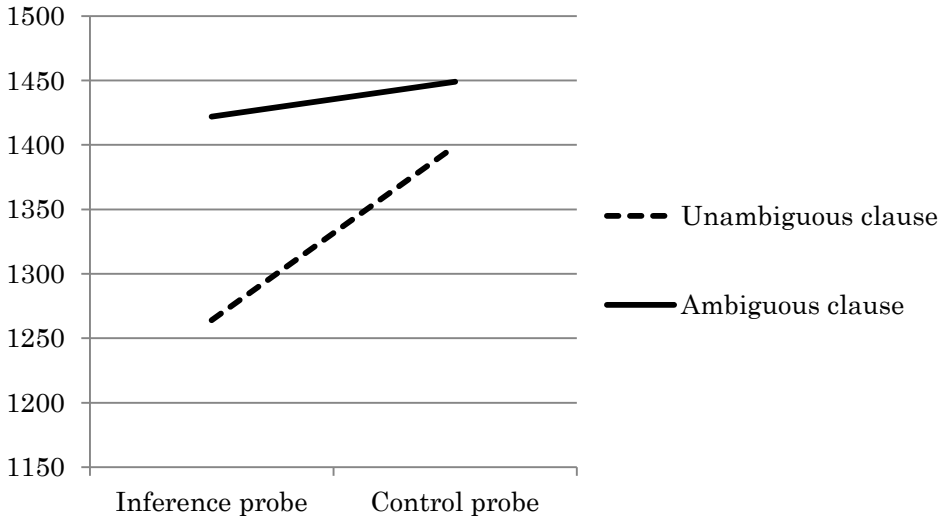


Figure 11. Mean response times to inference probe word and control probe word (in ms)

Overall, this pattern supports the conclusion that the increased resource demands in the ambiguous condition interfered with inferencing, whereas readers were able to form the inferences in the unambiguous condition.

4.3.2 Comprehension performance

Mean performance across individual means was 81.5% for unambiguous sentences and 74.63% for ambiguous sentences. Performance was significantly lower for ambiguous sentences than for unambiguous sentences (t (28) = 2.289, $p < .05$). As comprehension questions tested the understanding of the relative clause, this finding suggests that readers were less likely to arrive at the correct interpretation of the reduced relative clause in the ambiguous condition than in the unambiguous condition.

4.4 Discussion

This experiment investigated whether Japanese EFL learners' increased demand of syntactic parsing interferes with the correct understanding of a text or not. Mean reading times were significantly longer for ambiguous sentences than for unambiguous sentences. Comprehension performance was significantly lower for ambiguous sentences than for unambiguous sentences. Regarding the response times to probe words, there were main effects of the target sentence type

and probe word type. As expected, the advantage in response time for inference over control probe word was smaller after ambiguous than after unambiguous sentences. There was a slight interaction between target sentence type and probe word type. Consistent with the shared resource assumption, the results showed that the increased resource demands of syntactic analysis interfered with the successful operation of causal inferencing which is essential for the better understanding of texts.

A recent series of findings demonstrated that after reading a temporarily ambiguous sentence, the inappropriate analysis can linger in some form whether or not the sentence has been understood correctly (Christianson et al., 2001; Kaschak & Glenberg, 2004; van Gompel et al. 2006; Patson et al. 2009). It has been argued that the initial inappropriate analysis is not discarded and remains activated, either because it leaves a memory trace (Kaschak & Glenberg, 2004), or because readers do not fully reanalyze the sentence when they encounter the disambiguation (Christianson et al., 2001). If the inappropriate analysis is partly deactivated following the disambiguation and retains some residual activation, processing resources must be constrained by the burden of holding two interpretations. Therefore, there is a possibility that inference was not drawn by the burden of holding two interpretations as well as by the increased demand of syntactic reanalysis. Furthermore, the mean comprehension accuracy in ambiguous condition was 74.63% and was significantly lower than that of unambiguous condition. Considering the low comprehension performance in ambiguous condition, some readers must have failed to reanalyze the reduced relative clauses. However, in any case, participants had difficulty in processing the reduced relative clause, which resulted in the failure to draw an appropriate causal inference,

In sum, the results from the lexical decision task suggest that readers formed the causal inferences when the syntactic structure was less difficult to parse, but that inferencing was constrained when the syntactic structure was more difficult. The results demonstrated that insufficient resources or insufficient information was available for the operation of inference processes in the ambiguous condition due to the difficulty of syntactic processing. Hence, these results show that text comprehension depends on the efficient syntactic processing. The importance of lower-level processing, and especially that of syntactic processing, was underscored by this experiment.

5. EXPERIMENT 3: Repeated exposure effects on Japanese EFL learners' relative clause processing: Evidence from self-paced reading experiment

Experiment 1 showed that L2 proficiency is the prerequisite to efficient L2 reading and reading strategies such as focusing served to make up for the insufficient resources to some extent, although the effect was limited. The results of Experiment 2 demonstrated that text comprehension depends on the successful syntactic processing. Following the results of Experiment 1 and 2, this study focuses on the frequency effects on Japanese EFL learners' reading, to be specific, on the processing of a syntactic structure. This study investigated whether Japanese EFL learners' relative clause processing, especially processing of object relative clauses, can be facilitated by repeated exposure to relative clause structures. Based on previous research, I predict that relative clause processing, especially object relative processing, will be facilitated by repeated exposure to the relative clause construction. A structural priming task was used in this experiment, because it provides an assessment of linguistic performance that indexes learning in response to changes in the input.

5.1 Prediction

Based on previous research, it is predicted that relative clause processing, especially object relative processing, will be facilitated by repeated exposure to the relative clause construction.

5.2 Methods

5.2.1 Participants

A total of 36 Japanese undergraduate and graduate students participated in this experiment. In order to make two groups which are well matched in English proficiency and working memory capacity, proficiency test and reading span test were conducted before pretest. Out of 36 participants, 20 were assigned to the Relative Clause Experience group and the remaining 16 participants to the Control group.

5.2.2 Materials

5.2.2.1 Pretest and posttest for relative clause reading

All the words in a given subject relative/object relative pair remained the same as in (4) and (5); the only difference was the word order. As subject relative/object relative pairs were split into different sets, two sets of pre-test stimuli containing 10 subject relative sentences and 10 object relative sentences were constructed (see Appendix F). Also, two sets of post-test stimuli were also constructed. Each participant read one version of subject relative/object relative pair. The main verb immediately followed the end of the relative clause, such that it was always the seventh word in the sentence. The lexical properties of the experimental sentences were controlled in several respects so as not to give plausibility information to distinguish between subject relatives and object relatives. First, both the head noun and the noun in the relative clause were always animate. Second, no pronouns were used, though they are common in relative clauses, particularly in object relatives. Third, the relative pronoun was always *that*, though other choices are also common. These manipulations might have substantially increased comprehension difficulty. Yes/no comprehension questions were constructed for each experimental sentence. An equal number of questions interrogate each clause type (main clause/relative clause), with half having Yes and half having No as the correct answer. Examples of pretest and posttest are as follows.

(4) The judge that disliked the lawyer ignored the speech. (Subject relative)

(5) The judge that the lawyer disliked ignored the speech. (Object relative)

5.2.2.2 Materials for the experience manipulation

Two sets of stimuli were developed to manipulate the participant's reading experience, one for the Experience group and one for the Control group (see Appendix F). The stimuli for the Experience group such as (6) and (7) consisted of 80 relative sentences embedded in texts consisting of two sentences. The stimuli for the Control group such as (8) consisted of 80 texts in which no relative clauses were included. Compared to the pre and posttest stimuli, the subject and object relative sentences in the training session were more varied and did not contain the tightly controlled sequence structure as those in pre or posttest. Half of the questions have Yes as the correct answer. Texts indicated below are examples of training session materials for the Experience group and the Control group.

Texts for the Experience group

(6) Tom passed a new gym. The display that advertised the summer sports program interested him. (Subject relative)

(7) The man dragged the chair over to the girl. The teddy bear that he lifted up from the chair pleased her. (Object relative)

Texts for the Control group

(8) Mary apologized for being late and began to explain. Her taxi had been stuck in midtown traffic.

5.2.3 Procedure

Each participant was tested in the following five sessions, 1) proficiency test, 2) reading span test, 3) pretest, 4) training session, and 5) posttest.

1) Proficiency test

Participants completed Part 1 and Part 2 (paper version) of the Oxford Quick Placement Test to measure their English proficiency. This test assesses reading, vocabulary and grammar. All scores are reported on a scale of 0 to 60.

2) Reading span test

Participants performed reading span test in English (Nakanishi & Yokokawa, 2011) to measure their working memory capacity. In this test, sentences were presented on the computer screen. They are arranged in three sets, each of which comprised two, three, four, or five sentences. Within a set, the sentences were not related to each other. Participants were asked to read each sentence aloud at their own pace. After reading all the sentences in a set, the participants were asked to recall the last word of each sentence within the set. The order of reporting these words was based on the free recall procedure. Participants were prohibited from reporting the last target word first within each set to avoid recency effect. A participant's reading span was calculated as the total number of correctly recalled words from all the trials. The total number of the sentences was 42 in this reading span test. After the reading span test, they were assigned to either the Relative Clause Experience group or the Control group to balance the reading span scores and proficiency in English in the two groups.

3) Pretest session

Participants performed the self-paced reading task with a key press initiating the presentation of the next word. The materials containing relative clauses were presented on a computer screen using a word-by-word, moving window display. After the instructions, the participants completed a practice session to familiarize themselves with the task and the response keys. After 10 practice trials, a script of experimental trials was presented on computer screen. After participants read each sentence, a comprehension question was presented. The response of the participants in the form of yes/no was recorded.

4) Training session

Participants in the Relative Clause Experience group were given 80 relative clauses embedded in texts, while the Control group was not exposed to any relative clauses. A text consisting of two sentences was presented on two lines on computer screen with relative clause always present on the second line in the Relative Clause Experience condition. After reading each text, participants had to answer a comprehension question.

5) Posttest session

All the participants again read 20 sentences which include relative clauses in a word-by-word, participant-paced, moving window paradigm. After reading, they answered yes/no comprehension questions. No feedback was given to any answers for any of the stages.

5.3 Results

5.3.1 Results of proficiency test and reading span test

The two groups were well-matched in English proficiency and reading span as shown below. There were no significant differences between the two groups.

Table 9

Descriptive statistics for proficiency test

Group	N	Min	Max	Mean	SD
Experience	20	30	47	38.65	4.69
Control	16	30	49	38.06	5.23

Table 10

Descriptive statistics for reading span test

Group	N	Min	Max	Mean	SD
Experience	20	21	41	30.35	5.57
Control	16	18	39	30.63	5.24

5.3.2 Results of pretest

5.3.2.1 Accuracy rate on comprehension

Overall, participants' mean accuracy rate of the subject relative clause sentence comprehension questions was significantly better than that of the object relative sentences (t (35) = 2.307, $p < .05$). There were no significant differences between the Experience group and the Control group. These results conform to those of previous research.

Table 11

Mean proportion correct on pretest questions

Group	Pretest	Pretest SR	Pretest OR
Experience	.82	.86	.78
Control	.81	.87	.75
Total	.82	.87	.77

(SR = subject relative; OR = object relative)

5.3.2.2 Self-paced reading times

Table 12 shows the average self-paced reading times for the sentences in the pretest. Participants' mean reading time of subject relative sentences was significantly faster than that of object relative sentences (t (35) = 2.284, $p < .05$). Therefore, along with comprehension data, object relative sentences were shown to be more difficult to process and comprehend than subject relative sentences for Japanese EFL learners as was predicted.

Table 12

Mean self-paced reading times of sentences in pretest (in sec)

Group	Pretest	Pretest SR	Pretest OR
Experience	9.35	9.11	9.58
Control	8.46	8.23	8.69
Total	8.95	8.72	9.19

5.3.3 Results of posttest

5.3.3.1 Accuracy rate on comprehension

Participants showed overall improvement in accuracy in the post-test. Participant's accuracy rates on comprehension questions for the subject relative clause sentences and object relative sentences in the pretests and the posttests are shown in Table 13.

Table 13

Mean proportion correct on pretest and posttest comprehension questions

Group			Pretest		Posttest	
	pretest	posttest	SR	OR	SR	OR
Experience	.82	.94	.86	.78	.96	.91
Control	.81	.84	.87	.75	.88	.80

Repeated measures ANOVAs with Relative Clause Type (subject relatives vs. object relatives) and Session (pretest vs. posttest) as within-subject factors revealed main effects of Relative Clause Type for both the Experience group and the Control group（Experience group: ($F(1, 19) = 4.465$, $p < .05$, and the Control group: $F(1, 15) = 6.579$, $p < .05$). Participants in both groups had better comprehension accuracy on subject relatives than object relatives in both the pretest and the posttest. There was a main effect of Session (pretest/posttest) for only the Experiment group ($F(1, 19) = 11.409$, $p < .01$), in that the Experience group improved relative clause comprehension significantly in the posttest. In contrast, the Control group improved slightly in the posttest, and there were no reliable differences between the pretest and the posttest. The robust effect of experience was obtained by the Experience group after only 80 times exposure to relative clause

structure in the training session.

The Experience participants were grouped into a Proficient group (participants who scored above the average in pretest) and a Less Proficient group to see the effects of proficiency on the improvement in accuracy rates.

Table 14

Mean proportion correct for the proficient and less proficient participants of the Experience group

Group				Pretest		Posttest	
	N	Pretest	Posttest	SR	OR	SR	OR
Proficient	11	.94	.95	.94	.94	.96	.93
Less Proficient	9	.68	.93	.78	.58	.97	.89

Although the Proficient group showed little improvement partly due to the ceiling effect, the Less Proficient group improved significantly from pretest to posttest, as is apparent in Table 14. An examination of the figures shows an interaction of Session and Proficiency ($F(1, 18) = 37.731$, $p < .01$), in that the Less Proficient group had greater improvement in their comprehension accuracy from the pretest to the posttest than the Proficient group. To investigate whether the improvement in comprehension was symmetrical between the subject relatives and the object relatives, 2(Proficient vs. Less Proficient) by 2(pretest vs. posttest) ANOVAs for subject relatives and object relatives were performed. There was an interaction of Session and Proficiency (Subject relative clause sentences: $F(1, 18) = 7.983$, $p < .01$, Object relative clause sentences: $F(1, 18) = 35.411$, $p < .01$), indicating that the less proficient readers improved significantly more than the proficient readers. What is more, the less proficient readers improved comprehension on object relatives more than subject relatives as shown in Figure. 12. These results support the claim that weakly represented syntactic knowledge is more susceptible to priming.

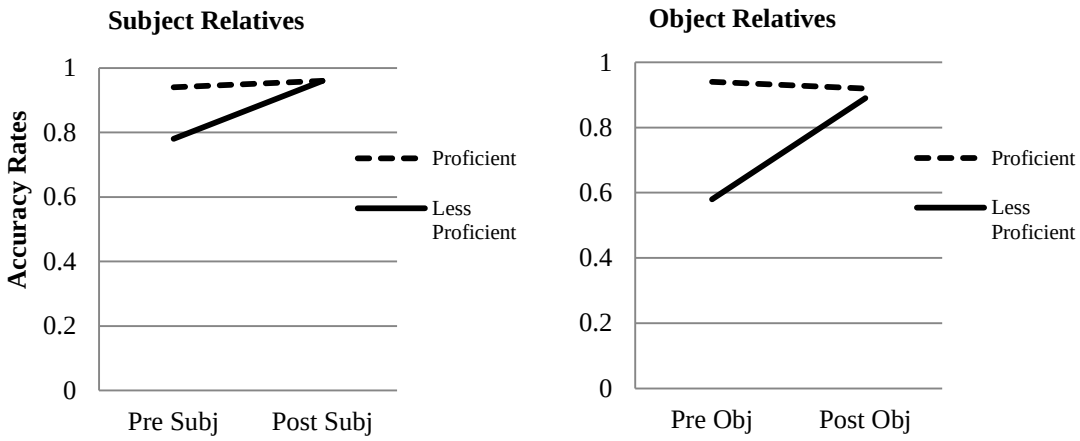


Figure 12. Accuracy rates on subject- and object-relative clause sentences across pre- and post-test for the Proficient and the Less Proficient group

5.3.3.2 Self-paced reading times

Participant's mean reading times for the relative clause sentences in the pretest and the posttest are shown in Table 15.

Table 15

Mean self-paced reading times in pretest and posttest (in sec)

Group			Pretest		Posttest	
	pretest	posttest	SR	OR	SR	OR
Experience	9.35	8.24	9.11	9.58	8.47	8.01
Control	8.46	7.10	8.23	8.69	6.80	7.40

Repeated measures ANOVAs were performed with Relative Clause Type (subject relatives vs. object relatives) and Session (pretest vs. posttest) as within-subject factors. Participants read more quickly in the posttest than in the pretest ($F(1, 34) = 18.129$, $p < .01$), as they had been exposed to 80 English texts during the training session. There was a main effect of Relative Clause Type for Control group ($F(1,15) = 5.662$, $p < .01$) and the result shows Control group read subject relative clause sentences faster than object relative clause sentences through pretest to posttest. On the other hand, there was an interaction between Session and Relative Clause Type for the Experience

group ($F(1, 19) = 4.39$, $p = .05$). The Experience group had greater improvement on object relative sentence reading ($t(19) = 2.963$, $p < .01$) than on subject clause sentence reading ($t(19) = 1.442$, $p > .05$). The pattern across pretest and posttest showed that the Experience group had benefited from the repeated exposure to relative clause construction in the training session and the effect of experience influences stronger on object relatives than on subject relatives as shown in Fig. 13. There was no significant difference in improvement between the proficient readers and less proficient readers for reading times across the pretest and the posttest.

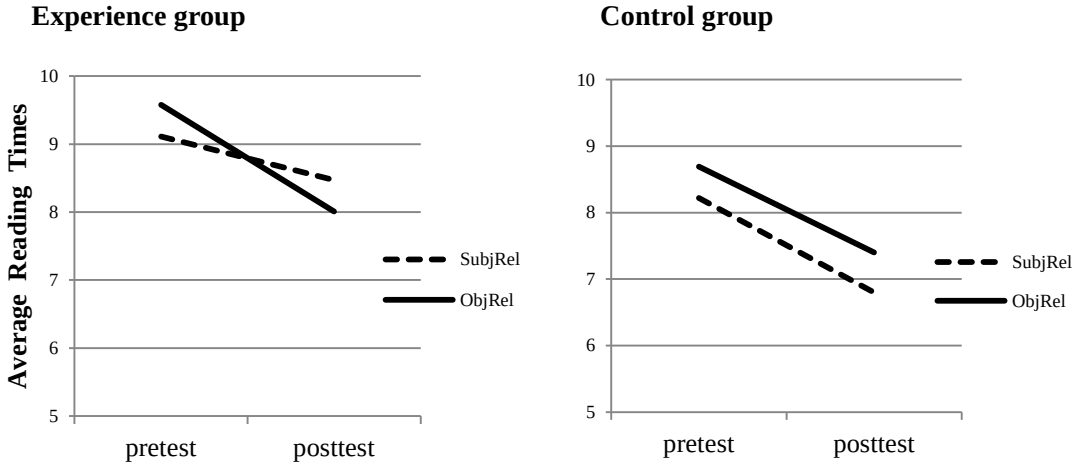


Figure 13. Average reading times of subject- and object-relative clause sentences across pre- and post-test for the Experience group and the Control group (in sec)

In order to investigate the changes in reading speed from the pretest to the posttest, residual reading times were used. I calculated each participant's predicted reading times as a function of word length by using linear regression equation, then, subtracted the predicted RT from the observed RT. The data were grouped into regions. The first region contains five words: the definite article, the head noun, the relative pronoun, *that*, and the next two words of the relative clause. Region 2 contained one word, the embedded object noun in the subject relative condition and embedded verb in the object relative condition. The third and fourth regions were identical for both subject relative condition and object relative condition. Region 3 contained the main verb. As is shown in Fig. 14, after training session, the Experience group's mean reading times in main verb region for the posttest became significantly faster than in the pretest ($t(19) = 2.114$ $p < .05$). As the

participants in the Experience group learned the gap-filling processing during the training session, they could integrate the head noun with the main verb more easily than before. Increased processing speed on the main verb region brought about an overall facilitation of processing object relative clauses.

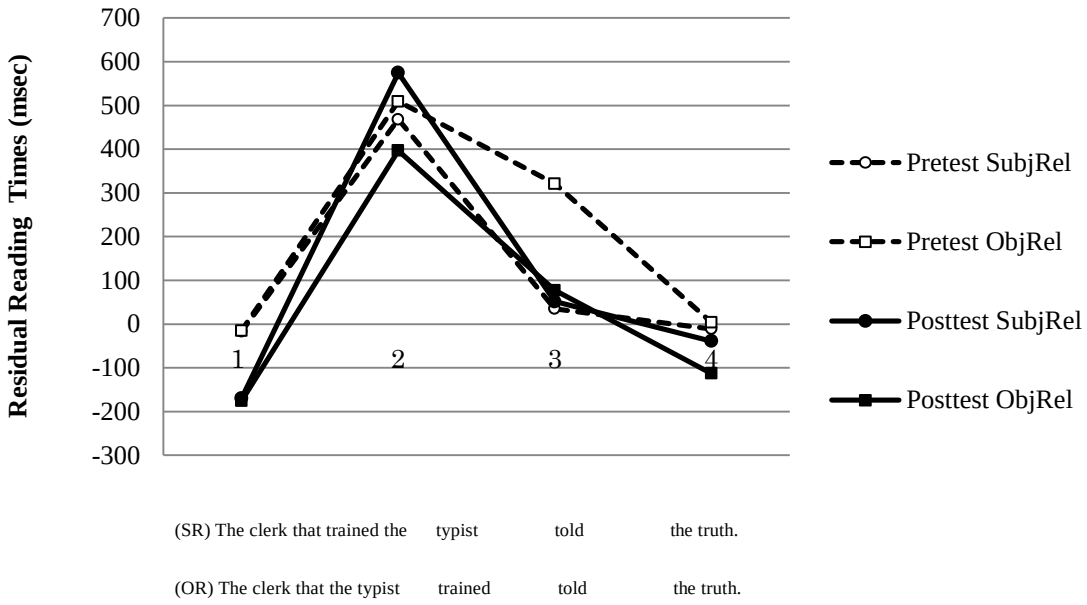


Figure 14. Residual reading times per word of subject and object relative clause sentences

5.4 Discussion

This study investigated the role of experience or exposure on the comprehension of relative clauses. Specifically, it tested whether a certain amount of exposure to the relative clauses affected the subsequent comprehension or processing of relative clause sentences by Japanese EFL learners and whether exposure equally affected subject relative clauses and object relative clauses. It was predicted that relative clause processing, especially object relative processing, would be facilitated by repeated exposure to the relative clause construction. The results, as a whole, supported the prediction. The results are discussed in terms of implicit learning, inverse frequency effect, and discourse-level explanation for the facilitated processing.

The results indicated that the Experience group showed a significant improvement in comprehension accuracy rates from pretest to posttest, whereas the Control group did not. Moreover, in the posttest session, the Less Proficient group (participants who scored less than the

average comprehension score at pretest) showed reliably more exposure effect than the Proficient group. For the relative clause sentence reading times, an interaction between Session and Relative Clause type was found for the Experience group. There was a main effect of Session for the Experience group as they read object relative sentences significantly faster in the posttest than in the pretest. As a result, this group read the object relative sentences faster than the subject relative sentences in the posttest. These improved reading times for the object relative sentences might have been a result of the participants' implicit learning of the processing of filler-gap dependencies at relative clause region during training session. More specifically, during the training session, this group was repeatedly exposed to relative clause construction and they implicitly learned how to process relative clause gap-filling, which lead to a facilitation of the integration process at the main verb region. It is assumed they have learned that certain meaning relationship map onto certain functional elements, which map onto constituent sequences. These mapping or automatized processing procedures were acquired through experience during the training session.

The results of the present study suggest that experience is a powerful source of learning. In this experiment, no special tasks were imposed on participants. However, relative clause experience in texts almost completely removed the difference in difficulty between the subject relative clauses and object relative clauses. What all participants did in the training session in this experiment was merely reading texts and answered comprehension questions, so the participants of the Experience group must have learned the abstract processing routines involved in relative clause processing unconsciously and implicitly. In difficult sentence comprehension, especially relative clause comprehension, capacity limits have been emphasized as a major source of processing difficulties (Gibson, 1998; Just & Carpenter, 1992; King & Just, 1991). However, this study, together with recent studies in L1, showed that processing experience is another source of individual differences in processing. In other words, it can be said that if we have enough processing experience, we can compensate for capacity deficit.

The common finding is that low frequency structures lead to greater priming effects than comparable higher frequency structures. In this experiment, infrequent object relative clauses were primed significantly more than frequent subject relative clauses. Another interesting result in this experiment concerning the inverse frequency effect is that the less proficient readers showed significantly greater improvement in comprehension after the training session than the proficient

readers. These priming effects could be observed because weakly represented syntactic knowledge is more susceptible to priming. It seems that less proficient readers are more susceptible to priming because they have less experience and have a weaker representation of the relative clause structure than proficient readers. Judging from the results of this experiment, exposure to relative clause structure turned out to be useful especially for less experienced and less proficient readers.

Structural priming effects in comprehension have been said to be weak compared with those of production. Considering the results of previous research, the structural priming effects in this study were more robust than expected. Exposure to 80 relative clauses embedded in texts led to a significant improvement in comprehension and facilitated processing for the Experience group. The main cause for this robust improvement is that participants, especially the less proficient readers, had a weak representation for the relative clause structures in comparison with L1 readers, which resulted in inverse frequency effects. Another possible reason for this facilitation is the discourse factor. There is a special relationship between object relative clauses and discourse topics. Object relatives are used to link a new entity to the discourse by explicitly relating it in the relative clause to a discourse topic. This phenomenon is called *grounding* (Fox & Thompson, 1990). In this manner, sentences in a text form a coherent whole. Therefore, according to the corpus data, the embedded nous phrases in the object relative clauses consistently refer back to old information in context (Roland et al., 2012). Roland et al. (2012) suggested that processing an object relative clause in a context is easier than to process it in isolation. This relatively easy processing experience during the training session might have resulted in the facilitated object relative clause processing in the posttest session.

As language is generally used for communication purpose, readers generate expectations based on how words or structures are generally used in discourse. Therefore, it can be argued that learning words or structures repeatedly in a naturalistic context is necessary to acquire the probabilistic information that substantially assists in reading comprehension.

6. EXPERIMENT 4: The role of frequency and discourse context in Japanese EFL learners' relative clause processing

Experiment 4 was conducted to clarify two issues of interest, namely, the effects on text processing of 1) level of exposure to relative clauses and 2) the discourse factors. In order to examine the first—whether levels of exposure to relative clause sentences affect the subsequent processing of that structure or not—the participants' experience of processing relative clauses was manipulated. Participants were assigned to three different levels of exposure groups, that is, 20, 50, and 80 times exposure group. In several production experiments, it has been demonstrated that a relatively short range of experience leads to cumulative priming effects and long-lasting adaptation. However, in language comprehension studies, few studies have demonstrated such cumulative priming effects.

The second issue of interest was whether the facilitation of relative clause processing in Experiment 3 was brought about mainly by the discourse factors. As mentioned in Chapter 5, the processing difficulties found in object relative clauses are partly due to discourse factors. There is a special relationship between object relative clauses and discourse topics. Object relatives are used to link a new entity to the discourse by explicitly relating it in the relative clause to a discourse topic (e.g., if the ongoing topic is the speaker's pet dog, and a cat is suddenly mentioned, the referent of the cat can be grounded by saying *The cat that he chased*…). As relative clause sentences were embedded in texts consisting of two sentences in Experiment 3, participants might have learned the procedure of processing relative clauses by repeated exposure to texts containing relative clauses, which could have led to implicit learning of the processing procedure, especially in the case of object relative clauses. At the same time, participants might have learned discourse cues relating to the processing of object relative clauses and applied them to subsequent processing.

6.1 Prediction

Compared with the results of Experiment 3 in which relative clause sentences were embedded in texts, the processing of relative clause sentences without context in this experiment is not expected to improve significantly. Specifically, it is predicted that object relative clause processing will not improve.

6.2 Methods

6.2.1 Participants

A total of 29 undergraduate and graduate students at Kobe University participated in this experiment.

6.2.2 Materials

6.2.2.1 Pretest and posttest for relative clause reading

The materials for the pretest and posttest were the same as those of Experiment 3.

6.2.2.2 Materials for the training session

Participants were assigned to three different groups. These groups differed in exposure times to the relative clause sentences in the training session, namely, at 20 times, 50 times, and 80 times. Relative clause sentences were the same as the second sentences of the texts in Experiment 3. The same amount of filler items was developed.

6.2.3 Procedure

Each participant was tested in the following five sessions, 1） proficiency test, 2) reading span test, 3) pretest, 4) training session, and 5) posttest. The procedure of each test was the same as that of Experiment 3, except that in the training session, participants were divided into three groups (20 times exposure group, 50 times exposure group, and 80 times exposure group). In this training session, relative clause sentences and the same amount of filler sentences were presented, based on the number of exposure time conditions.

6.3 Results

6.3.1 Results of proficiency test and reading span test

The three groups were well matched in English proficiency and reading span as shown in Table 16 and Table 17. There were no significant differences among the three groups.

Table 16

Descriptive statistics for proficiency test

Group	N	Min	Max	Mean	SD
20 times exposure group	10	38	47	42.20	3.46
50 times exposure group	10	38	47	41.70	2.91
80 times exposure group	9	38	45	42.56	2.07

Table17

Descriptive statistics for reading span test

Group	N	Min	Max	Mean	SD
20 times exposure group	10	27	38	31.00	3.65
50 times exposure group	10	25	41	32.70	4.45
80 times exposure group	9	28	41	33.33	4.18

6.3.2 Results of pretest

6.3.2.1 Accuracy rate on comprehension

Table 18 shows the mean accuracy rates of subject relative clause sentences and object relative clause sentences in the pretest. Participants' mean accuracy rates of subject relative clause sentences were slightly better than those of object relative clause sentence, however, there were no significant difference between the comprehension scores of subject relative clauses and object relative clauses (F (1, 26) = 1.188, p > .1). There were no significant differences among the three groups.

Table 18

Mean proportion correct on pretest questions

Group	Pretest	Pretest SR	Pretest OR
20 times exposure group	8.4	8.5	8.3
50 times exposure group	8.3	8.5	8.1
80 times exposure group	8.6	8.7	8.4
Total	8.4	8.6	8.3

6.3.2.2 Self-paced reading times

Participants read subject relative clause sentences significantly faster than object relative sentences (F (1, 26) = 4.221, p = .05). There was no significant difference among the three groups.

Table 19

Mean self-paced reading times of sentences in pretest (in sec)

Group	Pretest	Pretest SR	Pretest OR
20 times exposure group	6.98	6.74	7.22
50 times exposure group	5.97	5.94	6.01
80 times exposure group	8.82	6.67	6.96
Total	7.26	6.45	6.73

6.3.3 Results of posttest

6.3.3.1 Accuracy rate on comprehension

Participants' accuracy rates on comprehension questions for the subject and object relative clause sentences in the pretest and posttest are shown in Table 20. .

Table 20

Mean proportion correct on pretest and posttest comprehension questions

Group			Pretest		Posttest	
	Pretest	Posttest	SR	OR	SR	OR
20 times exposure group	8.4	8.7	8.5	8.3	9.0	8.4
50 times exposure group	8.3	8.5	8.5	8.1	9.0	8.0
80 times exposure group	8.6	8.8	8.7	8.4	9.2	8.4
Total	8.4	8.7	8.6	8.3	9.1	8.3

Participants in all groups had better comprehension accuracy on subject relatives than on object relatives in both the pretest and posttest. There was a main effect of session (pretest vs. posttest) for only subject relative comprehension (F (1, 26) = 5.741, $p < .05$), in that only the comprehension of subject relative clauses improved significantly from the pretest to posttest. There was no such significant improvement for object relative comprehension. Main effects of exposure level and interactions of session and exposure level were not reliable for both subject relatives and object relatives.

6.3.3.2 Self-paced reading times

Participants read object relative clause sentences significantly faster in the posttest than in the pretest (F (1, 26) = 5.493, $p < .05$). However, reading times of subject relative clause sentences did not improve significantly. Analyses of self-pace reading times did not yield reliable main effects of exposure levels for both subject relatives and object relatives. Likewise, there was no interaction of session and exposure level for both types of relative clauses.

Table 21

Mean self-paced reading times of sentences in posttest (in sec)

Group			Pretest		Posttest	
	Pretest	Posttest	SR	OR	SR	OR
20times exposure group	6.98	6.55	6.74	7.22	6.38	6.71
50 times exposure group	5.97	5.76	5.94	6.01	5.71	5.81
80 times exposure group	6.82	6.24	6.67	6.96	6.06	6.41
Total	6.59	6.18	6.45	6.73	6.05	6.31

6.4 Discussion

As shown in the results, there was no cumulative priming effect. Manipulation of the level of experience of relative clause processing did not bring about the cumulative priming effect. It is often shown that priming effects in comprehension are weaker than those in production. Therefore, there was no significant difference among the three levels of exposure to relative clauses.

In Experiment 3, relative clause processing, and especially object relative clause processing, was facilitated by repeated exposure to the relative clause structure embedded in texts. However, in this experiment, in which the relative clause sentence was presented in isolation without textual context, the facilitative effect was small compared with the results of Experiment 3. In particular, object relative clause processing did not show any improvement in Experiment 4, where the critical relative clause sentences were the same as those used in Experiment 3. The only difference between Experiment 3 and 4 was whether the critical sentence was presented in isolation or in text.

Fox and Thompson (1990) investigated the use of relative clauses in a corpus of spoken American English conversation. In effective communication, referents must be presented so as to be relevant for a comprehender at the points where they are introduced. The main way in which a comprehender make a noun phrase relevant is to relate it to another referent whose relevance is clear, and this process is called "*grounding* ". One way in which grounding is accomplished is by modifying the ungrounded new entity with a relative clause where the embedded nouns phrase refers back to a relevant referent in the ongoing discourse. Fox and Thompson (1990) claimed that object relative clauses are strongly associated with a discourse grounding function, while subject relative clauses fulfill other functions such as introducing new information about modified noun

phrases.

Roland et al. (2012) conducted five experiments and demonstrated that naturally occurring object relatives are no more difficult than subject relatives. They argued that discourse context affects relative clause processing, and that subject and object relative clauses are associated with different discourse expectations. Therefore, the expectations of object relative clauses are violated when they appear in isolation, while those of subject relative clause are not. They also analyzed the corpus data and demonstrated that embedded noun phrase in object relative clause nearly always has a discourse-old referent, while subject relative clause typically introduces new information about the modified noun phrase.

In experiment 3, participants were repeatedly exposed to relative clause sentences embedded in a text. As the referent of the embedded noun phrase in object relative clause was presented in the first sentence, they must have acquired the knowledge that the noun phrase in object relative clause always refers back to a relevant referent in the preceding context. This discourse expectation is specific to object relative clauses, so it influenced relative clause processing. Furthermore, repeated processing strengthened the participants' syntactic representation of relative clause construction. Consequently, they began to generate expectations based on the strengthened syntactic representation and the knowledge they had acquired about how relative clause structures are normally used in discourse. These expectations facilitated their relative clause processing, which in turn reduced their working memory loads.

Taken together, after repeated exposure to relative clause structures in texts, participants in Experiment 3 must have implicitly learned the processing procedure of relative clauses and simultaneously acquired discourse expectations, both of which can contribute to leaving more resources available for higher-level text processing.

7. GENERAL DISCUSSION

The present study set out to address two issues concerning text comprehension by Japanese EFL learners. One is the current situation of Japanese EFL learners' text comprehension and the source of individual differences, which was addressed in Experiments 1 and 2. The other is the repeated exposure effects on their processing of a syntactic construction, specifically, the relative clause construction, which was addressed in Experiments 3 and 4, to determine whether this could facilitate Japanese EFL learners' reading comprehension.

Experiment 1 investigated the effects of focusing, proficiency, and working memory capacity on the text comprehension of Japanese EFL learners to identify the likely source of differential text comprehension performance. The results showed that there was a significant difference in the mean value of English comprehension test scores between the high and low proficiency groups, suggesting that L2 specific knowledge and processing skills have considerable effects on L2 reading comprehension. Regarding the keyword detection task, the mean value of the participants' comprehension score in the task group outperformed that of the non-task group. Comparison of fixation frequencies and fixation durations between task group and non-task group was also made using eye tracking data, which showed that eye fixation frequencies in the second reading of the task group decreased more than that of the non-task group. Some previous research has demonstrated that the attentional control mechanism is one of the factors influencing language comprehension (Gernsbacher, 1990; Gernsbacher & Faust, 1991). Although there was no significant statistical difference between the task group and the non-task group, the better comprehension and eye movement data of the task group implies that differential performance of skilled and less skilled readers in text comprehension is partly due to attentional control skills. As our processing resource is limited (Just & Carpenter, 1992), the ability to focus on the important information and suppress the irrelevant information might contribute to better text comprehension. Another important finding relating to eye movements of the participants is that the less proficient readers fixated more words, spent more time on them and made more regressions to earlier words than the proficient readers. This finding suggests that the proficient readers can afford to allocate their processing resources to coherence building owing to their efficiency in lower-level processing, whereas the less proficient readers have no capacity left to take global text structure into

considerations.

Following the results of Experiment 1, Experiment 2 was conducted to examine whether the syntactic processing of Japanese EFL learners affects higher-level text comprehension performance, especially causal inference which is essential for coherence building of text comprehension. Short texts containing two critical sentences that together warrant a causal inference were used as experimental materials. The syntactic structure of the second critical sentence was either temporarily ambiguous reduced relative structure or unambiguous structure with relative pronoun. Results from a lexical decision task suggested that participants drew a causal inference when the syntactic structure was less difficult to parse but that inference was constrained when syntactic structure was more demanding to parse. Consistent with the shared resource assumption (Just & Carpenter, 1992), the results demonstrated that the increased resource demands of syntactic analysis interfered with the successful operation of causal inferencing which is indispensable for coherent text comprehension. The importance of automatic syntactic processing for efficient text comprehension was shown in this experiment.

As Experiment 2 demonstrated that the syntactic processing demands limit the resources available for higher-level text comprehension, Experiment 3 was conducted to investigate whether Japanese EFL learners' relative clause processing, especially that of difficult object relative clauses processing can be facilitated by repeated exposure to relative clause sentences embedded in two-sentence texts. This experiment manipulated participants' experience with relative clause constructions in a training session. Half of the participants were assigned to a Relative Clause Experience group and had reading experience with an equal number of subject and object relative clauses embedded in texts. The other half was assigned to a Control condition in which participants read two-sentence texts without relative clause constructions. The results showed that the Experience group showed a significant improvement in comprehension accuracy rates from pretest to posttest, whereas the Control group did not. Moreover, in the posttest session, the Less Proficient group (participants who scored less than the average comprehension score at pretest) showed reliably more exposure effect than the Proficient group. Regarding the relative clause sentence reading time, an interaction between Session and Relative Clause type was found for the Experience group. Therefore, the Experience group read the object relative sentences faster than the subject relative sentences in the posttest. Taken together, the results of Experiment 3

demonstrated that experience or exposure is a powerful source of learning. In line with recent studies in L1, this study showed that processing experience is one source of individual differences in language processing. In other words, it can be said that if we have enough processing experience in syntactic processing, we can leave enough processing resource for the subsequent higher-level text processing.

A recent series of studies have demonstrated that discourse context plays an important role in a relative clause processing (Mak, Vonk, & Schriefers, 2008; Reali & Christiansen, 2007; Roland et al. 2012). According to previous studies, the embedded noun phrase in the object relative clause usually has a discourse-old referent, because the object relative clause has a discourse grounding function. On the other hand, the subject relative clause introduces new information about the modified noun phrase. Therefore, the referent of the embedded noun phrase in subject relative clause is typically discourse-new. Roland et al. (2012) argued that discourse context influences the relative clause processing, and that different discourse expectations are associated with subject and object relative clause processing. If the participants acquired this expectation during the training session in Experiment 3, the expectation associated with discourse context might have played a large role in the robust facilitation of object relative processing. Accordingly, Experiment 4 was conducted to examine whether the improvement of object relative clause processing without context is smaller than the results of Experiment 3, in which relative clause sentences were embedded in the text. Another purpose of this experiment was to investigate whether levels of exposure to the relative clause sentences affect the subsequent processing of the structure. The results showed that there was no significant difference among three levels of exposure group. Regarding the discourse factor, in Experiment 4 in which relative clause sentences were presented in isolation, the facilitative effect of object relative clause comprehension was much smaller than the result of Experiment 3. This result suggested that as the participants did not acquire the discourse expectation in an isolated context condition, processing difficulties relating to object relative clauses could not be reduced or eliminated.

The present empirical results in Experiments 3 and 4 demonstrate the powerful role of experience in language comprehension. The results support the traditional view emphasizing the importance of practice or experience in gaining skills (e.g., Ericsson, Krampe, & Tesch-Römer, 1993). There is an abundant evidence attesting to the importance of practice or experience in

language acquisition and language learning. Huttenlocher et al. (2002) examined the later syntactic development in children and concluded that the amount of input affects the level of syntactic skill that individuals achieve. Luka and Barsalou (2005) showed experimentally that participants judged the same types of sentences as more acceptable following exposure to similar sentences. Thus, we tend to comprehend the most probable meaning of phrases or sentences on the basis of frequency and recency. Acheson, Wells, & MacDonald, (2008) examined the effects of experience with different amounts of reading experience or "print exposure". The result demonstrated a clear relationship between the amount of print exposure and performance on standardized tests of reading and verbal ability. The total time spent on reading is one of the largest determinants of reading performance (Just & Carpenter, 1987; Segalowitz, 2003).

We naturally acquire knowledge of the frequencies of the elements of language through experience. Fluent readers have a vast statistical knowledge about the behavior of the lexical items of their language and tend to comprehend the most probable meaning of phrases and sentences on the basis of the frequency information. In Experiment 3, in order to investigate the role of frequency, participants were exposed to the same number of subject relative clauses and object relative clauses in the training session, such that reading experience was manipulated. Consistent with previous research, the results of pretest showed that object relative sentences were more difficult to process and comprehend than subject relative sentences. However, repeated exposure to relative clauses yielded more improvement with object relatives than subject relatives. Moreover, in the posttest session, the Less Proficient Group (participants who scored less than the average scores in pretest) showed reliably more exposure effects than the Proficient Group. Compared with priming in production, structural priming effects in comprehension studies have been shown to be relatively weak, often requiring the repetition of a verb between a prime and a target sentence. However, in Experiment 3, a robust effect could be observed without content word overlap between a prime and a target, after 80 times exposure to relative clause constructions.

These results also confirmed the finding that, in general, less frequent or less preferred structures cause stronger syntactic priming than those that are more frequent or preferred (Bock, 1986; Bock & Griffin, 2000). This inverse frequency effect arises from long-range accumulation of production or comprehension experience and is predicted by implicit learning accounts of structural priming (Chang et al., 2006). According to the error-based implicit learning account

(Chang, Dell, & Bock, 2006), syntax is acquired via error-based learning and the processing of an infrequent or less preferred structure yield a larger error and stronger priming than the processing of a frequent or preferred structure. It is assumed that comprehension systems learn more about representation that is not well known, and this coincides with the implicit learning view. For a language to change, the linguistic knowledge of individual learners must change and this modified knowledge must remain stable for long enough to be reproduced later. When such changes persist and occur outside of conscious awareness, it can be considered a type of implicit learning. The results of Experiment 3 demonstrated that various representations in Japanese EFL learners' language system can be tuned by language experience.

Another important finding in this study is the role of discourse context in syntactic processing. The facilitative effect of repeated exposure to relative clause sentences embedded in the text was more robust than the facilitative effect caused by repeated exposure to relative clause sentences presented in isolation. It appears that discourse expectations were used to guide relative clause comprehension. Based on the distributed pattern of relative clauses, readers acquired the relevant expectation that the embedded noun phrase in an object relative clause refers back to a referent in the ongoing discourse. Previous studies have shown that discourse expectation play a role in language comprehension (e.g., Altman & Steedman, 1988). As language is normally used for communication purposes, readers generate expectations based on how words and structures are normally used in discourse. There are cases in which the syntactic structure does not provide enough information about its correct semantic interpretation. Therefore, non-syntactic factors such as expectation based on frequency or plausibility also play an important role in comprehension (e.g., McRae, Spivy-Knowlton, & Tanenhaus, 1998; Spivy & Tanenhaus,1998). Linguistic experience substantially influences sentence and text processing over time. There is a bias in favor of analyses that occur most frequently in the language (Mitchell et al. 1995). Prior comprehension experiences have an effect on the choice of one structural interpretation over another. Previous studies indicated that probabilistic information influences language acquisition and comprehension (e.g., MacDonald, Pearlmutter, & Seidenberg, 1994; McRae, Spivy-Knowlton, & Tanenhaus, 1998; Trueswell, 1996). Acquiring probabilistic knowledge of distributional regularities governing language structures contributes to reduction of processing difficulties. In this study, repeated exposure to relative clause sentences brought about the implicit learning of the processing

procedure, as well as the acquisition of discourse expectation which is hypothesized to shape comprehension performance. Overall, this study underlines the importance of frequent exposure to syntactic structures in texts to improve text comprehension.

8. CONCLUSION AND FURTHER STUDIES

The relative clause processing, especially object relative clause processing, of Japanese EFL learners could be facilitated by repeated exposure to the relative clause structure. Participants could rapidly learn from comprehension experience and apply it to subsequent linguistic input. These facilitative effects were robust among participants who were less proficient in relative clause processing in the pretest. Experience with the language strengthened the processing connections related to the object relative clauses and enabled the participants to acquire the relevant discourse expectation.

In sum, the present study demonstrated that Japanese EFL learners' increased demand of syntactic processing interferes with the successful text comprehension. In addition, it provided evidence that repeated exposure to a particular structure can facilitate the processing of subsequent inputs by the strengthened connection between the elements of that structure and contribute to the acquisition of discourse expectations. Additional attention should be directed to the experience effect and the importance of reading in context in English language education. Further work is required to clarify the relationship between structural priming effects and the long-range frequency effects in comprehension and to explore how the mechanisms of learning and memory contribute to language comprehension of Japanese EFL learners.

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APPENDIX

Appendix A

Experiment1

A Cultural Difference: Being on Time

In the United States, it is important to be on time, or punctual, for an appointment, a class, a meeting, etc. However, this may not be true in all countries. An American professor discovered this difference while teaching a class in a Brazilian university. The two-hour class was scheduled to begin at 10A.M. and end at 12 P.M. On the first day, when the professor arrived on time, no one was in the class room. Many students came after 10 A.M. Several arrived after 10:30 A.M. Two students came after 11 A.M. Although all students greeted the professor as they arrived, few apologized for their lateness. Were these students being rude? He decided to study the students' behavior.

The professor talked to American and Brazilian students about lateness in both an informal and a formal situation: lunch with a friend and in a university class, respectively. He gave them an example and asked them how they would react. If they had a lunch appointment with a friend, the average American student defined lateness as 19minutes after the agreed time. On the other hand, the average Brazilian students felt the friend was late after 33 minutes.

In an American university, students are expected to arrive at the appointed hour. In contrast, in Brazil, neither the teacher nor the students always arrive at the appointed hour. Classes not only begin at the scheduled time in the United States, but they also end at the scheduled time. In the Brazilian class, only a few students left the class at noon; many remained past 12:30 to discuss the class and ask more questions. While arriving late may not be very important in Brazil, neither is staying late.

The explanation for these differences is complicated. People from Brazilian and North American cultures have different feelings about lateness. In Brazil, the students believe that a person who usually arrives late is probably more successful than a person who is always on time. In fact, Brazilians expect a person with status or prestige to arrive late, while in the United States lateness is usually considered to be disrespectful and unacceptable. Consequently, if a Brazilian is

late for an appointment with a North American, the American may misinterpret the reason for the lateness and become angry.

As a result of his study, the professor learned that the Brazilian students were not being disrespectful to him. Instead, they were simply behaving in the appropriate way for Brazilian students in Brazil. Eventually, the professor was able to adapt his own behavior so that he could feel comfortable in the new culture.

Appendix B

［現代人は音痴である］

「同じ」にすること、概念的思考の産物の代表例が言葉です。

例えば目の前にリンゴが二個あるとします。すると普通の人は「リンゴが二個ある」ということを理解できます。だから、目の前に何があるか聞かれれば「リンゴが二個」とこたえることでしょう。

ここで「右のリンゴは左のリンゴより赤い。左のリンゴは右のリンゴよりも大きい。両者は別のモノである。したがって、これらを『リンゴ』などという大雑把なくくりで同じというのには無理がある」などと考える人はめったにいません。

リンゴとメロンがならんでいる場合でも、「目の前に果物があります」と答えて不思議はありません。

このように人間は概念的に考えることができるから、感覚では別のものを「同じ」と捉えて考えることができるのです。

つまり「同じ」にするということの性質がもっとも良く出ているのが「言葉」なのです。言葉というのは、別のものでも「同じ」だとして話を進めるのに便利な道具です。「そりゃ細かく見れば、どのリンゴも違うに決まってるさ。でも、そこは目をつぶって同じものだってことにしようよ」と皆で了解して「リンゴ」という言葉を使うわけです。

便利といえば便利ですが、感覚的に世界をとらえている動物からすれば乱暴な話だとなるかもしれません。

実は人間は動物と比べると「音痴」だということばわかっています。たとえば人間の場合、絶対音感の持ち主というのは非常に少ない。ところが動物は感覚でとらえていますから、音に関しては敏感で、彼らは絶対音感の持ち主です。

だから「ホーホケキョ」はどの土地でも同じメロディなのです。人間のように「音が少し外れているけど、きっとホーホケキョって言いたいんだな」という大雑把な捉え方は通用しません。

概念的に考えることが出来るおかげで、人間は複雑な言語を使えるようになり、それが現在の文明を築いたのは間違いありません。

しかし、それでも私は概念的な考えのみ比重を置くことは健全ではないと思います。つまり

「リンゴはどれも同じ」と簡単にまるめて考えない面を持つ人の方がまっとうではないかと思うのです。

もちろん何もいちいち「『Ａ＝Ｂ』って何だ？」と疑問を持てというのではありません。それでは大人として問題があります。その調子で会話していたら、喧嘩になるか相手にされなくなるかのいずれかです。

しかしもんだいは　最近の人は概念的な思考ばかりが優先して感覚的な思考が出来なくなってきていることです。感覚が鈍くなっているのです。

平たく言えば、頭でっかちになって、目の前のことに鈍くなってしまっている人が増えているのです。

Appendix C

氏名＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

以下の文を読んで、その内容が文中にあったと思うものには○、なかったと思うものには×を(　)の中につけて下さい。

(　　) アメリカでは時間に正確であることは大切ではない。
(　　) すべての国で、時間に正確であることが大切というわけではない。
(　　) アメリカ人の教授がブラジルでの授業の初日、時間通りに行ったら、学生はほとんど全員定刻に来ていた。
(　　) 全ての学生が来ると教授にあいさつした。
(　　) 教授はアメリカ人とブラジル人の学生に友人とのランチや大学の授業の遅刻に対してどういう反応をするか尋ねた。
(　　) アメリカ人は決められた時間より１９分遅れると遅刻だと考えた。
(　　) ブラジル人は５分おそくても遅刻と考えた。
(　　) アメリカの大学では、学生は必ず定刻に来るものだと考えられている。
(　　) ブラジルでは教師も学生も必ず定刻に来る。
(　　) ブラジルでは遅刻することはたいした問題ではないが、遅くまで居残ることは良くないと考えられている。
(　　) アメリカでは授業は定刻に終わる。
(　　) ブラジルでは遅刻することは失礼なことだが、まあ仕方ないと考えられている。
(　　) アメリカ人がブラジル人との約束に遅れたら、ブラジル人は遅刻の理由を誤解して怒る。
(　　) ブラジルでは授業が終わると学生はすぐに帰る。
(　　) ブラジル人と北米の文化圏の人は遅刻について異なる感情を持っている。
(　　) アメリカ人の教授はブラジルの学生がブラジル流に行動していただけだと分かった。

（　　）アメリカ人は地位のある人は遅く来るものだと思っている。

（　　）ブラジルでは時間に正確な人は、遅刻する人より偉いと考えられている。

（　　）アメリカ人の教授はブラジル人の学生が自分に敬意を払っていないわけではないと分かった。

（　　）アメリカ人の教授は新しい文化に慣れることが出来た。

Appendix D

氏名＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

以下の文を読んで、その内容が文中にあったと思うものには○、なかったと思うものには×を(　)の中につけて下さい。

(　　) 感覚的思考の代表例が言葉だ。
(　　) リンゴが目の前に２個あると、「りんご」などという大雑把なくくりで同じものというのは無理があると考える人は多い。
(　　) 人間は概念的に考えることが出来る。
(　　) 人間は感覚では別のものを「同じ」と捉えて考えることはできない。
(　　) 人間はどのリンゴも全く同じだと確認して、「リンゴ」という言葉を使う。
(　　) 「同じ」にするということの性質が最も良く出ているのが「言葉」だ。
(　　) 言葉というものは別のものでも「同じ」だとして話を進めるのに便利な道具だ。
(　　) 動物は概念的にものを考える。
(　　) 動物は人間と比べると「音痴」だ。
(　　) 動物は絶対音感の持ち主だ。
(　　) 「ホーホケキョ」はどの土地でも同じメロディだ。
(　　) 概念的に考えることが出来るおかげで人間は複雑な言語を使えるようになった。
(　　) 最近の人は概念的な思考を優先しながらも感覚的な思考も出来るようになってきている。
(　　) 人間は感覚的に考えることが出来るので現代の文明を築いた。
(　　) 概念的な考えのみに比重をおくことは健全ではない。
(　　) 「リンゴはどれも同じ」と簡単に丸めないで考えた方がまっとうだ。
(　　) いちいち「『A=B』」って何だと疑問を持つべきだ。

(　　) 何でもかんでも疑問を持つ大人の方が人から相手にされる。

(　　) 最近の人は感覚が鈍くなってきている。

(　　) 頭でっかちになって目の前のことに鈍くなってしまっている人が増えている。

Appendix E

Experiment 2

Appendix Critical sentence pairs, inference and control probe words for lexical decision, and comprehension questions

Note: For the target sentence in each pair, the words in brackets were included in the unambiguous condition and were not included in the ambiguous condition. The bold letters below each pair are the corresponding inference and control probe words, respectively.

1) When Mary got back home, she found her younger son lying on sofa.

She felt his forehead with her hand.

The family doctor (who was) asked to come at once to see him would arrive soon.

illness session

She tried to cool his forehead with an ice pillow.

Q: The doctor asked Mary to come.

2) John gave up teaching and went into business.

He had to drive to his office two hours every day.

An advertisement for an apartment house (that was) put in a newspaper caught his eyes.

move grow

He called the real estate agent to see the apartment house.

Q: An advertisement for an apartment house caught his eyes.

3) Bob got up half an hour later than usual this morning.

He was not able to eat breakfast before work.

The restaurant (that was) recommended for a big lunch satisfied him.

hungry stupid

He worked energetically after lunch.

Q: Bob recommended the restaurant.

4) Tom and his friend were playing catch.

The ball hit the front of the doghouse.

The dog (that was) wakened from sleep dashed forward suddenly.

surprise research

The dog started barking at them.

Q: The dog dashed forward suddenly.

5) Many boys gathered in the empty space to play after school

A few boys were throwing stones for fun.

The boy (who was) rushed to the hospital was bleeding and had to get eight stiches.

accident audience

His mother worried about him and drove hurriedly to the hospital.

Q: The boy went to the hospital by himself.

6) The climbers tried to get to the mountain cottage as soon as possible.

The clouds over the mountain looked threatening.

Some climbers (who were) expected to descend on the day were delayed.

storm grass

Up in the mountains the weather is likely to change.

Q: Some climbers were delayed to descend.

7) Susan opened the refrigerator door to take out the ice cream bar.

She discovered that the ice cream bar had melted in the refrigerator.

Her mother (who was) asked to cook beef steak for dinner had to buy new meat again.

damaged advised

Her mother drove to a nearby supermarket hurriedly.

Q: Her mother asked Susan to cook beef steak for dinner.

8) The principal directed is steps toward the school gym.

Two boys were smoking behind the school gym when the principal came walking toward them.

The boys (who were) recognized by the principal tried to crush out their cigarette and ran off.

rule sign

The principal ordered them to stay where they were.

Q: The principal tried to crush his cigarette.

9) Luckily it was fine on that day.

John and Mary dressed in white stepped out the church.

The guests (who were) invited celebrated their start of new life from the heart.

wedding channel

After a while, they moved in small groups to a reception hall to attend a party.

Q: The guests were invited by John and Mary.

10) A research team was climbing toward their destination.

A member of the team disappeared from the cliff while climbing.

The man (who was) rescued two hours later waited for the helicopter to arrive.

fall soul

The helicopter arrived half an hour later.

Q: The man waited for the helicopter to arrive.

11) It rained heavily.

A flash of lightning struck suddenly.

The old wooden cottage (that was) built on the hillside was destroyed by fire.

thunder impulse

The residents narrowly escaped death.

Q: The cottage was destroyed by fire.

12) Joey rode on his brother’s new motorcycle without permission.

His brother became furiously angry with him.

Joey’s body (that was) covered with bruises ached on the next day.

fight learn

His mother urged him to see a doctor.

Q: Joey’s body ached on the next day.

13) A newly-wed bride made clam chowder soup for dinner.

After trying some of the soup, her husband looked displeased.

The poor woman (who was)hurt emotionally said that she would never cook again.

terrible creative

The woman cleared the table without a word.

Q: The woman hurt her husband

14) Vicky planned to take a vacation.

She was looking forward to take a rest under a palm tree.

The pink parasol and bathing suit (that were) put in her suitcase were her favorite.

beach guide

She bought some books to read during vacation.

Q: The suitcase was her favorite.

15) Mark has a dog named Charlie.

Charlie likes small animals and wants to play with them.

The squirrel (that was) surprised climbed up a tall oak tree.

escape heaven

Charlie waited for the squirrel under the tree.

Q: The squirrel surprised Charlie.

16) John was absent himself from work.

He couldn’t stand the sharp pain any longer.

The new method (that was) used to pull out is tooth was painless.

dentist quarrel

Q: A new method was used to pull out the tooth.

Appendix F

Experiment3

Pretest A

1) The reporter that attacked the politician admitted the error.

Q: The reporter admitted the error.

2) The boy that the doctor ignored watched television.

Q: The doctor watched television.

3) The dealer that called the teacher visited the school.

Q: The dealer called the teacher.

4) The musician that the teacher respected wrote the school song.

Q: The musician respected the teacher.

5) The driver that trusted the doctor rushed to the hospital.

Q: The driver rushed to the hospital.

6) The boy that the teacher believed told the truth.

Q: The teacher believed the boy.

7) The policeman that shot the suspect was our neighbor.

Q: The policeman shot the suspect.

8) The parents that the daughter phoned believed the story.

Q: The daughter believed the story.

9) The accountant that the lawyer visited bowed politely.

Q: The lawyer bowed politely.

10) The soldier that the enemy attacked was wounded.

Q: The enemy was wounded.

11) The nurse that followed the doctor got in the car.

Q: The doctor followed the nurse.

12) The scientist that the teacher respected made a speech.

Q: The teacher made a speech.

13) The judge that disliked the lawyer ignored the speech.

Q: The judge ignored his speech.

14) The woman that helped the children waved her hand.

Q: The woman helped the children.

15) The singer that criticized the actor was famous.

Q: The actor criticized the singer.

16) The boss that the secretary killed had no family.

Q: The secretary had no family.

17) The writer that the girl interviewed wrote the best seller.

Q: The girl interviewed the writer.

18) The salesman that hit the customer was to blame.

Q: The salesman hit the customer.

19) The boy that kicked the classmate moved to the country.

Q: The classmate kicked the boy.

20) The guitarist that the singer praised performed well.

Q: The guitarist performed well.

Posttest A

1) The man that the reporter attacked had a bad reputation.

Q: The man attacked the reporter.

2) The patient that ignored the doctor went out.

Q: The patient went out.

3) The client that the lawyer called visited the office.

Q: The client called the lawyer.

4) The pianist that respected the conductor joined the concert.

Q: The pianist joined the concert.

5) The nurse that the doctor trusted worked hard.

Q: The doctor worked hard.

6) The principal that believed the teacher told the truth.

Q: The teacher believed the principal.

7) The man that the boss shot was my friend.

Q: The boss was my friend.

8) The wife that called the husband believed the story.

Q: The wife called the husband.

9) The lawyer that visited the client believed the story.

Q: The lawyer visited the client.

10) The man that attacked the protester was wounded.

Q: The man attacked the protester.

11) The doctor that the wife followed got in the train.

Q: The wife followed the doctor.

12) The novelist that resected the teacher delivered a speech.

Q: The novelist delivered a speech.

13) The judge that the lawyer disliked denied his protest.

Q: The judge disliked the lawyer.

14) The girl that the children helped waved her hand.

Q: The girl helped the children.

15) The actress that the director criticized finally stepped down.

Q: The actress finally stepped down.

16) The executive that killed the actress had no family.

Q: The executive had no family.

17) The writer that interviewed the girl wrote a moving story.

Q: The girl wrote a moving story.

18) The photographer that the model married won a prize.

Q: The model won a prize.

19) The boy that the teacher hit stayed away from school.

Q: The boy stayed away from school.

20) The pianist that praised the violinist wanted to perform together.

Q: The violinist praised the pianist.

Pretest B

1) The reporter that the politician attacked admitted the error.

Q: The politician admitted the error.

2) The boy that ignored the doctor watched television.

Q: The boy watched television.

3) The dealer that the teacher called visited the school

Q: The dealer called the teacher.

4) The musician that respected the teacher wrote the school song.

Q: The musician respected the teacher.

5) The driver that the doctor trusted rushed to the hospital.

Q: The doctor rushed to the hospital.

6) The boy that believed the teacher told the truth.

Q: The teacher believed the boy.

7) The policeman that the suspect shot was our neighbor.

Q: The policeman shot the suspect.

8) The parents that phoned the daughter believed her story.

Q: The parents phoned the daughter.

9) The accountant that visited the lawyer bowed politely.

Q: The accountant visited the lawyer.

10) The soldier that attacked the enemy was wounded.

Q: The soldier was wounded.

11) The nurse that the doctor followed got in the car.

Q: The doctor followed the nurse.

12) The scientist that respected the teacher delivered a speech.

Q: The scientist delivered a speech.

13) The judge that the lawyer disliked ignored the speech.

Q: The lawyer ignored his speech.

14) The woman that the children helped waved her hand.

Q: The woman helped the children.

15) The singer that the actor criticized was famous.

Q: The actor criticized the singer.

16) The boss that killed the secretary had no family.

Q: The boss had no family.

17) The writer that interviewed the girl wrote the best seller.

Q: The girl interviewed the writer.

18) The salesman that the customer hit was to blame.

Q: The salesman hit the customer.

19) The boy that the classmate kicked moved to the country.

Q: The classmate kicked the boy.

20) The guitarist that praised the singer performed well.

Q: The singer performed well.

Posttest B

1) The man that attacked the reporter had a bad reputation.

Q: The man attacked the reporter.

2) The patient that the doctor ignored went out.

Q: The patient ignored the doctor.

3) The client that called the accountant visited the office.

Q: The client called the accountant.

4) The pianist that the conductor respected joined the concert.

Q: The pianist respected the conductor.

5) The nurse that trusted the doctor worked hard.

Q: The nurse trusted the doctor.

6) The principal that the teacher believed told the truth.

Q: The teacher believed the principal.

7) The man that shot the boss was my friend.

Q: The man was my friend.

8) The wife that the husband called believed his story.

Q: The wife called the husband.

9) The lawyer that the client visited believed the story.

Q: The lawyer visited the client.

10) The man that the protester attacked was wounded.

Q: The man attacked the protester.

11) The doctor that followed the wife got into the train.

Q: The wife followed the doctor.

12) The novelist that the teacher respected delivered a speech.

Q: The novelist respected the teacher.

13) The judge that disliked the lawyer denied his protest.

Q: The judge disliked the lawyer.

14) The girl that helped the children waved her hand.

Q: The girl helped the children.

15) The actress that criticized the director finally stepped down.

Q: The director criticized the actress.

16) The executive that the actress killed had no family.

Q: The executive killed the actress.

17) The writer that the girl interviewed wrote a moving story.

Q: The girl interviewed the writer.

18) The photographer that married the model got a prize.

Q: The photographer got a prize.

19) The boy that hit the teacher stayed away from school.

Q: The teacher hit the boy.

20) The pianist that the violinist praised wanted to perform together.

Q: The violinist praised the pianist.

Appendix G

Training materials（Experience group）

1) The rock concert was held in an outdoor stadium.

The guitarist that Beth liked began to play a hit song.

Q: The guitarist liked Beth.

2) Tom is a lifesaver.

The boy that Tom saved yesterday came to thank him.

Q: Tom saved the boy.

3) There had been many break-ins in this neighborhood.

The burglar that the police arrested was put in prison.

Q: The burglar was put in prison.

4) The construction project on the mall was about to begin.

Some of the workers that the company hired were foreigners.

Q: The company hired foreigners.

5) A young woman was found shot dead in the park.

Several witnesses that the police questioned saw a suspicious man.

Q: The police saw a suspicious man.

6) John had been depressed lately.

The doctor that John consulted advised him to take a vacation.

Q: John advised the doctor to take a vacation.

7) Mike was fifty years old.

The gardener that Mike hired is much older than he.

Q: Mike is older than the gardener.

8) The thief was brought to the prison.

The prisoners that he saw were sitting on the floor.

Q: The thief was sitting on the floor.

9) Bob was watching a tennis game on TV.

The player that Bob supported won the game.

Q: Bob supported the player.

10) The city decided to build a new school.

The architect that the city hired began to complain about the budget.

Q: The city began to complain about the budget.

11) John is an elementary school teacher.

The pupils that like John obey his order.

Q: The pupils obey his order.

12) Tom visited a local pet shop.

The dog that Tom chose was named Bill.

The dog was named Tom.

13) Paul and Mary are planning their wedding ceremony.

The colleagues that they planned to invite gave them some presents.

Q: The colleagues gave them their advice.

14) Mark is a student at the local art school.

The professor that Mark respected won a prize.

Q: The professor won a prize.

15) The novelist was invited to give a lecture.

The novelist that respected the professor talked about Hemingway.

Q: The professor talked about Hemingway.

16) Mr. Smith wanted to remodel his living room.

The carpenter that was highly skilled remodeled the room.

The carpenter was highly skilled.

17) Mary cooked Thanksgiving dinner at her house.

The guests that she invited talked about the newly opened store.

Q: Mary talked about the newly opened store.

18) The students were studying for a major social studies test.

The teacher that the students respected gave them a hard examination.

Q: Their teacher gave them a hard examination.

19) Tom got up and went to college.

The student that Tom saw on his way to college was caught for speeding.

Q: Tom was caught for speeding.

20) The apartment was on fire.

The man that saved his neighbor from the building was hospitalized.

Q: The man saved his neighbor.

21) The movie was being filmed.

The director that scolded the actress was unpopular.

Q: The actress was unpopular.

22) It was time to work in the garden.

The neighbor that liked gardening helped Lucy plant roses.

Q: The neighbor helped Lucy.

23) Her birthday party was just getting under way.

The friends that she invited enjoyed the party.

Q: The friends invited her to the party.

24) Jill went to visit her mother in the hospital.

The nurse that liked her mother was very kind.

Q: The nurse was very kind.

25) The army was being defeated by the enemy.

The soldier that the officer trusted was sent to ask for support.

Q: The officer trusted the soldier.

26) Jack went to a movie theater.

The man that sat next to him was sleeping.

Q: The man was sleeping.

27) Susan went to a restaurant.

The waiter that waited at the table dropped a napkin by mistake.

Q: Susan dropped a napkin by mistake.

28) Bill was playing golf with his friends.

The caddy that liked him suggested he should use a nine iron.

Q: The caddy liked Bill.

29) The director shot a new movie.

The actress that liked the director performed well.

Q: The actress liked the director.

30) The wolf was hungry.

The deer that the wolf approached looked delicious.

Q: The wolf approached the deer.

31) David was looking for a traveler’s handbook.

The shopkeeper that David trusted recommended a lightweight handbook.

Q: The shopkeeper trusted David.

32) Susan sat in the library thinking about the examination.

A friend that also worried about the examination called her.

Q: They worried about the examination.

33) Peter enjoyed going for a walk in the morning.

The woman that was his neighbor greeted Peter with a smile.

Q: The woman greeted him with a smile.

34) Beth sat in her garden.

The neighbor that often helps her work in the garden is busy this year.

Q: The neighbor is busy this year.

35) Mary stood at the center of the stage.

The audience that admired her clapped their hands.

Q: Mary clapped her hands.

36) Jane loved to spend time at the seaside.

The friend that owns a summer house let her use it.

Q: She loves to spend time at the seaside.

37) Jim was driving his new sports car.

The police car that flashed its lights ordered him to stop.

Q: Jim’s car flashed its lights.

38) Joanne was looking into the window of a jewelry store.

The storeowner that opened the door invited her in.

Q: The storeowner opened the door.

39) Jack is a science teacher at a local high school.

The boy that Jack trusted helped him with his experiment.

Q: The boy trusted Jack.

40) Jim ran across the street to play with friends.

The friends that played with Jim taught him a new game.

Q: Jim taught his friends a new game.

41) Juliet is 5 years old.

The dogs that barked at her scared her.

Q: The barking dogs scare her.

42) Tom used to run in the early morning.

The man that he often saw running was killed in the park.

Q: The man often saw Tom running.

43) The man dragged the chair over to the girl.

The teddy bear that he lifted up from the chair pleased her.

Q: The girl lifted up the teddy bear.

44) Lucy placed the box on the table.

The man that received the box from her left the table.

Q: The man received the box from her.

45) It was a beautiful morning.

The housemaid that picked some flowers arranged them in the vase.

Q: The housemaid arranged some flowers.

46) George will give a party this weekend.

The gardener that trimmed the plants made the house more attractive.

Q: George made the house more attractive.

47) Tom likes movies.

The actor that criticized the director received a prize at a film festival.

Q: The director received a prize at a film festival.

48) Jack likes eating out on weekends.

The new restaurant that has just opened in town has a good reputation.

Q: The restaurant has just opened.

49) Beth is allergic to eggs.

The cook that Beth trusted made a meal without eggs for her.

Q: Beth made a meal without eggs.

50) Margaret heard her mobile phone ringing.

Her friend that called her had arranged the party.

Q: Margaret arranged the party.

51) Susan was rushing because she was running late for a party

The bellboy that greeted the guests was surprised to find her running in a party dress.

Q: She was running late for a party.

52) Henry is a freshman.

The rugby team captain that he respected asked him to join the team.

Q: The captain asked him to join the team.

53) Andy loved to travel, but he was terrified of flying.

The long flight that would be involved this time worried him.

Q: The long flight worried him.

54) Tom passed a new gym.

The display that advertised the summer sports program interested him.

Q: The display advertised the summer sports program.

55） The landlord raised the apartment’s rent by 50 percent.

The tenant that the landlord disliked wrote a letter to a newspaper.

Q: The tenant disliked the landlord.

56) Bill was watching the news on TV.

The banker that the burglar killed had no family.

Q: The burglar had no family.

57) Jimmy went to a movie.

The spy that blackmailed the diplomat was forced to leave the country.

Q: The diplomat was forced to leave the country.

58) Mr. and Mrs. Smith hired a babysitter.

The babysitter that the child chased tripped over the toy.

Q: The child chased the babysitter.

59) Tom likes drinking.

The landlady that dislikes drunks kicked him out.

Q: The landlady kicked a tenant out.

60) The fans at the rock concert were going wild.

The fans that pushed down the security guards ran to the stage.

Q: The security guards pushed down the fans.

61) Jane was shopping in a department store.

The shop assistant that a customer asked for advice was very kind.

Q: A customer asked for advice.

62) Bill had an interview with an actress.

The actress that talked about the new movie criticized the director.

Q: The director criticized the actress.

63) Mary lives in an apartment house.

The landlady that all the tenants like holds a party most weekends.

Q: All the tenants like the landlady.

64) The birthday party for Jill came to an end.

The parents that held this party drove the children home.

Q: The parents drove the children home.

65) A terrible crime was committed in the palace.

The king that the nephew killed had no children.

Q: The king killed the nephew.

66) The Browns were visiting the local state forest.

The ranger that they walked with talked about the wild life.

Q: The ranger talked about the wild life.

67) The football game came to an end.

The star player that John supported was surrounded by fans.

Q: The star player was surrounded by fans.

68) Bill opened the door to the office.

The secretary that Bill smiled at handed him a newspaper.

Q: The secretary smiled at Bill.

69) Julia used to be married to a director.

The director that left her married a young actress.

Q: The director left the young actress.

70) Hanna reached her office at nine.

The secretary that she liked handed her a cup of coffee.

Q: Hanna liked the secretary.

71) The lawyer had a lot of things to do.

The secretary that the lawyer loved helped him.

Q: The lawyer loved the secretary.

72) Tom stepped inside his office.

The secretary that he trusted was absent for family reasons.

Q: Tom was absent for family reasons.

73) Mary apologized for being late and began to explain.

The secretary that she hired made a lot of mistakes.

Q: Mary made a lot of mistakes.

74) Steve spent weekends at a hotel.

The front desk clerk that welcomed him asked him to sign the guest book.

Q: The front desk clerk welcomed him.

75) Jack took an airplane bound for Paris.

The passenger that the flight attendant spoke to didn’t understand French.

Q: The flight attendant didn’t understand French.

76) The table was cleared.

The waiter that served us recommended a vintage wine.

Q: We recommended a vintage wine.

77) It was nine o’clock on Saturday night.

The policeman that spoke to the man noticed that he was wanted.

Q: The man spoke to the policeman.

78) Mrs. Johnson was very pleased.

The lawyer that she hired resolved the problem.

Q: The lawyer hired Mrs. Johnson.

79) I opened the door.

The guests that I invited arrived exactly on time.

Q: The guests arrived on time.

80) Jack pushed the door open.

The receptionist that Jack spoke to showed him the way to the elevator.

Q: The receptionist spoke to Jack.

Training materials (Control group)

1) Jane and Tom were looking for a wedding ring.

They thought it was difficult to find a nice ring.

Q: It was difficult for them to find a nice ring.

2) Bill had been at an interview with an actress for ten minutes.

Bill noticed a gold ring on her finger.

Q: He noticed a gold ring on her finger.

3) Terry commutes to work in his car.

The traffic jam annoyed him on his way to the office.

Q: Terry commutes on foot.

4) The secretary had a lot of things to do.

She complained that she was unable to eat lunch.

Q: The secretary had nothing to do.

5) Tom put the computer on the desk.

He bought the computer yesterday.

Q: Tom bought the computer the day before yesterday.

6) John had always enjoyed walking on Sundays.

Today, John stopped to talk with Mr. Smith.

Q: John talked with Mr. Johnson.

7) Jane and Mary were having a dinner at a restaurant.

They complained about the food.

Q: They talked about clients.

8) Richard had always wanted to be a public accountant.

It was hard getting started, but he obtained his qualifications two years ago.

Q: Richard is a public accountant.

9) Joan always ate lunch with her colleagues.

She was well liked and felt that she belonged.

Q: Her colleagues disliked Joan.

10) John checked the menu one more time.

He thought it was hard to decide what to have for lunch.

Q: He had a hard time deciding what to have for lunch.

11) Mary apologized for being late and began to explain.

Her taxi had been stuck in a traffic jam.

Q: She was late because of a traffic jam.

12) Bill took Carol out to dinner.

They finalized the plans for their trip over dinner.

Q: They finalized the plans for their trip.

13) John lived in an apartment house.

On the first day of every month, the rent was collected by the landlady.

Q: The landlady collected the rent on the first day of every month.

14) Jack and Mary decided to go on a hiking trip.

Jack finished the rest of his breakfast quickly so that they could make an early start.

Q: Jack and Mary decided to play golf.

15) The birthday party for Jill was just getting underway.

The parents sat back and watched all the children having a good time.

Q: The parents watched all the children having a good time.

16) The rock band is becoming more and more popular.

They think it is hard to manage everything by themselves.

Q: They are managing everything by themselves right now.

17) A young man was found in the park with three bullet wounds to his head.

After careful examination, the time and cause of death were recorded.

Q: The young man was stabbed to death.

18) A terrible crime had been committed in the palace.

A thief had stolen the royal crown.

Q: The thief stole the royal crown.

19) The movie was being filmed on location in Siberia.

Because they were behind schedule, they were trying to film as much as possible.

Q: The movie was being filmed on schedule.

20) The Browns were visiting the local state forest.

The ranger talked about the local wild life.

Q: The Browns were visiting the local zoo.

21) The football game came to an end.

The home team won the game by forty points.

Q: The home team won the game.

22) David headed for school.

It was hard for him to believe that it was Monday.

Q: David headed for school on Sunday.

23) Fred was still undecided about his clothes.

He was afraid that he might be late.

Q: Fred decided on the blue shirt.

24) Ben had breakfast alone.

Because his parents left home early, Ben was alone.

Q: Ben had breakfast alone.

25) Most people in Europe speak more than one language.

Jane decided to study French.

Q: Jane decided to study Spanish.

26) Bill opened the door to the office.

Jenny looked up from her computer with a smile.

Q: Jenny looked up from her computer.

27) It was midnight on a Saturday.

The three boys were yelling at the TV screen as they played a video game.

Q: A boy was playing a video game.

28) The truth was that Mrs. Grey enjoyed spending money on clothes.

Mr. Grey cared nothing for clothes and even less for neatness.

Q: Mr. Grey enjoyed spending money on clothes.

29) Bill's laptop was already wired to the projector.

Bill borrowed the projector from his friend yesterday.

Q: Bill borrowed the laptop from his friend yesterday.

30) Mark's health problems created a big challenge for the company.

Many presidents would prefer to keep their personal problems private.

Q: Mark had problems with his health.

31) Steve spent weekends at a farm.

He was in charge of keeping the apple orchards in good shape.

Q: He kept the apple orchards in good shape.

32) When Mike was a freshman, he was shy and quiet.

Mike thought he should open up and become friendly.

Q: Mike used to be shy and quiet.

33) Someone had taken her jewelry from her closet.

The police estimated that the value of her jewelry would be almost one million dollars.

Q: Her jewelry was valueless.

34) When they ate dinner at home, they ate at seven.

When they visited friends, they couldn't be so rude as to suggest a time for dinner.

Q: They usually eat dinner at seven.

35) She was wearing a black leather jacket.

Her eye glasses, as always, matched the color of her jacket.

Q: Her eye glasses matched the color of her jacket.

36) Her French and German were perfect.

Her students believed that she could speak any language.

Q: Her French was far from perfect.

37) Hanna reached her office at nine.

Mark made her a cup of coffee and handed her the morning newspaper.

Q: Mark handed the newspaper to Hanna.

38) John noticed a small red light in the darkness.

That red light warned him of the danger.

Q: John noticed the danger.

39) Mark ate his breakfast in the coffee shop.

He knew he had to hurry to get to the office in time.

Q: He had plenty of time to waste.

40) Mr. Jones put out his cigarette and went to his car.

He thought he should go back home as soon as possible.

Q: Mr. Jones put out his cigarette.

41) It was Monday and Bill was the only kid on the street.

He didn't want anyone to ask why he wasn't at school.

Q: There were many kids on the street.

42) She used to be married to a rich businessman.

After he left her, she started drinking heavily.

Q: It was before he left her that she started drinking heavily.

43) She moved back to Denver.

She would have a few friends over to watch game at her house.

Q: She moved back to Denver.

44) Angela wanted to enroll at an elementary school.

The principal of the local school said that she was too young to enroll.

Q: The principal admitted her to the school.

45) During the meal, Tom was unable to concentrate.

He couldn't take in what was being said around him.

Q: Tom was unable to concentrate.

46) On arrival at Heathrow, they checked their baggage on to the charter flight.

They selected two nonsmoking seats.

Q: They selected two smoking seats.

47) The dealer took out a small calculator from his jacket pocket.

He entered some number into it.

Q: The dealer took out a pen.

48) We sat back and enjoyed a magnificent wine and smoked cigars.

It was very warm in that room.

Q: It was warm in that room.

49) He started his homework.

He had to finish his homework before dinner, according to his family's rule.

Q: He had to finish his homework before dinner.

50) His father was alone in his office.

He sat on the sofa and read a morning newspaper.

Q: His father sat on the sofa.

51) The ride from his house to the high school would take fifteen minutes.

Students must obey the traffic laws and refrain from speeding.

Q: Students must obey the traffic laws.

52) Jane's desk was neatly organized.

Her current files were in that rack behind her.

Q: Jane's desk was organized.

53) The secretary picked up the phone and pushed a button.

She listened some more, then put down the phone without a word.

Q: The secretary didn't say anything.

54) There were a few men hanging around the entrance of the school.

He walked past them with a polite "Excuse me "and a smile.

Q: He walked past the men.

55) After ten minutes, they were both bored.

Just then, Bill’s cell phone rang.

Q: When they were bored, Bill’s cell phone rang.

56) They finished nine holes in two hours.

They decided that they would play in the North Course.

Q: They went to the North Course.

57) Bill was watching a movie when his cell phone rang in his pocket.

The call was from a stranger.

Q: Bill’s friend called him.

58) The judge had spent hours buried in law books looking for an answer.

Finally, he thought he should eat something.

Q: He wanted to sleep.

59) Tom’s computer went down.

He was afraid that he couldn’t fix it.

Q: Tom was confident that he could fix it.

60) The jurors arrived with tired faces, determined to finish the job.

They were not sure what would happen next.

Q: The jurors arrived with tired faces.

61) Tom sat in the library doing nothing.

He thought she forgot to meet him in the library.

Q: Tom sat in the library thinking about the examination.

62) Beth sat in her garden.

The fine weather pleased her.

Q: She was pleased with the fine weather.

63) Mary stood at the center of the stage.

She was glad that the hall was full.

Q: There weren't so many people in the hall.

64) Jim was driving his new sports car.

Suddenly, a police car approached and stopped him.

Q: He stopped the police car.

65) Diane was looking into the window of a pet shop.

A brown puppy attracted her attention.

Q: Diane was attracted by a white puppy.

66) The actress demanded the starring role in the movie.

She insisted that she would be the right person for the role.

Q: The actor demanded the starring role.

67) Tom is a life-saver.

Yesterday, Tom saved a drowning boy.

Q: Tom saved a boy yesterday.

68) John was waiting for Mary in a coffee shop.

He was afraid that she would not come.

Q: He was confident that Mary would come.

69) The boy kicked the classmate and stayed away from school.

The teacher thought he wouldn't come back.

Q: The classmate kicked the boy.

70) Bob was watching a football game on TV.

Bob was satisfied with the result of the game.

Q: Bob was satisfied with the game’s result

71) The man was suspected of stealing the diamond.

There was no proof of his stealing it.

Q: There was no evidence of his stealing the diamond.

72) Jack employed a technical expert.

He soon realized his competence.

Q: The technical expert was incompetent.

73) Mike was playing golf with his friends.

A caddy advised him to use a nine iron.

Q: His friend advised him to use a nine iron..

74) David was looking for a traveler’s handbook.

He was planning a holiday in France with his brother.

Q: David was planning a holiday in Japan.

75) Jane plans to spend time at the seaside this weekend.

The trouble is that her son has a fever with a cold.

Q: Jane has a fever.

76) Margaret heard her mobile phone ringing.

She was convinced that the call was from her mother.

Q: Margaret thought her mother called her.

77) He passed a new gym and found a display advertising the attractive programs.

He regretted not being a member of the gym.

Q: He was a member of the gym.

78) Bill was watching the news on TV.

The murderer killed a wealthy man living alone.

Q: The wealthy man was murdered.

79) John is an elementary school teacher.

He is glad that all the pupils like him.

Q: The pupils like him.

80) Mark has been deeply depressed lately.

He regretted having been fired for negligence.

Q: He regretted his divorce.