L2 READING BY LEARNERS OF JAPANESE:
A COMPARISON OF DIFFERENT L1S

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By
Koichi Sawasaki, M.A.

*****

The Ohio State University
2007

Dissertation Committee:
Professor Mineharu Nakayama, Adviser
Professor Etsuyo Yuasa
Professor Shari Speer

Approved by

Adviser
Graduate Program in East Asian Languages and Literatures
ABSTRACT

This study investigates the processing strategies learners of Japanese employ while reading Japanese. Language researchers theorize that native speakers process sentences incrementally. However, little is known about processing in a second language when the first and second languages are typologically different. For example, English and Chinese take an SVO word order with little or no overt Case marking while Japanese and Korean take an SOV word order with overt Case marking. In SVO languages, verb information may provide upcoming postverbal information, and in SOV languages, preverbal information (Case information) may provide upcoming information for argument and verb. Based on these assumptions, this study examines how groups of Japanese language learners process sentences in reading when their first languages are English, Chinese, or Korean. Of special interest is whether learners
process arguments and adjuncts differently before reaching a verb. Equally, of another piece of interest is how each learner group reads each phrase of a sentence.

Experiments with self-paced reading tasks were conducted with two intermediate and one advanced Japanese level of English groups, an advanced Japanese level of Chinese group, an advanced Japanese level of Korean group, and a control group (native speakers of Japanese).

Results of the experiments revealed that advanced learners as well as the control group showed some sensitivity to the arguments/adjuncts differentiation. English-speaking intermediate groups failed to demonstrate the distinction, but all learner groups provided some indication that they tried to employ incremental processing in a way that seemed most appropriate for their ability level.

When reading times at each phrase are examined, advanced learner groups (English L1, Chinese L1, and Korean L1) showed similar reading patterns regardless of
their L1s, but groups of a different proficiency level (native speakers, advanced learners, and intermediate learners) exhibited reading patterns distinctive to each group in terms of where the reading times were elevated. We argue that distinctive patterns occur because learners (especially those with lower proficiency) experience cognitive limitations due to lacking linguistic experiences and knowledge in the target language. From these results we argue that while learners and native speakers may differ in how they utilize specific processing strategies to compensate for their cognitive limitations, both learners and native speakers share some fundamental features of processing, i.e., incremental processing while reading.
Dedicated to my family
ACKNOWLEDGMENTS

This dissertation was made possible through partial funding from the Department of East Asian Languages and Literatures, The Ohio State University, and the University of Shizuoka. Without the support of teachers, study participants, friends, students, and family, I could never have completed this dissertation. There are many people I would like to thank. Among those, I would like to express my special appreciation to the following individuals.

My gratitude goes to my advisor, Professor Mineharu Nakayama. Since I met Professor Nakayama in 1998, he has been a constant source of advice and support, helping me to proceed at every step. Each time I was able to accomplish a task, such as publishing a paper, succeeding in candidacy exams, finding a job, and finally, finishing this dissertation, he was always with me. I also would like to express my gratitude to the other committee members, Professor Etsuyo Yuasa and Professor Shari
Speer, whose advice was always inspiring and insightful. In taking classes from them, I both learned and enjoyed the process of learning.

There are also other teachers who I would like to thank. Professors Mari Noda and Patricia Wetzel gave me the initial reasons for beginning a doctoral program. I am grateful to Professors Suwako Watanabe, Beatrice Oshika, Charles Quinn, William Tyler, Cathy Harris, and Thomas Dieterich for their consistent encouragement and support.

At the office of the Department of East Asian Languages and Literatures, I received significant help from Debbie Knicely, Hui Chu, Yuko Kuwai, Misako Terashima, Rika Ihei, Haruko Iwami, and Dana Vanterese. My study in the department was made both easier and more pleasant because of their active help.

My friends gave me the energy and power to continue. I am especially grateful to Stephen and Atsue Horn, Noriko Chino, Gwen Stockwell, Michael Sprunger,

I also would like to thank my colleagues who continuously encouraged me. I would especially like to thank Noriko Yoshimura, Kimio Yatsuki, Kaoru Mizuno, Atsuro Tsubomoto, Masaki Yoshida, Yasushi Terao, Hisaki Kenmochi, Kazunori Kurita, Eizo Ogusu, Philip Hawke, and Mari Koyano at the University of Shizuoka, and Tadashi Shimizu, Masaharu Iwata, Yukio Wada, Tetsuji Nishida, Shinichi Suzuki, and Satoko Kusumoto at IHCSA and Pacifico Yokohama.

I also would like to thank Inda Shirley and Kunie Sawada, who supported me through a very patient, and efficient proofreading process.
Finally, my gratitude goes to my family, Akitoshi, Takako, Yumiko, Robu, and Shinya, and also to Ho-Hsin Lee, for whose unending love I am deeply grateful.
VITA

February 8, 1965 .................. Born – Fukui, Japan

1989 ............................... B.A., English Literature, Tsuru University

1989 (Spring and Summer) ....... Instructor of English,
                                      Kokusai Jiyu Gakuen, Tokyo, Japan

1989 – 1991 ........................ Travel Coordinator,
                                      The International Hospitality and Conference
                                      Service Association, Tokyo, Japan

1991 – 1995 ........................ Conference Coordinator,
                                      Pacific Convention Plaza Yokohama, Japan

1995 – 1998 ........................ Graduate Teaching Associate,
                                      Portland State University

1998 ................................. M.A., TESOL, Portland State University

1998 – 2002 ........................ Graduate Teaching and Research Associate,
                                      The Ohio State University

2005 ................................. M.A., Japanese Linguistics,
                                      The Ohio State University

2003 – present ....................... Assistant Professor, The University of Shizuoka
PUBLICATIONS

Research Publication


FIELDS OF STUDY

Major Field: East Asian Languages and Literatures
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Abstract</strong> ..................................................................................</td>
<td>ii</td>
</tr>
<tr>
<td></td>
<td><strong>Dedication</strong> ................................................................................</td>
<td>v</td>
</tr>
<tr>
<td></td>
<td><strong>Acknowledgments</strong> .........................................................................</td>
<td>vi</td>
</tr>
<tr>
<td></td>
<td><strong>Vita</strong> ..........................................................................................</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td><strong>List of Tables</strong> ...........................................................................</td>
<td>xv</td>
</tr>
<tr>
<td></td>
<td><strong>List of Figures</strong> ..........................................................................</td>
<td>xvi</td>
</tr>
</tbody>
</table>

Chapters:

1. **Introduction** .............................................................................. 1

2. **Literature Review** ........................................................................ 7
   2.1 L1 Sentence Processing in English ........................................... 8
   2.2 L1 Sentence Processing in Japanese ........................................... 13
   2.3 Previous Studies on L2 Sentence Processing by Learners of Japanese 24

3. **Experiment 1** .............................................................................. 39
   3.1 Experimental Design .................................................................... 41
       3.1.1 Subjects ........................................................................... 47
       3.1.2 Procedure ......................................................................... 49
       3.1.3 Test Materials ................................................................. 52
   3.2 Results ....................................................................................... 56
       3.2.1 Modification of the Data .................................................. 56

xii
3.2.2 Control Group ......................................................... 64
3.2.3 JSL Group .............................................................. 72
3.2.4 JFL1 Group ............................................................ 76
3.2.5 JFL2 Group ............................................................ 82
3.3 Discussion .................................................................. 88
  3.3.1 Processing Arguments vs. Adjuncts ......................... 89
    3.3.1.1 Control Group ............................................... 90
    3.3.1.2 Learner Groups .......................................... 96
  3.3.2 General Reading Patterns by English-Speaking Learners ...... 99
    3.3.2.1 How the Same Syntactic Phrase Is Processed ........... 99
    3.3.2.2 Where RRT Peaks Appear in a Sentence ............. 106
    3.3.2.3 Developmental Sequence Between Learner Groups
            and Native Speakers .................................. 113
3.4 General Discussion ................................................... 120

4. Experiment 2 ............................................................... 130
  4.1 Experimental Design .................................................. 131
    4.1.1 Subjects ......................................................... 131
    4.1.2 Procedure ..................................................... 135
    4.1.3 Test Materials ................................................. 135
  4.2 Results .................................................................. 136
    4.2.1 Modification of Data .......................................... 136
    4.2.2 JSL-C Group ................................................... 139
    4.2.3 JSL-K Group ................................................... 143
  4.3 Discussion ............................................................... 148
    4.3.1 Processing Arguments vs. Adjuncts ....................... 148
    4.3.2 General Reading Patterns .................................. 153
5. General Discussion .............................................................. 166

5.1 Summary of the Results ...................................................... 166
5.2 Similarities and Differences Between L1 and L2 Readers .......... 171
  5.2.1 Differences: L2 Cognitive Restrictions ............................. 171
  5.2.2 Similarities: Incremental Processing While Reading .......... 176
  5.2.3 Would Learners Ultimately Become Just Like Natives? ..... 181

5.3 Limitations of the Current Study and Implications for Future
  Research .............................................................................. 183
  5.3.1 Limitations of the Current Study ..................................... 183
  5.3.2 Implications for Future Research ................................. 185
    5.3.2.1 Individual Differences .......................................... 185
    5.3.2.2 Relationship Between L1 Child and L2 Adult ....... 187

List of References ...................................................................... 192

Appendix A .............................................................................. 204

Appendix B .............................................................................. 206
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Mean number, range, and SD of morae in each test region</td>
<td>55</td>
</tr>
<tr>
<td>3.2</td>
<td>Mora and syllable comparison</td>
<td>59</td>
</tr>
<tr>
<td>3.3</td>
<td>Mean number of phonological units in each word category</td>
<td>59</td>
</tr>
<tr>
<td>3.4</td>
<td>Comparison of percentages of RTs that exceed SDx2</td>
<td>63</td>
</tr>
<tr>
<td>3.5</td>
<td>Mean RRTs and SDs for 50 JPN subjects</td>
<td>65</td>
</tr>
<tr>
<td>3.6</td>
<td>Mean RRTs and SDs for 30 JPN subjects</td>
<td>69</td>
</tr>
<tr>
<td>3.7</td>
<td>Mean RRTs and SDs for JSL subjects</td>
<td>73</td>
</tr>
<tr>
<td>3.8</td>
<td>Mean RRTs and SDs for JFL1 subjects</td>
<td>77</td>
</tr>
<tr>
<td>3.9</td>
<td>Mean RRTs of family names</td>
<td>78</td>
</tr>
<tr>
<td>3.10</td>
<td>Mean RRTs and SDs for JFL2 subjects</td>
<td>83</td>
</tr>
<tr>
<td>3.11</td>
<td>Mean RRT difference between verb and pre-verb regions (30 JPN subjects)</td>
<td>94</td>
</tr>
<tr>
<td>3.12</td>
<td>Summary of statistical comparison between arguments and adjuncts</td>
<td>98</td>
</tr>
<tr>
<td>3.13</td>
<td>Reading patterns and consistency ratio in each subject group.</td>
<td>110</td>
</tr>
<tr>
<td>4.1</td>
<td>Comparisons of percentages of RTs that exceed SDx2 (4 subject groups)</td>
<td>138</td>
</tr>
<tr>
<td>4.2</td>
<td>Mean RRTs and SDs for JSL-C subjects</td>
<td>140</td>
</tr>
<tr>
<td>4.3</td>
<td>Mean RRTs and SDs for JSL-K subjects</td>
<td>144</td>
</tr>
<tr>
<td>4.4</td>
<td>Comparison between cognates and non-cognates</td>
<td>151</td>
</tr>
<tr>
<td>4.5</td>
<td>Reading patterns and consistency ratio in each subject group</td>
<td>160</td>
</tr>
<tr>
<td>5.1</td>
<td>Summary of findings (Experiments 1 and 2): Similarities and differences</td>
<td>171</td>
</tr>
<tr>
<td></td>
<td>between learners and native speakers</td>
<td></td>
</tr>
<tr>
<td>Figure</td>
<td>Description</td>
<td>Page</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>3.1</td>
<td>Non-cumulative word-by-word presentation of stimuli</td>
<td>51</td>
</tr>
<tr>
<td>3.2</td>
<td>Basic phonological unit and RT calculation mismatch (1)</td>
<td>60</td>
</tr>
<tr>
<td>3.3</td>
<td>Basic phonological unit and RT calculation mismatch (2)</td>
<td>62</td>
</tr>
<tr>
<td>3.4</td>
<td>RRTs for 50 JPN subjects</td>
<td>65</td>
</tr>
<tr>
<td>3.5</td>
<td>RRTs for 30 JPN subjects</td>
<td>68</td>
</tr>
<tr>
<td>3.6</td>
<td>RRTs for Int types (JPN group with 30 subjects)</td>
<td>70</td>
</tr>
<tr>
<td>3.7</td>
<td>RRTs for Tran types (JPN group with 30 subjects)</td>
<td>70</td>
</tr>
<tr>
<td>3.8</td>
<td>RRTs for JSL group</td>
<td>72</td>
</tr>
<tr>
<td>3.9</td>
<td>RRTs for Int types (JSL group)</td>
<td>74</td>
</tr>
<tr>
<td>3.10</td>
<td>RRTs for Tran types (JSL group)</td>
<td>75</td>
</tr>
<tr>
<td>3.11</td>
<td>RRTs for JFL1 group</td>
<td>76</td>
</tr>
<tr>
<td>3.12</td>
<td>Adjusted RRTs for JFL1 group</td>
<td>80</td>
</tr>
<tr>
<td>3.13</td>
<td>RRTs for Int types (JFL1 group)</td>
<td>81</td>
</tr>
<tr>
<td>3.14</td>
<td>RRTs for Tran types (JFL1 group)</td>
<td>81</td>
</tr>
<tr>
<td>3.15</td>
<td>RRTs for JFL2 group</td>
<td>83</td>
</tr>
<tr>
<td>3.16</td>
<td>RRTs for Int types (JFL2 group)</td>
<td>85</td>
</tr>
<tr>
<td>3.17</td>
<td>RRTs for Tran types (JFL2 group)</td>
<td>85</td>
</tr>
<tr>
<td>3.18</td>
<td>RRTs for Int types by the order of appearance (JFL2 group)</td>
<td>87</td>
</tr>
<tr>
<td>3.19</td>
<td>RRTs for Tran types by the order of appearance (JFL2 group)</td>
<td>87</td>
</tr>
<tr>
<td>3.20</td>
<td>RRTs for Int types by the order of appearance (JFL2 group)</td>
<td>101</td>
</tr>
<tr>
<td>3.21</td>
<td>RRTs for Tran types by the order of appearance (JFL2 group)</td>
<td>102</td>
</tr>
<tr>
<td>3.22</td>
<td>RRTs for Int types by the order of appearance (JFL1 group)</td>
<td>104</td>
</tr>
<tr>
<td>3.23</td>
<td>RRTs for Tran types by the order of appearance (JFL1 group)</td>
<td>104</td>
</tr>
<tr>
<td>3.24</td>
<td>RRTs for JFL1 group by the pseudo-order of word appearance</td>
<td>106</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

In the field of sentence processing, over the past few decades, many researchers have tried to discover strategies, rules and principles that govern our comprehension of sentences when reading or listening, mainly for the processing of one’s first language (L1). Although we are not yet at the stage of understanding the whole mechanism, many in the field have come to agree that sentences are processed incrementally, i.e., L1 readers/listeners comprehend a sentence as it unfolds (without delay).¹

Although incremental processing should be at work for both English and Japanese, how exactly it takes place may be different. For example, when reading the word thought in sentence (1), English speakers may expect that a complement clause will follow thought rather than expect that the sentence will finish with the word thought.

¹ Sentence production is also a field of psycholinguistics closely related to sentence processing. In this study, however, the scope of the discussion will be sentence comprehension.
Moreover, at the word *that*, they may expect a new sentence will follow because *that* frequently appears as a complementizer.

(1) Ken thought that [people ignored Mary].

(2) Ken-ga [hitobito-ga Mary-o musisita] to omotta.

Ken-nom people-nom Mary-acc ignored that thought

“Ken thought that people ignored Mary.”

In Japanese, however, one uses another way of expecting upcoming elements because sentence construction differs from that of English. For example, in sentence (2), *omotta* ‘thought’ comes at the end of the sentence. Thus, at *omotta*, Japanese speakers cannot expect that the complement clause will follow the verb because the complement clause has already appeared. Similarly, because the word *to* ‘that’ is also introduced after the clausal elements have appeared, one cannot expect a clause will follow *to*. Such differences emerge because English is an SVO language, in which a
sentence is constructed with a canonical word order of subject, verb, and object. In contrast, Japanese is an SOV language, in which a sentence takes the canonical word order of subject, object, and finally verb.

Another difference between the two languages that can affect the way to process a sentence is Case marking. In (2) above, a subject NP and an object NP are explicitly marked with the nominal Case marker *ga* (nom) and accusative Case marker *o* (acc), respectively. As a result, Japanese speakers can rely on Case information to incorporate the meaning and structure of sentence. In contrast, English Case is not as overtly marked as in Japanese. For instance, in (3a), *Ken* and *people* are subjects and *Mary* is an object but without any distinguishable overt Case marker. Switching these phrases around does not require any overt change of Case as in (3b).

---

2 When pronouns are used (and also when possessive Case is used), Case marking becomes explicit in English; e.g. *he, she, and they* for the nominative Case, and *him, her, and them* for the accusative Case. (i)a and (i)b below show that switching pronouns without altering morphological form of their Case result in an ungrammatical sentence.

(i) a. *He* thought that *they* ignored *her*.
   b. *Her* thought that *he* ignored *they*.
(3)  a. Ken thought that people ignored Mary.

        b. Mary thought that Ken ignored people.

These differences between English and Japanese give rise to an intriguing question.\(^3\) That is, what happens if L1 speakers of one language read the other language? In the current research, we will try to answer this question by examining how Japanese sentences are read as a second language (L2). The following research questions were raised, and experiments were conducted. The experiments were done with English-speaking, Chinese-speaking, and Korean-speaking learners of Japanese.

(4)  Research question: What kinds of processing strategies do learners of Japanese employ while reading Japanese sentences?

A. Do English-speaking learners of Japanese treat arguments (i.e., accusative NPs) and adjuncts (i.e., adverbs) differently while reading simplex sentences?

\(^3\) Although there are more differences between English and Japanese, we will not discuss the other differences because word order and Case marking are the two relevant issues in this dissertation.
B. What are the general reading patterns by English-speaking learners of Japanese?

C. Do Chinese-speaking learners of Japanese behave the same as English-speaking learners of Japanese while reading simplex sentences?

D. Do Korean-speaking learners of Japanese behave the same as English-speaking learners of Japanese while reading simplex sentences?

The organization of this dissertation is as follows. Chapter 2 presents a number of relevant issues about L1 English sentence processing, L1 Japanese sentence processing, and L2 Japanese sentence processing from previous studies. Chapter 3 shows an experiment for three levels of English-speaking learners (Experiment 1); i.e., two intermediate learner groups of Japanese as a foreign language (JFL) and one advanced learner group of Japanese as a second language (JSL).4 The experiment will

---

4 In the field of second language acquisition, the terms foreign language and second language are often distinguished based on the circumstances in which the target language is studied. In general, learners of a foreign language (FL) usually indicate that learners are studying in their home country or in a non-target language speaking country. In contrast, learners of a second language (SL) usually indicate that learners are studying in the country of the target language. In this dissertation, we use JFL and JSL when appropriate to do so but simply use L2 as a general term for FL and SL.
show that advanced JSL learners process arguments and adjuncts differently but
intermediate JFL learners cannot do so. Moreover, advanced JSL learners tend to read
nominative NP and verb slowly compared to other parts of the sentence, which was not
the reading pattern observed among native speakers. In chapter 4, Experiment 1 is
replicated for advanced Chinese-speaking JSL learners and advanced Korean-speaking
JSL learners (Experiment 2) and reveals that the findings almost match those of
advanced English-speaking JSL learners in spite of the typological difference among
their L1s. Finally, chapter 5 provides a summary and implications for future studies.
Chapter 5 also discusses L1 and L2 processing similarities (i.e., incremental processing)
and differences (i.e., how learners read each phrase throughout a sentence in terms of
reading times).
CHAPTER 2

LITERATURE REVIEW

Only in the past few decades have researchers seriously investigated the human sentence processing mechanism. The history of L2 sentence processing is much younger than that of L1 sentence processing. There are many unanswered questions including such questions as commonalities and differences of sentence processing mechanisms and strategies between L1 and L2, appropriate data collection methodologies, and appropriate data analysis methods.

In this chapter, we will review the issue of incremental processing in the literature in terms of L1 English sentence processing and L1 Japanese sentence processing. Then, we will discuss previous studies of L2 Japanese sentence processing.
2.1. L1 Sentence Processing in English

One widely held L1 sentence processing hypothesis is that the processing is incremental. That is, the parser tries to analyze the structure and meaning of a sentence as the words are received, rather than waiting until the end of the sentence or clause. In English, an SVO language, the verb appears relatively early in the sentence. Consequently, research shows that verb information can aid the parser to predict subsequent elements based on some processing principles or strategies such as well-known minimal attachment (cf. Frazier, 1987; Kimball, 1973),\(^5\) thematic roles (cf. Frazier and Clifton, 1996; Pritchett, 1991; 1992), and subcategorization preferences (cf. MacDonald, Pearlmutter, and Seidenberg, 1994).

For example, Frazier and Rayner (1982), supporting minimal attachment, showed that the reading times (RTs) of (5a) below were slower (RTs per character) with more eye regression at the phrase after the verb argued than that of (5b) in their eye-movement study.

---

\(^5\) Minimal attachment generally states that the parser makes an initial analysis in a way that the phrase or clause being processed is incorporated into the previously built sentence structure using the fewest nodes.
(5) a. The new city council argued their position was immoral.

   b. They say the city council argued their position forcefully.

Frazier and Rayner took the slower RTs and more frequent regressive eye-movements for (5a) as evidence that the parser experienced surprise at the post-verbal phrase because in (5a), the NP *their position* was not an object of *argued*. Minimal attachment predicts that the NP *their position* is an object of *argued* since it consists of a smaller number of nodes than when *their position* is a subject of a clausal complement (i.e., (5a)), and this should be the only analysis the parser is initially committed to. Such analysis is possible as soon as the parser encountered a verb, without waiting for the subsequent NP.

Trueswell, Tanenhaus, and Kello (1993) showed another example of how a verb could provide information about upcoming elements. Trueswell et al. claimed that subcategorization preference could guide the parser to predict what would follow a verb. In their experiment, subjects heard a sentence fragment such as (6) below.
(6)  

a. The old man insisted…  
Visual target: Him/He

b. The young boy observed…  
Visual target: Him/He

The verb insisted predominantly takes a sentence complement rather than an NP as its object (thus, he should be more likely to follow), whereas the word observe predominantly takes an NP as its object (him should be more likely to follow). Upon hearing the final word of each fragment, subjects saw a target word, either him or he, and were asked to read it aloud (naming task). The results showed that naming times for he were significantly faster than for him when the target was presented immediately after the verb insisted. On the contrary, naming times for him were significantly faster than for he when it was presented immediately after the verb observed. These findings indicated that the naming times became faster when the visual target matched the word with more expected Case. Consequently, information about subcategorization preference of a verb could guide the parser to predict an upcoming element.
Furthermore, Altmann and Kamide (1999) claimed that even more specific lexical information (semantic information) that a verb carried could help the parser employ predictive reading. Using world visual paradigm in which a subject saw visual stimuli such as pictures or objects at the same time an auditory stimulus is presented, Altmann and Kamide showed that semantic as well as syntactic information played a role in predictive reading. For example, their subjects heard sentences such as (7) and at the same time, they saw a picture that depicted the following objects: a boy, a ball, a piece of cake, a toy train, and a toy truck.

(7)  a. The boy will move the cake.

     b. The boy will eat the cake.

The picture was presented when they heard the verb (move/eat). Eat is usually a transitive verb and its patient is typically some kind of food, but the same expectation is not true for the verb move in (7a). If the parser utilizes semantic information of the
verb as well, the likelihood of eye fixation on the picture cake will be greater than on
the other objects. This prediction was borne out. As a result, they found that the
subjects fixated on the picture of cake more often and earlier before the onset of the
following NP cake when they heard the word eat as compared with when they heard the
word move. Altmann and Kamide argued that a verb could provide semantic and
syntactic information that was useful for predicting unencountered elements.

As illustrated above, different researchers have shown that a verb played a
significant role employing incremental and predictive readings in English. How far
the parser would predict from a verb should vary depending on the theory. For
example, research based on a strict syntactic parsing model may simply predict a noun
will follow a verb (e.g., Frazier and Rayner, 1982; also see Clifton, Speer, and Abney,
1991; Pickering and Traxler, 2003; Speer and Clifton, 1998; Traxler and Pickering,
1996). In contrast, research based on a constraint model will allow predicting
upcoming elements using not only syntactic information but also semantic and
frequency information and even world knowledge (e.g., Altmann and Kamide, 1999;
Trueswell, Tanenhaus, and Kello, 1993; also see Jennings, Randall, and Tyler, 1997; MacDonald, Pearlmutter, and Seidenberg, 1994). However, no matter which camp one was based at, both camps shared one aspect. That is, a sentence was processed incrementally and a verb played a significant role in making predictive reading possible.⁶

2.2. L1 Sentence Processing in Japanese

While English is an SVO language, Japanese is an SOV language, which makes the two languages look different in terms of how sentences are processed. As shown in (8) below, a verb in Japanese usually appears clause-finally and consequently the parser would often be led to reanalyze its initial interpretation if incremental processing is at work.

---

⁶ Prosodic cues are also important information to make predictive reading possible. However, this dissertation focuses on reading comprehension we will not discuss oral/aural sentence processing.
(8) a. Ken-ga ringo-o katta.

Ken-nom apple-acc bought

“Ken bought an apple.”

b. Ken-ga [ e₁ ringo-o katta] onnanohito₁-ni koe-o kaketa.

Ken-mom apple-acc bought woman-dat spoke

“Ken spoke to the woman who bought an apple.”

c. Ken-ga ringo₁-o [ e₁ e₁ katta] onnanohito₁-ni kaeshita.

Ken-nom apple-acc bought woman-dat returned

“Ken returned the apple to the woman who bought it.”

In reading (8b), the parser will initially construct a simplex sentence such as (8a), up until the verb *katta* ‘bought.’\(^7\) When the next word *onnanohito-ni* ‘to the woman’ is received, however, the initial analysis needs to be changed into a relative clause analysis, in which ‘the woman’ plays an agent role of ‘bought.’ Consequently, the first subject NP *Ken-ga* no longer belongs to the same clause headed by ‘bought.’ Moreover,

\(^7\) We assume the parser starts to process a sentence as a simplex clause until a reanalysis becomes necessary (Kamide and Mitchell, 1999; Mazuka and Itoh, 1995; Nagata, 1993).
because Japanese allows empty pronouns, it is also possible that (8a) in fact continues like (8c), in which both subject NP Ken-ga and object NP ringo-o are arguments of the matrix verb kaeshita ‘returned.’ For these reasons, it was once a critical issue in the literature whether the Japanese sentence was processed incrementally (incremental model) or the processing was delayed until some point of the sentence (delay model) (Kamide and Mitchell, 1999; Mazuka and Itoh, 1995; Nakayama, 1996; Yamashita, 1994).

Nevertheless, most of their research findings supported the view in favor of the incremental model. That is, the information from Case markers detectable from each argument phrase guides the parser to make predictions about an upcoming element (Kamide, Altmann, and Haywood, 2003; Kamide and Mitchell, 1999; Miyamoto, 2002; Nagata, 1993; Sakamoto, 1995, 2002; Yamashita, 1994; 1995; 1997).

For example, Yamashita (1997) conducted an experiment using a lexical decision task with test fragments such as those below.
(9) a. Kawaii onnanoko-ga wakai sensee-ni oisii otya-o… Target: dasita/nonda
cute girl-nom young teacher-dat good tea-accs served/drank

“A cute girl [served/drink] good tea to the teacher.”

b. Wakai sensee-ni kawaii onnanoko-ga oisii otya-o… Target: dasita/nonda
young teacher-dat cute girl-nom good tea-acc served/drank

“A cute girl [served/drank] a good tea to the teacher.”

Both fragments (9a) and (9b) consisted of a nominative NP ‘cute girl,’ a dative NP ‘young teacher,’ and an accusative NP ‘good tea’ although the two differed from each other in terms of the word order. Each fragment was presented on a computer screen phrase by phrase, and when the target word was visually provided immediately after the last phrase of the fragment, the subject was asked to judge if the target in question was a real word (lexical decision task). One condition for the target word was a transitive verb ‘drank’ and the other was a ditransitive verb ‘served.’

As a result, Yamashita

---

8 Although the canonical word order of Japanese is SOV, Japanese does allow relatively flexible word order for phrases before a verb. For example, see Yamashita (2002) and Miyamoto and Takahashi (2002a) for evidence from a corpus-based study.
found that the response times to judge ditransitive verbs were significantly faster than
the response times to judge transitive verbs, and this was the same for both (9a) and (9b).
The faster RTs for ditransitive verbs can be interpreted as compatibility between the
previously assumed structure, such as (i.e., three arguments in a simplex clause) and the
target word (i.e., three-place-predicate), while the slower RTs in the other sentence types
could be interpreted as conflict between the previously assumed structure (i.e., three
arguments in a simplex clause) and the target word (i.e., two-place-predicate).

Consequently, she concluded that these results supported the view that a sentence was
processed incrementally without waiting for the clause-final verb.9

Expanding Yamashita’s (1997) findings, Miyamoto (2002) showed a parser could
detect whether a sentence being read was a simplex sentence or not from Case
information before reaching a verb. Miyamato employed an experiment with a self-
paced reading task using sentences such as those below.10

---

9 Yamashita also concluded that the parser would be tolerant with a non-canonical word order as long as
sufficient information could be obtained from Case. See Miyamoto and Takahashi (2002a) and Mazuka,

10 In a self-paced reading task, subjects read through a sentence segment by segment that appears on a
computer screen by pressing a certain key on a keyboard or a button box. A press of the key prompts the
appearance of the next segment, and the subject can control the rate of reading. RTs are automatically
measured and the RTs of critical segments are typically used for analysis. Slower RTs are usually
(10) a. Ofisu-de / syokuin-ga / kakarityoo-ni / otya-o / dasita / zyosei-o / teineini /

    Office-at/ employee-nom/ manager-dat/ tea-acc/ served/ woman-acc/ politely/

    syookai-sita.

    introduced.

    “At the office, the employee politely introduced the woman who served the tea to the manager.”

b. Ofisu-de / syokuin-ga / kakarityoo-o / otya-o / dasita / zyosei-ni / teineini /

    office-at / employee-nom / manager-acc / tea-acc /served / woman-acc /politely/

    syookai-sita.

    introduced

    “At the office, the employee politely introduced the manager to the woman who served the tea.”

__________________________________________________________________________

assumed to indicate some sort of processing difficulty.

In sentences (10) above, the slash indicates the segment boundary that subjects read at one time.
c. Ofisu-de / kakarityoo-o / syokuin-ga / otya-o / dasita / zyosei-ni / teineini /

office-at / manager-acc / employee-nom / tea-acc / served / woman-dat / politely/

syookai-sita.

introduced

“At the office, the employee politely introduced the manager to the woman who

served the tea.”

All three sentences in (10) are similar in that (i) three arguments appear before the

first verb; (ii) the sentence has one embedded clause (relative clause). However, (10a)

diffs from (10b,c) in that the latter two sentences have accusative phrases appearing

twice before the first verb while in the former sentence, the same Case appears only

once. Since Japanese does not allow an accusative phrase appearing more than once in

the same clause (Harada, 1973; Kuroda, 1992), it was predicted the parser would detect

that the sentence would not be a simplex clause as soon as reaching the second

accusative Case in (10b,c). As predicted, the result showed slower RTs at the second
accusative phrase ‘tea’ in (10b,c) in comparison with the first accusative phrase ‘tea’ in (10a). This slowdown was taken as evidence of predictive reading making use of Case information. That is, the parser had originally assumed that the sentence was simplex but had to change the initial analysis upon encountering the second accusative Case.

Kamide, Altmann, and Haywood (2003) also found evidence in favor of predictive reading using Case information using a different experimental method, world visual paradigm. In their study, subjects were presented with a picture while hearing a sentence such as (11). The picture shown with (11) depicted the following four items: a waitress, a customer at a table, a hamburger on different table, and a trash box. Then Kamide et al. examined which item in the picture was looked at most when the subjects heard the third phrase tanosigeni ‘merrily.’


\[\text{waitress-nom customer-dat merrily hamburger-acc bring}\]

“The waitress will merrily bring the hamburger to the customer.”
b. Ueitoresu-ga kyaku-o tanosigeni karakau.

waitress-nom customer-acc merrily tease

“The waitress will merrily tease the customer.”

Before the critical region, sentence (11a) contains a nominative phrase (waitress) and a dative phrase (customer). If a sentence would be processed in a predictive manner using Case information, the parser would most likely seek an object that fits in an accusative phrase. The best candidate as such in the picture was a hamburger, which was predicted to receive eye-fixations. In contrast, sentence (11b) contains a nominative phrase (waitress) and an accusative phrase (customer) before the critical region, which would not necessarily cause eye-fixations on the hamburger. As predicted, more looks were directed at the hamburger for (11a) than for (11b), and the difference was significant. From this, Kamide et al. argued that a parser could effectively utilize Case information to predict upcoming elements even though a grammatical head (verb) was not encountered.
Thus far, we have seen that both English sentences and Japanese sentences are processed incrementally without delay. It was shown that although the two languages differ in typological word order, the English parser can utilize verb information to predict how a sentence will continue, and the Japanese parser does the same by utilizing argument information. Both parsers fully use the available information on-line to enhance incremental processing regardless of the language. Such similarity between the two typologically different languages can be viewed as a universal processing strategy (see also Aoshima, Phillips, and Weinberg (2004) and Lieberman, Aoshima, and Phillips (2005) for a similar discussion); i.e., a basic feature that sentences are processed incrementally is shared by different languages.

A question arises as to whether this universal strategy applies to L2 sentence processing, especially when English-speaking JSL/JFL learners read Japanese sentences. JSL/JFL learners need to utilize available information differently from how they do so in their L1 because overt linguistic cues such as word order and case marking are coded differently from English in Japanese. In (12), the English parser may predict that
something one can throw follows the verb *threw*, based on the information from the subject and the verb.

(12) Ken threw a ball.

(13) a. Ken-ga booru-o nageta.

Ken-nom ball-acc threw

“Ken threw a ball.”

b. Ken-ga sakki okita.

Ken-nom just a while ago woke up

“Ken woke up just a while ago.”

However, when the same parser reads a Japanese sentence in (13), it can make a prediction about a verb based on the information from the subject and object (arguments). More specifically, at the second phrase *booru-o* ‘ball’ in (13a), the parser may need to predict that a two/three-place predicate that can involve Ken and a ball will
follow next or later. In contrast, if the parser reads the second phrase sakki ‘just a while ago’ in (13b), the same prediction is not possible because sakki is an adjunct. The verb to follow sakki ‘just a while ago’ can be a one-place predicate as well as a two/three-place predicate. Processing the second phrase appropriately without delay either as an argument or adjunct allows predictive reading for (13a) more than it does for (13b).

2.3. Previous Studies on L2 Sentence Processing by Learners of Japanese

Although not enough, there have been some studies that discuss how JFL/JSL learners process Japanese sentences. Among them, Lieberman, Aoshima, and Phillips (2004) claim that both L1 and L2 parsers behaved in a similar fashion in terms of resolving syntactic ambiguity in a sentence with a wh-phrase. Using a paper and pencil sentence completion study, they tested how their subjects (natives speakers of Japanese and English-speaking JFL learners)11 would complete the sentence fragments shown in (14a).

---

11 It is not possible to specify their L2 learners’ previous Japanese experiences in terms of their classroom instruction hours. Their study experiences varied depending on the subject whose range was from 2.5 to 15 years of study.
(14) a. Sensei-wa gakusei-ga toyositsu-de dare-ni …

teacher-top student-nom library-at who-dat …

b. Sensei-wa [gakusei-ga toyositsu-de dare-ni atta-to] wakatta-no?

teacher-top student-nom library-at who-dat met-comp figured out-QM

“Who did the teacher figure out that the student met?”


teacher-top student-nom library-at who-dat met-QM figured out

“The teacher figured out who the student met.”

Fragment (14a) is ambiguous in that the sentence can continue either as a direct
question as in (14b), in which a question marker (QM) no appears at the end of a
sentence, or as an indirect question as in (14c), in which the QM ka appears at the end
of an embedded clause. Because Japanese is a wh-in-situ language, the surface
position of a wh-phrase (e.g., dare) does not determine whether it is a direct or an
indirect question, unlike English. Rather, it is the position of a QM that is responsible for determining whether the interrogative sentence in question is direct or indirect.

In their study, Lieberman et al. (2004) found that JFL learners as well as native speakers of Japanese completed an ambiguous sentence fragment (such as (14a)) as an indirect question (as in (14c)) rather than a direct question (as in (14b)). Because the learners completed the sentence in the same manner as native speakers in spite of the fact that a structure of wh-question as in (14a) is absent in English, Lieberman et al. interpreted this as evidence that sentence processing (ambiguity resolution) in both L1 and L2 is motivated by the same underlying mechanism. That is, as soon as the parser comes across a wh-phrase, it expects to find a QM (or its thematic position in English).  

---

12 Lieberman et al. also illustrated similar results that had been reported in other L1 processing studies of Japanese and English. For example, Miyamoto and Takahashi (2002b) found that the L1 Japanese parser, in reading sentences as in (i), slowed down at tsukatte iru to ‘that the vice president uses’ in (i)a more than at tsukatte iru ka ‘(what type of computer) the vice president uses’ in (i)b. Miyamoto and Takahashi reasoned that upon reading wh-phrase donna ‘what type,’ the parser expected to find a corresponding question marker at the closest clause boundary.

(i) a [Senmu-ga donna pasokon-o tsukatte iru-to] kakaricho-ga itta-no?
    vice president-nom what type computer uses-comp section chief-nom said-QM
    “What type of computer did the section chief say that the vice president uses?”

b. [Senmu-ga donna pasokon-o tsukatte iru-ka] kakaricho-ga itta.
    vice president-nom what type computer uses-QM section chief-nom said
    “The section chief said what type of computer the vice president uses.”

Lieberman et al. (2004) did not discuss why both languages needed to be in this way. In contrast, Miyamoto and Takahashi (2002b) implied that this was due to the limitation of cognitive resources
While Lieberman et al. (2004) show the uniformity between L1 and L2 parsing strategies, a majority of previous studies claim otherwise. They claim L2 parsing strategies by JFL learners are not native-like, at least at an early stage of development. For example, Kanno (2001) employed a self-paced reading task to test how sentences with canonical and scrambled word order such as the ones in (15) would be processed on-line.


give and/ home-to/ returned (canonical order)

“The American student gave the English student an expensive present and went home.”

(working memory); i.e., the parser could not keep a wh-phrase with its scope ambiguous for a long time.

give/ home  (scrambled order)

“The American student gave the English student an expensive present and went home.”

Her subjects were late beginning to early intermediate levels JFL learners who were American college students with 250 to 500 hours of classroom instruction. She found that while native speakers (control group) tended to spend a longer time reading clause boundaries compared to the other regions, English-speaking JFL learners tended to spend an equally long time reading phrase boundaries throughout the sentence. From this finding, she concluded that “learners are slow at utilizing case marking information and they are not as good as native speakers at allocating the on-line time necessary to
integrate larger structural/conceptual units into the sentence” (p. 35). Consequently, L1 and L2 parsing strategies were different.

Sawasaki (2004) also used a self-paced reading method to examine how English-speaking learners would parse simplex sentences. In his study, two subject groups were tested, besides a control group, according to their proficiency level: intermediate level JFL learners studying at an American university (450 to 600 hours of classroom instruction) and advanced JSL learners studying in Japan (more than 1,320 hours of classroom instruction). He found that both native speakers and learners demonstrated consistent processing loads (RT peak(s)) prior to a verb, which he interpreted as evidence that some incremental processing had taken place because such overload could be the result of having analyzed a sentence as it unfolded. However, the processing

---

13 Test sentences were like the ones below, however, the test sentences were presented in Japanese characters.

   Mr./Ms.Tanaka -nom/ yesterday / very / was surprised
   “Mr./Ms. Tanaka was very surprised yesterday.”

b. Tanaka-san-ga / kinoo / sensei-o / tetudaimasita.
   Mr./Ms.Tanaka -nom / yesterday / teacher-acc / helped
   “Mr./Ms. Tanaka helped the teacher yesterday.”

c. Tanaka-san-ga / sensei-o / tetudaimasita.
   Mr./Ms.Tanaka -nom / teacher-acc / helped
   “Mr./Ms. Tanaka helped the teacher.”

These sentences are a smaller set of the current study. The current study employed more test conditions and more subject groups than Sawasaki (2004) did. In this dissertation, some parts of Experiment 1 in chapter 3 overlap with the content of Sawasaki (2004) in terms of experimental sentences, subjects, findings, and discussions.

29
patterns of the three groups were not the same in terms of where in a sentence a
processing load was experienced. While native speakers and advanced (JSL) learners
showed a processing load only once preverbally, less proficient (JFL) learners showed
processing loads more than once (once in almost every two phrases). From these
findings, he claimed that inexperienced learners could not utilize their working memory
in the same way as the native speakers because they needed more time to incorporate
not only syntactic information but also non-syntactic information such as decoding
Japanese characters and words.

Based on Sawasaki’s findings, Kashiwagi and Nakayama (2005) examined how
English-speaking JFL learners read an NP of different length and syntactic complexity
in a sentence. The following sentences were tested in a self-paced reading task.

(16) a. Teraki-san-wa / kyooju-ga / dorama-o / mita / to / itta /. (3 morae)

   Mr./Ms. Teraki-top / professor-nom/ drama-acc/ saw/ that/ said/.

   “Mr./Ms. Teraki said that the professor saw the drama.”
b. Teraki-san-wa / kyooju-ga / **hoomudorama-o** /mita/ to / itta /. (6 morae)

Mr./Ms. Teraki-top / professor-nom/ serial drama-acc/ saw/ that/ said/.

“Mr./Ms. Teraki said that the professor saw the serial drama.

c. Teraki-san-wa / kyooju-ga / **kuji-no-dorama-o** / mita / to / itta /. (6 morae)

Mr./Ms. Teraki-top / professor-nom/ 9 o’clock-gen-drama-acc/ saw/ that/ said/.

“Mr./Ms. Teraki said that the professor saw the 9 o’clock drama.”

The third region in each sentence is the phrase of their interest: it is either 3 morae NP, 6 morae NP, or 6 morae NP with NP+genitive+NP structure. Kashiwagi and Nakayama found that native speakers spent a longer time reading structurally complicated phrases such as **kuji-no-dorama-o** ‘9 o’clock drama’ in (16c) than structurally simpler phrases regardless of length such as **dorama-o** ‘drama’ in (16a) and **hoomudorama-o** ‘serial drama’ in (16b). However, JFL learners with a lower proficiency level (580 hours of classroom instruction) failed to make such differentiation although more advanced learners (more than 700 hours of classroom instruction) showed at least some evidence
of native-like processing. Based on these findings, Kashiwagi and Nakayama also reached the conclusion that learners of Japanese, especially less proficient learners, utilized working memory differently from native speakers because the learners needed more time to decode and store phonemes.\textsuperscript{14}

Using a paper and pencil study, Yamashita (2003) compared beginning level Mandarin, Korean, and English-speaking JFL learners (160 hours of classroom instruction). After her subjects had read sentences as in (17), they were asked to either say the sentence meaning in English (for (17a), Exp. 1) or choose a correct interpretation out of three English sentences (for (17b), Exp. 2).

(17) a. Sensei-ga gakusee-o matte imasu.

teacher-nom student-acc is waiting

‘The teacher is waiting for the student.’

\textsuperscript{14} In their follow-up study, however, Nakayama and Kashiwagi (2006) found some evidence that supported both native speakers and the JFL learners at a lower proficiency level parsed a sentence in a similar way. That is, they both spent a relatively longer time at the sentence subject phrase than when the same phrase was read as a word in isolation, which Nakayama and Kashiwagi claimed as an indication that a sentence structure started being built at the subject position.

32
b. [Sensei-o mita] gakusee-ga kaerimasita.

teacher-acc saw student-nom went home

‘The student who saw the teacher went home.’

(17a) is a simplex sentence with a canonical word order, and (17b) is a sentence with a relative clause. Her prediction is that Korean speakers would have the highest score because Korean is structurally most similar to Japanese than the other two languages, and that English speakers would get the lowest score because English shares the least structural similarities with Japanese.\(^\text{15}\) Yamashita found that all three groups understood (17a) with a very high correct response rate (more than 80%). From this, she claimed that false processing was not likely to occur when the sentence was structurally simple. However, after they read (17b), Korean speakers were found to be the highest in the accurate response rate and English speakers the lowest. Also, English speakers tended to misunderstand sensei-o ‘teacher-acc’ as a nominative phrase.

\(^{15}\) Yamashita used word order, head-branching direction, and Case marking system, as indications of the “structural proximity.” Korean shares these three features with Japanese while English and Japanese do not share any of the features. In contrast, Chinese and Japanese (and Korean) share one feature, head-branching direction in relative clauses: a relative head comes after a relativized clause.
such as “the teacher went home” or “the teacher saw the student,” while such
misinterpretation was unlikely among Korean and Chinese speakers. Based on these
results, Yamashita concluded that English speakers tended to neglect information from
Case markers but employed a strategy to understand the first appearing NP as a sentence
subject when the sentence structure becomes more complicated. Moreover, she argued
that the more L1 and L2 were structurally similar, the more L2 readers were sensitive to
the same grammatical information manifested in the sentence.

Yamashita’s (2003) finding that English speakers tend to understand the first NP
as a subject is reminiscent of the claims based on the Competition Model (e.g., Bates
and MacWhinney, 1981; MacWhinney and Bates, 1989). In a study with this model,
L2 learners with various L1s such as Japanese, English, and Italian, were typically
presented with a series of word sequences consisting of two nouns and one verb and
asked to judge which noun was the subject. As a result, they found that English
speakers tended to rely on word order to decide the subject, and also that Chinese
speakers tend to rely on an animacy cue to judge the subject. (See also Bates and

Although a majority of the literature seems to share the claim that L1 and L2 parsing patterns are different from each other as shown above, the findings seem to have some limitations due to methodological problems. First, many of the studies focus only on the L2 learners of a single proficiency level. For example, some tested only the learners of pre-advanced levels with less than 500 hours of classroom instruction (e.g., Kanno, 2004; Yamashita, 2003, and most of the studies from Competition Model framework), and others treated learners with multi-levels as a single subject group (e.g., Lieberman, Aoshima, and Phillips, 2004). Consequently, we are not sure what kind of developmental route learners take.

Second, many of the studies discuss L2 processing based only on off-line data (e.g., Lieberman, Aoshima, and Phillips, 2004; Yamashita, 2003, and most of the studies from Competition Model framework). Because their data usually rely on the

---

16 See footnote 11.
17 Off-line data here refer to the data obtained when a subject is not reading a test sentence or a fragment. Typical off-line data come from answering post sentence reading questions such as comprehension questions, difficulty rating, and translation tasks. In contrast, on-line data refer to the data obtained
subjects’ conscious judgments such as translation of a sentence meaning, sentence completion, and decision of a sentence subject, it is possible that the data are influenced by experimental artifacts as a result of the subjects’ having developed some task-specific problem-solving strategies.\(^\text{18}\)

Third, even when the experimental findings come from on-line data, such as RTs, their ways of presenting the data may need more consideration (e.g., Kanno, 2001). In analyzing the RTs, Kanno adjusted the raw data into “mean RTs per region,” which is calculated by dividing the RTs of each region by the number of morae because each region had a word of different morae. However, Trueswell, Tanenhaus, and Garnsey (1994) claimed that such a simple linear regression did not reflect the actual RTs because a shorter region tended to have longer RTs. Similar findings were also reported in reading Japanese words by Goryo (1987).\(^\text{19}\)

\(^{18}\) Also see Gibson (1992) for other possible drawbacks that the experimental paradigm of the Competition Model could have, and Sasaki and MacWhinney (2006) for counter arguments against Gibson (1992).

\(^{19}\) The claims by Trueswell et al. (1994) and Goryo (1987) were based upon L1 processing studies.
Last, although Japanese is usually claimed as a mora-based language (Kubozono, 1999; Culter and Otake, 1994; but see Otake, 2000; Tamaoka and Terao, 2004), English is often treated as a syllable-based language (Kubozono, 1999; Otake and Yamamoto, 2001). Because of this difference, previous studies report that English-speakers have difficulty in pronouncing Japanese words based on mora (Han, 1992; Kashima, 1999). This suggests that when reading Japanese silently, too, English-speaking learners may tend to perceive Japanese words based on syllable as a result of L1 transfer. Such L1 transfer, if it takes place, may pertain only to learners at a lower proficiency level, or it may pertain to all the English-speaking learners. Consequently, we need to be cautious about deciding what phonological unit learners of Japanese tend to employ when analyzing the data.

To summarize, although there is some previous research on sentence processing in light of second language acquisition (SLA), we are still far from answering the questions of how L2 processing mechanism operates on-line in comparison with that of

---

20 Japanese morae and English syllables coincide in most cases, but the two differ from each other in that those such as the following are counted as two distinct phonological units in Japanese: a diphthong (e.g., /ai/); a long vowel (e.g., /u/); a vowel followed by a nasal (e.g., /man/); a geminate consonant (e.g., /kk/).
native speakers and how the sentence processing mechanism develops as learners
improve their proficiency and other related questions.

In this dissertation, we investigate how learners of Japanese of different L1s read
through simplex sentences. Of particular interest is how the learners process preverbal
information on-line in comparison with native speakers. In doing so, we compare
English-speaking JFL/JSL learners at three different proficiency levels with native
speakers of Japanese (Experiment 1), and also compare them with Chinese/Korean-
speaking JSL learners (Experiment 2). Comparing Chinese- and Korean-speaking
learners with English-speaking learners should also show interesting aspects of on-line
L2 processing preferences. Chinese is an SVO language, the same as English, and
with no explicit Case marking device, but Korean shares the canonical SOV word order
and a post-NP Case marking system with Japanese. If such syntactic differences and
similarities between L1 and L2 influence how sentences are processed in L2, reading
patterns of Korean-speaking learners should be similar with those of Japanese natives
but different from those of English-speaking and Chinese-speaking learners.

38
CHAPTER 3

EXPERIMENT 1

In this chapter, we investigate how English-speaking learners of Japanese process preverbal information on-line in comparison with native speakers of Japanese. One of our interests is whether learners process preverbal Case information in the same way as native speakers do.

One way to examine if the parser fully utilizes Case marking information on-line is to see if arguments are processed differently from adjuncts. As was discussed in chapter 2, Case markers in Japanese are very helpful cues to make efficient use of preverbal information in on-line processing. For example, Case marked arguments can provide crucial information to predict what kind of verb will follow. In contrast, adjuncts may not be able to provide such information to predict subsequent elements.
Consequently, processing arguments can be different from processing adjuncts, and one such difference may be reflected in how fast or slow these phrases are read.

Previous studies suggest that arguments are processed faster than adjuncts in English (Ahrens, 2003; Boland and Blodgett, 2006; Frazier and Clifton, 1996; Schütze and Gibson, 1999; Speer and Clifton, 1998). For example, Frazier and Clifton (1996) claim that processing arguments plays more significant roles, and Schütze and Gibson (1999) and Speer and Clifton (1998) show that argument information is processed faster than adjunct information.²¹, ²²

Faster RTs for arguments can be explained with syntactic preference for arguments over adjuncts (Abney, 1989; Frazier and Clifton, 1996). In Abney’s model, the parser utilizes a strategy in which arguments are autonomously preferred over non-arguments in analyzing a sentence structure, and this preference can result in faster RTs.

²¹ Schütze and Gibson (1999) compare a prepositional phrase, which is an argument of a noun (e.g., *The company lawyers considered employee demands for a raise*) and a prepositional phrase that is an adjunct of a verb (e.g., *The company lawyers considered employee demands for a month*). In contrast, Speer and Clifton (1998) compare a prepositional phrase that is either an argument or an adjunct of the same verb (e.g., *The people who lived near Love Canal blamed the toxic waste dump for their leukemia for several months*).

²² Babyonyshev and Gibson (1995; 1999) claim that processing arguments requires more processing load than processing adjuncts. If so, we could interpret that arguments may be processed more slowly than adjuncts in Japanese. In this dissertation, however, we will follow Frazier and Clifton’s (1996) perspective.
Alternatively, Frazier and Clifton claim that arguments constitute primary phrases that are parsed based on syntactic information, but that adjuncts constitute nonprimary phrases that are interpreted using non-syntactic information at a later stage. In their model, adjuncts result in slower RTs due to extra time spent because they are first (automatically) interpreted as a primary phrase, but soon after that they need to be reanalyzed as a nonprimary phrase (Speer and Clifton, 1998).\footnote{In contrast, it is also possible to explain it in terms of lexical frequency (MacDonald, Pearlmutter, and Seidenberg, 1994), which claims that argument words are more frequently associated with predicates than adjunct words and consequently easier (faster) to process. While an account such as Abney’s emphasizes syntactic autonomy, the frequency account by MacDonald et al. focuses more on experiential knowledge. (See also Boland and Blodgett (2006) for a somewhat different view.)}

\section*{3.1. Experimental Design}

Based on the discussion above, this chapter examines Questions A and B of the set of questions raised in chapter 1 and repeated below.

(18) Research question: What kinds of processing strategies do learners of Japanese employ while reading Japanese sentences?\footnote{The full set of research questions originally raised in chapter 1 are below. Research question: What kinds of processing strategies do learners of Japanese employ while}
A Do English-speaking learners of Japanese treat arguments (i.e., accusative NPs) and adjuncts (i.e., adverbs) differently while reading simplex sentences?

B What are the general reading patterns by English-speaking learners of Japanese?

Question A asks if learners of Japanese differentiate Case marked NPs such as the accusative NPs and others such as adverbs while reading. Question B asks if there are any distinctive patterns of reading that differ from those of native speakers.

In order to answer the questions in (18), an experiment with a self-paced reading task was conducted to examine how intermediate and advanced JFL/JSL learners treat preverbal arguments and adjuncts in single simplex sentences. Five types of sentences as shown in (19) were prepared as test sentences. Phrases divided by slashes are regions that a parser reads one at a time during the experiment.

---

A. Do English-speaking learners of Japanese treat arguments (i.e., accusative NPs) and adjuncts (i.e., adverbs) differently while reading simplex sentences?
B. What are the general reading patterns by English-speaking learners of Japanese?
C. Do Chinese-speaking learners of Japanese behave the same as English-speaking learners of Japanese while reading simplex sentences?
D. Do Korean-speaking learners of Japanese behave the same as English-speaking learners of Japanese while reading simplex sentences?
(19) a. Tanaka-san-ga / bikkuri-simasita.  (Int1 Type)

   Mr./Ms.Tanaka-nom / was surprised

   “Mr./Ms. Tanaka was surprised.”

b. Tanaka-san-ga / kinoo / bikkuri-simasita.  (Int2 Type)

   Mr./Ms.Tanaka-nom / yesterday / was surprised

   “Mr./Ms. Tanaka was surprised yesterday.”

c. Tanaka-san-ga / kinoo / totemo / bikkuri-simasita.  (Int3 Type)

   Mr./Ms.Tanaka-nom/ yesterday / very / was surprised

   Mr./Ms. Tanaka was very surprised yesterday.”

d. Tanaka-san-ga / sensei-o / tetudaimasita.  (Tran2 Type)

   Mr./Ms.Tanaka-nom / teacher-acc / helped

   Mr./Ms. Tanaka helped the teacher.”

e. Tanaka-san-ga / kinoo / sensei-o / tetudaimasita.  (Tran3 Type)

   Mr./Ms.Tanaka-nom / yesterday / teacher-acc / helped

   “Mr./Ms. Tanaka helped the teacher yesterday.”
All the sentences in (19) are simplex sentences that have at least a subject and a verb. Sentence (19a) consists of the subject Tanaka and the intransitive verb bikkuri-simasita ‘was surprised.’ We call this the Int1 type. (19b) contains the subject Tanaka, time adverb kino ‘yesterday,’ and the intransitive verb bikkuri-simasita ‘was surprised.’ We refer to this as the Int2 type since it has an intransitive verb preceded by two phrases. (19c) consists of the subject Tanaka, time adverb kino ‘yesterday,’ manner adverb totemo ‘very,’ and the intransitive verb bikkuri-simasita ‘was surprised.’ We call this the Int3 type since it has an intransitive verb preceded by three phrases. In comparison, (19d) is different from (19a,b,c) because it contains an accusative NP sensei ‘teacher’ in the second phrase as well as because the verb in (19d) is the transitive verb tetudaimasita ‘helped’ whereas the verb in (19a,b,c) is an intransitive verb. This will be referred as the Tran2 type. Finally, (19e) is identical with (19d) except a time adverb is attached before an accusative NP in (19e). We call this the Tran3 type. As can be seen in (20), the number of arguments and adjuncts and the total number of phrases in a sentence vary among the sentences.
If arguments and adjuncts are processed differently while reading, a couple of predictions would be possible by comparing RTs for some preverbal regions across sentence types. The regions to compare are the second and third preverbal regions.

In the second preverbal region (except for (20a) since it has only one preverbal region), the parser will need to detect whether the word is an argument or adjunct for the sake of incremental processing. Consequently, shorter RTs for reading an accusative NP in the Tran2 type (compared to reading a time adverb in the other three types) can indicate that

---

25 It is also possible to compare the accusative NP in the Tran2 type with the accusative NP in the Tran3 type in the third region.
adjuncts and arguments are processed differently before reaching a verb.26 Similarly, in the third preverbal region, shorter RTs for reading an accusative NP in the Tran3 type (than reading a manner adverb in the Int3 type) can also indicate argument/adjunct differentiation.

Besides the prediction above, we are also interested in comparing participant groups. As we do not know of any study that investigated on-line processing of JFL/JSL in simplex sentences across different proficiency levels of learners, it is not certain what kind of RT patterns will emerge as a sentence unfolds and how learners are different from native speakers. For example, before reaching a verb, we do not know how fast or slow each phrase is processed in comparison with its adjacent phrase. The Int1 type has a subject immediately before an intransitive verb whereas the Int3 type has two adjunct words intervening between a subject and an intransitive verb, and we do not know if such difference will have any effect on a pattern of RTs. The current experiment will enable us to compare the distribution of RTs across sentences between different proficiency levels of L2 and also between L1 and L2 speakers.

26 A direct comparison of RTs can be so interpreted under the assumption that there are no differences in the effect of individual lexical access between the argument-type word and adjunct-type word.
3.1.1. Subjects

Four groups with a total of 104 subjects participated in the study on a voluntary basis: 53 native Japanese speakers, 27 JSL learners, and 24 JFL learners. They were all undergraduate or graduate students at the time of the study and were recruited from seven different schools. The control group (JPN) consisted of students from four different universities in the Kobe area in Japan with an average age of 21, 19-39 of range, and 4.6 of standard deviation (SD).

The 27 JSL subjects (JSL), who are all native speakers of English, were advanced learners studying Japanese at three different schools in Japan. They had completed at least 600 hours of classroom instruction before arriving in Japan and nine months of studies at their schools in Japan (approximately another 700 hours). However, we decided to disqualify one subject who had lived in Japan for 168 months (14 years), which was far longer than the period other subjects had lived in Japan at the time of experiment. The remaining 26 subjects averaged 27.9 years of age (range= 20-36;
SD= 4.3), 34.8 months of living in Japan (range= 9-80; SD= 18.4), and 50.5 months having studied Japanese (range= 17-92; SD= 19.9).

The 24 JFL subjects were further divided into two groups: 15 subjects (JFL1) and 9 subjects (JFL2) based on their proficiency level (i.e., according to the level of class there were placed). All were native English speakers and intermediate learners studying Japanese at the same American university. The 15 JFL1 subjects were recruited from the fourth year of Japanese class, which was equivalent to having had approximately 520 hours of classroom instruction at the time of the study. They averaged 21.9 years of age (range= 19-28; SD= 2.4), and 33.9 months of Japanese studies (range= 22-65; SD= 12.5) including 4.7 months of living in Japan (range= 0-15; SD= 4.3). 27 In contrast, the 9 JFL2 subjects were recruited from the fifth year of Japanese class, which was equivalent to having had at least 630 hours of classroom instruction at the time of the study. They averaged 24.3 years of age (range= 21-30;

---

27 Out of the 15 JFL1 subjects, 13 had lived in Japan. Twelve had studied at a language program or at a high school in Japan, and 1 had had an internship experience in Japan.
SD = 2.9), and 50.3 months of Japanese studies (range = 39-79; SD = 12.8) including
13.9 months of living in Japan (range = 0-30; SD = 11.6).\(^{28}\)

Of the 26 JSL subjects, eight had taken the Japanese Language Proficiency Test
(JLPT) and had passed Level 1 or 2, which is the level generally required to be admitted
to a Japanese university.\(^{29}\) The rest of the JSL subjects had not taken JLPT but were
considered to be somewhere between Level 3 and Level 1 from a post-experiment
interview. We do not know the JLPT levels of the JFL1 and JFL2 subjects since no
one had taken the test. However, we considered that the JFL1 subjects would be
closest to Level 4 and the JFL2 subjects would fall on to Level 3, based on the number
of words and kanji (Chinese characters) they had been taught.

3.1.2. Procedure

This study employed a self-paced reading task using a modified Psyscope based
on Cohen, MacWhinney, Flatt, and Provost (1993). The stimuli were presented on a

---

\(^{28}\) Out of the 9 JFL2 subjects, 8 had lived in Japan. Seven had studied at a language program or at a high
school in Japan, and 1 did not answer why he was in Japan.

\(^{29}\) JLPT is a standardized test to examine the proficiency level of Japanese learners in listening
comprehension, vocabulary and grammar, and reading. Though taking the test is not necessarily
required, it is generally assumed that those who wish to study in a regular program at a Japanese
university need to be at least at Level 2. See Appendix A for more information for the JLPT.
computer screen (Macintosh, iBook G3) in a non-cumulative, word-by-word (moving window) fashion. RTs for each segment were automatically measured and stored in the computer file. Each subject did the experiment individually using a computer screen and keyboard in a quiet room. It took about 15 to 30 minutes to read through all 65 sentences, including five practice sentences.

The subjects’ task was to read each sentence appearing on the screen as quickly and accurately as possible while pressing the space bar. They were first asked to press the space bar on the keyboard, and dots (...) appeared in the center of the screen when they did this, which looks like screen (i) in Figure 3.1 below. The length of the dots represented the length of the sentence they read, and there were spaces at the word boundaries. They were prompted to press the space bar again, and then the first region of the sentence became visible, as presented in screen (ii) in Figure 3.1. When they pressed the space bar again, the second region of the sentence became visible, and the previous region turned back to dots, as shown in screen (iii). Subjects were instructed to read the sentence in this manner until the end (screens (iv) to (vi)).
Figure 3.1. Non-cumulative word-by-word presentation of stimuli

Each box in the figure represents a computer screen, and a flow from screen (i) to screen (v) indicates how subjects read a sentence in the experiment.
Half of the sentences were followed by single comprehension questions to ensure the subjects read the sentences for comprehension. After the experiment, they received nominal participation fees of eight dollars in the US or 800 yen in Japan.

3.1.3. Test Materials

Based on the sentence structures shown in (20) earlier, 20 sets of the five types of test sentences were first created. However, each sentence was modified so it started with a postpositional phrase indicating a place such as gakkoo-de ‘at school’ and ended with an additional phrase such as to itta ‘said that…’ or ka mo sirena ‘may.’ The modified sentence structures schematically look like (21) below. The postpositional phrase was added because initial words have a tendency to be read with little syntactic or semantic effect (Yamashita, Stowe, and Nakayama, 1993). Another region was added sentence-finally, so that the fifth region with the verb would not be the final region. The sentence final region tends to demonstrate a wrap-up effect and obscure other effects (Just, Carpenter, and Woolley, 1982; Kamide, 2006).30

---

30 A study of English processing by Just et al. (1982) reports that a sentence final word is more likely to effect reading times than a sentence initial word.
(21) Region  1  2  3  4  5  6
Int1:  Adv-place NP-nom   Intran V  (Comp+V/Aux V)
Int2:  Adv-place NP-nom  Adv-time  Intran V  (Comp+V/Aux V)
Tran2: Adv-place NP-nom  NP-acc   Trans V  (Comp+V/Aux V)
Tran3: Adv-place NP-nom  Adv-time  NP-acc   Trans V  (Comp+V/Aux V)

Each subject read exactly 60 sentences (20 test sentences and 40 fillers), which were sequenced in a fixed order so that successive items did not use exactly the same structure. (See Appendix B for a complete set of the test sentences.) Five lists were created in such a way that each list contained exactly four sentences for each test structure and no list had the same word appearing more than once.\footnote{Creating the five lists requires an assumption that there is no variance within a subject group just as is the case among native speakers. Although we are not certain if such an assumption indeed holds in L2 sentence processing, we believe that cross-sectional studies among L2 learners which are conventionally found in the field of second language acquisition (see for example, Larsen-Freeman and Long, 1991) naturally presupposes invariance within a subject group in the first place. Consequently, we decided to follow the same assumption.}

Only human-denoting nouns were used for the arguments to ensure that animacy cues would not affect the learners’ reading (Inoue and Den, 1997; Harrington, 1987; Kilborn and Ito, 1989; Yamashita, 2003). Due to the limited vocabulary from which
we could choose, we always kept the nominative phrase (i.e., NP-ga) as a family name, and the accusative phrase (i.e., NP-o) as a common noun that indicates human (e.g., teacher).

All sentences were presented in Japanese scripts using kanji, hiragana, and katakana, but their presentation was not always authentic. Because only the kanji the JFL subjects had already learned in class were used, the number of kanji we were able to use was limited. Consequently, some words were presented partially with kanji and partially with hiragana, even though they are usually only written with kanji by native speakers.

The kanji, vocabulary, and structures were selected from Japanese: The written language (Part 1 and Part 2) and Japanese: The spoken language (Part 1 and Part 2) both by Jorden and Noda (1994/1995; 1987/1988). They were the textbooks used in classes that both JFL groups were placed in. We wanted to control the frequency and familiarity of vocabulary, but it was not possible to do so because the total number of words we could choose from the textbooks was already very small. However, because
the words were taken from the Japanese textbooks, they consequently ended up being ones of a relatively high familiarity rate as measured by Amano and Kondo (1999).\(^{32}\)

Their average familiarity rate was 6.26 in a 1-7 scale, with 7 being the highest in familiarity, and ranged between 4.97 and 6.75 (SD= 0.33). However, we tried to control the number of morae in each test region. The mean numbers of morae are shown in Table 3.1 below.

<table>
<thead>
<tr>
<th>Region</th>
<th>NP-nom</th>
<th>Time/NP-acc</th>
<th>Manner/NP-nom</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Morae</td>
<td>6.4</td>
<td>4.6</td>
<td>4.5</td>
<td>4.6</td>
</tr>
<tr>
<td>(Range: SD)</td>
<td>(5-7: 0.6)</td>
<td>(3-7: 1.2)</td>
<td>(3-7: 0.9)</td>
<td>(3-6: 1.1)</td>
</tr>
</tbody>
</table>

Table 3.1. Mean number, range, and SD of morae in each test region

\(^{32}\) Amano and Kondo’s familiarity ratings are based on native speakers’ judgments and do not include proper nouns. The subjects of our test sentences are all proper nouns (family names), and according to Suzuki’s (1999) frequency database on family names, all the Japanese names in the test sentences rank within the top 140 out of more than 100,000 family names found in Japan.
3.2. Results

3.2.1. Modification of the Data

Before comparing the RTs of each region, the obtained raw data were modified in the following four ways. First, the data were screened based on the rate of correct responses for the comprehension questions. All RTs of the JPN who did not reach 90% of the correct response rate and all RTs for the learners who did not reach 80% of the correct response rate were removed from the data set. This disqualified three JPN, but not any JSL/JFL subjects, leaving 50 JPN, 26 JSL, 15 JFL1, and 9 JFL2 subjects for the later analyses with average correct response rates of 98.2%, 94%, 94.1%, and 95.9%, respectively.

Second, the RTs of the whole sentence whose comprehension questions were answered incorrectly were also deleted from the data set and were not replaced with any data. Third, each subject’s mean RT per mora was calculated for each word, and then each subject’s mean RT per mora for whole sentences (including filler sentences) was also calculated. When the former exceeded two SDs of the latter, it was replaced by
the “mean RTs + (SDx2).” The ratio of the RTs exceeding the “mean RTs + (SDx2)” was also used later as criteria to determine basic phonological unit (i.e., mora) employed by the learners, which will be explained shortly.

Finally, in order to compare RTs among subjects and subject groups, the obtained data were converted to residual RTs (RRT, henceforth), adopted from Trueswell, Tanehous, and Garnsey (1994), by using the number of morae. Formulas in (22) show how to obtain the RRTs (cf. Mazuka, Itoh, and Kondo, 2002). Expected RTs per mora were calculated for each subject by using the linear regression formula in (22a). In the formula, ‘a’ (= intercept) and ‘b’ (= slope) are parameters that vary among the subjects.33

(22) a. Expected RT = a + b*(number of morae)

b. Residual RT (RRT) = Raw RT – Expected RT

33 There should always be individual differences in how fast one reads through a sentence, but the differences will be minimized by adopting RRTs provided the baseline reading rate is the same within the individual. For instance, the mean value of the intercept for the 50 JPN subjects was 480.6 with the SD of 196.7 (Max. 979.0; Min. 197.0). Likewise, the mean value of the slope was 62.6 with the SD of 36.0 (Max. 141.0; Min. 3.2). This shows that the subjects did not read sentences at a similar pace. RRTs could also make it easier to compare the subject groups of different proficiency levels than comparing actual RTs.
Then the RRTs were determined by subtracting the expected RTs from the actual RTs as in (22b). The statistic results reported henceforth are based on these RRTs, unless noted otherwise, and we differentiate RRTs from simple RTs in the rest of this paper.

As shown in formula (22a), we decided to use the mora instead of the syllable as the basic phonological unit for the learners, and this was due to the following reason. When dealing with English-speaking JSL/JFL subjects, it is necessary to consider whether the learners read the test sentences based on mora unit or syllable unit. For instance, as Table 3.2 below shows, a Japanese word such as sensyuu ‘last week’ constitutes four phonological units in morae, se-n-syu-u, while the same word is read with only two phonological units when calculated based on syllables, sen-syuu. The same mora/syllable differences also emerge when we look at the 20 test sentences in terms of mean number of phonological units. As shown in Table 3.3, the mean number of units differs depending upon which phonological unit is taken.

---

34 The RRTs try to look at the subjects’ RTs in terms of how deviate their RTs are in each region in comparison with their expected RTs. Consequently, they are either positive or negative figures. Positive RRTs exemplify that the subject took more time than the subject’s expected RTs whereas negative RRTs indicate that the subject took less time than was expected. RRT of zero means they match the expected times.
35 Also see footnote 20 in chapter 2.
<table>
<thead>
<tr>
<th>Word</th>
<th>Number of morae</th>
<th>Number of syllables</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>sensyuu</em> ‘last week’</td>
<td>four morae (se-n-syu-u)</td>
<td>two syllables (sen-syuu)</td>
</tr>
<tr>
<td><em>akegata</em> ‘dawn’</td>
<td>four morae (a-ke-ga-ta)</td>
<td>four syllables (a-ke-ga-ta)</td>
</tr>
</tbody>
</table>

Table 3.2. Mora and syllable comparison

<table>
<thead>
<tr>
<th></th>
<th>Place</th>
<th>NP-nom</th>
<th>Time</th>
<th>Manner</th>
<th>NP-acc</th>
<th>V</th>
<th>SentFinal</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mora</td>
<td>5.3</td>
<td>6.4</td>
<td>4.6</td>
<td>4.4</td>
<td>4.7</td>
<td>4.6</td>
<td>6.2</td>
<td>5.16</td>
</tr>
<tr>
<td>Syllable</td>
<td>4.1</td>
<td>5</td>
<td>3.7</td>
<td>3.7</td>
<td>3.6</td>
<td>3.8</td>
<td>4.8</td>
<td>4.1</td>
</tr>
</tbody>
</table>

Table 3.3. Mean number of phonological units in each word category

In order to examine which phonological unit the learners employed, we used each subject’s mean RTs per mora and mean RTs per syllable and looked at how many exceeded two SD (SD x 2). As a result, we found that more RTs fell outside the range of “SDx2” when they were calculated based on syllables (512 words: 258 for native speakers and 254 for non-native speakers) than when calculated based on morae (416 words: 210 for native speakers and 206 for non-native speakers). We took this as an
indication that the test sentences were more likely to be processed based on morae than on syllables.

Suppose that a learner read the words sensyuu ‘last week’ and akegata ‘dawn,’ with mora as the basic phonological unit, and that he or she spent 400ms to read each word, as illustrated in (I) in Figure 3.2 below. As both words consist of four morae (Table 3.2), the mean RT/mora for each word is 100ms ((Ia) and (Ib) in Figure 3.2), which coincides with the mean RT/mora for the two words together ((Ic) in Figure 3.2).

| (I) If a learner read the words using mora as a basic unit and spent 400ms to read each word: |
|----------------------------------|----------------------------------|----------------------------------|
| [se / n / syu / u] RT: 400ms     | [a / ke / ga / ta] RT: 400ms     | (Ic): Mean RT/mora for the two words: 100ms |
| (Ia): Mean RT/more for sensyuu: 100ms | (Ib): Mean RT/more for akegata: 100ms | |
| (Id): (Ia) – (Ic) = 0ms           | (Ie): (Ib) – (Ic) = 0ms           | |

| (II) If the RTs in (I) are calculated by syllables instead of morae: |
|----------------------------------|----------------------------------|----------------------------------|
| [sen / syuu] RT: 400ms           | [a / ke / ga / ta] RT: 400ms     | (Iie): Mean RT/syl for the two words: 122ms |
| (IIa): Mean RT/syl for sensyuu: 200ms | (IIb): Mean RT/syl for akegata: 100ms |
| (IIId): (IIa) – (Iic) = 78ms     | (IIe): (IIb) – (Iic) = ▲22ms     | |

Figure 3.2. Basic phonological unit and RT calculation mismatch (I)
However, if the same calculation were done using a syllable as a basic unit, instead of mora, as illustrated in (II) in Figure 3.2, the mean RT/syllable for each word ((IIa) and (IIb)) and the mean RT/syllable for the words together (IIc) would no longer coincide with each other. First, the mean RT/syllable for the two words together increases to approximately 122ms (IIc) because the total number of syllables for the two words becomes six instead of eight ((400ms+400ms)/6 syllables=122.22). The RT/syllable spent to read sensyuu also increases to 200ms (IIa) since the word has only two syllables. As a result, the RT/syllable (200ms) for sensyuu exceeds the mean RT per syllable (122ms) for the words together by 78ms (IId). Recall that these two were the same when the calculation was done based on morae (IId). Consequently, if learners use mora as a basic phonological unit, more RTs exceeding the mean RTs for the words together will be found when calculated based on syllables than when calculated based on morae. This happens for a word such as sensyuu having the number of morae larger than the number of syllables.
In contrast, if learners use syllables instead of mora as the basic phonological unit, more RTs exceeding the mean RTs will then be found when calculated based on morae (IIe), than when calculated based on syllables as shown in Figure 3.3. This happens for a word such as *akegata*, whose number of syllables and number of morae are identical.

| (I) If a learner read the words using syllable as a basic unit to read each word: |
|-----------------|-----------------|-----------------|-----------------|
| [sen / syuu] | RT: 200ms | [a / ke / ga / ta] | RT: 400ms | (Ic): Mean RT/syl for the two words: 100ms |
| (la): Mean RT/syl for *sensyuu*: 100ms | (lb): Mean RT/syl for *akegata*: 100ms | (le): (lb) – (lc) = 0ms |
| (ld): (la) – (lc) = 0ms | |

| (II) If the RTs in (I) are calculated by morae (instead of syllables): |
|-----------------|-----------------|-----------------|-----------------|
| [se / n / syu / u] | RT: 200ms | [a / ke / ga / ta] | RT: 400ms | (lIc): Mean RT/mora for the two words: 75ms |
| (IIa): Mean RT/mora for *sensyuu*: 50ms | (IIb): Mean RT/mora for *akegata*: 100ms | (IIe): (IIb) – (IIc) = 25ms |
| (IId): (IIa) – (IIc) = ▲ 25ms | |

Figure 3.3. Basic phonological unit and RT calculation mismatch (2)
Due to the reason mentioned above, we looked at the percentages for the excess of the “mean RTs + (SDx2)” calculated based on syllables and also the percentages for the excess of the “mean RTs + (SDx2)” calculated based on morae. If morae are used as the phonological unit, we should expect to find more excess RTs when looking at the calculation based on syllables than the calculation based on morae. Table 3.4 below shows that this is the case. Table 3.4 compares the percentages of the excess based on morae and syllables by groups and word categories. Looking at the JPN group, we can observe more RT excess throughout the sentence when the RT is calculated based on syllables than when calculated based on morae.

<table>
<thead>
<tr>
<th></th>
<th>Place</th>
<th>NP-nom</th>
<th>Time</th>
<th>Manner</th>
<th>NP-acc</th>
<th>V</th>
<th>SentFinal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Syl</td>
<td>Mor</td>
<td>Syl</td>
<td>Mor</td>
<td>Syl</td>
<td>Mor</td>
<td>Syl</td>
</tr>
<tr>
<td>JPN</td>
<td>2.70</td>
<td>2.10</td>
<td>2.80</td>
<td>2.10</td>
<td>10.50</td>
<td>7.17</td>
<td>9.50</td>
</tr>
<tr>
<td>JSL</td>
<td>5.00</td>
<td>3.08</td>
<td>4.62</td>
<td>4.04</td>
<td>5.45</td>
<td>3.53</td>
<td>0.96</td>
</tr>
<tr>
<td>JFL3</td>
<td>8.67</td>
<td>6.00</td>
<td>4.33</td>
<td>2.33</td>
<td>7.78</td>
<td>5.56</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Table 3.4. Comparisons of percentages of RTs that exceed SDx2
*The “Syl” columns indicate the percentages of the RTs that exceed the “mean RTs + (SDx2)” calculated based on syllables. The “Mor” columns indicate the percentages of the RTs that exceed the “mean RTs + (SDx2)” calculated based on morae.
*The underlined figures indicate more excess RTs than when calculated based on the other way.
This suggests that JPN subjects generally read the sentences using morae as the basic phonological unit, which is congruous with the vast majority of previous studies that claim Japanese is a mora-based language. Now, comparing the three learner groups with the JPN group in the table, the learner groups also show a very similar distribution pattern of the excess of RTs with the JPN group. While only one or two regions had more RT excess in terms of morae, as many as four to five regions were found to have more RT excess in terms of syllables.

Based on these observations, we concluded that both JFL and JSL subjects demonstrated a strong tendency to read Japanese words using a basic phonological unit like native speakers of Japanese. Consequently, morae were used when calculating the RRTs of JSL and JFL groups as well as the RRTs of JPN group, as shown in (21) above.\textsuperscript{36}

\textbf{3.2.2. Control Group}

Figure 3.4 and Table 3.5 show the average RRTs of each condition and region for the 50 JPN subjects.

\textsuperscript{36} It should be noted that this conclusion is applicable to our subjects, but the same conclusion may not be true for other subject groups such as those with a lower proficiency level.
Figure 3.4.  RRTs for 50 JPN subjects

<table>
<thead>
<tr>
<th>Sent. Type</th>
<th>Place</th>
<th>NP-nom</th>
<th>Time/NP-acc</th>
<th>Mann/NP-acc</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Int1</td>
<td>-68.40</td>
<td>287.49</td>
<td>-36.39</td>
<td>295.14</td>
<td></td>
</tr>
<tr>
<td>Int2</td>
<td>-64.59</td>
<td>260.17</td>
<td>30.34</td>
<td>336.10</td>
<td>122.33</td>
</tr>
<tr>
<td>Int3</td>
<td>-48.60</td>
<td>283.47</td>
<td>5.68</td>
<td>354.36</td>
<td>56.06</td>
</tr>
<tr>
<td>Tran2</td>
<td>-58.83</td>
<td>274.41</td>
<td>2.98</td>
<td>350.45</td>
<td>37.60</td>
</tr>
<tr>
<td>Tran3</td>
<td>-19.63</td>
<td>293.49</td>
<td>21.01</td>
<td>357.18</td>
<td>85.74</td>
</tr>
</tbody>
</table>

Table 3.5.  Mean RRTs and SDs for 50 JPN subjects

JPN subjects started with a moderate rise of RRTs as soon as they began to read the sentence.  They had their first peak at the third region.  The RRTs then showed a
moderate drop until the verb region. This drop was generally true regardless of sentence types except for the Int1 type, whose RRTs continued to increase until the end of the sentence. All the mean RRTs appeared within the range of approximately 200ms (max: +122ms, min: -68ms) and a mean of SD across all the regions was 287.

A statistical tool analysis of variance (ANOVA) was employed with a sentence type as an independent variable and RRTs as a dependent variable. The analysis was made for the time adverb/NP-acc region, the manner adverb/NP-acc region, and the verb region. Among the 20 test sentences that each subject read, the numbers of the sentences to compare in each region were as follows: 12 sentences for the time adverb, 4 sentences for the manner adverb, 4 sentences for the NP-acc for each of the third and fourth regions, and 20 sentences for the verb.

At the time adverb/NP-acc region, the difference was significant by subject but marginal by item (F1(3,49)=3.189, p<.026; F2(3,19)=2.39, p<.078). Post-hoc Tukey’s analyses revealed that this difference was because an NP-acc in Tran2 type was

---

37 All statistical analyses were performed using statistical software, Statistical Package for Social Science (SPSS), v. 11.0 for Mac. The significant level was set at .05 throughout the statistical analyses in this dissertation.
read faster than a time adverb in Int2 type.\textsuperscript{38} When compared between arguments and adjucts at this region, significant differences emerged by subject (F1(1,49)= 5.049, p< .029; F2(1,19)= 2.101, p< .164). At the manner adverb/NP-acc region, a manner adverb (Int3 type) was numerically read faster than an NP-acc (Tran3 type), but it was not significant (F1(1,49)=2.769, p< .102; F2(1,19)= .713, p< .404) and this was the same at the verb region (F1(4,49)= 1.65, p< .163; F2(4,19)= 1.123, p< .35).

The statistical differences found among the control group are small, and this is possibly because the test sentences were too easy for the native speakers to demonstrate any consisting processing differences, which could have allowed them to demonstrate individual differences even after the data had been adjusted using RRTs. Moreover, it has been reported that sentence processing data such as reading times can be susceptible to individual differences and minimizing such differences can be useful to make the

\textsuperscript{38} Time adverbs included 13 adverbs that could have been interpreted as noun arguments without a Case marker such as kinoo ‘yesterday’ and kono natu ‘this summer’ while the remaining 7, such as itumo ‘always’ and moo sugu ‘soon,’ were consistently interpreted as adverbs. (Arguments appear with no overt Case marker, typically in speech.) Thus, the former adverbs might have been processed differently from the latter due to the possibility of this lexical ambiguity. When the RRTs of both adverbial groups were compared, no significant difference was found (t(590)=3.327, p< .158). Moreover, among those time adverbs, two had a postposition (i.e., ni ‘on’ in getuyoobi ni ‘on Monday’ and made ‘until’ in sakki made ‘until just before’). If the learners would have considered postpositions and Case markers had been alike, i.e., particles, then these could have been processed differently from the rest due to the presence of the postpositions. However, again, the \(t\)-test yielded no significant differences (t(590)= 9.009, p< .924). Consequently, we consider these particular items would not have affected our data, and we keep the current data set for further analyses.
data clearer (e.g., Just and Carpenter, 1992; MacDonald, Pearlman, and Seidenberg, 1994). As a result, we further looked at the reading pattern for each of the 50 subjects and reduced them into 30 subjects whose reading patterns were considered similar to each other. The results are shown in Figure 3.5 and Table 3.6.

ANOVA revealed further reliable differences (but marginal by item) at the manner adverb/NP-acc region (F1(1,29)= 8.836, p< .006; F2(1,19)= 1.270, p< .07); i.e., a manner adverb was read faster than an NP-acc. There were also marginal differences only by subject at the verb region (F1(4,29)= 2.166, p< .077; F2(4,19)= 1.127, p< .287).

![RRTs for 30 JPN Subjects](image)

Figure 3.5. RRTs for 30 JPN subjects
Table 3.6. Mean RRTs and SDs for 30 JPN subjects

Post-hoc Tukey’s tests indicate this is because an intransitive verb preceded by three phrases (Int3 type) was read faster than an intransitive verb preceded by only one phrase (Int1 type). It seems that an intransitive verb is processed more slowly when it was preceded by a lesser number of phrases. We will return to this issue later in the discussion section with the claim that this may be due to the order of word appearance.

In addition to comparing the RRTs of the five test sentences in the same figure, test sentences were also looked at by their verb types: sentences with an intransitive verb and sentences with a transitive verb. Figure 3.6 illustrates the RRTs for intransitive type sentences, and Figure 3.7 for transitive type sentences.
Figure 3.6. RRTs for Int types (JPN group with 30 subjects)

Figure 3.7. RRTs for Tran types (JPN group with 30 subjects)
In both figures, regions are categorized based on the same syntactic category, rather than as shown in (20) and (21) earlier. This way enables us to compare the RRTs of the same syntactic class (especially between NP-acc regions, between intransitive verb regions, and between transitive verb regions become possible), which was not possible in Figure 3.5 above.

Figures 3.6 and 3.7 show that overall reading patterns remain consistent regardless of the verb type: e.g., the peak appears at the third phrase and the RRTs keep dropping toward the end of the sentence. The RRTs for accusative NPs, intransitive verbs, and transitive verbs were separately entered into ANOVA. Marginal differences were found among intransitive verbs (F1(2,29)= 3.067, p< .054; F2(2,19)= 3.067, p< .057), due to Int1 type being read faster than Int3, but no other differences were observed either for NP-acc region (F1(1,29)= .324, p< .573; F2(1,19)= .037, p< .849) or for transitive verb (F1(1,29)= 1.163, p< .290; F2(1,19)= .743, p< .393).
3.2.3. JSL Group

The 26 JSL subjects with the highest proficiency level showed somewhat different reading patterns from those of the control group. Figure 3.8 and Table 3.7 demonstrate their patterns. JSL demonstrated an increase of RRTs twice in a sentence. The first peak was observed in the NP-nom position, which was one region earlier than where it was observed with JPN. The second peak was found at the verb region, at which the JPN group showed a decrease of RRTs.

Figure 3.8. RRTs for JSL group
Table 3.7. Mean RRTs and SDs for JSL subjects

The range of mean RRTs across the regions was about 350ms (max: 190ms, min: 153ms) with 666 of mean SD for all regions, which is larger than that of the JPN group (range: 200ms and mean SD: 287).

The third region (time adverb/NP-acc) showed a tendency in which an NP-acc was read faster than a time adverb, but no significant differences were found (F1(3,25) = .312, p < .675; F2(3,19) = .158, p < .924). Marginal differences were observed at the fourth region (manner adverb/NP-acc) only by subject (F1(1,25) = 3.158, p < .087; F2(1,19) = 1.872, p < .179). No statistically significant differences were found at the verb region (F1(4,25) = 1.109, p < .357; F2(4,19) = .563, p < .690).
Figures 3.9 and 3.10 below illustrate the RRTs of the sentences with an intransitive verb and the sentences with a transitive verb, respectively. In each figure, regions are grouped based on the same syntactic category, so that comparisons between NP-acc and between each type of verb become possible. The two figures show that the overall reading patterns are similar regardless of the verb type; i.e., the first peak appears at the NP-nom region and the second peak at the verb region.

Figure 3.9. RRTs for Int types (JSL group)
Figure 3.10. RRTs for Tran types (JSL group)

ANOVA was performed for the NP-acc region, intransitive verb region, and transitive verb region. However, no significant differences were found at any of the regions: (F1(1,25)= .002, p< .961; F2(1,198)= .112, p< .742) for the NP-acc;

(F1(1,25)= .894, p< .415; F2(2,19)= 2.291, p< .115) for the intransitive verb;

(F1(1,25)= .920, p< .347; F2(1,19)= .715, p< .408) for the transitive verb.
3.2.4. JFL1 Group

JFL1 is the group with the lowest proficiency level. Their RRTs are shown in Figure 3.11 and Table 3.8, and the reading patterns are not consistent across sentence types. A closer look at Figure 3.11 indicates that the inconsistency seems largely attributed to the RRT variation at the second region (NP-nom).

This variation at the second region could stem from the fact that it was always a family name.

Figure 3.11. RRTs for JFL1 group
Table 3.8. Mean RRTs and SDs for JFL1 subjects

<table>
<thead>
<tr>
<th>Sent. Type</th>
<th>Place Mean</th>
<th>Place SD</th>
<th>NP-nom Mean</th>
<th>NP-nom SD</th>
<th>Time/NP-acc Mean</th>
<th>Time/NP-acc SD</th>
<th>Mann/NP-acc Mean</th>
<th>Mann/NP-acc SD</th>
<th>V Mean</th>
<th>V SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Int1</td>
<td>400.87</td>
<td>1810.1</td>
<td>112.37</td>
<td>1646.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>424.4</td>
<td>1438.3</td>
</tr>
<tr>
<td>Int2</td>
<td>112.55</td>
<td>1391.9</td>
<td>351.35</td>
<td>1965.7</td>
<td>25.57</td>
<td>1105.3</td>
<td></td>
<td></td>
<td>237.9</td>
<td>1165.9</td>
</tr>
<tr>
<td>Int3</td>
<td>200.70</td>
<td>1574.3</td>
<td>-69.38</td>
<td>1468.1</td>
<td>407.30</td>
<td>1128.2</td>
<td>-328.9</td>
<td>815.1</td>
<td>293.1</td>
<td>1591.3</td>
</tr>
<tr>
<td>Tran2</td>
<td>246.84</td>
<td>1631.4</td>
<td>-106.0</td>
<td>1337.4</td>
<td>195.60</td>
<td>1257.2</td>
<td></td>
<td></td>
<td>258.7</td>
<td>1237.2</td>
</tr>
<tr>
<td>Tran3</td>
<td>2.09</td>
<td>1211.3</td>
<td>96.29</td>
<td>1640.6</td>
<td>264.13</td>
<td>1128.1</td>
<td>69.3</td>
<td>1250.6</td>
<td>-61.1</td>
<td>1065.2</td>
</tr>
</tbody>
</table>

It is possible that learners felt recognizing some family names more difficult than recognizing others because some names were written in kanji and hiragana mixed (e.g., 中むら “Nakamura”, in which 中 “naka” is written in kanji and むら “mura” is written in hiragana) and others were foreign names written in katakana (e.g., ブラウン “Brown,” and ミラー “Miller”). Family names written in mixed kanji and hiragana may have caused decoding difficulties due to the unauthentic way of presentation, and foreign names may also have caused decoding difficulties due to the katakana script which is less frequently used in daily life and classrooms than hiragana and kanji are.
The RRTs of the 20 names were entered into ANOVA to see if any specific family name caused the unnatural deviation. Table 3.9 shows mean RRTs of each family name. A significant difference was found among the 20 names (F = 6.466, p = .00).

<table>
<thead>
<tr>
<th>Item No</th>
<th>Family Name</th>
<th>Mean RRTs</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nakamura （中村）</td>
<td>2307.50</td>
<td>2437.35</td>
</tr>
<tr>
<td>2</td>
<td>Nishida （西田）</td>
<td>443.52</td>
<td>771.72</td>
</tr>
<tr>
<td>3</td>
<td>Takano （高野）</td>
<td>-26.70</td>
<td>667.43</td>
</tr>
<tr>
<td>4</td>
<td>Sumisu (Smith) （スミス）</td>
<td>-1160.82</td>
<td>839.44</td>
</tr>
<tr>
<td>5</td>
<td>Miraa (Miller) （ミラー）</td>
<td>-163.56</td>
<td>907.11</td>
</tr>
<tr>
<td>6</td>
<td>Kitamura （北村）</td>
<td>358.48</td>
<td>1457.38</td>
</tr>
<tr>
<td>7</td>
<td>Harisu (Harris) （ハリス）</td>
<td>2104.28</td>
<td>1566.56</td>
</tr>
<tr>
<td>8</td>
<td>Nakata （中田）</td>
<td>-248.69</td>
<td>1041.15</td>
</tr>
<tr>
<td>9</td>
<td>Beka (Baker) （ベーカー）</td>
<td>904.88</td>
<td>1857.99</td>
</tr>
<tr>
<td>10</td>
<td>Lii (Lee) （リー）</td>
<td>-495.67</td>
<td>596.67</td>
</tr>
<tr>
<td>11</td>
<td>Yamaguchi （山口）</td>
<td>-1163.79</td>
<td>799.15</td>
</tr>
<tr>
<td>12</td>
<td>Kimura （木村）</td>
<td>571.29</td>
<td>1107.75</td>
</tr>
<tr>
<td>13</td>
<td>Noguchi （野口）</td>
<td>-664.96</td>
<td>803.99</td>
</tr>
<tr>
<td>14</td>
<td>Tanaka （田中）</td>
<td>22.37</td>
<td>1734.40</td>
</tr>
<tr>
<td>15</td>
<td>Morimoto （もりもと）</td>
<td>250.06</td>
<td>1884.09</td>
</tr>
<tr>
<td>16</td>
<td>Hashimoto （橋本）</td>
<td>522.88</td>
<td>1840.43</td>
</tr>
<tr>
<td>17</td>
<td>Yamada （山田）</td>
<td>-543.46</td>
<td>1401.46</td>
</tr>
<tr>
<td>18</td>
<td>Yamamato （山本）</td>
<td>-1009.46</td>
<td>1064.63</td>
</tr>
<tr>
<td>19</td>
<td>Buraun (Brown) （ブラウン）</td>
<td>-38.03</td>
<td>1785.38</td>
</tr>
<tr>
<td>20</td>
<td>Hayashi （林）</td>
<td>-588.15</td>
<td>1539.80</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>78.98</td>
<td>1624.60</td>
</tr>
</tbody>
</table>

Table 3.9. Mean RRTs of family names
Post-hoc Tukey’s tests and homogeneous subsets showed that two family names, 

*Nakamura* (item number 1) and *Harisu* “Harris” (item number 7), were read especially slowly. The RRTs of *Nakamura* were found significantly different from the RRTs of 15 other names and the RRTs of *Harisu* from 13 other names.\(^{39}\) In order to make the later analyses easier, we decided to adjust this RRT deviation by replacing these two RRTs with the average RRTs of the remaining 18 family names. The adjusted RRTs are shown in Figure 3.12 below.

Reading patterns presented in Figure 3.12 differ from those of the JPN and JSL groups discussed earlier. JFL1 repeated a robust rise and drop of RRTs, starting with high RRTs at the beginning of the sentence. They tended to have RRT peaks at the sentence initial position, the time adverb/NP-acc position, and the verb position. The range of mean RRTs across the regions was approximately 750ms (max: 424, min: -329ms) with 1237 of mean SD for all regions, which is much larger than JPN (range: 200ms and mean SD: 287) and JSL (range: 350ms and mean SD: 666).

---

\(^{39}\) We also performed the same test against the other subject groups, but JFL1 was the only group that yielded such strong differences as observed in *Nakamura* and *Harisu*. 
Figure 3.12. Adjusted RRTs for JFL1 group

There was the tendency of a manner adverb being read faster than an NP-acc at the fourth region, but with a marginal difference only by item (F1(1,14)= 2.636, p< .127; F2(1,19)= 4.241, p< .053). No differences were observed for the time adverb/NP-acc region (F1(3,14)= 1.037, p< .386; F2(3,19)= .896, p< .448) and the verb region (F1(4,14)= .714, p< .586; F2(1,19)= .847, p< .499).

Figures 3.13 and 3.14 illustrate the RRTs for intransitive type sentences and transitive type sentences, respectively.
Figure 3.13. RRTs for Int types (JFL1 group)

Figure 3.14. RRTs for Tran types (JFL1 group)
Unlike the JPN and JSL groups, the overall reading patterns in the two figures do not completely mirror each other. The way the RRTs unfold for intransitive sentences is reminiscent of a zigzag line.

ANOVA revealed no significant differences for NP-acc (F1(1,14)= .400, p< . 537; F2(1, 19)= .006, p< .940), intransitive verb (2, 14)= .264, p< .770; F2(2,19)= .422, p< .659), and transitive verb (F1(1,14)= 1.386, p< .259; F2(1,19)= 1.947, p< .178).

3.2.5. JFL2 Group

JFL2 is the group whose proficiency level lies between the JFL1 and JSL groups. JFL2 shares similar reading patterns with the JFL1 group (Figure 3.15 and Table 3.10). The group tended to repeat an RRT drop and a rise, with RRT peaks at the sentence initial region, the time adverb/NP-acc region, and the verb region. However, JFL2 differs from JFL1 in that the range of the mean RRTs among JFL2 was about 500ms (max: 296ms, min: -212ms) and mean SD for all regions was 790, which is much smaller than JFL1 (range: 750ms and mean SD: 1237).
Figure 3.15. RRTs for JFL2 group

Table 3.10. Mean RRTs and SDs for JFL2 subjects
 Compared to the other groups, the range of mean RRTs of JFL2 is larger than that of JSL (range: 350ms and mean SD: 666) and JPN (range: 200ms and mean SD: 287). In other words, the RRT range becomes larger in the following order: JPN < JSL < JFL2 < JFL1, which coincides with the order of proficiency level.

ANOVA revealed no reliable differences for any regions: the time adverb/NP-acc region (F1(3,8)= 1.914, p< .154; F2(3,19)= .985, p< .404); the manner adverb/NP-acc region (F1(1,8)= .235, p< .641; F2(1,19)= .158, p< .693); and the verb region (4,8)= 1.321, p< .283; F2(4,19)= 1.278, p< .283). The lack of significant processing differences could be due to the small number of subjects (nine subjects).

The RRTs for intransitive type sentences are shown in Figure 3.16, and the RRTs for transitive type sentences are shown in Figure 3.17. ANOVA indicated marginal differences for the transitive verb by subject (F1(1,8)= 5.280, p< .051; F2(1,19)= 1.889, p< .184), but no other differences were found for the intransitive verb (F1(2,8)= 1.044, p< .375; F2(2,19)= 1.458, p< .244) and NP-acc (F1(1,8)= 1.672, p< .232; F2(1,19)= .632, p< .436).
Figure 3.16. RRTs for Int types (JFL2 group)

Figure 3.17. RRTs for Tran types (JFL2 group)
As can be seen from Figures 3.16 and 3.17, overall reading patterns do not overlap between the two figures. While intransitive sentences tend to demonstrate a zigzag line (Figure 3.16), such generalization is not possible for sentences with a transitive verb (Figure 3.17). Discrepancies between the two verb type sentences were also observed among JFL1 learners. For example, the fact that marginal difference was found between the two transitive verbs suggests that the grammatical function of the word does not play as crucial a role in explaining JFL2 learner RRTs as it does to the other groups.

A closer look at Figures 3.16 and 3.17 allows us to speculate that JFL2 learners are in fact more affected by the order in which the words were read rather than the grammatical function of the phrase. This possibility becomes clear if we align the regions of the sentences in terms of the presentation order, which is shown in Figures 3.18 and 3.19.
Figure 3.18. RRTs for Int types by the order of appearance (JFL2 group)

Figure 3.19. RRTs for Tran types by the order of appearance (JFL2 Group)
These two figures now look much more alike than Figures 3.16 and 3.17 did.

Therefore, JFL2 subjects may have processed sentences in a manner different from the other groups. This processing will be discussed again in the following section.

3.3. Discussion

In this section, the findings shown above will be discussed. We will return to the research questions raised at the beginning of this chapter. The research questions are restated as (23) below. In order to examine what kinds of processing strategies learners of Japanese employ, Experiment 1 focused on Questions A and B.

(23) Research question: What kinds of processing strategies do learners of Japanese employ while reading Japanese sentences?

A. Do English-speaking learners of Japanese treat arguments (i.e., accusative NPs) and adjuncts (i.e., adverbs) differently while reading simplex sentences?
B. What are the general reading patterns by English-speaking learners of Japanese?

First, we will discuss how preverbal arguments and adjuncts were processed among the control group, followed by the learner groups. Next, we will show how different reading patterns of learner groups were observed in comparison with native speakers for three factors: (i) how a particular syntactic phrase is processed; (ii) where RRT peaks appear in a sentence; (iii) how a proficiency level influences processing patterns.

3.3.1. Processing Arguments vs. Adjuncts

One of the aims of the current experiment was to see if the L2 parser processes preverbal arguments and adjuncts differently in a simplex sentence. The assumption was that if the two are treated differently on-line, preverbal arguments would be processed faster from preverbal adjuncts since arguments can provide more information in predicting what kind of predicate will follow, based on the previous findings discussed in the beginning of this chapter.
3.3.1.1. Control Group

As was predicted, the control group showed some evidence of processing arguments (NP-acc) differently from adjuncts (time/manner adverbs) while reading. However, what went against our prediction was that arguments were not consistently read faster than adjuncts. NP-acc was read faster than time adverbs in the third region (time adverb/NP-acc), but on the contrary, the same NP-acc was then read slower than manner adverbs in the fourth region (manner adverb/NP-acc). Note that while NP-acc was faster than time adverbs at the third region and slower than manner adverbs at the fourth region, NP-acc at the third region and NP-acc at the fourth region themselves did not significantly differ from each other (see Figure 3.7). In other words, manner adverbs were processed the fastest and time adverbs the slowest, while arguments fell in the middle of the two. It appears that manner adverbs were more easily processed than time adverbs.

This finding may suggest that in making efficient use of preverbal information, the L1 Japanese parser may do more than simply differentiating arguments; i.e., manner
and time adverbs may also need to be processed differently. The question of why these
two types of adverbs showed processing differences instead of behaving the same has at
least two possible explanations. The first explanation is that manner adverbs were able
to provide more information than time adverbs in order for the parser to reduce possible
upcoming words. In the test sentences, time adverbs in the test sentences were such as
kinoo ‘yesterday,’ mainiti ‘every day,’ itumo ‘always,’ and sensyuu ‘last week.’ These
adverbs modify a whole clause (sentence modifier) and do not necessarily pick up a
particular lexical item that neither structurally nor semantically associates with the
adverbs in question. In comparison, manner adverbs were such as totemo ‘very,’
yukkuri ‘slowly,’ tyotto ‘a little,’ and sukkari ‘completely,’ which modify a verb phrase
(VP modifier). Processing a VP modifier allows the parser to know the sentence has
already reached a verb phrase and anticipate that a verb will soon appear and also that
parts of a clause being read will end. Such manner adverbs, together with the
preceding words, may tend to semantically pick up a certain group of predicates
describing some event such as walk or forget (e.g., ‘At the park, Mr. Tanaka slowly
walked’ and ‘At the library, Ms. Suzuki completely forgot something’) and some other predicates compatible with an adverb showing a degree such as surprise (e.g., ‘At the school, Mr. Brown was very surprised,’ and ‘At the department, Ms. Lee was a little confused.’). Therefore, processing may become easier when reading manner adverbs as compared with reading time adverbs because manner adverbs help the parser to reduce the possible following items. Consequently, reading manner adverbs result in faster RRTs. This claim differs from our prediction because we originally assumed all adjuncts would behave the same.

However, this difference does not necessarily constitute counter-evidence to our original assumption because both (i.e., distinction between arguments and adjuncts and distinction between manner adverbs and time adverbs) do not differ in the view that L1 parser of Japanese utilizes preverbal information including Case markers to interpret sentence structure and meaning before reaching a verb.

---

This discussion may make one wonder if the same results are found in English sentence processing (i.e., verb modifiers are read faster than sentential modifiers in English). However, previous studies do not seem to indicate such results (Ahrens, 2003; p.c. Shari Speer). The current finding may be a phenomenon specific to Japanese, which has an SOV word order with overt Case marking system. This is an empirical question, and in this dissertation, we leave this question for future research.
Another possible explanation is that the RRT differences observed between time
adverbs and manner adverbs are simply caused by the order in which they were read in
a sentence. As was seen earlier in Figure 3.5, native speakers demonstrated a
consistent reading pattern that RRTs kept increasing for the first three phrases and then
dropped at the following region, and such a reading pattern was shared across test
conditions. Looking at the time adverb and manner adverb in the test sentences, the
time adverb always appeared at the third region, and the manner adverb the fourth. As
a result, we can speculate that the time adverb had slower RRTs because it was
presented at the third region, which coincides with the position of the RRT peak. If the
manner adverb had appeared at the third region instead of the fourth region, it might
have taken as many RRTs as the time adverb did. The RRT differences between time
adverbs and manner adverbs may stem from the order that they appeared in a sentence.

This claim also explains another discrepancy of RRTs found at the intransitive
verb position. Earlier, we pointed out that intransitive verbs were processed most
slowly when they were preceded by the least number of phrases (Int1).
<table>
<thead>
<tr>
<th></th>
<th>Pre-verb Region</th>
<th>Verb Region</th>
<th>RRT Difference (V − preV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Int1 Type</td>
<td>-46.75 (2)</td>
<td>38.38 (3)</td>
<td>85.14</td>
</tr>
<tr>
<td>Int2 Type</td>
<td>131.72 (3)</td>
<td>7.36 (4)</td>
<td>-124.36</td>
</tr>
<tr>
<td>Int3 Type</td>
<td>-13.89 (4)</td>
<td>-34.27 (5)</td>
<td>-20.39</td>
</tr>
<tr>
<td>Tran2 Type</td>
<td>51.80 (3)</td>
<td>-24.21 (4)</td>
<td>-76.00</td>
</tr>
<tr>
<td>Tran3 Type</td>
<td>32.92 (4)</td>
<td>3.08 (5)</td>
<td>-29.83</td>
</tr>
</tbody>
</table>

Table 3.11. Mean RRT differences between verb and pre-verb regions (30 JPN subjects)

* A number in parentheses indicates the order of the appearance in a sentence.

Table 3.11 shows this RRT difference. Table 3.11 provides the mean RRT differences between the verb region and the region immediately prior to the verb. Figures in “pre-verb region” column are the mean RRTs of the region immediately before the verb. Figures in “verb region” column are the mean RRTs at the verb region. Figures in the last column were calculated by subtracting the RRTs in “pre-verb region” from the RRTs in “verb region.” A positive figure in the last column indicates a rise of RRTs and a negative figure a drop of RRTs from the previous region. While most RRTs make a drop towards the verb region, only Int1 type exhibits an increase of RRTs.

ANOVA revealed reliable differences for the RRT differences among sentence types.
(F1(4,29)= 0.531, p= .000; F2(4,19)= 8.603, p= .000). Post-hoc Tukey’s tests showed the difference in Int1 was larger than any other types. This clear difference between Int1 sentence and the other sentence types can stem from the order the verb was read in a sentence. Because the intransitive verb appeared immediately following a subject, Int1 is the only sentence type that has its verb region appearing at the third phrase (i.e., the position of the RRT peak). Therefore, it can be that although a verb at the end of the clause is usually read faster, an exception to this tendency occurs when the verb appears at the RRT peak position.

We have shown two possible explanations for RRT differences between time adverbs and manner adverbs among the control group. One explanation stems from the syntactic/semantic differences between the two adverb types, and the other from the order of appearance in a sentence. However, we believe that the two possibilities are not exclusive to each other. For example, if the order of appearance is the only reason for the observed effect, we still need some explanation as to why manner adverbs in Int3 type and accusative NP in Tran3 type were read with different RRTs (cf. Figure 3.5).
Both phrases appeared at the fourth region. Moreover, we also need some explanation as to why accusative NPs in Tran2 type (third region) and accusative NPs in Tran3 type (fourth region) demonstrated the same range of RRTs. If the order of appearance affects the RRTs, the accusative NPs appearing in the third region should yield longer RRTs than the one appearing in the fourth region because the third region coincides the RRT peak in the sentence, but this did not happen. Thus, the order of appearance should not be the only reason for the observed RRT differences between time adverbs and manner adverbs. Rather, both factors (i.e., the syntactic/semantic differences between the two adverb types and the order of appearance in a sentence) seem to play a role in the RRT differences.

3.3.1.2. Learner Groups

As was seen above, the control group demonstrated some evidence for processing arguments and adjuncts differently, when looked at the time adverb/NP-acc region and the manner adverb/NP-acc region. When learners’ groups are compared, their reading patterns are not exactly the same as those of native speakers.
First, the JSL group demonstrated weak processing differences for arguments and 
adjuncts at the time adverb/NP-acc region (numerically different) and at the manner 
adverb/NP-acc region (marginally significant). Although JSL failed to demonstrate 
statistically significant differences, the way they read NP-acc, time adverb, and manner 
adverb paralleled that of the control group. That is, among the three, they read manner 
adverbs the fastest and time adverbs the slowest, which suggests that as was the case 
among the JPN subjects, they were also sensitive to information provided by manner 
adverbs on one hand and by time adverbs on the other.

JFL1 and JFL2 failed to show statistically significant processing differences at 
both regions. However, as long as numerical differences are concerned, they 
paralleled the control group in terms of manner adverbs being read the fastest and time 
adverbs being read the slowest. These results are summarized in Table 3.12.
<table>
<thead>
<tr>
<th>Group</th>
<th>Time-adv/NP-acc Region</th>
<th>Manner-adv/NP-acc Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPN</td>
<td>p &lt; .05</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>JSL</td>
<td>n.s.*</td>
<td>p &lt; .1</td>
</tr>
<tr>
<td>JFL2</td>
<td>n.s.*</td>
<td>n.s.</td>
</tr>
<tr>
<td>JFL1</td>
<td>n.s.</td>
<td>n.s.*</td>
</tr>
</tbody>
</table>

Table 3.12. Summary of statistical comparisons between arguments and adjuncts
1. p < .05 indicates the comparison was significant.
2. p < .1 indicates the comparison was marginally significant.
3. n.s.* indicates that the comparison was statistically not significant (n.s.), but the mean RRTs at least showed some tendency for the difference.

To summarize, learners did not demonstrate clear evidence for differentiation of arguments and adjuncts while reading as native speakers did. However, the differences between native speakers and learners become smaller as a learner’s proficiency level turns higher. The reading patterns of JFL learners (JFL1 and JFL2) share fewer commonalities with those of JPN, compared to the reading patterns of JSL learners (a higher proficiency group), which have more commonality with those of JPN group, though the differences are not robust. Although processing of arguments and adjuncts was found to be different between native speakers and learners, the processing appears to gradually become native-like as learner proficiency levels improve.

98
3.3.2. General Reading Patterns by English-Speaking Learners

In addition to arguments/adjuncts differentiation, the other aim of the current study is to examine how each phrase would be read (overall reading patterns). A comparison of the reading pattern in terms of rises and falls of RRTs allows us to see similarities and differences between native speakers and learners. In doing so, we will discuss the reading patterns by focusing on three perspectives: (i) how the same syntactic phrase is processed; (ii) where RRT peaks appear in a sentence; (iii) how a proficiency level influences processing patterns. We will argue that learners of Japanese seem to behave differently from native speakers in many respects, but at the same time, we can observe some developmental sequence within JFL/JSJ learner groups.

3.3.2.1. How the Same Syntactic Phrase Is Processed

Comparing how the same syntactic phrase is processed among subject groups offers interesting pictures of how similar and dissimilar native speakers and learner groups are. Earlier in this chapter, RRTs were looked at from the perspective of
intransitive type sentences and transitive type sentences. A closer look at them shows that there are similarities between native speakers and JSL learners, and differences appear between them (JPN and JSL) and JFL learners (JFL1 and JFL2).

First, for both JPN (Figures 3.6 and 3.7) and JSL (Figures 3.9 and 3.10), reading patterns do not differ among intransitive sentence types or among transitive sentence types. The RRTs did not differ when reading the phrase belonging to the same syntactic phrase. This finding suggests that both JPN and JSL parsers are sensitive to the information that each grammatical function carries (e.g., nominative NP and accusative NP). They generally treat the phrase of the same grammatical function in the same manner even though they are read in different sentence types.

In contrast, JFL2 learners showed somewhat different pictures between intransitive and transitive sentences. Although intransitive sentence types share similar reading patterns to some extent (Figure 3.16), the same is not true for transitive sentence types (Figure 3.17). It was suggested earlier that JFL2 learners did not treat information from the same syntactic phrase in the same way that JPN and JSL subjects
did, but there may be some other factor that is affecting their reading patterns. This observation is well exemplified in Figures 3.18 and 3.19, which are repeated below as Figures 3.20 and 3.21. These figures present the RRTs by the order of word appearance in a sentence. In these figures, the reading patterns appear to be more consistent among each verb type than in Figures 3.16 and 3.17, the comparison in terms of grammatical function.

Figure 3.20. RRTs for Int types by the order of appearance (JFL2 group)
Figure 3.21. RRTs for Tran types by the order of appearance (JFL2 group)

Thus the order of word appearance may play a more crucial role in explaining the reading pattern of the JFL subjects rather than the information of a grammatical function. In this regard, JFL2 seems to have behaved differently from JPN and JSL groups.

Next, let us look at JFL1 learners, the group with the lowest proficiency level. Similarly with JFL2 learners, this group also demonstrated an inconsistent reading pattern between transitive type sentences (Figure 3.14) while they showed a consistent
reading pattern among intransitive type sentences (Figure 3.13). When we realign the regions in terms of the order of word appearance as was done for JFL2 group, the RRTs in Figures 3.13 and 3.14 look like Figures 3.22 and 3.23 below, respectively.

Both figures have a reading pattern in common for the first three phrases, but they start to look differently among sentence types after the third phrase. In intransitive sentences (Figure 3.22), Int 2 type and Int3 type sentences show different RRTs at the fourth phrase. The RRTs of Int2 increase towards the fourth phrase while the RRTs of Int3 decrease at the same region. Similarly in transitive sentences (Figure 3.23), the RRTs of Tran2 type increase towards the fourth phrase but the RRTs of Tran3 type drop towards the fourth phrase. The reading pattern of JFL1 group seems to be regulated by the order of word appearance up until the third phrase, but there seems to be some other factor that was affecting the reading times at the fourth region.
Figure 3.22. RRTs for Int types by the order of appearance (JFL1 group)

Figure 3.23. RRTs for Tran types by the order of appearance (JFL1 group)
If looked at carefully, we can see that the fourth region of Int2 and Tran2 types coincides with a verb region, and the RRTs in this group tend to increase at the verb region. Because of this, we can speculate that JFL1 subjects were also sensitive to the information that a verb caries as well as the information that the order of word appearance carries.

Based on this assumption, Figures 3.22 and 3.23 were converted into Figure 3.24 below, such that preverbal regions were aligned based on the order of word appearance and also such that the verb phrase was treated as the same region. This alignment of regions happens to be the same as the regions were originally presented in the test conditions (21) and Figure 3.12. Figure 3.24 shows a more consistent similarity of reading patterns among the five sentence types, compared to the previous ways of presenting the data. Consequently, the order of word appearance influences the reading patterns for the preverbal regions, but as soon as the verb is reached, such influence vanishes and an RRT increase seems to take place.
Figure 3.24. RRTs for JFL1 group by the pseudo-order of word appearance

3.3.2.2. Where RRT Peaks Appear in a Sentence

Where RRT peaks appear in a sentence also indicates that native speakers and learners behave differently. Below we will first show that all four subject groups exhibit distinctive reading patterns. Then we will further show that in spite of such distinctiveness, a closer look at the individual differences reveals that JFL1 group and
JFL2 group in fact behave in a similar way, and also that there is some reading pattern in common among the learner groups.

Let us begin by discussing the uniqueness of each group regarding where RRT peaks appear. First, JPN had only one RRT peak at the time adverb/NP-acc region (third region). As for JSL group, however, they generally had two RRT peaks: the first peak came at the nominative NP region (second phrase) and the second peak appeared at the verb region. JSL subjects seem to have been more cautious in reading the regions both at the beginning (i.e., NP-nom) and the end (i.e., verb) of a clause than native speakers who tended to spend longer time at the time adverb/NP-acc region.

In contrast, the JFL2 group demonstrated the RRT peaks three times: the sentence initial region, the third region, and the fifth region. As was claimed in the previous section, this group was more sensitive to the information of word appearance order rather than the information of the syntactic category. The way their RRTs proceed is reminiscent of a zigzag line with repeated drops in every other region, which is very different from JPN and JSL.
Finally, JFL1 also showed three peaks in a sentence just like the JFL2 group, but the peaks were slightly different from JFL2. Before reaching a verb, RRT peaks appeared at every other region (i.e., first region and third region), which is reminiscent of a zigzag shape similarly with what we saw among JFL2 learners. However, the last RRT peak appeared when a verb was read even if the region did not mach the zigzag pattern.

All four groups (including JPN) demonstrate RRT peaks in a different manner. The JPN group had a peak at the third (NP-acc/Time-adverb) region while the JSL group had peaks at both the second (NP-nom) region and verb region. The JFL1 group tended to show its RRT peak at every other region (i.e., first, third, and verb region), and JFL2 group tended to have it at every other region (i.e., first, third, and fifth region). Although each group has a distinctive pattern, the following generalization seems possible among the learner groups. There is more than one RRT peak in a sentence, and the last peak appears clause-finally, typically at the verb.
If such a generalization is possible, the JFL2 group still appears to be behaving in a slightly different manner among the three groups. While JSL and JFL1 both demonstrated an RRT peak at the verb, the JFL2 group, whose proficiency level falls in the middle of the other two groups, failed to demonstrate the similar RRT peak at the verb. In order to confirm if this discontinuity is indeed the case, we looked at individual differences within a learner group by comparing each subject’s reading pattern with the group’s prototypical reading pattern. Table 3.13 shows the ratio of the subjects who demonstrate prototypical reading patterns of the subject group they belong to. The prototype reading patterns are the reading patterns that have been discussed above. The ratio of the JSL group is also shown for comparison purposes.

The prototype of the JFL1 group is a zigzag reading with the RRT peaks at the first phrase, the third phrase, and the verb region. The prototype of the JFL2 group is also a zigzag pattern, but the RRT peaks are at the first, third and fifth phrases (i.e., purely by the order of word appearance).
<table>
<thead>
<tr>
<th></th>
<th>Prototype Pattern</th>
<th>Pattern 2 (Two-way zigzag)</th>
<th>Pattern 3 (Two-way zigzag and rise at V)</th>
<th>Pattern 2 or Pattern 3 (Two-way zigzag or rise at V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JFL1</td>
<td>28.0%</td>
<td>46.7%</td>
<td>44.6%</td>
<td>64.6%</td>
</tr>
<tr>
<td>JFL2</td>
<td>33.3%</td>
<td>55.6%</td>
<td>40.0%</td>
<td>60.0%</td>
</tr>
<tr>
<td>JSL</td>
<td>36.2%</td>
<td>14.6%</td>
<td>31.5%</td>
<td>48.5%</td>
</tr>
</tbody>
</table>

Table 3.13. Reading patterns and consistency ratio in each subject group

1. Prototype for JFL1: RRT peaks at the first phrase, the third phrase, and the verb. (10%)
2. Prototype for JFL2: RRT peaks at the first phrase, the third phrase, and the fifth phrase. (10%)
3. Prototype for JSL: RRT peaks at the second phrase (NP-nom) and the verb. (10%)
4. Pattern 2: Two-way zigzag reading with the start of either RRT increase or RRT decrease. (19%)
5. Pattern 3: Two-way zigzag reading for preverbal regions, and RRT rise at verb. (19%)
6. Percentages in parentheses indicate chance level.\(^{41}\)

The prototype of the JSL group is not a zigzag reading. Instead, it had two RRT peaks at the nominative NP region and the verb region.

Higher ratios are considered that the subjects in the group consistently show a similar reading pattern, but smaller ratios are considered to indicate larger variance of the data within each group. For instance, JFL1’s 28.0% in the column for Prototype Pattern means that 28% of the JFL1 data was an exact match of the prototype pattern.

\(^{41}\) Chance level for each reading pattern was obtained from simple probability calculation, positing that there are two possible ways of RRT movements (either rise or fall) when moving to the next region. For example, if a sentence has two inter-regions (i.e., three regions), four possible ways of RRT movements were assumed (i.e., rise+rise, rise+fall, fall+rise, and fall+fall). Consequently, the chance level for the RRT to be rise+fall, for instance, is 25% (one out of the four).
As a result, the JFL2 subjects seem to have more variance than the JSL subjects, but the JFL1 subjects seem to have more variance than the JFL2 subjects because the JSL consistency ratio for the prototype pattern was the largest (36.2%) and JFL1 consistency ratio the smallest (28.0%).

However, the ratios of JFL1 and JFL2 become higher and the two groups look alike when the criteria are slightly relaxed. “Pattern 2” lists the ratio of subjects that demonstrated a zigzag reading in either of two ways. That is, this zigzag pattern counts both the one starting with an increase of the RRTs as well as the one starting with the decrease of the RRTs, unlike the prototype reading that counts only the zigzag starting with the RRT decrease. In these criteria, consistency ratios for JFL1 and JFL2 increase up to 46.7% and 55.6%, respectively. This increase suggests a two-way zigzag reading pattern that allows the first region, starting with both high RRTs and low RRTs, shares more fundamental characteristics with the JFL subjects than a stricter zigzag pattern that we originally assumed.
Let us also see the ratios when the criteria are further modified into Pattern 3. In Pattern 3, preverbal regions take a two-way zigzag reading pattern but the verb region is marked with the RRT rise. Matching ratios are 44.6 for JFL1 and 40.0 for JFL2, which are lower than the ratios for Pattern 2 but much higher than chance level. From this, we can speculate that while the JFL1 and JFL2 groups share a two-way zigzag reading pattern as their characteristic reading pattern, there is some indication that the RRT rise at the verb region is also another characteristic reading. (If we allow Pattern 2 or Pattern 3 for criteria (the rightmost column of Table 3.13), the matching ratios now increase up to 64.6% for JFL1 and 60.0% for JFL2.) In this regard, the RRT rise at the verb can be also regarded as a shared reading pattern among all three learner groups.

To conclude, by comparing reading patterns of individual subjects, JFL1 and JFL2, whose differences were pointed out earlier, can now be seen from an angle of their similarities: a zigzag reading and an RRT peak at the verb. Moreover, reading patterns of the three learner groups can be captured in terms of one commonality, an RRT peak
at the verb. In contrast, native speakers do not seem to share much of the reading pattern with learner groups.

3.3.2.3. Developmental Sequence Between Learner Groups and Native Speakers

In this section, the JPN group and learner groups are compared by each sentence type. Although their reading patterns do not show a clear commonality, we will argue that there is some indication of developmental sequence among the groups. Differences between native speaker and learner groups are reduced as learner proficiency level improves.

First, Figure 3.25 presents a comparison of reading patterns among the four subject groups for Int1 type. Int1 type is a shortest sentence with a verb immediately following a nominative NP. As can be seen, the JFL1 and JFL2 groups are almost parallel to each other in terms of a V-shaped reading pattern. However, they look very different from JSL because the JSL reading pattern is in a reversed V-shape.
Figure 3.25. RRTs for Int1 type

In contrast, the JPN group does not show much rise and fall of the RRTs. When mean SDs for all regions are compared, JFL1 (1632) is ranked first as its largest range, followed by JFL2 (793), JSL (668), and JPN (270) as its smallest range. This order coincides with the order of proficiency level, indicating that the RRT range becomes more consistent as learner proficiency improves. Let us see if the same pattern is observed with the other sentence types.
Reading patterns of the four subject groups for Int2 type are presented in Figure 3.26. Int2 type is a sentence that has a time-adverb intervening a nominative NP and a verb.

![Graph of RRTs for Int2 Type]

**Figure 3.26.** RRTs for Int2 type

While all four groups appear to show a unique reading pattern, JPN and JSL could be considered similar to each other, and JFL1 and JFL2 also seem to parallel each other for the first three regions. When mean SDs for all regions are compared, JFL1 (1407)
demonstrates the greatest distribution, followed by JFL2 (825), JSL (669), and JPN (271), whose order is identical with the order of Int1 type.

Int3 type is one of the longest sentences with time adverbs and manner adverbs intervening a nominative NP and a verb. Figure 3.27 presents the comparison of RRTs among the subject groups. As can be seen, overall reading patterns of JFL1 and JFL2 look similar in terms of their zigzag pattern.

Figure 3.27. RRTs for Int3 type
JSL and JPN do not necessarily look identical, but compared to JFL1 and JFL2, the
rises and falls of RRTs are much less robust. Mean SDs for all regions show the same
order as the previous two sentence types: JFL1 (1316), JFL2 (891), JSL (668), JPN
(286).

Tran2 type has an intervening accusative NP between a nominative NP and a verb.
Figure 3.28 shows the comparison of RRTs among the subject groups. In Figure 3.28,
reading patterns of JPN and JFL2 look similar to each other.

![Figure 3.28. RRTs for Tran2 type](image)

Figure 3.28. RRTs for Tran2 type
In contrast, JFL1 and JFL2 do not seem to overlap each other. This is different from the previous two sentence types in which JPN and JSL behaved similarly. However, when the mean SDs for all regions are looked at, a similar pattern with other sentence types emerges: JFL1 (1366) shows the largest deviation, JPN (294) the smallest, and JSL (649) and JFL2 (644) fitting between JPN and JFL1. Though the order of JSL and JFL2 are reversed, their differences are almost null.

![RRTs for Tran3 Type](image)

**Figure 3.29.** RRTs for Tran3 type
Type Tran3 is one of the longest sentences that has a time-adverb and an accusative NP intervening a nominative NP and a verb. In Figure 3.29, JFL1 and JFL2 are back together, showing a similar zigzag reading pattern.

We have looked at reading patterns and mean SDs of the four groups for each sentence type. From our results, the following observations are possible: (i) JFL1 and JFL2 groups tend to behave in a similar way; (ii) JSL group could be regarded as behaving similarly as JPN group rather than with JFL1 and JFL2 groups; (iii) mean SDs of RRTs become smaller as their proficiency level becomes higher (the native speakers show the smallest mean SDs). Similar behaviors between JFL1 and JFL2 were observed from all the sentence types except for Tran2. JSL’s behaviors similar to JPN were observed from Int2, Int3, and Tran3 types. Mean SDs becoming smaller in accordance with the proficiency level was found in all the sentence types. Recall the similar observation made in Table 3.13 earlier, in which consistency rates with each group prototype reading pattern became higher as the group proficiency improves.
All of these observations indicate that reading patterns of learner groups change in accordance with their proficiency level, and they appear to approximate those of native speakers although not to the degree that JSL and JPN completely mirror each other. It is interesting to be able to see some indication of developmental sequence among learner groups and also between learners and native speakers while other findings (see earlier sections) illustrate the contrast between learners and native speakers.

### 3.4. General Discussion

In this chapter, RRTs and reading patterns of simplex sentences were compared among native speakers and three levels of English learners of Japanese to examine the on-line effect of arguments/adjuncts differentiation. As a result, the following two conclusions seem possible: (i) a strong effect of argument/adjunct distinction was not confirmed, but incremental processing may be at work in some way in each group; (ii) all four groups exhibited different reading patterns, but at the same time, a tendency
found was that learner reading patterns approach those of native speakers as their proficiency level becomes higher.

First, we originally expected differentiation of preverbal argument/adjunct information while reading. This is because we assumed preverbal arguments would provide more information (e.g., Case marker) for making predictions about the upcoming elements in a sentence than adjuncts would do, and this difference was assumed to result in faster reading time for arguments. However, what we found was not such a simple result. Adverbs were not processed in the same way between time-adverbs and manner-adverbs; i.e., time-adverbs were read more slowly than arguments while manner-adverbs were read faster than arguments. This was observed among native speakers, but as shown in Table 3.12, learner groups also demonstrated such an effect to a lesser degree. While advanced learners (JSL) yielded somewhat similar results when compared with native speakers, learners of lower proficiency levels (JFL1 and JFL2) failed to show a clear effect.
JSL subjects behaved similarly to native speakers in terms of differentiation between arguments and adjuncts, but their reading pattern was yet not identical with the JPN subjects. Their RRTs reached a first peak at the NP-nom position and the second peak came at the verb region, where the clause ends. It seems that they needed to pay special attention to a clause boundary because the sentence subject and verb usually appear at the beginning and end of the clause, respectively (also see, Sawasaki, 2002). Detecting the nominative Case marker ga as a sentence subject without delay is important. Ga-marked NP can play a significant role for Japanese sentence processing because it indicates the beginning of a clause as a sentence subject (Miyamoto, 2002).

Similarly, finding a verb that corresponds to the clause subject is also important for the parser to correctly identify and understand the clause being read.

The observation that the parser is sensitive to a clause boundary is not the only behavior observed by the learners. Kanno (2001) found that native speakers took longer time to process phrases at a clause boundary in more complicated sentences. Miyamoto (2002) also suggests native speakers parse a nominative Case-marked NP
with special attention as a clause inducer. Furthermore, an increase of reading times at a sentence final position is also confirmed in the literature as a wrap-up effect.

Therefore, it can be true that both the sentence subject and the verb play a significant role in reading a sentence for native speakers, too.

However, as far as simplex sentences such as the ones in the current experiment are concerned, increased RRTs found at the sentence subject and verb among the JSL group were not observed among JPN group.\(^{42}\) Similarly, when looking at the data in a different study targeted at L1 Japanese processing (Miyamoto, 2002), the increasing RRTs at these two positions were also missing.\(^{43}\)

Although the clause boundary information induced by the sentence subject and verb may be important for native speakers as well, parsing such information does not take enough extra load to influence reading times especially for a simplex sentence such as in the current study. In contrast, JSL learners may not be as skilled as native

\(^{42}\) An increase of RRT, which is believed to be a wrap-up effect, was found at the sentence final phrase (i.e., phrase immediately after the verb) among native speakers in the current experiment.

\(^{43}\) Miyamoto’s (2002) test sentences are multiple-clause sentences, but the first three or four regions were identical to the sequence of the current test sentences. In his results, a processing difficulty arose only when a reader came across a second NP-nom, but the first NP-nom was not necessarily read with longer RRTs in comparison to the other regions.
speakers and thus they may take longer time to process the clause boundary cues.

Although they are advanced learners, their previous linguistic experiences are still limited when compared with the native speakers. Their vocabulary knowledge may be shallower due to weak syntagmatic and paradigmatic knowledge (Matsumoto, Horiba, Suzuki, and Kobayashi, 2006) and their predicting skill of upcoming elements by combining syntactic and lexical knowledge may be much lower than that of native speakers. Consequently, learners may tend to rely more on relatively salient cues such as the sentence initial nominative Case marker and corresponding first verb. Thus, this heavy reliance on the NP-nom and verb lead the learners to exhibit longer RRTs.

Now, if the JSL learners’ greater RRTs at the subject position are a result of having paid attention to the nominative Case as clause boundary, this means that they made use of Case information to process a sentence before reaching a verb. Though this was not the way we originally planned to examine the data, our result suggests incremental processing is at work among JSL learners as well as among native speakers.

---

44 Teramura (1987) shows that native speakers can predict with a high rate of accuracy how a sentence finishes upon reading the first couple of phrases. I am indebted to Etsuyo Yuasa for this information.
Compared to JSL group, however, JFL1 and JFL2 showed very different behavior in terms of their zigzag reading pattern. Unlike JSL, they were sensitive to the order of word appearance as well as the verb information. Their RRTs before reaching a verb became slower at each of the two phrases whereas the RRTs at the other regions became relatively faster, as if the parser took a chunk of two phrases as an analysis unit. This is reminiscent of the Sausage Machine (Frazier and Fodor, 1978), which says the parser processes through a sentence chunk by chunk consisting of approximately six words. However, as was also suggested in Sawasaki (2004), one chunk for the JFL groups seems to consist of two words, instead of six words. This is probably due to limited linguistic knowledge that was also mentioned above to explain the JSL subjects’ processing strategy, but it is more serious than for JSL because their previous linguistic experiences and working memory resources are even more limited (Sawasaki, 2004). They are much more inexperienced with incorporating syntactic and non-syntactic information. For example, decoding Japanese characters and words may not be easy for JFL learners either, due to the limited level of linguistic automaticity compared with
the JSL learners. Japanese orthography is significantly different from the English alphabet because a Japanese sentence is usually written in two kinds of characters: *kanji*, Chinese characters, and *kana*, moraic script forms. Consequently, even processing basic levels of sentential information must have required more time, attention, and effort from unskilled learners, which would have easily caused a working memory overload.  

45 It is not surprising that they had to develop a processing strategy which looked very different from the JSL group, but best suited their level of linguistic knowledge and automaticity level. They try to calculate a sentential meaning by evenly chunking a clause into every two or so words, rather than paying more attention to specific syntactic items such as Case markers.  

46 Trying to divide preverbal phrases into chunks of equal length suggests that the JFL learners did not wait to parse phrases until a verb was reached. Rather, learners

---

45 Following Just and Carpenter (1992), we presuppose that different types of L1 processing, such as decoding, lexical access, syntactic and pragmatic comprehension, are operative in one working memory capacity. When working memory overload takes place, Just and Carpenter claim that a higher level of processes, such as understanding pragmatic information, suffers. In the current study, we speculated that much attention on decoding Japanese letters consumed a considerable amount of working memory of the JFL learners, consequently making each chunking smaller. The results suggest that learners are less sensitive to higher levels of processes such as arguments/adjuncts distinction.  

46 Daneman and Carpenter (1980) report that poor L1 readers tend to have chunks with less semantic content.
started to handle a sentence with some regularity as soon as the sentence began. It is not certain, however, if such a reading strategy enabled them to perform a successful incremental processing syntactically as well as semantically. Even so, they at least tried the best they could, coping with a very limited linguistic knowledge and low level of automaticity. We believe that such efforts by the JFL groups would in the long run lead them to a more native-like way of incremental processing such as the one we saw among the JSL group.

In summary, although the three learner groups demonstrated different reading patterns and we could not always confirm the expected effect of arguments/adjuncts differentiation, all share one fundamental way of processing. That is, they start to parse or at least try to parse early in the sentence without waiting for a verb whether or not an incremental parsing was successful. In this regard, we can say English-speaking learners and native speakers of Japanese are the same in that their processing is immediately incremental in making use of the available information. The difference between L1 and L2 processing is that L2 learners need to adapt specific strategies to
fulfill incremental processing which accords with their linguistic experiences, automaticity, and working memory resources. The reading patterns observed in the current experiment appear to be such strategies.

While the way they process a sentence looks distinct with each subject group, their general reading patterns in fact seem to develop and approach those of native speakers over time. As learner proficiency levels increase, the learners become more able to utilize syntactic information such as Case information and clause boundary information. Each group’s RRT range also becomes smaller and smaller as learners become more proficient in Japanese.

Having said the above, however, the question remains as to whether or not the current results are also applicable to other than English L1 speakers. Since the present data come only from native speakers of English, it is desirable to examine if the same findings are also applicable among learners of other languages, especially languages that are typologically different from English. If the data from English speakers coincide with those from the speakers of other languages, we can make a stronger claim
that the current findings hold independently of the learners’ L1. In contrast, if the data from English speakers differ from the data from other speakers, we would have to assume that the current findings are to some extent the result of influences by some language specific rules. In the next chapter, we will present the experiment targeted at Chinese and Korean learners of Japanese (Experiment 2). Chinese has an SVO word order (English type) and Korean has an SOV word order (Japanese type). Examining similarities and differences among these learners will provide useful information to understand more about the mechanism of L2 processing.
CHAPTER 4

EXPERIMENT 2

In this chapter, we will examine how Chinese-speaking advanced JSL learners and Korean-speaking advanced JSL learners behave when reading simplex sentences.

Chapter 3 showed that the JSL subject group utilized Case information (nominative marker and accusative marker) to parse sentences incrementally. Moreover, they read nominative NPs and verbs taking longer time, by which we assumed they were sensitive to a clause boundary.

In order to examine if these findings also hold with the learners of other L1s, this chapter compares English-speaking JSL learners with Chinese and Korean-speaking JSL learners. Chinese is an SVO language like English, and Korean is an SOV language like Japanese. Experiment 1 was replicated targeting Chinese- and Korean-
speaking learners (Experiment 2). The questions that Experiment 2 tries to investigate are shown below. They basically replicate research questions C and D, which were raised in chapter 1.


C. Do Chinese-speaking learners of Japanese behave the same as English-speaking learners of Japanese while reading simplex sentences?

D. Do Korean-speaking learners of Japanese behave the same as English-speaking learners of Japanese while reading simplex sentences?

4.1. Experimental Design

4.1.1. Subjects

Two groups with a total of 44 subjects participated in the study: 20 Chinese-speaking JSL learners (JSL-C) and 24 Korean-speaking JSL learners (JSL-K). All
subjects were advanced JSL learners taking regular undergraduate or graduate level
classes at Japanese universities at the time of this study. The 20 JSL-C subjects were
all from the People’s Republic of China and were recruited from the Shizuoka area in
Japan. Of the 20 subjects, 19 had taken the Japanese Language Proficiency Test
(JLPT) and passed Level 1.\(^47\) The remaining one subject had taken a different test but
had a score that could be considered as equivalent of the JLTP Level 2.\(^48\) The subjects
averaged 23.9 years of age (range= 20-30; SD= 3), 31.6 months living in Japan (range= 1-62; SD= 13), and 39.1 months of having studied Japanese (range= 16-71; SD= 12).

The 24 JSL-K subjects were recruited from the Kobe and Shizuoka areas in Japan.
However, one subject was removed from the group because the total length of having
studied Japanese was small (five months) and also the subject’s proficiency level was
considered not as high as the other subjects, after consulting this subject’s Japanese
instructor. Of the remaining 23 subjects, 13 had passed Level 1 of JLPT, 2 passed

\(^{47}\) See footnote 29 of chapter 3 and Appendix A for the explanation of JLPT (Japanese Language
Proficiency Test).

\(^{48}\) The test is called Examination for Japanese University Admission for International Students (EJU),
which the Japan Student Service Organization started in 2002. A direct comparison between EJU and
JLTP is difficult, but many Japanese university admission guidelines are either 200 or above for the EJU
or Level 2 or above for the JLPT.
Level 2, and 1 passed Level 3.  The rest had not taken the test, but we determined they
were between Levels 1 and 3 based on personal communication with the subjects and
their Japanese instructors.  Those who had not passed Level 2 or above, including
those who had not taken the test, were undergraduate students from a university that
does not require the JLPT for admissions.  We regarded their proficiency level as high
as the other subjects either because they had lived in Japan and had already taken
regular courses exclusively in Japanese for longer than the average period of time (27.8
mos), or because they were planning to take the JLPT for Level 1 or 2 soon.  JSL-K
subjects averaged 28.9 years of age (range= 23-37; SD= 3.43), 36 month living in Japan
(range= 2-83; SD= 23.5), and 51.3 months of having studied Japanese (range= 8-147;
SD= 34.5).

Compared to JSL-C and JSL-K subjects, the proficiency level of English-speaking
JSL subjects in chapter 3 (JSL-E, henceforth) appears to be lower since nearly half of
the JSL-E subjects are considered to be at Level 2 of the JLPT.  The JSL-C subjects
may be the highest proficiency group since almost all were at Level 1 of JLPT.

---

49 This instructor was teaching them Japanese language classes as part of foreign language requirements.
However, a simple comparison using the JLPT score is dangerous. For example, many of those who had passed Level 2 or 3 in the past did not go back to take the test again for a better level simply because they had no reason to do so. Reasons not to take the test may include that they had been accepted to a university, or they did not plan to go to a Japanese university. The JLPT is not a required test unless one has a particular reason such as admission to a Japanese university.

The three groups do not exactly match each other in terms of average age or mean length of study, but they are not greatly different in terms of the following respects.

The average age of JSL-E (27.9 yr) is similar to that of JSL-K subjects (but 4 years older than JSL-C subjects). The mean length of JSL-E subjects having lived in Japan (average: 34.8 mos) is almost comparable with the JSL-C and JSL-K subjects. The mean length of their having studied Japanese (50.5 mos) is also comparable with the JSL-K subjects but 11 months longer than the JSL-C subjects.
4.1.2. Procedure

The same self-paced reading task was employed as in Experiment 1. It took about 20 to 25 minutes to finish each experimental session.

4.1.3. Test Materials

The materials used in this experiment were also identical with those in Experiment 1. The structures of the five test conditions are repeated below.

<table>
<thead>
<tr>
<th>Region</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Int1:</td>
<td>Adv-place NP-nom</td>
<td>Intran V</td>
<td>(Comp+V/Aux V)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int2:</td>
<td>Adv-place NP-nom Adv-time</td>
<td>Intran V</td>
<td>(Comp+V/Aux V)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tran2:</td>
<td>Adv-place NP-nom NP-acc</td>
<td>Trans V</td>
<td>(Comp+V/Aux V)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tran3:</td>
<td>Adv-place NP-nom Adv-time NP-acc</td>
<td>Trans V</td>
<td>(Comp+V/Aux V)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As was explained in the previous chapter, all sentences were presented in Japanese scripts using *kanji*, *hiragana*, and *katakana*, but their presentation was not always authentic because we had to limit the *kanji* to only those characters that the JFL subjects
of the lowest proficiency level had already learned in class. We decided to use the
same materials to enable us to compare the two sets of data between the experiments.

4.2. Results

4.2.1. Modification of Data

Before comparing the RTs of each region, the obtained raw data were modified in
the same four ways as for JSL-E subjects. First, the data were screened based on the
rate of correct responses for the comprehension questions. The entire RTs of the
subjects who did not reach 80% of the correct response rate were removed from the data
set. This disqualified one JSL-C subject but no JSL-K subjects, leaving 19 JSL-C and
23 JSL-K subjects for the further analyses with average correct response rates of 92.7%
and 95.3%, respectively.

Next, the following three adjustments were made: (i) the RTs of the whole
sentence whose comprehension questions were answered incorrectly were deleted from
the data set (and were not replaced with any data); (ii) each subject’s mean RTs per
mora for each word and also for the whole sentences were calculated, and when the
former mean exceeded the latter mean + its two SDs, it was replaced by the mean RTs +
(SDX2); (iii) after all the adjustments mentioned above had been made, the data were
finally corrected to RRTs, using the formula (22) shown in chapter 3.

As was the case with JSL-E subjects, we decided to use morae as a basic
phonological unit for the learners due to the same reason we explained in the previous
chapter. In order to examine which phonological unit the learners employed, we
calculated each subject’s mean RTs per mora and mean RTs per syllable and looked at
how many of them exceeded two standard deviations (SDX2). As a result, we found
that slightly more RTs fell outside the range of SDX2 when they were calculated based
on syllables (148 phrases: 66 for JSL-C group and 82 for JSL-K group)⁵⁰ than when
calculated based on morae (134 phrases: 54 for JSL-C group and 80 for JSL-K group).

Although the number of the deviated RTs based on syllables and morae are
relatively close, we found a preponderance of the syllable-based deviations when both

⁵⁰ When the number of syllables was counted, different criteria were used between JSL-K group and the
other groups because diphthongs are treated as separate syllables in Korean (p.c. Sunhee Lee).
Consequently, in counting the number of syllables for JSL-K group, diphthongs such as /ai/ and /oi/ (but
not lengthened vowels such as /e:/ and /o:/) were counted as two syllables.
numbers were compared in each syntactic category, as shown in Table 4.1. Table 4.1 lists percentages of RTs that exceeded SDx2 of mean RTs.

<table>
<thead>
<tr>
<th>Place</th>
<th>NP-nom</th>
<th>Time</th>
<th>Manner</th>
<th>NP-acc</th>
<th>V</th>
<th>SentFinal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Syl : Mor</td>
<td>Syl : Mor</td>
<td>Syl : Mor</td>
<td>Syl : Mor</td>
<td>Syl : Mor</td>
<td>Syl : Mor</td>
</tr>
<tr>
<td>JPN</td>
<td>2.70 : 2.10</td>
<td>2.80 : 2.10</td>
<td>10.50 : 7.17</td>
<td>9.50 : 5.00</td>
<td>5.75 : 5.50</td>
<td>4.10 : 4.30</td>
</tr>
<tr>
<td>JSL-E</td>
<td>5.00 : 3.08</td>
<td>4.62 : 4.04</td>
<td>5.45 : 3.53</td>
<td>0.96 : 0.96</td>
<td>4.81 : 5.77</td>
<td>2.31 : 3.65</td>
</tr>
<tr>
<td>JSL-C</td>
<td>2.37 : 1.05</td>
<td>2.89 : 1.32</td>
<td>1.75 : 2.63</td>
<td>2.63 : 2.63</td>
<td>1.97 : 0.66</td>
<td>3.68 : 5.00</td>
</tr>
<tr>
<td>JSL-K</td>
<td>2.83 : 2.17</td>
<td>3.04 : 1.96</td>
<td>4.33 : 3.26</td>
<td>2.17 : 1.09</td>
<td>2.17 : 1.09</td>
<td>3.26 : 5.43</td>
</tr>
</tbody>
</table>

Table 4.1. Comparisons of percentages of RTs that exceed SDx2 (4 subject groups)

*The “Syl” columns indicate the percentages of the RTs that exceed the “mean RTs + (SDx2)” calculated based on syllables. The “Mor” columns indicate the percentages of the RTs that exceed the “mean RTs + (SDx2)” calculated based on morae.

*The underlined figures indicate there are more excess RTs than when calculated based on the other phonological unit.

Comparing the four subject groups, both the JPN group and the learner groups share similar distribution patterns of the excess of RTs. While only two regions had more excess RTs when calculated based on morae, as many as four to five regions were found to have more excess RTs in each group when calculated based on syllables. This is the same result we obtained between JPN group and JSL/JFL groups in Experiment 1. We
interpreted this result as an indication that the test sentences were more likely to be processed based on morae rather than syllables, as in Experiment 1. Moreover, the proficiency level of both Chinese and Korean subjects was high enough to attend Japanese college lectures in Japanese at the time of this study. We assumed learner perceptions for a phonological unit became native-like (i.e., mora-based) as learner linguistic perception skills improved.51

4.2.2. JSL-C Group

The average RRTs of each test condition for the 19 subjects are shown in Figure 4.1 and Table 4.2 below.

51 However, there is some counter evidence that is worth pointing out regarding Chinese learners reading Japanese sentences. During a post-experimental informal interview, an experimenter asked some Chinese subjects to read a couple of the experimental sentences. As taking notes, he observed that they sometimes pronounced Japanese words with L1 pronunciation as if they had been reading Chinese. This is possible because both the Japanese and Chinese writing systems use Chinese characters (kanji, in Japanese). However, the pronunciations of kanji and Chinese characters are not identical: some are similar as in Japanese butyoo and Chinese buzhang to mean ‘division manager,’ but some are largely different as in Japanese kinoo and Chinese zhouri to mean ‘yesterday.’ The two writing systems differ in several other ways; e.g., (i) kanji is one of the three kinds of scripts used in Japanese (together with hiragana and katakana), but the Chinese character is the only script used in Chinese; (ii) Chinese characters used in People’s Republic of China are written with simplified fonts while kanji is written with semi-simplified fonts; (iii) there are many Chinese characters and Chinese words whose counterpart cannot be found in Japanese (and vise versa for Kanji and Japanese words). Consequently, we could not reach a solid generalization of when a learner uses Chinese pronunciation in reading a Japanese word because there seemed to be a significant amount of individual differences and also because we could not test this issue for all the subjects in a systematic way. Some tendencies that an experimenter noticed were that proper nouns such as family names and words to express time such as every morning, this year, and last year, were more likely to be pronounced in a Chinese way when compared to other types of words. In Table 4.1, Chinese learners show data in favor of ‘syllable’ reading for time adverbs. This could be attributed to their reading time-adverbs in a syllable-based Chinese way rather than in a mora-based Japanese way. We will return to this issue later in the discussion section.
Figure 4.1. RRTs for JSL-C group.

<table>
<thead>
<tr>
<th>Sent. Type</th>
<th>Place</th>
<th>NP-nom</th>
<th>Time/NP-acc</th>
<th>Mann/NP-acc</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Int1</td>
<td>-322.2</td>
<td>534.33</td>
<td>-183.2</td>
<td>784.97</td>
<td>217.29</td>
</tr>
<tr>
<td>Int2</td>
<td>-311.31</td>
<td>551.77</td>
<td>-156.2</td>
<td>730.62</td>
<td>91.22</td>
</tr>
<tr>
<td>Int3</td>
<td>-183.07</td>
<td>591.42</td>
<td>66.19</td>
<td>844.18</td>
<td>-87.18</td>
</tr>
<tr>
<td>Tran2</td>
<td>-359.16</td>
<td>589.92</td>
<td>-88.86</td>
<td>765.20</td>
<td>-178.45</td>
</tr>
<tr>
<td>Tran3</td>
<td>-225.84</td>
<td>768.58</td>
<td>-97.07</td>
<td>842.87</td>
<td>-168.42</td>
</tr>
</tbody>
</table>

Table 4.2. Mean RRTs and SDs for JSL-C Subjects
The RRTs of JSL-C subjects had a moderate peak at a second region (NP-nom) for Int3, Tran2, and Tran3 types. A major RRT peak appeared at the verb region for all five sentence types. The range of RRTs was about 580ms (max: 217ms, min: -359ms) with 660 of means SD for all regions. Compared to JSL-E group (range: 350 and mean SD: 666), the range of JSL-C is much larger but mean SD is almost identical.

Separate ANOVAs were carried out with type of sentence as the main factor for the third region (time adverb/NP-acc), fourth region (manner adverb/NP-acc), and the fifth region (verb). However, none of the regions showed any significant differences: time adverb/NP-acc region (F1(3,18)= 1.481, p< .23; F2(3,19)= 1.365, p< .259); manner adverb/NP-acc region (F1(1,18)= .048, p< .829; F2(1,19)= .003, p< .955); verb region (F1(4,18)= 1.35, p< .265; F2(4,19)= .537, p< .709).

Figure 4.2 illustrates the RRTs for the test sentences with an intransitive verb, and their regions were grouped according to the syntactic category of each phrase.

Similarly, Figure 4.3 illustrates the RRTs for the test sentences with a transitive verb.
Figure 4.2. RRTs for Int types (JSL-C group)

Figure 4.3. RRTs for Tran types (JSL-C group)
Generally speaking, the two figures together with Figure 4.1 suggest that the JSL-C learners tend to read the words of the same syntactic category in the same fashion though there are some discrepancies at NP-nom and time adverb. ANOVA was performed for intransitive verb, NP-acc, and transitive verb, but no differences were observed at any region. That is, for intransitive type sentences, intransitive verb 

\[(F1(2,18) = .466, p < .644; F2(2,19) = .555, p < .578);\] for transitive type sentences, NP-acc \[(F1(1,18) = .001, p < .98; F2(1,19) = .001, p < .982),\] and for transitive verb 

\[(F1(1,18) = 1.668, p < .218; F2(1,19) = .602, p < .447).\]

### 4.2.3. JSL-K Group

The 23 JSL-K subjects performed a similar (though not identical) reading pattern with the JSL-C subjects. Figure 4.4 and Table 4.3 show their RRT patterns. They had an RRT peak at the second region (NP-nom), followed by an RRT drop (with an exception of Int1 type). The second rise of the RRTs came at the verb region.
Figure 4.4.  RRT for JSL-K group

<table>
<thead>
<tr>
<th>Sent. Type</th>
<th>Place Mean</th>
<th>Place SD</th>
<th>NP-nom Mean</th>
<th>NP-nom SD</th>
<th>Time/NP-acc Mean</th>
<th>Time/NP-acc SD</th>
<th>Mann/NP-acc Mean</th>
<th>Mann/NP-acc SD</th>
<th>V Mean</th>
<th>V SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Int1</td>
<td>-19.88</td>
<td>637.26</td>
<td>-17.17</td>
<td>605.94</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>127.48</td>
<td>599.43</td>
</tr>
<tr>
<td>Int2</td>
<td>-112.46</td>
<td>573.47</td>
<td>207.32</td>
<td>777.70</td>
<td>6.78</td>
<td>493.19</td>
<td></td>
<td></td>
<td>124.13</td>
<td>557.66</td>
</tr>
<tr>
<td>Int3</td>
<td>-50.87</td>
<td>569.42</td>
<td>113.89</td>
<td>681.01</td>
<td>58.88</td>
<td>551.66</td>
<td>-140.18</td>
<td>397.23</td>
<td>68.80</td>
<td>560.84</td>
</tr>
<tr>
<td>Tran2</td>
<td>-177.84</td>
<td>422.94</td>
<td>-77.91</td>
<td>577.89</td>
<td>-152.11</td>
<td>486.50</td>
<td></td>
<td></td>
<td>51.00</td>
<td>486.78</td>
</tr>
<tr>
<td>Tran3</td>
<td>-130.99</td>
<td>467.52</td>
<td>129.63</td>
<td>754.28</td>
<td>4.66</td>
<td>515.11</td>
<td>-145.84</td>
<td>348.26</td>
<td>28.97</td>
<td>435.34</td>
</tr>
</tbody>
</table>

Table 4.3.  Mean RRTs and SDs for JSL-K subjects
The difference between JSL-K and JSL-C is that the RRT peak at the NP-nom among JSL-K subjects seems more robust than that of JSL-C subjects. The JSL-K’s reading pattern is similar to the JSL-E group. The range of RRTs was 380ms (max: 207ms, min: -177ms), which is almost the same as JSL-E (range: 350ms), and the mean SD for all regions was 547, which is slightly smaller than JSL-E (mean SD: 666).

ANOVA revealed a significant difference at the third region (time adverb/NP-acc) only by subjects (F1(3,22)= 3.676, p< .016; F2(3,19)= 1.843, p< .139). Post-hoc Tukey’s tests show this difference stemmed mainly from an NP-acc in Tran2 type having been read faster than a time adverb in Int3 type. (A comparison between arguments and adjuncts also revealed reliable differences by subject (F1(1,22)=10.789, p< .003; F2(1,19)=2.716, p< .115). No statistical differences were found at the manner adverb/NP-acc region (F1(1,22)= .014, p< .908; F2(1,29)= .004, p< .953), and the verb region (F1(4,22)= .511, p< .728; F2(4,19)= .811, p< .522).

Figure 4.5 illustrates the RRTs for the test sentences with an intransitive verb, and their regions were grouped according to the syntactic category of each phrase.
Similarly, Figure 4.6 illustrates the RRTs for the test sentences with a transitive verb.

Generally speaking, though there is some discrepancy at NP-nom, the two figures suggest that JSL-K learners tend to read words of the same syntactic category in the same fashion, which was also true for the JSL-C/JSL-E subjects.

Figure 4.5. RRTs for Int types (JSL-K group)
ANOVA was performed for intransitive verb, NP-acc, and transitive verb, but no differences were observed; i.e., for intransitive verb (F1(2,22)= .209, p< .812; F2(2,19)= .625, p< .540); for transitive sentences, NP-acc (F1(1,22)= .035, p< .854; F2(1,19)= .192, p< .666); for transitive verb (F1(1,22)= .000, p< .983; F2(1,19)= 1.044, p< .317).
4.3. Discussion

4.3.1. Processing Arguments vs. Adjuncts

As far as the JSL-C subjects are concerned, the results provide no clear evidence for differentiating arguments from adjuncts while reading. They showed processing differences neither between a time adverb and accusative NP at the third region nor between a manner adverb and accusative NP at the fourth region. This is different from what we found among the JSL-E learners, who at least differentiated a manner adverb from accusative NP at the fourth region. In contrast, the JSL-K group showed some evidence for differentiating arguments from adjuncts. The JSL-K subjects demonstrated differences between a time adverb and accusative NP at the third region (but not at the fourth region).

These results seem to indicate that JSL-C behave differently from JSL-K and JSL-E groups because only the JSL-C group did not show any evidence for the differentiation of arguments and adjuncts. However, this conclusion may not be warranted because the RRTs of JSL-C may be attributed to their L1 knowledge of
Chinese characters. Japanese and Chinese are similar in that both use Chinese character (or *kanji*) for writing. Because of this similarity, it is highly likely that Chinese readers have an advantage in reading *kanji* over other learners, such as Americans, who do not use Chinese characters in their L1, and Koreans, who use Chinese characters but not as extensively as the Chinese in their L1 (cf. Ito and Wada (2004), but Chiu (2002) for a somewhat different view).

Earlier in footnote 51 of this chapter, we reported that during a post-experimental informal interview, an experimenter asked a number of Chinese subjects to read some of the experimental sentences. As a result, we observed that a subject sometimes pronounced Japanese *kanji* words with L1 pronunciation as if he or she had been reading Chinese. For example, several subjects pronounced Japanese word *butyoo* (部長) “division manager” as *butzhang*, which is the way pronounced in Chinese. Similar examples could be Japanese *kinoo* (昨日) “yesterday” pronounced as Chinese *zhouri*, Japanese *gaikokuzin* (外国人) “foreigner” pronounced as Chinese *weiguoren*, Japanese *Hashimoto* (橋本, family name) pronounced as Chinese *Jiaoben*, to name a few. These
are either the Japanese words that also exist in Chinese but have different pronunciation (cognate words), or Japanese family names written with only the kanji that exists in Chinese.\textsuperscript{52} The consequence of this is, as also noted in footnote 51, these words could be recognized with syllable as a phonological unit. If so, then these words will often have a smaller number of phonological units than when the words were pronounced with Japanese morae. If this pronunciation is the case, the phrase in questions tends to result in smaller RRTs (see the result section of chapter 3 for the details of RRT calculation), and Chinese learners’ RRTs can look as if they read the phrase faster than the learners of other L1s.

To see if this is the case, such cognate words (including family names) written only with kanji were compared with non-cognate words in each syntactic category. The results are presented in Table 4.4, which lists the number of words, mean numbers of syllable or mora, and mean RRTs.

\textsuperscript{52} Authentic Japanese family names are almost always written exclusively with kanji. However, as previously suggested, some family names in the experiment (4 out of 20) were written with kanji and kana mixed due to the limited kanji knowledge by lower level learners, and some family names (6 out of 20) were written only with kana because they were non-Japanese names such as Brown (ブラウン) and Harris (ハリス), which cannot be converted into kanji in Japanese.
Table 4.4. Comparison between cognates and non-cognates
1. ** shows the result of a t-test found to be significant between cognates and non-cognates.
2. * shows the result of a t-test found to be marginally significant between cognates and non-cognates.
3. As for the mean number of syllable/mora, cognates are shown with the mean number of syllable assuming they were read with Chinese syllable-based pronunciation, and non-cognates are given with the mean numbers of mora assuming they were read with Japanese mora-based pronunciation.

As was predicted, the RRTs were significantly faster for NP-nom cognates (family names) and marginally faster for time adverb cognates than their non-cognates counterparts. (Statistical tests were not performed for manner adverbs and verbs because of too few cognate items.) It is very likely that Chinese subjects underwent the influence of L1 transfer when reading cognates in kanji. Such orthographic L1 transfer by advanced Chinese JSL learners is also reported by other studies (Ito and

Consequently, although we need more research on this issue, we could speculate that the effect of arguments/adjuncts differentiation among the JSL-C group was obscured in the current experiment due to their L1 reading of Chinese characters.53

For the Korean subjects, as contrasted with the Chinese subjects, some effect of arguments/adjunct differentiation was confirmed. Although their writing system includes Chinese characters called hancha, they use hancha much less frequently in their daily life when compared to Japanese and Chinese speakers (An, 1999; Taylor, 1997). The Korean writing system mainly uses the phonogram, hangul, and only occasionally uses hancha. Taylor (1997) reports that some Korean texts contain up to 50% hancha for the entire script, but others have no hancha at all. She introduced a study by Taylor and Park (1995), in which Korean university students could read a sentence faster when it had no hancha as compared with when the sentence was written with hancha and hangul mixed. This is strikingly different from Japanese speakers

53 Faster RRTs for time adverbs may explain some discrepancies observed at the time-adverb region in Table 4.1. However, in order to fully support this L1 transfer claim, more follow-up, controlled experiments would be necessary to determine if such cognates are easier to access. We will leave this issue open for future research.
who are familiar with *kanji* in their daily life because in the same study, Japanese read a sentence written in *kanji* and *hiragana* mixed much faster than a sentence written only in *hiragana*. Taylor (1997) notes the following:

Most critically, Korean students are far more practised in reading all-Han’gul texts than mixed texts. They learn Hancha not in primary school but only in middle and high schools, and then half-heartedly. In and out of school, they are not well practised in reading Hancha, which are used sparingly or not at all in normal texts. They are likely to see Sino-Korean words often in Han’gul and only occasionally in Hancha. (p. 315)

Consequently, Korean speakers must be much less familiar with *kanji* than Chinese speakers, and it is understandable that the same L1 transfer we assumed to have appeared among the JSL-C subjects was not observed among the JSL-K subjects (cf. Ito and Wada (2004), but Chiu (2002) for a somewhat different view).

**4.3.2. General Reading Patterns**

Although the three learner groups did not show identical results in terms of processing arguments and adjuncts, possibly because of L1 transfer among Chinese
subjects, they seemed to share a general reading pattern. That is, they tended to have
an RRT peak twice at the NP-nom region and the verb region. For the sake of
convenience, RRTs for the JSL-E group (Figure 3.8 in chapter 3) is presented below as
Figure 4.7. These reading patterns are similar among the current learner groups and
are clearly different from the reading patterns by native speakers as in Figure 3.5,
presented again as Figure 4.8. Native speakers had only one RRT peak at the third
region (time adverb/NP-acc).

![RRTs for JSL Group](image)

**Figure 4.7.** RRTs for JSL-E group

154
Figure 4.8. RRTs for JPN group

In order to more carefully examine the shared reading patterns among the learner groups, we will first compare three learner groups by each sentence type and then examine individual differences within each group. First, RRTs of the four groups for Int1 type are presented in Figure 4.9. The data for the control group are shown for comparison purposes.
Figure 4.9. RRTs for Int1 type

Only the JSL-C group demonstrates RRT rises at the NP-nom and the verb. JSL-K and JSL-E satisfy only one of the two RRT rises; i.e., JSL-K shows a rise at the verb and JSL-E at the NP-nom. However, this sentence is unique among the five test conditions because the NP-nom and verb appear consecutively with no intervening phrases. The lack of the shared reading pattern may be due to this unique sentence structure.
Second, RRTs for Int2 type sentences are shown in Figure 4.10. An RRT rise at the NP-nom is observed among all three learner groups, and the rise at the verb is present among the JSL-C and JSL-K groups. The JSL-C group, however, has relatively lower RRTs at the NP-nom region compared to the other two groups and does not clearly show two RRT peaks. JSL-K is the only group that demonstrates the two clear RRT peaks.

![Graph of RRTs for Int2 Type](image)

**Figure 4.10.** RRTs for Int2 type
RRTs for Int3 type sentences are shown in Figure 4.11. Here, contrary to the previous two sentence types, the two RRT peaks at the two regions are clearly observed in all three JSL groups.

Figure 4.11. RRTs for Int3 type

The same reading pattern also appears for Tran2 and Tran3 types, which are presented as Figure 4.12 and Figure 4.13 below, respectively.
Figure 4.12. RRTs for Tran2 type

Figure 4.13. RRTs for Tran3 type
Now, let us examine individual differences in the reading patterns found above.

Table 4.5 gives the ratio of the subjects who demonstrate the prototypical and other reading patterns. Higher ratios indicate that the subjects in the group consistently show a similar reading pattern among the others in the group, but smaller ratios are considered to indicate a larger variance of the within group data.

<table>
<thead>
<tr>
<th></th>
<th>Prototype Pattern (Rise at NP-nom &amp; V)</th>
<th>Pattern 2 (Rises around NP-nom &amp; at V)</th>
<th>Pattern 3 (Rise at NP-nom)</th>
<th>Pattern 4 (Rise at V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JSL-C</td>
<td>43.2%</td>
<td>67.4%</td>
<td>47.4%</td>
<td>71.3%</td>
</tr>
<tr>
<td>JSL-K</td>
<td>36.5%</td>
<td>53.0%</td>
<td>47.8%</td>
<td>69.6%</td>
</tr>
<tr>
<td>JSL-E</td>
<td>36.2%</td>
<td>52.3%</td>
<td>53.8%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Table 4.5. Reading patterns and consistency ratio in each subject group

1. Prototype pattern: Two RRT peaks at the NP-nom and verb regions. (10%)
2. Pattern 2: Two RRT peaks, one either at the initial or second (NP-nom) region and the other at the verb region. (35%)
3. Pattern 3: At least an RRT peak at the NP-nom region. (50%)
4. Pattern 4: At least an RRT peak at the verb region. (50%)
5. Percentages in parentheses indicate chance level.54

The prototype reading pattern is the two RRT peaks appearing at the NP-nom and verb regions. The ratio of the subjects who matched this prototype reading pattern are

---

54 Chance level for each reading pattern was obtained from the same probability calculation as was explained in footnote 41 in chapter 3.
43.2% for JSL-C, 36.5% for JSL-K, and 36.2% for JSL-E; all of which are above chance level. When an RRT rise at the NP-nom region (Pattern 3) and an RRT rise at the verb region (Pattern 4) are separately looked at, the rise at the verb shows much higher consistency ratios across the three groups. Consequently, it appears that the learners are more likely to spend time on the verb than on the NP-nom when compared (especially JSL-C and JSL-K).

Furthermore, if the criteria of the stereotype reading are relaxed (Pattern 2) such that they allow the first RRT peak at either the initial region or NP-nom (second region) instead of only at NP-nom, the ratio increases up to 67.4% for JSL-C, 53.0% for JSL-K, and 52.3% for JSL-E. In chapter 3, we speculated that the prototype reading could indicate that learners were sensitive to clause boundaries as a result of recognizing the nominative Case (NP-nom) as a clause inducer and the verb as a clause terminator. Pattern 2 reading, in contrast, can suggest that learners were sensitive to clause boundaries as a result of recognizing either the initial phrase or nominative Case as a clause inducer and the verb as a clause terminator. When JSL-E alone was examined
in chapter 3, the reading pattern was distinctive in terms of the two RRT peaks at the
NP-nom and verb regions. However, when JSL-C and JSL-K are taken into
consideration together with JSL-E, it seems more appropriate to say that the two RRT
peaks are actually at the first part of the clause (clause-initial phrase or NP-nom) and the
verb. In this regard, the learner groups may show minor differences between the JSL-
E group on the one hand and the JSL-C and JSL-K groups on the other, but such
differences do not seem to constitute a sufficiently strong claim to reject our view that
the three learner groups generally share the same reading patterns.

4.4. Conclusion

The purpose of Experiment 2 was to examine how Chinese-speaking advanced
JSL learners and Korean-speaking advanced JSL learners read simplex sentences for us
to answer the research questions C and D, shown below.
(26) Research question: What kinds of processing strategies do learners of Japanese employ while reading Japanese sentences?

C. Do Chinese-speaking learners of Japanese behave the same as English-speaking learners of Japanese while reading simplex sentences?

D. Do Korean-speaking learners of Japanese behave the same as English-speaking learners of Japanese while reading simplex sentences?

In the previous chapter, advanced English-speaking learners (JSL-E subjects) showed two characteristics; (i) they were sensitive to the difference between arguments and adjuncts; (ii) they tended to spend a longer time reading a nominative NP and a verb compared to other parts of a sentence. In order to examine whether these results are language specific or applicable to the learners of other L1s, this chapter compared English-speaking JSL learners with the learners whose L1 is Chinese (an SVO language) and Korean (an SOV language, the same as Japanese).
As for the effect of arguments/adjuncts differentiation, we found the JSL-C group behaving differently from the JSL-E and JSL-K groups. The JSL-K group showed some evidence of the differentiation by reading arguments faster than adjuncts when accusative NP and time-adverbs were compared. In contrast, the JSL-C group failed to show such effect at all. We speculated that the lack of the effect in JSL-C could be due to orthographic L1 transfer. Chinese speakers are so familiar with Chinese characters that such strong familiarity may have obscured the effect that we originally expected to observe.

As for the positions where RRT peaks appear in a sentence, both JSL-C and JSL-K demonstrated a very similar reading pattern with the JSL-E group. That is, they tended to spend longer time when reading a region around the nominative NP (clause initial phrase or NP-nom) and also at the verb region. As a result, it can be claimed that reading patterns are generally shared among the three learner groups.

In summary, we can conclude that the findings for the JSL-E group are also applicable to the JSL-C and JSL-K groups. Typological word order in learner L1s
(SVO in English and Chinese vs. SOV in Japanese and Korean) did not cause any differences in our results. Although more research is necessary for a strong conclusion, it seems there are certain reading patterns that various L1 groups employ regardless of their typological differences. One possible exception to this was an L1 transfer among the JSL-C group due to orthographic similarities. For Chinese speakers, reading kanji (family names and cognate words) appears to invite some interfering effects from L1, which is not observed among English and Korean speakers.
CHAPTER 5

GENERAL DISCUSSION

5.1. Summary of the Results

In chapter 1, we presented our research question for this dissertation. The question asked follows:

(27) Research question: What kinds of processing strategies do learners of Japanese employ while reading Japanese sentences?

A. Do English-speaking learners of Japanese treat arguments (i.e., accusative NPs) and adjuncts (i.e., adverbs) differently while reading simplex sentences?

B. What are the general reading patterns by English-speaking learners of Japanese?
C. Do Chinese-speaking learners of Japanese behave the same as English-speaking learners of Japanese while reading simplex sentences?

D. Do Korean-speaking learners of Japanese behave the same as English-speaking learners of Japanese while reading simplex sentences?

In order to answer these questions, experiments with a self-paced reading task were conducted. Intermediate and advanced English-speaking JFL/JSI learners were tested in Experiment 1 (chapter 3) and advanced Chinese-speaking and Korean-speaking JSI learners were tested in Experiment 2 (chapter 4).

As for Question A, the results of Experiment 1 showed that advanced English-speaking learners of Japanese (JSI-E) demonstrated some sensitivity to argument/adjunct differentiation. The same outcome was also found among native speakers of Japanese. However, such sensitivity seemed to decline at lower levels of proficiency (JFL1 and JFL2). These observations suggest that how learners differentiate preverbal information becomes native-like as their proficiency improves.
For Question B, English-speaking learners demonstrated two types of reading patterns, which were in accordance with their proficiency level. Advanced learners (JSL-E) had two RRT peaks at the NP-nom and verb regions, and they were sensitive to phrases of the same syntactic category. In contrast, learners of lower proficiency level (JFL1 and JFL2) also tended to have an RRT peak at the verb, but they repeated an RRT rise and fall in the preverbal regions (zigzag reading pattern). As a result, RRT peaks appeared at every other phrase. We claimed that learners were more sensitive to the order of word appearance than to the syntactic category.

Comparing the three levels of English-speaking learners, we argued that zigzag reading patterns of lower proficiency learners are a result of short term memory limitations. There was some sign that reading patterns develop as learner proficiency becomes higher. For example, the range of RRT standard deviations became smaller as learner proficiency turns higher (1.237 for mean SD of JFL1; 790 for JFL2; 666 for JSL). However, the reading patterns of advanced learners were still different when compared with those of native speakers.
For Question C, the advanced Chinese-speaking learners (JSL-C) did not show sensitivity to arguments/adjuncts differences while reading. Unlike JSL-E subjects, Chinese subjects read arguments in the same way as adjuncts. However, the speculation was that this may be attributed to Chinese subjects’ strong familiarity with Chinese characters (L1 transfer), especially family names and cognate words. Learners may have processed some kanji-based Japanese words as if they had read Chinese words in L1. In contrast, JSL-C showed general reading patterns similar with those of JSL-E subjects. Chinese-speaking learners tended to read the phrases of the same syntactic category in a similar fashion.\textsuperscript{55} Furthermore, the RRT peaks appeared twice, first at clause-initially or at NP-nom and second at the verb.

For Question D, the advanced Korean-speaking learners (JSL-K) yielded results similar with those for JSL-E subjects. JSL-K showed some evidence for arguments/adjuncts differentiation. Also, they demonstrated two RRT peaks in a

\textsuperscript{55} These results sound contradictory because L1 transfer from Chinese characters obscured the arguments/adjuncts difference, but in contrast, did not obscure the reading pattern based on syntactic category. One explanation could be that the arguments/adjuncts difference is a comparison between different phrases while reading pattern of syntactic category is a comparison within the same phrase. The ratio of cognates and non-cognates varies phrase to phrase (see Table 4.4 in chapter 4); e.g., NP-acc phrases contain 60\% of cognates, time adverbs 75\%, and manner adverbs 10\%. Consequently, a stronger L1 transfer could be observed when phrases with different ratios of cognates were compared.
clause, first at clause-initially or NP-nom region and second at the verb region. Like
Japanese, Korean takes an SOV word order, but English and Chinese take an SVO word
order. In spite of the word order difference, Korean subjects’ general reading patterns
were found similar to other learner groups rather than showing similarities to Japanese
native speakers.

The results summarized above present us some contradictions. That is, the
results for arguments/adjuncts differentiation indicate similarities between L1 and L2
reading for advanced learners whereas the results for general reading patterns indicate
differences. A summary of similarities and differences is presented in Table 5.1. In
the remainder of this final chapter, we will discuss why such similarities and differences
occur between L1 and L2 readers. We will then touch upon the question of whether
learners will ultimately become completely native-like if they further improve their
language abilities. Finally, some implications of this study will be discussed.
Table 5.1. Summary of findings (Experiments 1 and 2): Similarities and differences between learners and native speakers.

5.2. Similarities and Differences Between L1 and L2 Readers

As pointed out above, L1 and L2 reading have some similarities as well as differences. This section will argue that while learners and native speakers may differ in how to utilize specific processing strategies, they still share some fundamental feature of processing, i.e., incremental processing while reading.

5.2.1. Differences: L2 Cognitive Restrictions

Let us first discuss the differences between L1 and L2 readers. Many of the differences between learners and native speakers were found in how they read through a sentence (general reading patterns). For example, the two groups differed in terms of
the location where the RRT peaks appeared. While native speakers had only one RRT peak, learner groups had two or more RRT peaks. We claim that these differences stem from L2 cognitive restrictions and from such restrictions, the learner intuitively develops compensating strategies.

Such differences probably occurred because learners have limited linguistic experiences that affect how efficiently they can use their knowledge to process a word or a phrase. Processing a sentence involves processing a number of types of information, both linguistic and non-linguistic. How effectively learners can synthesize these pieces of information is important. L2 learners may become competent in grammatical rules, but they will still need time to acquire native-like knowledge about actual vocabulary use in daily life such as frequently co-occurring items (e.g., out+of, of+the); frequently used expressions (e.g., by and large, for good); grammatical uniqueness in some expressions (e.g., kick the bucket, go to bed); and other related patterns (Nation, 2001). Such vocabulary knowledge plays a significant
role in efficiently employing incremental processing, but attaining a native-like level is not easy even for advanced learners of Japanese (Matsumoto et al., 2006).

To compensate for the lack of skills, less experienced learners may possibly develop the strategy of paying special attention to some salient linguistic cues in a sentence such as the nominative Case marker and verb meaning. The RRT peaks appearing at the nominative NP and the verb among advanced learners can be the result of learners paying special attention to such cues. This can be why their RRT patterns looked different from those of native speakers.\textsuperscript{56}

Besides more limited vocabulary knowledge that was just mentioned above, less proficient learners may have another source of difficulty, decoding Japanese \textit{kana} and \textit{kanji} scripts. As was pointed out in chapters 3 and 4, reading Japanese can cause a significant processing load especially when learner proficiency level is low and when the L1 does not include Chinese characters. If the learners’ L2 is still not sufficient to read Japanese scripts at a high automaticity level, decoding Japanese letters alone will require more working memory space (because of conscious effort) as compared with the

\textsuperscript{56} As was discussed in chapter 3, this does not mean that native speakers of Japanese do not pay any attention to the nominative Case marker and verb meaning at all.
amount more proficient learners would need. As a result, less proficient learners will
easily run out of working memory, which possibly causes them to chunk up a sentence
into smaller pieces, consequently a zigzag reading pattern. If this is true, it is quite
understandable that learners of lower proficiency (JFL1 and JFL2) demonstrated very
different reading patterns from higher proficiency groups (JSL-E, JSL-K, and JSL-C).

Another difference observed between L1 and L2 readers were the RRT ranges.

When mean SDs were compared, the mean SD of the two JFL groups was much greater
than that of the native group. However, the mean became smaller as learner
proficiency level became higher. Among the JFL/JSL groups, the mean SD of the JSL-
E group (mean SD: 666) was the closest group to that of native speakers (mean SD:
287). The mean SDs of JSL-C (mean SD: 660) and JSL-K (mean SD: 548) were also
comparable to JSL-E. This indicates that learners become more automatic
(unconscious) in processing a sentence as they improve their language abilities although
their automaticity still does not seem as high as that of native speakers.
These differences between learners and native speakers shown above can be due to L2 cognitive restrictions. Cognitive restrictions in L2 are widely reported in terms of poorer or slower performance by L2 learners as compared with native speakers in many instances; e. g., naming tasks, reading times, recall tasks, and arithmetic tasks. (See Cook (1997) and Frenck-Mestre (2002) for a comprehensive review.) For instance, Frenck-Mestre (2002) points out that when an eye-movement study is conducted for both L1 and L2 speakers, L2 learner results often show longer times for the second pass reading although the reading times for the first pass do not differ between the two groups. From this, Frenck-Mestre argues that L2 learners tend to re-read a sentence more often than L1 speakers. This is an observation similar to the current study that learners and native speakers exhibit different reading patterns to compensate for processing difficulties they have.

Worth noting is that the current study revealed even advanced learners suffered from such L2 cognitive restrictions regardless of their L1s. Though Korean is typologically different from English and Chinese (but the same as Japanese) in terms of

---

57 Frenck-Mestre uses the term “lesser abilities” due to “lesser automatization of lower-level processes” (p. 218) and Cook uses “deficiency.”
canonical word order, Korean-speaking learners demonstrated similar general reading patterns to English-speaking and Chinese-speaking learners, rather than showing similarities with native speakers of Japanese. This suggests there are some universal L2 processing strategies or paths that all learners eventually take, and what we saw in this study may be one such example though we need more data to reach a conclusion.\footnote{This does not mean to reject the possibilities of any language-specific L2 processing strategies. For example, JSL-C learners in Experiment 2 showed some sign of strategies specific to Chinese speakers when reading \textit{kanji}-based Japanese words. However, this was thought due to orthographic L1 transfer rather than due to cognitive restrictions. See Clahsen and Felser (2006) for a review of possible factors influencing L2 processing.}

\subsection*{5.2.2. Similarities: Incremental Processing While Reading}

The differences due to L2 cognitive restrictions do not necessarily mean L1 and L2 parsers are always different. For example, Frenck-Mestre (2002) shows that in spite of the fact that English-French bilinguals demonstrate slower reading times when compared with native speakers of French, learners still exhibited a native-like grammatical competence for a sentence containing syntactic ambiguity.

In the current experiments, too, learner groups and native speakers shared a similarity. That is, both seem to employ incremental processing without waiting until the end of a clause. The finding that advanced learners (JSL learners) and native
speakers exhibited some sensitivity to arguments/adjuncts distinctions indicates that they utilized the syntactic information from the accusative Case (arguments) and lexical information from adjuncts. Moreover, the finding that many of the advanced learners had an RRT peak at a sentence subject can be interpreted that they utilized the nominative Case information in order to pay attention to the beginning of a clause.

Both findings indicate that learners started to process a sentence from early on by making use of the preverbal information (e.g., Case marker) before reaching a verb.

For less proficient learners (JFL learners), RRTs did not show utilizing preverbal information in an explicit way. However, their RRTs exhibited a zigzag reading pattern that could be interpreted as a result of processing preverbal information by chunking up every two phrases.\(^{59}\) The way the less proficient learners actually read the sentence was appreciably different from advanced learners as the RRTs show, but the

\(^{59}\) It is not certain if this processing strategy (chunking every two phrases) is always employed with a sentence structure of different complexity level. For instance, JFL learners in Kanno’s (2001) study did not demonstrate the same zigzag reading pattern when reading more complicated sentences than the ones in the current study (see sentence (15) in chapter 2). Her study reported that equally long reading times had been spent at each phrase boundary throughout the sentence. However, the two studies differ in several respects; e.g., her subjects seem less proficient than our JFL subjects; she did not use RRT for data analysis; the way test sentences were prepared was also different, etc. We need more future research to further explore this issue.
way is similar in that learners started to compute the meaning before reaching a verb in a way that best matched their proficiency abilities.

In sum, L2 speakers share a fundamental processing strategy with L1 speakers; a sentence is processed incrementally and immediately. This is true even when L1 and L2 differ in canonical word order. The way learners try incremental processing can be different from the way native speakers do so because L2 learners are susceptible to L2 cognitive restrictions. Consequently, the experimental data can look contradictory when we try to compare L1 and L2 readers.

Contradictory data may explain why previous research on Japanese L2 processing has two seemingly opposing views. Recall in chapter 2 the study by Lieberman, Aoshima, and Phillips (2004) in which they found both L1 and L2 parsers behaved in a similar fashion in terms of resolving syntactic ambiguity in a sentence with a wh-phrase. However, other studies (e.g., Kanno, 2004; Kashiwagi and Nakayama, 2005; Yamashita, 2003) claim differences between learners and native speakers. It is possible that such contradictions stem largely from whether the obtained data reflect a fundamental
processing strategy pertaining to both L1 and L2 readings or whether the data reflect specific processing strategies due to L2 cognitive restrictions.

For example, in a production study, Lieberman et al. tested whether JFL learners would anticipate the presence of a question marker after they read a wh-phrase. The test asked subjects to finish a fragment such as (28) below.

(28) sensei-wa gakusei-ga toyositsu-de dare-ni …

teacher-top student-nom library-at who-dat …

The learner group anticipated a question marker in a continuing sentence in the same manner as the native speaker control group did. This result suggests that learners as well as native speakers demonstrated an instance of predictive processing in this experiment, which appears to be the same result found in the current study among advanced learners (arguments/adjuncts differentiation).
Other studies that pointed out the difference between L1 and L2 reading did not necessarily deny the possibility of incremental reading by L2 learners. For example, Kanno (2004) asked her subjects to read sentences of both canonical and non-canonical order and examined their reading times. Likewise, the study by Kashiwagi and Nakayama (2005) examined morpho-syntactic processing, in which they looked at the reading times of a certain NP in a sentence when the structure and length were manipulated.\(^6^0\) Although these studies emphasized differences in reading times between learners and native speakers (e.g., longer reading times by the learners), such differences could be explained by L2 cognitive restrictions. That is, the reading times would possibly reflect learner lack of linguistic knowledge, but these differences would not necessarily mean that they could not perform incremental processing.\(^6^1\)

\(^{60}\) In Nakayama and Kashiwagi (2006), by looking at the same data as Kashiwagi and Nakayama (2005) from a different perspective, they pointed out some similarities between L2 learners and native speakers in terms of incremental processing. See footnote 14 in chapter 2.

\(^{61}\) In order to claim this in a more comprehensive way, we also need to show a case of L2 processing in which the relationship between L1 and L2 is reversed; e.g., a learner whose L1 is an SOV language type (e.g., Japanese) reads a language of an SVO type (e.g., English). We could not examine this reversed order because it was outside the scope of the current experiments. However, previous research also suggests learners of English with different L1s demonstrate non-native-like reading patterns because of performance problems, but their processing mechanism is not fundamentally different from native speakers. See Hirose, Goya, and Ofuru (2005) for Japanese-speaking learners reading a sentence with a V NP PP PP structure (e.g., put X on the plate into the box) and Juffs and Harrington (1996) for Chinese-speaking learners reading a filler-gap sentence (e.g., who does Tom expect t to fire the manager?).
5.2.3. Would Learners Ultimately Become Just Like Natives?

We have argued that while L1 and L2 readers share a commonality in performing incremental processing while reading, their reading patterns, including those of advanced learners, are still different from those of native speakers. The question arises as to why even advanced learners are different from native speakers. The question becomes whether it is possible that as learner proficiency improves, learners become less affected by L2 cognitive restrictions because their linguistic knowledge increases. If their linguistic knowledge approximates that of native speakers, can we expect that the processing differences found in this study would disappear over time?

Although additional research is needed to answer this question, we can speculate that learners may not become exactly native-like. Learners may not have to perform exactly native-like processing unless failure to do so causes a serious problem. What they need to learn and do is how to compute meaning without delay in order to avoid working memory overload. As long as this task is accomplished, reading patterns that do not harm incremental processing may not be crucial for successful sentence
comprehension and consequently do not require a reason to change. In the current
experiments, all test sentences were simplex sentences that should not contain
ambiguity or garden-path effects in meaning or structure. Reading these sentences
with special attention (i.e., elevated reading times) on one particular phrase or another
may not cause a misanalysis or create much difference in total understanding.

When reading sentences, the goal is to efficiently understand the sentences and the
goal should not differ between L1 and L2 readers, but there is no reason to believe that
the goal is always restricted with only one certain way of reading. As long as a
sentence is efficiently understood, L2 readers should be allowed to have some degree of
freedom in how to reach the goal. (This can be applicable even within L1 speakers.)

L2 parser often needs longer time to reach the goal because of the L2 cognitive
restrictions and learners may use some strategies to compensate for the restrictions. In
the course of the development of L2 processing, it is possible that some strategies
remain as processing habits (e.g., longer RRTs at NP-nom and verb) even after language
learners become highly proficient and no longer require such strategies, as long as such
habits do not generate problems. Consequently, their processing patterns can look different from those of native speakers (see also Clahsen and Felser, 2006).

**5.3. Limitations of the Current Study and Implications for Future Research**

**5.3.1. Limitations of the Current Study**

Though this study revealed interesting results about similarities and differences between L1 and L2 processing, it also contained a number of limitations. For example, it was claimed that (i) the basic phonological unit employed by the Japanese learners is morae, (ii) there were processing difficulties in some particular family names in the experimental sentences for JFL1 learners (chapter 3), and (iii) JSL-C learners demonstrated a strong L1 transfer for family names and cognate *kanji* words (chapter 4). All these claims should be justified in a separate set of experiments, for example, through lexical judgment tasks.

In chapter 3, the relationship between advanced level and lower level JFL/JSL learners was shown. However, we could not examine the data of different levels for
Chinese speakers and Korean speakers. This is also an issue that requires future examination.

Moreover, a crucial limitation is that the number of subjects and the content of test stimuli were very restricted. The number of subjects was small especially for JFL learners (15 for JFL1 and 9 for JFL2). Recruiting many subjects for the JFL1 and JFL2 groups was extremely difficult because subjects at these levels were enrolled in a 4th or 5th year class in the university curriculum where the data were gathered, and the number of the students in these classes was already small. For test stimuli, to examine preverbal processing, the ideal would be to include sentences with relative clauses, center-embedded structures, and ditransitive verbs rather than only simplex sentences with intransitive and transitive verbs. However, doing so was not possible because of the limited vocabulary and grammatical knowledge that the subjects at the lowest proficiency level had. These limitations are probably applicable not only to the current study but also to other studies targeted at similar groups of subjects. These factors must be considered in the future.
5.3.2. Implications for Future Research

Other than the limitations pointed out above, previous chapters left a number of other potential issues not discussed. Such issues will lead to further research. Before concluding this dissertation, we will explore some of the possible questions for future studies.

5.3.2.1. Individual Differences

The first issue is about individual differences. Chapters 3 and 4 showed that learner groups had distinctive reading patterns. However, not all reading patterns were shared by all group members; there were individual differences. Some of the subjects did not match the general reading patterns of their group (cf. Table 3.13 in chapter 3 and Table 4.5 in chapter 4). The question of what creates individual differences would be a thought provoking topic for future research. For example, some previous studies show that learners of high working memory span in L2 would be able to utilize L2 linguistic information more efficiently than L2 learners of low memory span (Osaka, 2002; Harrington, 2003; Walter, 2004). Other studies suggest that L2 vocabulary size or
intensity of study experiences such as the length of study through intensive classes and study abroad would affect how well a learner could predict and understand a text (Harrington, 203; Matsumoto et al., 2006; Nation, 2001; Sawasaki and Nakayama, 2001). Which factors are more responsible for distinctive reading patterns and which factors are not are questions that need further investigation.

The issue of individual differences can be extended to the relationship between L1 readers and L2 readers. Though we have primarily discussed L2 Japanese learners, individual differences should exist among L1 Japanese readers as well. This dissertation could not examine the qualities of non-prototypical reading patterns for L1 and L2 readers. However, a brief look at each individual’s reading patterns for the current control group suggests that some native speakers also demonstrate a zigzag pattern of reading, which is exactly like the prototypical pattern for JFL learners. If this is the case, then what is the factor that makes L1 and non-fluent L2 readers (JFL) look alike? We could speculate that both L1 and L2 poor readers (possibly due to low memory span) may tend to behave in a similar manner. For example, Osaka and
Osaka (1992) and Osaka (2002) claim that the size of memory span in L1 has a positive correlation with that of L2. Research will offer important findings to know whether the observed differences between L1 and L2 processing in the current study can be explained, to some extent, in terms of the differences between good readers and poor readers.

5.3.2.2. Relationship Between L1 Child and L2 Adult

Another possible issue for future research is the relationship between L2 adult reading and L1 child reading. If L1 processing were similar in some way to L2 processing, would L1 children also be similar to low proficient L2 adults? By comparing previous L1 and L2 processing studies, Clahsen and Felser (2006) claimed that L1 child processing and L2 adult processing would be different. They argued that while L1 children would utilize the same syntactic rules as L1 adults, L2 adults could not employ the same syntactic information such as empty category that both L1 children and L1 adults could use.
For example, citing findings of Roberts, Marinis, Felser, and Clahsen (2006), Clahsen and Felser (2006) showed that L1 English children (5- to 7-years old) were sensitive to a filler word at the gap position in (29). In their cross-modal picture priming study, subjects heard the sentence, and at the gap position they saw a picture that was either identical or unrelated to the filler (peacock) for a lexical judgment task.

(29) John saw the peacock to which the small penguin gave the nice birthday present for ___ in the garden last weekend.

The children with a high-memory span yielded significantly shorter reaction times for the identical visual stimuli than for the unrelated stimuli. The same results were obtained from an adult control group as well, indicating both children and adults successfully posited an empty category at the gap position.

In contrast, Clahsen and Felser (2006) introduced a study by Marinis, Roberts, Felser, and Clahsen (2005) to show that L1 and L2 processing are not the same. In
their self-paced reading study, Marinis et al. tested pairs of sentences such as (30) with adult ESL learners of various L1s (Chinese, German, Greek, and Japanese).

(30)  a. The nurse who the doctor argued \([e_2]\) that the rude patient had angered \([e_1]\) is refusing to work late.

b. The nurse who the doctor’s argument about the rude patient had angered \([e_1]\) is working late.

Sentence (30a) has an intermediate gap \((e_2)\) before the original gap \((e_1)\) is reached.

Sentence (30b) has no intermediate gap. The assumption was that if syntactic information (empty category) would be fully utilized on-line by the parser, the filler would be activated at each gap position (cf. Chomsky, 1995). As a result, the RTs around the original gap position \((e_1)\) would be measured faster for (30a) than for (30b) because the distance between the original gap and the position the filler previously activated was shorter for (30a). The result showed that no learner groups
demonstrated the expected RT effect around the original gap position although the
native control group clearly exhibited such effect. By comparing these two results,
Clahsen and Felser (2006) concluded that while L1 child processing was fundamentally
the same as the L1 adult processing, L2 adult processing was different from L1 adult
processing because L2 adults would not utilize syntactic information as much as L1
children and adults would do so.\footnote{Besides the similarities between L1 child and L1 adult, Clahsen and Fesler also point out differences between the two; i.e., L1 child is not as skilled as L1 adult in utilizing pragmatic information and world knowledge. Likewise, besides the differences between L1 adult and L2 adult, they also point out similarities between the two; i.e., both L1 and L2 adults can efficiently utilize predicate-argument information when resolving filler-gap dependency and comprehending garden-path sentences.} It should follow that L1 children and L2 adults do
not parallel each other.

However, since Clahsen and Felser’s observation is based on findings from
separate previous studies and each study is targeted at different groups with different
test conditions, simple comparisons of the findings may not be adequate. For example,
Roberts et al. examined only L1 children while Marini et al. tested only L2 adults, and
their test materials were not identical as shown in (29) and (30) above. Therefore,
their claim about the relationship between L1 children and L2 adults should be
interpreted with come caution. (Also see, for example, Dowens and Carreiras (2006) and Carroll (2006) for criticism against Clahsen et al.’s claims.)

As briefly mentioned above, the current study has not fully discussed a number of issues including individual differences and the relationship between L1 child and L2 adult. These issues are future research topics in which I hope to reveal intriguing aspects of L2 sentence processing. More comprehensive understanding of this field is only possible by adding new findings, one by one, through continuing research.
LIST OF REFERENCES


197


Miyamoto, E. T., & Takahashi, S. (2002a). Sources of difficulty in the processing of scrambling in Japanese. In M. Nakayama (Ed.), *Sentence processing in East Asian Languages* (pp. 167-188), Stanford, CA: CSLI.


APPENDIX A

JAPANESE LANGUAGE PROFICIENCY TEST (JLPT)
JLPT has four different levels; the examinee can choose the level that best matches his or her ability and training. Each test is made up of three sections: writing-vocabulary; listening; reading-grammar. The contents and criteria of the test are as follows:

<table>
<thead>
<tr>
<th>Level</th>
<th>Contents</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sections</td>
<td>Hours</td>
</tr>
<tr>
<td>1</td>
<td>Writing-Vocabulary</td>
<td>45min</td>
</tr>
<tr>
<td></td>
<td>Listening</td>
<td>45min</td>
</tr>
<tr>
<td></td>
<td>Reading-Grammar</td>
<td>90min</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>180min</td>
</tr>
<tr>
<td>2</td>
<td>Writing-Vocabulary</td>
<td>35min</td>
</tr>
<tr>
<td></td>
<td>Listening</td>
<td>40min</td>
</tr>
<tr>
<td></td>
<td>Reading-Grammar</td>
<td>70min</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>135min</td>
</tr>
<tr>
<td>3</td>
<td>Writing-Vocabulary</td>
<td>35mins</td>
</tr>
<tr>
<td></td>
<td>Listening</td>
<td>35min</td>
</tr>
<tr>
<td></td>
<td>Reading-Grammar</td>
<td>70min</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>140min</td>
</tr>
<tr>
<td>4</td>
<td>Writing-Vocabulary</td>
<td>25min</td>
</tr>
<tr>
<td></td>
<td>Listening</td>
<td>25min</td>
</tr>
<tr>
<td></td>
<td>Reading-Grammar</td>
<td>50min</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100min</td>
</tr>
</tbody>
</table>

All of the above was quoted from the homepage of the Japan Foundation as of October 10, 2006 (http://momo.jpf.go.jp/jlpt/e/about_e.html).
APPENDIX B

TEST SENTENCES
(1)  a. Tosyokan-de / Tanaka-san-ga / bikkuri-sita / to iimasita.
library-at / Mr./Ms.Tanaka-nom / surprised / said that
“Mr./Ms. Tanaka said that he or she was surprised at the library.”
図書館で／田中さんが／びっくりした／と言いました。
b. Tosyokan-de / Tanaka-san-ga / kinoo / bikkuri-sita / to iimasita.
library-at / Mr./Ms.Tanaka-nom / yesterday / surprised / said that
“Mr./Ms. Tanaka said that he or she was surprised at the library yesterday.”
図書館で／田中さんが／昨日／びっくりした／と言いました。
c. Tosyokan-de/ Tanaka-san-ga / kinoo / totemo / bikkuri-sita / to iimasita.
library-at / Mr./Ms.Tanaka-nom/ yesterday / very / surprised / said that
“Mr./Ms. Tanaka said that he or she was very surprised at the library yesterday.”
図書館で／田中さんが／昨日／とても／びっくりした／と言いました。
d. Tosyokan-de / Tanaka-san-ga / okyaku-o / tetudatta / to iimasita.
library-at / Mr./Ms.Tanaka-nom / guest-acc / helped / said that
“Mr./Ms. Tanaka said that he or she helped the guest at the library.”
図書館で／田中さんが／お客様／手伝った／と言いました。
e. Tosyokahn-de / Tanaka-san-ga / kinoo / okyaku-o / tetudta / to iimasita.
library-at / Mr./Ms.Tanaka-nom / yesterday / guest-acc / helped / said that
“Mr./Ms. Tanaka said that he or she helped the guest at the library yesterday.”
図書館で／田中さんが／昨日／お客様／手伝った／と言いました。

(2)  a. Kono heya-de / Sumisu-san-ga / okiru / soo desu.
this room-at / Mr./Ms. Smith-nom / wake up / they say
“They say Mr./Ms. Smith wakes up in this room.”
この部屋で／スミスさんが／おきる／そうです。
this room-at / Mr./Ms. Smith-nom / every morning / wake up / they say
“They say Mr./Ms. Smith wakes up in this room every morning.”
この部屋で／スミスさんが／毎朝／おきる／そうです。
this room-at / Mr./Ms. Smith-nom / every morning / slowly / wake up / they say
“They say Mr./Ms. Smith wakes up in this room every morning.”
この部屋で／スミスさんが／毎朝／ゆっくり／おきる／そうです。
d. Kono heya-de / Sumisu-san-ga / katyoo-o / okosu / soo desu.
this room-at / Mr./Ms. Smith-nom / section manager-acc / wake up / they say
“They say Mr./Ms. Smith wakes up the section manager in this room.”
この部屋で／スミスさんが／課長を／おこす／そうです。
e. Kono heya-de / Sumisu-san-ga / maiasa / katyoo-o / okosu / soo desu.
this room-at/Mr./Ms. Smith-nom/every morning/section manager-acc/wake up /they say
“They say Mr./Ms. Smith wakes up the section manager in this room every morning.”
この部屋で／スミスさんが／毎朝／課長を／おこす／そうです。

(3)  a. Paakuhoteru-de / Yamamoto-san-ga / kekkonsita / to kikimasita.
Park Hotel-at / Yamamoto-nom / married / heard that
“(I) heard that Mr./Ms. Yamamoto married at Park Hotel.”
パークホテルで／山本さんが／けっこんした／と聞きました。
b. Paakuhoteru -de / Yamamoto-san-ga / kyonen / kekkonsita / to kikimasita.
Park Hotel -at / Yamamoto-nom / last year / married / heard that
“(I) heard that Mr./Ms. Yamamoto married at Park Hotel last year.”
パークホテルで／山本さんが／去年／けっこんした／と聞きました。
c. Paakuhoteru -de / Yamamoto-san-ga / kyonen / hutaridakede / kekkonsita / to kikimasita.
Park Hotel -at / Yamamoto-nom / last year / two of them alone / married / heard that
“(I) heard that Mr./Ms. Yamamoto married at Park Hotel in the presence of no one last year.”
パークホテルで／山本さんが／去年／二人だけで／けっこんした／と聞きました。
d. Paakuhoteru -de / Yamamoto-san-ga / tomodati-o / mituketa / to kikimasita.
   Park Hotel -at / Yamamoto-nom / friend-acc / found / heard that
   “(I) heard that Mr./Ms. Yamamoto found his or her friend at Park Hotel.”
   パークホテルで／山本さんが／友だちを／見つけた／と聞きました。

e. Paakuhoteru -de / Yamamoto-san-ga / kyonen / tomodati-o / mituketa / to kikimasita.
   Park Hotel -at / Yamamoto-nom / last year / friend-acc / found / heard that
   “(I) heard that Mr./Ms. Yamamoto found his or her friend at Park Hotel last year.”
   パークホテルで／山本さんが／去年／友だちを／見つけた／と聞きました。

(4) a. Kaigisitu-de / Lee-san-ga / suwatte ita / yoo da.
   meeting room-at / Mr./Ms. Lee-nom / was sitting / it seems
   “It seems that Mr./Ms. Lee was sitting in the meeting room.”
   かいぎ室で／リーさんが／すわっていた／そうだ。

b. Kaigisitu-de / Lee-san-ga / sakki made / suwatte ita / yoo da.
   meeting room-at / Mr./Ms. Lee-nom / until just before / was sitting / it seems
   “It seems that Mr./Ms. Lee had been sitting in the meeting room until just before.”
   かいぎ室で／リーさんが／さっさまで／だれかと／すわっていた／そうだ。

c. Kaigisitu-de / Lee-san-ga / sakki made / dareka to / suwatte ita / yoo da.
   かいぎ室で／リーさんが／さっきまで／だれかと／すわっていた／そうだ。
   meeting room-at/ Mr./Ms. Lee-nom /until just before /someone with /was sitting /it seems
   “It seems that Mr./Ms. Lee had been sitting with someone in the meeting room until just before.”
   かいぎ室で／リーさんが／さっきまで／だれかと／すわっていた／そうだ。

d. Kaigisitu-de / Lee-san-ga / sensei-o / yonde ita / yoo da.
   meeting room-at / Mr./Ms. Lee-nom / teacher-acc / was calling / it seems
   “It seems that Mr./Ms. Lee was calling someone in the meeting room.”
   かいぎ室で／リーさんが／先生を／呼んでいた／そうだ。

e. Kaigisitu-de / Lee-san-ga / sakki made / sensei-o / yonde ita / yoo da.
   meeting room-at / Mr./Ms. Lee-nom /until just before teacher-acc /was calling /it seems
   “It seems that Mr./Ms. Lee was calling someone in the meeting room until just before.”
   かいぎ室で／リーさんが／さっきまで／先生を／呼んでいた／そうだ。
(5)  a. Kyoto-de / Noguti-san-ga / yasumu / koto ni kimemasita.
    Kyoto-at / Mr./Ms. Noguchi-nom / rest / decided
    “Mr./Ms. Noguchi decided to rest in Kyoto.”
    京都で／野口さんが／休む／ことに決めました。
b. Kyoto-de / Noguti-san-ga / getuyoobi-ni / yasumu / koto ni kimemasita.
    Kyoto-at / Mr./Ms. Noguchi-nom / Monday-on / rest / decided
    “Mr./Ms. Noguchi decided to rest on Monday in Kyoto.”
    京都で／野口さんが／月曜日に／休む／ことに決めました。
c. Kyoto-de / Noguti-san-ga / getuyoobi-ni / hitoridakede / yasumu / koto ni kimemasita.
    Kyoto-at / Mr./Ms. Noguchi-nom / Monday-on / all by him/herself / rest / decided
    “Mr./Ms. Noguchi decided to rest on Monday all by him/herself in Kyoto.”
    京都で／野口さんが／月曜日に／ひとりだけで／休む／ことに決めました。
d. Kyoto-de / Noguti-san-ga / doituzin-o / sagasu / koto ni kimemasita.
    Kyoto-at / Mr./Ms. Noguchi-nom / German-acc / look for / decided
    “Mr./Ms. Noguchi decided to look for a German in Kyoto.”
    京都で／野口さんが／ドイツ人を／さがす／ことに決めました。
e. Kyoto-de / Noguti-san-ga / getuyoobi-ni / doituzin-o / sagasu / koto ni kimemasita.
    Kyoto-at / Mr./Ms. Noguchi-nom / Monday-on / German-acc / look for / decided
    “Mr./Ms. Noguchi decided to look for a German on Monday in Kyoto.”
    京都で／野口さんが／月曜日に／ドイツ人を／さがす／ことに決めました。

(6)  a. Daigaku-de / Nakada-san-ga / yorokonda / kadooka sirimasen.
    university-at / Mr./Ms. Nakada-nom / was pleased / not know whether or not
    “I don’t know whether or not Mr./Ms. Nakada was pleased at the university.”
    大学で／中田さんが／喜んだ／かどうか知りません。
b. Daigaku-de / Nakada-san-ga / kyoo no gogo / yorokonda / kadooka sirimasen.
    university-at / Mr./Ms. Nakada-nom / today’s afaternoon / was pleased / not know
    whether or not
    “I don’t know whether or not Mr./Ms. Nakada was pleased at the university today’s
    afternoon.”
    大学で／中田さんが／今日の午後／喜んだ／かどうか知りません。
c. Daigaku-de / Nakada-san-ga / kyoo no gogo / hisasibirini / yorokonda / kadooka sirimasen.

university-at / Mr./Ms. Nakada-nom / today’s afternoon / for the first time after a while / was pleased / not know whether or not
“I don’t know whether or not Mr./Ms. Nakada was pleased for the first time after a while at the university.”

大学で／中田さんが／今日の午後／ひさしぶりに／喜んだ／かどうか知りません。

d. Daigaku-de / Nakada-san-ga / dansei-o / atumeta / kadooka sirimasen.

university-at / Mr./Ms. Nakada-nom / men-acc / gathered / not know whether or not
“I don’t know whether or not Mr./Ms. Nakada gathered men at the university.”

大学で／中田さんが／男性を／集めた／かどうか知りません。

e. Daigaku-de / Nakada-san-ga / kyoo no gogo / dansei-o / atumeta / kadooka sirimasen.

university-at / Mr./Ms. Nakada-nom / today’s afternoon / men-acc / gathered / not know whether or not
“I don’t know whether or not Mr./Ms. Nakada gathered men at the university today’s afternoon.”

大学で／中田さんが／今日の午後／男性を／集めた／かどうか知りません。


airport-at / Mr./Ms. Brown-nom / is late / may

“Mr./Ms. Brown may be late at the airport.”

空港で／ブラウンさんが／遅れる／かもしれません。


airport-at / Mr./Ms. Brown-nom / tonight / is late / may

“Mr./Ms. Brown may be late at the airport tonight.”

空港で／ブラウンさんが／今晚／遅れる／かもしれません。


airport-at / Mr./Ms. Brown-nom / tonight / for about five minutes / is late / may

“Mr./Ms. Brown may be late for about five minutes at the airport tonight.”

空港で／ブラウンさんが／今晚／５分ほど／遅れる／かもしれません。

211
d. Kuukoo-de / Buraun-san-ga / syatyou-o / matte iru / kamo siremasen.
   airport-at / Mr./Ms. Brown-nom / company president-acc / is waiting for / may
   “Mr./Ms. Brown may be waiting for the company president at the airport.”
   空港で／ブラウンさんが／社長を／待っている／かもしれません。

e. Kuukoo-de / Buraun-san-ga / konban / syatyou-o / matte iru / kamo siremasen.
   airport-at / Mr./Ms. Brown-nom / tonight / company president-acc / is waiting for / may
   “Mr./Ms. Brown may be waiting for the company president at the airport tonight.”
   空港で／ブラウンさんが／今晚／社長を／待っている／かもしれません。

(8)  a. Kaisya-de / Kitamura-san-ga / tukarete ita / to ossyaimasita.
   company-at / Mr./Ms. Kitamura-nom / was tired / said that
   “Mr./Ms. Kitamura said that he or she was tired at the company.”
   会社で／北村さんが／つかれていた／とおっしゃいました。

b. Kaisya-de / Kitamura-san-ga / itumo / tukarete ita / to ossyaimasita.
   company-at / Mr./Ms. Kitamura-nom / always / was tired / said that
   “Mr./Ms. Kitamura said that he or she was always tired at the company.”
   会社で／北村さんが／いつも／つかれていた／とおっしゃいました。

c. Kaisya-de / Kitamura-san-ga / itumo / tyotto / tukarete ita / to ossyaimasita.
   company-at / Mr./Ms. Kitamura-nom / always / a little / was tired / said that
   “Mr./Ms. Kitamura said that he or she was always a little tired at the company.”
   会社で／北村さんが／いつも／ちょっと／つかれていた／とおっしゃいました。

d. Kaisya-de / Kitamura-san-ga / isya-o / sirabete ita / to ossyaimasita.
   company-at / Mr./Ms. Kitamura-nom / doctor-acc / was inspecting / said that
   “Mr./Ms. Kitamura said that he or she was inspecting the doctor at the company.”
   会社で／北村さんが／医者を／しらべていた／とおっしゃいました。

e. Kaisya-de / Kitamura-san-ga / itumo / isya-o / sirabete ita / to ossyaimasita.
   company-at / Mr./Ms. Kitamura-nom / always / doctor-acc / was inspecting / said that
   “Mr./Ms. Kitamura said that he or she was always inspecting the doctor at the company.”
   会社で／北村さんが／いつも／医者を／しらべていた／とおっしゃいました。
(9) a. Sono kuni de / Miraa-san-ga / rikon suru / kadooka ukagaimasita.
   that country-at / Mr./Ms. Miller-nom / get divorced / asked whether or not
   “(I) asked whether or not Mr./Ms. Miller would get divorced in that country.”
   その国で／ミラーさんが／りこんする／かどうかがいました。

b. Sono kuni de / Miraa-san-ga / kotosi no huyu / rikon suru / kadooka ukagaimasita.
   that country-at / Mr./Ms. Miller-nom / this winter / get divorced / asked whether or not
   “(I) asked whether or not Mr./Ms. Miller would get divorced in that country this
   winter.”
   その国で／ミラーさんが／今年の冬／りこんする／かどうかがいました。

c. Sono kuni de / Miraa-san-ga / kotosi no huyu / hontoo ni / rikon suru / kadooka
   ukagaimasita.
   that country-at / Mr./Ms. Miller-nom / this winter / really / get divorced / asked whether
   or not
   “(I) asked whether or not Mr./Ms. Miller would really get divorced in that country this
   winter.”
   その国で／ミラーさんが／今年の冬／本当に／りこんする／かどうかがいました。

d. Sono kuni de / Miraa-san-ga / kaisyain-o / mukaeni iku / kadooka ukagaimasita.
   that country-at / Mr./Ms. Miller-nom / employee / pick up / asked whether or not
   “(I) asked whether or not Mr./Ms. Miller would pick up the employee in that country.”
   その国で／ミラーさんが／会社員を／むかえに行く／かどうかがいました。

e. Sono kuni de / Miraa-san-ga / kotosi no huyu / kaisyain-o / mukaeni iku / kadooka
   ukagaimasita.
   that country-at / Mr./Ms. Miller-nom / this winter / employee / pick up / asked whether
   or not
   “(I) asked whether or not Mr./Ms. Miller would pick up the employee in that country
   this winter.”
   その国で／ミラーさんが／今年の冬／会社員を／むかえに行く／かどうかがいました。
(10) a. Resutoran-de / Nisida-san-ga / gakkari sita / to omoimasu.
   restaurant-at / Mr./Ms. Nisida-nom / got disappointed / think that
   “I think Mr./Ms. Nisida got disappointed at the restaurant.”
   レストランで／西田さんが／がっかりした／と思います。

b. Resutoran-de / Nisida-san-ga / ototoi no hiru / gakkari sita / to omoimasu.
   restaurant-at / Mr./Ms. Nisida-nom / afternoon on the day before yesterday / got 
   disappointed / think that
   “I think Mr./Ms. Nisida got disappointed at the restaurant in the afternoon of the 
   day before yesterday.”
   レストランで／西田さんが／おとといの昼／がっかりした／と思います。

c. Resutoran-de / Nisida-san-ga / ototoi no hiru / kanari / gakkari sita / to omoimasu.
   restaurant-at / Mr./Ms. Nisida-nom / afternoon on the day before yesterday / fairly / got 
   disappointed / think that
   “I think Mr./Ms. Nisida got fairly disappointed at the restaurant in the afternoon of the 
   day before yesterday.”
   レストランで／西田さんが／おとといの昼／かなり／がっかりした／と思います。

d. Resutoran-de / Nisida-san-ga / gaikokuzin-o / tasuketa / to omoimasu.
   restaurant-at / Mr./Ms. Nisida-nom / foreigner-acc / helped / think that
   “I think Mr./Ms. Nisida helped the foreigner at the restaurant.”
   レストランで／西田さんが／外国人を／助けた／と思います。

e. Resutoran-de / Nisida-san-ga / ototoi no hiru / gaikokuzin-o / tasuketa / to omoimasu.
   restaurant-at / Mr./Ms. Nisida-nom / afternoon of the day before yesterday / foreigner- 
   acc / helped / think that
   “I think Mr./Ms. Nisida helped the foreigner at the restaurant in the afternoon of the day
   before yesterday.”
   レストランで／西田さんが／おとといの昼／外国人を／助けた／と思います。

   Hospital-at / Mr./Ms. Yamaguti-nom / made a mistake / it appears
   “It appears that Mr./Ms. Yamaguti made a mistake at the hospital.”
   病院で／山口さんが／間違いった／みたいだ。
Hospital-at / Mr./Ms. Yamaguti-nom / while working / made a mistake / it appears
“It appears that Mr./Ms. Yamaguti made a mistake while working at the hospital.”
病院で／山口さんが／仕事中／間違った／みたいだ。
Hospital-at / Mr./Ms. Yamaguti-nom / while working / a lot / made a mistake / it appears
“It appears that Mr./Ms. Yamaguti made a mistake a lot while working at the hospital.”
病院で／山口さんが／仕事中／たくさん／間違った／みたいだ。
Hospital-at / Mr./Ms. Yamaguti-nom / baby-acc / forgot / it appears
“It appears that Mr./Ms. Yamaguti forgot the baby while working at the hospital.”
病院で／山口さんが／赤ちゃんを／忘れた／みたいだ。
Hospital-at / Mr./Ms. Yamaguti-nom / while working / baby-acc / forgot / it appears
“It appears that Mr./Ms. Yamaguti forgot the baby while working at the hospital.”
病院で／山口さんが／仕事中／赤ちゃんを／忘れた／みたいだ。

School-at / Mr./Ms. Hasimoto-nom / stay overnight / plan to
“Mr./Ms. Hasimoto is going to stay overnight at school.”
学校で／橋本さんが／泊まる／つもりだ。
School-at / Mr./Ms. Hasimoto-nom / Friday night / stay overnight / plan to
“Mr./Ms. Hasimoto is going to stay overnight at school Friday night.”
学校で／橋本さんが／金曜の夜／泊まる／つもりだ。
School-at / Mr./Ms. Hasimoto-nom / Friday night / once again / stay overnight / plan to
“Mr./Ms. Hasimoto is going to stay overnight at school once again Friday night.”
学校で／橋本さんが／金曜の夜／もう一度／泊まる／つもりだ。
   School-at / Mr./Ms. Hasimoto-nom / friend-acc / see off / plan to
   “Mr./Ms. Hasimoto is going to see off his or her friend at school Friday night.”
   学校で／橋本さんが／友だちを／見送る／つもりだ。

(13) a. Amerika-de / Hayasi-san-ga / ryokoo-suru / koto ni simasita.
   America-in / Mr./Ms. Hayasi-nom / travel / decided
   “Mr./Ms. Hayashi decided to travel in the United States.”
   アメリカで／林さんが／旅行する／ことになりました。

b. Amerika-de / Hayasi-san-ga / kono natu / ryokoo-suru / koto ni simasita.
   America-in / Mr./Ms. Hayasi-nom / this summer / travel / decided
   “Mr./Ms. Hayashi decided to travel in the United States this summer.”
   アメリカで／林さんが／この夏／旅行する／ことにしました。

c. Amerika-de / Hayasi-san-ga / kono natu / hitoride / ryokoo-suru / koto ni simasita.
   “Mr./Ms. Hayashi decided to travel alone in the United States this summer.”
   America-in / Mr./Ms. Hayasi-nom / this summer / alone / travel / decided
   アメリカで／林さんが／この夏／ひとりで／旅行する／ことにしました。

d. Amerika-de / Hayasi-san-ga / okyaku-o / tetudau / koto ni simasita.
   America-in / Mr./Ms. Hayasi-nom / customer-acc / help / decided
   “Mr./Ms. Hayashi decided to help the customer in the United States.”
   アメリカで／林さんが／お客様を／手伝う／ことにしました。

e. Amerika-de / Hayasi-san-ga / kono natu / okyaku-o / tetudau / koto ni simasita.
   America-in / Mr./Ms. Hayasi-nom / this summer / customer-acc / help / decided
   “Mr./Ms. Hayashi decided to help the customer in the United States this summer.”
   アメリカで／林さんが／この夏／お客様を／手伝う／ことにしました。
(14) a. Eegakan-de / Nakamura-san-ga / nete ita / to osiemasa.
   movie theater-at / Mr./Ms. Nakamura-nom / was sleeping / told that
   “(Someone) told that Mr./Ms. Nakamura was sleeping at the movie theater.”
   映画館で／中むらさんが／ねていた／と教えました。

b. Eegakan-de / Nakamura-san-ga / sensyuu / nete ita / to osiemasa.
   movie theater-at / Mr./Ms. Nakamura-nom / last week / was sleeping / told that
   “(Someone) told that Mr./Ms. Nakamura was sleeping at the movie theater last week.”
   映画館で／中むらさんが／先週／ねていた／と教えました。

c. Eegakan-de / Nakamura-san-ga / sensyuu / takusan / nete ita / to osiemasa.
   movie theater-at / Mr./Ms. Nakamura-nom / last week / a lot / was sleeping / told that
   “(Someone) told that Mr./Ms. Nakamura was sleeping a lot at the movie theater last week.”
   映画館で／中むらさんが／先週／たくさん／ねていた／と教えました。

d. Eegakan-de / Nakamura-san-ga / gakusee-o / okosita / to osiemasa.
   movie theater-at / Mr./Ms. Nakamura-nom / student-acc / woke up / told that
   “(Someone) told that Mr./Ms. Nakamura woke up the student at the movie theater.”
   映画館で／中むらさんが／学生を／おこした／と教えました。

e. Eegakan-de / Nakamura-san-ga / sensyuu / gakusee-o / okosita / to osiemasa.
   movie theater-at / Mr./Ms. Nakamura-nom / last week student-acc / woke up / told that
   “(Someone) told that Mr./Ms. Nakamura woke up the student last week at the movie theater.”
   映画館で／中むらさんが／先週／学生を／おこした／と教えました。

(15) a. Anomiti-de / Morimoto-san-ga / magaru / desyoo.
   that street-at / Mr./Ms. Morimoto-nom / make a turn / will
   “Mr./Ms. Morimoto will make a turn on that street soon.”
   あの道で／もりもとさんが／まがる／でしょう。

b. Anomiti-de / Morimoto-san-ga / moosugu / magaru / desyoo.
   that street-at / Mr./Ms. Morimoto-nom / soon / make a turn / will
   “Mr./Ms. Morimoto will make a turn on that street soon.”
   あの道で／もりもとさんが／もうすぐ／まがる／でしょう。
c. Anomiti-de / Morimoto-san-ga / moosugu / yuuki / magaru / desyoo.
that street-at / Mr./Ms. Morimoto-nom / soon / slowly / make a turn / will
“Mr./Ms. Morimoto will slowly make a turn on that street soon.”
あの道で／もりもとさんが／もうすぐ／ゆっくり／まがる／でしょう。
d. Anomiti-de / Morimoto-san-ga / butyoo-o / mitukeru / desyoo.
that street-at / Mr./Ms. Morimoto-nom / division manager-acc / find / will
“Mr./Ms. Morimoto will find the division manager on that street.”
あの道で／もりもとさんが／部長を／見つける／でしょう。
e. Anomiti-de / Morimoto-san-ga / moo sugu / butyoo-o / mitukeru / desyoo.
that street-at / Mr./Ms. Morimoto-nom / soon / division manager-acc / find / will
“Mr./Ms. Morimoto will find the division manager on that street soon.”
あの道で／もりもとさんが／もうすぐ／部長を／見つける／でしょう。

(16) a. Ginkoo-de / Harisu-san-ga / awateta / to kakimasita.
bank-at / Mr./Ms. Harris-nom / became panic / wrote that
“(Someone) wrote that Mr./Ms. Harris became panic at the bank.”
銀行で／ハリスさんが／あわてたと／書きました。
b. Ginkoo-de / Harisu-san-ga / sengetu / awateta / to kakimasita.
bank-at / Mr./Ms. Harris-nom / last month / became panic / wrote that
“(Someone) wrote that Mr./Ms. Harris became panic at the bank last month.”
銀行で／ハリスさんが／先月／あわてた／と書きました。
c. Ginkoo-de / Harisu-san-ga / sengetu / sukkari / awateta / to kakimasita.
bank-at / Mr./Ms. Harris-nom / last month / completely / became panic / wrote that
“(Someone) wrote that Mr./Ms. Harris became completely panic at the bank last month.”
銀行で／ハリスさんが／先月／すっかり／あわてた／と書きました。
d. Ginkoo-de / Harisu-san-ga / sensee-o / yonda / to kakimasita.
bank-at / Mr./Ms. Harris-nom / teacher-acc / called / wrote that
“(Someone) wrote that Mr./Ms. Harris called the teacher at the bank.”
銀行で／ハリスさんが／先生を／呼んだ／と書きました。
e. Ginkoo-de / Harisu-san-ga / sengetu / sensee-o / yonda / to kakimasita.
   bank-at / Mr./Ms. Harris-nom / last month / teacher-acc / called / wrote that
   “(Someone) wrote that Mr./Ms. Harris called the teacher at the bank last month.”
   銀行で／ハリスさんが／先月／先生を／呼んだ／と書きました。

17) a. Ie no mae de / Yamada-san-ga / tatte iru / hazu da.
   in front of the house-at / Mr./Ms. Yamada-nom / is standing / should
   “Mr./Ms. Yamada is supposed to be standing in front of the house.”
   家の前で／山田さんが／立っている／はずだ。

b. Ie no mae de / Yamada-san-ga / asu no asa / tatte iru / hazu da.
   in front of the house-at / Mr./Ms. Yamada-nom / tomorrow morning /is standing /should
   “Mr./Ms. Yamada is supposed to be standing in front of the house tomorrow morning.”
   家の前で／山田さんが／明日の朝／立っている／はずだ。

c. Ie no mae de / Yamada-san-ga / asu no asa / hitoride / tatte iru / hazu da.
   in front of the house-at / Mr./Ms. Yamada-nom / tomorrow morning / alone / is standing
   / should
   “Mr./Ms. Yamada is supposed to be standing alone in front of the house tomorrow
   morning.”
   家の前で／山田さんが／明日の朝／ひとりで／立っている／はずだ。

d. Ie no mae de / Yamada-san-ga / syatyoo-o / sagasite iru / hazu da.
   in front of the house-at / Mr./Ms. Yamada-nom / company president-acc / is looking for
   / should
   “Mr./Ms. Yamada is supposed to be looking for the company president in front of the
   house.”
   家の前で／山田さんが／社長を／さがしている／はずです。

e. Ie no mae de / Yamada-san-ga / asu no asa / syatyoo-o / sagasite iru / hazu da.
   in front of the house-at / Mr./Ms. Yamada-nom / tomorrow morning / company
   president-acc / is looking for / should
   “Mr./Ms. Yamada is supposed to be looking for the company president in front of the
   house tomorrow morning.”
   家の前で／山田さんが／明日の朝／社長を／さがしている／はずです。
(18) a. Taisikan-de / Beekaa-san-ga / isoide ita / rasio.
    embassy-at / Mr./Ms. Baker-nom / was in a hurry / I heard
    “I heard that Mr./Ms. Baker was in a hurry at the embassy.”
    大使館で／ベーカーさんが／いそいでいた／らしい。

b. Taisikan-de / Beekaa-san-ga / senzitu / isoide ita / rasio.
    embassy-at / Mr./Ms. Baker-nom / the other day / was in a hurry / I heard
    “I heard that Mr./Ms. Baker was in a hurry considerably at the embassy the other day.”
    大使館で／ベーカーさんが／先日／いそいでいた／らしい。

c. Taisikan-de / Beekaa-san-ga / senzitu / zuibun / isoide ita / rasio.
    embassy-at / Mr./Ms. Baker-nom / the other day / considerably / was in a hurry / I heard
    “I heard that Mr./Ms. Baker was in a hurry considerably at the embassy the other day.”
    大使館で／ベーカーさんが／先日／ずいぶん／いそいでいた／らしい。

d. Taisikan-de / Beekaa-san-ga / zyosee-o / atumete ita / rasio.
    embassy-at / Mr./Ms. Baker-nom / woman-acc / was assembling / I heard
    “I heard that Mr./Ms. Baker was assembling women at the embassy.”
    大使館で／ベーカーさんが／女性を／集めていた／らしい。

e. Taisikan-de / Beekaa-san-ga / senzitu / zyosee-o / atumete ita / rasio.
    embassy-at / Mr./Ms. Baker-nom / the other day / woman-acc / was assembling / I heard
    “I heard that Mr./Ms. Baker was assembling women at the embassy the other day.”
    大使館で／ベーカーさんが／先日／女性を／集めていた／らしい。

    park-at / Mr./Ms. Kimura / was walking / explained that
    “(Someone) explained that Mr./Ms. Kimura was walking in the park.”
    公園で／木村さんが／歩いていた／と説明しました。

b. Kooen-de / Kimura-san-ga / yozi goro / atuite ita / to setumee simasita.
    park-in / Mr./Ms. Kimura / around four o’clock / was walking / explained that
    “(Someone) explained that Mr./Ms. Kimura was walking in the park around four o’clock.”
    公園で／木村さんが／4時ごろ／歩いていた／と説明しました。
c. Kooen-de / Kimura-san-ga / yozi goro / yuukuri / atuie ita / to setumee simasita.
   park-in / Mr./Ms. Kimura / around four o’clock / slowly / was walking / explained that
   “(Someone) explained that Mr./Ms. Kimura was slowly walking in the park around four
   o’clock.”
   公園で／木村さんが／4時ごろ／ゆっくり／歩いていた／と説明しました。

d. Kooen-de / Kimura-san-ga / kodomo-o / matte ita / to setumee simasita.
   park-in / Mr./Ms. Kimura / child-acc / was waiting for / explained that
   “(Someone) explained that Mr./Ms. Kimura was waiting for the child in the park.”
   公園で／木村さんが／子どもを／待っていた／と説明しました。

e. Kooen-de / Kimura-san-ga / yozi goro / kodomo-o / matte ita / to setumee simasita.
   park-in / Mr./Ms. Kimura / around four o’clock / child-acc / was waiting for / explained
   that
   “(Someone) explained that Mr./Ms. Kimura was waiting for the child in the park around
   four o’clock.”
   公園で／木村さんが／4時ごろ／子どもを／待っていた／と説明しました。

(20)  a. Depaato-de / Takano-san-ga / hataraku / kadooka wakarimasen.
   department store-at / Mr./Ms. Takano-nom / work / not sure whether or not
   “(We are) not sure whether Mr./Ms. Takano will work at the department store.”
   デパートで／高野さんが／はたらく／かどうかわかりません。

b. Depaato-de / Takano-san-ga / mainiti / hataraku / kadooka wakarimasen.
   department store-at / Mr./Ms. Takano-nom / every day / work / not sure whether or not
   “(We are) not sure whether Mr./Ms. Takano will work at the department store every
   day.”
   デパートで／高野さんが／毎日／はたらく／かどうかわかりません。

c. Depaato-de / Takano-san-ga / mainiti / hati zikan hataraku / kadooka wakarimasen.
   department store-at / Mr./Ms. Takano-nom / every day / for eight hours / work / not sure
   whether or not
   “(We are) not sure whether Mr./Ms. Takano will work at the department store four eight
   hours every day.”
   デパートで／高野さんが／毎日／8時間／はたらく／かどうかわかりません。
d. Depaato-de / Takano-san-ga / gaizin-o / siraberu / kadooika wakarimasen.

department store-at / Mr./Ms. Takano-nom / foreigner-acc / inspect / not sure whether or not

“(We are) not sure whether Mr./Ms. Takano will inspect the foreigner at the department store.”

デパートで／高野さんが／外人を／しらべる／かどうかわかりません。

e. Depaato-de / Takano-san-ga / mainiti / gaizin-o / siraberu / kadooika wakarimasen.

department store-at / Mr./Ms. Takano-nom / every day / foreigner-acc / inspect / not sure whether or not

“(We are) not sure whether Mr./Ms. Takano will inspect the foreigner at the department store every day.”

デパートで／高野さんが／毎日／外人を／しらべる／かどうかわかりません。