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Processing Japanese Adnominal Structures: An empirical study of native and non-native speakers' strategies

by

Satomi Currah 

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Department of Linguistics

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Snagwood (SW 1654 19 W4)
Box 65 Lamont
AB. T0B 2R0
Canada

Date: Apr. 15, 2002

University of Alberta

Faculty of Graduate Studies and Research

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled **Processing Japanese Adnominal Structures: An empirical study of native and non-native speakers' strategies** submitted by **Satomi Currah** in partial fulfillment of the requirements for the degree of **Doctor of Philosophy**.

Gary D. Prideaux

Gary Libben

John T. Hogan

Lois M. Stanford

Janice Brown

Joseph F. Kess

Date: 10 April 2002

This thesis is dedicated to Randy.

Abstract

In Japanese, noun phrases (NP) can be modified by preceding clauses (CL). In this study, four types of noun modifying constructions (NMC) are recognized. In the Regular Relative (RR), the NP is a part of the proposition that the CL expresses. In the Gapless Relative (GR), the NP is a part of the proposition of which an unexpressed verb is also a part. In the Complement (COMP), the NP is the name of what the CL denotes. In the Clause and Noun Host Type (CN), the NP is a name of a participant in the proposition expressed by the CL. Compared to English, the Japanese RR is equivalent to a relative clause and the COMP to a complement with a nominal head. A markedness relation, in terms of the resources required for processing, is proposed to characterize the distinction among the four types. In the absence of prior empirical studies investigating how speakers of Japanese comprehend NMCs, a series of experiments was designed to determine what kinds of cues are used by Japanese native speakers and English speaking learners of Japanese to comprehend NMCs. The experiments involved 23 Japanese native speakers and 11 English Japanese as a second language learners (English JSLs) who were given sets of sentences containing the four types of NMC and were asked to rate them in terms of naturalness and ease of understanding. In addition, English JSLs did a translation task under a time constraint, and finally, both groups carried out a task in which reading speed and probe recognition times were measured. Native speakers use different processing resource domains as a cue, making distinction among the four types as follows: GR involves the largest resource domain and COMP the least, while CN and RR make intermediate demands on processing resources. The same cue is used by English JSLs; additional cues used by English JSLs are the elements involved in forming

cohesion between the CL and the NP, such as a gap, semantics of the NP, the NP's status in the proposition, and the number of roles the NP plays. Transfer also plays a role.

Acknowledgement

I am indebted to Dr. G.D. Prideaux for his patient guidance for many years; even after his official retirement, his supervision never stopped. This study was greatly influenced when I asked Dr. G. Libben for his co-supervision; he guided me until the end point of this study.

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I would like to thank the administrators, D. Kudryk (retired) and D. Elliot, and the secretaries, M. Daily (retired) and J. Tomasovic, who guided me through the administrative aspects of my program.

I am truly grateful to the anonymous participants who kindly and willingly offered their time for this study. My work would not have been possible without them.

While I was a student at the Department of Linguistics, I made many interesting friends; to all of them, much gratitude for their companionship and conversation.

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List of Abbreviations

ACC	accusative case marker
CL	modifying clause
CN	Clause and Noun Host Type
COMP	Complement
COP	copula
e	empty category, gap, trace
EUR	ease of understanding for English JSLs rating
GEN	genitive case marker
GR	Gapless Relative
H	head noun
HN	head noun
JSL	Japanese as a second language learner
NCl	noun in the modifying clause
NEG	Negative marker
NMC	noun modifying construction, adnominal structures
NOM	nominative case marker
NOMNLZR	nominalizer
NR	naturalness rating
ORT	overall reading times
PASS	passive marker
PAST	past tense marker
pro	small pro, null anaphora
PRO	big pro, non-overt subject NP of non-finite clause
PRT	probe recognition times
Q	question marker
RR	Regular Relative
Seg	segment
TA	translation accuracy
TOP	topic or theme marker
TRT	transition reading times
V	verb

Chapter 1

Introduction

A central feature of Japanese is that its noun phrases can be modified by preceding sentences, unlike English whose modifying sentences follow the head noun phrases. The following exemplify the range of such Japanese structures.

(1-1) [hon'ya-de katta] shinbun
bookstore-at bought newspaper
The newspaper (I/ you/ he/ she) bought at the bookstore

(1-2) [hon-o utta] okane
book-ACC sold money
The money (I/ you/ he/ she received as a consequence from) having sold the book

(1-3) [jiko-ga okita] gen'in
accident-NOM occurred cause
The cause resulting from which the accident occurred

(1-4) [ageta] jijitsu
gave fact
The fact that (I/ you/ he/ she) gave (it) (to you/him/her)

These structures can all be represented syntactically as $[S\ NP]_{NP}$, indicating that the noun phrase is composed of a noun phrase head plus a preceding modifying clause. This configuration has been called the "adnominal" structure (Martin, 1975) and the "noun-modifying construction" (Matsumoto, 1997). The four subtypes exemplified above are superficially similar but have dramatically different functions and code very different types of semantic information. Moreover, of the four subtypes above, only two have direct English counterparts (i.e., (1-1) and (1-4)). Accordingly, English speakers learning Japanese might be expected to have more difficulty learning unfamiliar structures than the more familiar English parallels

This study deals with how Japanese speakers, native and non- native, process such noun phrases and whether processing differences exist among the subtypes.

The present study was designed to:

1. Characterize the four subtypes syntactically and semantically;
2. Investigate experimentally how Japanese native speakers differentiate and process such structures;
3. Investigate experimentally how non-native speakers differentiate and process such structures;
4. Evaluate the competing analyses and principles which have been offered for such structures, using evidence from 2 and 3.

Overview

This study involved two kinds of Japanese speakers: native Japanese speakers and English speakers who are learning Japanese as a second language. Four tasks involving reading, memory, translating, and rating were employed in order to cast light on how Japanese speakers respond to the four subtypes outlined above.

Chapter 2 first presents the structural and semantic characteristics of the four adnominal subtypes, which are the object of study. Next, a variety of theoretical perspectives which have been offered in the analysis of the subtypes are discussed. Finally, the research hypotheses to be investigated are presented.

Chapters 3, 4, and 5 report on a series of experiments focusing on the four subtypes of adnominal structures. In Experiment 1, participants were presented with sentences containing the key structures and asked to rate them in terms of naturalness and ease of understanding. In Experiment 2, non-native speakers of Japanese were asked to translate the target structures into English under time constraint. In Experiment 3, on-line processing of these structures was investigated by measuring the speed with which both native speakers and second language learners were asked to read sentences containing the four subtypes as quickly as possible. Their overall reading times were analyzed as well as reading times in critical syntactic locations. Finally, participants' sensitivity to differences among the types was measured by the speed of the recognition of a probe word presented after the sentence.

Chapter 6 brings together the results of the experiments and evaluates the impact of the findings on the characterization of adnominal constructions in Japanese. In

addition, the efficacy of competing theories to account for the processing results is analyzed. Finally, implications for future studies are discussed.

Chapter 2
Theories

In Japanese, there are four types of clausal modifications with a nominal head. Two of these have English counterparts known as the *relative clause* and the *complement clause* with nominal head. The other two have no English counterparts. These four "Japanese Noun-Modifying Constructions (NMC)" (Matsumoto, 1997) are similar in having a sentence-like modifier followed by a head noun. Theoretically, the four NMCs are distinct but whether, or the extent to which, speakers of Japanese discriminate among these categories is unknown. Consequently, the objective of this thesis was to investigate how speakers of Japanese distinguish among these NMCs.

It is well known that speakers are not aware of the processes involved in their language use. This "cognitive impenetrability" (Fodor, 1983, p.78) predicts that speakers of Japanese would not be aware of the linguistic and psycholinguistic distinctions among the four NMCs. Thus, a more appropriate question would be to ask how fundamentally sensitive speakers are to these distinctions and what characterizes this sensitivity.

In this study, the nature of sensitivity to the four types of Japanese noun-modifying construction (NMC) in the two groups of Japanese speakers (Japanese native speakers and English Japanese as a second language learners (English JSLs)) was investigated, with the help of the following four theoretical concepts. The first two were Gap theory (Chomsky, 1981; Tsujimura, 1997) and Frame theory (Matsumoto, 1997), which theoretically distinguish the four types of NMC. The third concept was markedness (e.g., Battistella, 1996), which is defined by the relations among the four types. The fourth was the traditional notion of transfer in second language acquisition, which allows predictions about the relative ease of acquisition of certain forms. These four concepts are to be interpreted to make psychological predictions on relative difference in processing among the four types. In this chapter, these relevant concepts are surveyed.

Four Types of Japanese Noun-Modifying Construction

The term "Japanese noun-modifying construction" (NMC) refers to a clausal modification with a nominal head, symbolized here as: $[.....V]_{CL}$ N.[1] That is, the modifying clause ends with verbal elements,[2] and the head noun follows it.[3] The four types of NMC, as found in Table 2-1, are the Regular Relative (RR), the Gapless Relative (GR), the Clause and Noun Host Type (CN), and the Complement (COMP).

Table 2-1
Four Types of NMC

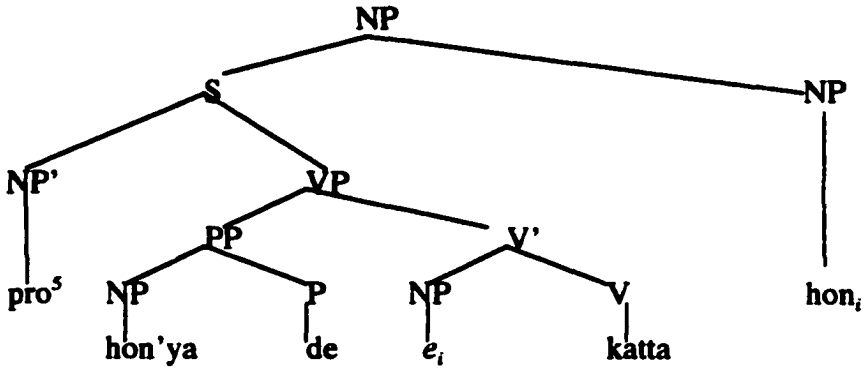
NMC	Example
RR (Regular Relative)	[hon'ya-de katta] shinbun bookstore-at bought newspaper The newspaper (I/ you/ he/ she) bought at the bookstore
GR (Gapless Relative)	[hon-o utta] okane book-ACC sold money The money (I/ you/ he/ she received as a consequence from) having sold the book
CN (Clause and Noun Host Type)	[jiko-ga okita] gen'in accident-NOM occurred cause The cause resulting from which the accident occurred
COMP (Complement)	[ageta] jijitsu gave fact The fact that (I/ you/ he/ she) gave (it) (to you/him/her)

Two distinct syntactic/ semantic theories have been formulated, and each provides unique characterizations for the four types of NMC. The first is Gap theory (e.g., Chomsky, 1981; Murasugi, 1993), and the second is Frame theory (Matsumoto, 1997). Each describes, in a unique way, the manner in which the modifying clause and the head noun are associated.

Gap Theory

Gap theory posits a syntactic gap in the RR, namely, a syntactic gap, a phonetically null element with a syntactic role.[4] For example, in RR in Table 2-1 a gap is posited before the clausal verb *katta* ('bought'), and the gap is coreferential with the head noun *shinbun* ('newspaper'). This situation is illustrated by the tree below.

(2-1)

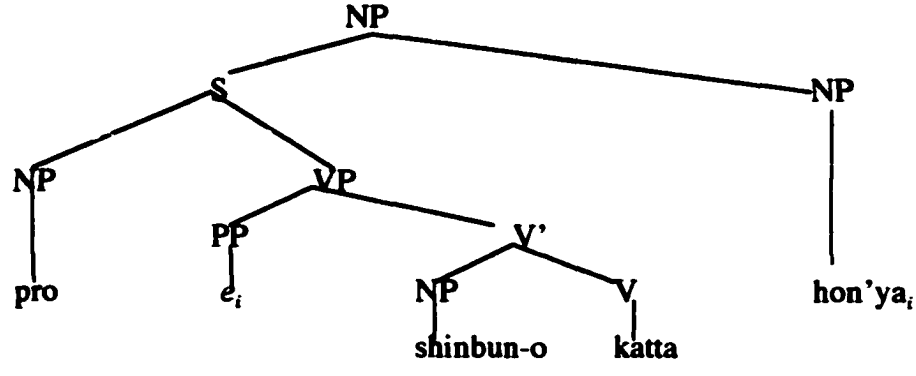


The gap indicated by the empty category e_i is coindexed with the head noun showing the sense that the head noun *hon* ('book') is a part of the embedded sentence. The gap occupies an argument position, in this case, the direct object NP[6] of the verb *katta* ('bought') within the modifying clause.

Not only with an argument NP as in the example of RR in Table 2-1, can the head noun of RR be coindexed with an adjunct PP (Yamashita, 1995) of the verb.[7] For example, in the example of RR in Table 2-1, a PP *hon'ya* ('bookstore') marked with the locative marker *de* can be found in the modifying clause to form a RR yielding (2-2), illustrated by the following tree.

(2-2) [shinbun-o katta] <u>hon'ya</u>
newspaper-ACC bought bookstore
<u>The bookstore</u> at which (I/ you/ he/ she) bought newspaper

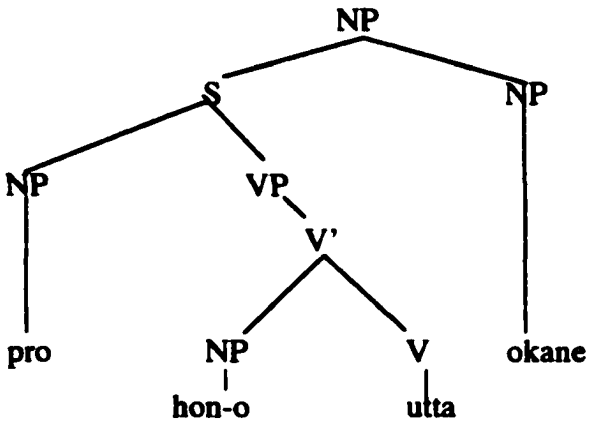
(2-3)



The critical feature of the RR is that the modifying clause and the head noun are associated by this syntactic relation, i.e., the gap, coreferential with the head noun has a syntactic relation (argument NP or adjunct PP) with the clausal verb.

The other subtypes do not exhibit this syntactic relation between the constituents. The first non-gap type is the Gapless Relative (GR) or "*relative clauses without gaps*" (Tsujimura, 1996, p. 266), exemplified in Table 2-1. In the example of the GR in Table 2-1, originally *okane* ('money') is neither an argument NP nor an adjunct PP of the clausal verb *utta* ('sold'). As the corresponding tree (2-4) illustrates, the modifying clause does not contain missing arguments.

(2-4)

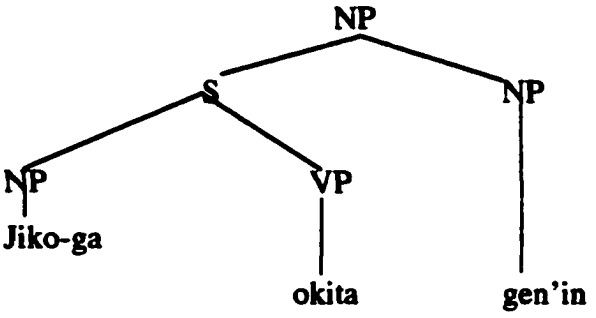


The modifying clause is complete in the sense that all the NPs that are subcategorized for by the verb including the subject NP (filled by a null anaphora "pro") are present. In other words, the head noun does not have a syntactic relation with the verb. Rather, the relation between the head and the clause is a pragmatic one (Kitagawa, 1982; Matsumoto, 1990; Tsujimura, 1996). There is no gap in the clause and, thus, the name Gapless Relative has been proposed.[8]

The second non-gap type is the Clause and Noun Host Type (CN) exemplified in Table 2-1. Illustrated by (2-5), the modifying clause in the CN is again complete in the sense that the subject NP that is subcategorized for by the intransitive verb *okita* ('occurred') is present. The head noun *gen'in* ('cause') is not syntactically related to the clausal verb *okita* ('occurred'). *Jiko* ('accident') is an external argument (subject NP) of

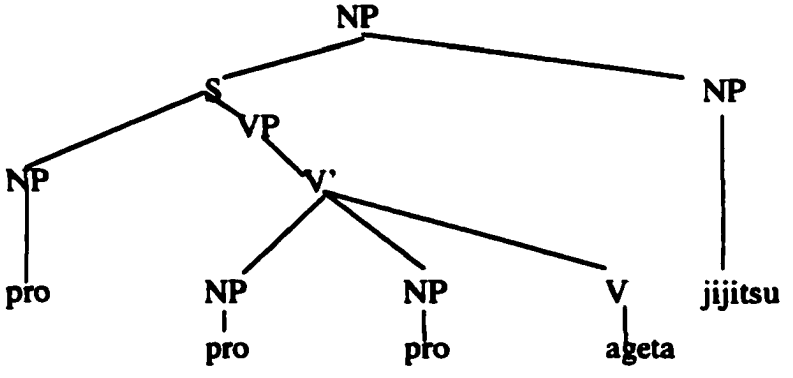
okita ('occurred'), but *gen'in* ('cause') is not. Therefore, there is no syntactically bound empty category in this type.

(2-5)



The third non-gap type, the Complement (COMP), illustrates an appositive relation between the head noun and the modifying clause. For example, in the example of the COMP in Table 2-1, *jijitsu* ('fact') is described by the modifying clause *ageta* ('gave'). Illustrated by (2-6), the modifying clause is complete in the sense that all the NPs that the verb 'give' subcategorizes (direct object NP, indirect object NP, and subject NP) are expressed by pro. There is no syntactic relation between *jijitsu* ('fact') and *ageta* ('gave'). Therefore, there is no gap in this type.[9]

(2-6)



In summary, Gap theory distinguishes between NMCs with a gap and with no gap.[10] Only the RR belongs to the gap type, while the remaining three types belong to the non-gap type. The association of the head noun and the modifying clause is possible via

a gap in the RR but not possible in the GR, CN, and COMP. The theory does not say specifically how the three non-gap types differ. Table 2-2 summarizes the distinctions among four NMC types by Gap theory.

Table 2-2
Distinction among Four NMC Types by Gap Theory

NMC	Schematic Expression	Distinction
RR (Regular Relative)	[...e_i..V] N_i	Gap Type
GR (Gapless Relative)	[.....V] N	Non-Gap Type
CN (Clause and Noun Host Type)		
COMP (Complement)		

Note. *e* indicates empty category.

Frame Theory

Frame theory (Matsumoto, 1997) captures the association between the modifying clause and the head noun by a hosting and hosted relation rather than by presence/ absence of a syntactic gap. The hosting constituent evokes a frame while the hosted constituent plays a role in the frame. If one constituent hosts, the other constituent needs to be hosted. The four types of NMC are classified among three types: Clause Host, Noun Host, and Clause and Noun Host. The RR and the GR belong to the Clause Host Type, the COMP belongs to the Noun Host Type, and the CN belongs to the Clause and Noun Host Type.

The RR is a Clause Host Type. In the example of the RR in Table 2-1, the modifying clause, *hon'ya-de katta* ('bookstore'-'at ''bought'), evokes the 'having bought at the bookstore' frame, inviting the head noun *shinbun* ('newspaper') to play a role in this frame. *Shinbun* ('newspaper') plays the role of the object of buying in this frame. In this way, the modifying clause hosts the head noun, and an association between two constituents is made. In the RR, the head noun neither evokes a frame nor hosts the modifying clause. Therefore, it is not necessary for the modifying clause to play a role in the association of the two constituents.

The GR is a Clause Host Type, as is the RR, and the same principle comes into play between the two constituents. In the example of the GR in Table 2-1, the modifying clause *hon*-o *utta* ('book'-ACC 'sold') evokes the 'having sold the book' frame, inviting

the head noun *okane* ('money') to play a role in this frame. Because selling something typically involves money exchange, *okane* ('money') plays the role of the exchanged object in this frame. In this way, the modifying clause hosts the head noun, and the association between two constituents is made.

Matsumoto further describes the GR, as a part of Clause Host Type, in terms of semantic relations between the modifying clause and the head noun. For example, in the example of the GR in Table 2-1, the meaning of the modifying clause and the meaning of the head noun are related by condition and consequence. In this case, the head noun *okane* ('money') is not an argument of the clausal verb *utta* ('sold'); rather, it is an argument of an unexpressed predicate 'receive', as the English translation suggests, which is pragmatically associated with the meaning of the clause, i.e., having sold the book. As a consequence of the event of 'selling the book,' another event of 'receiving money' took place. In this sense, the GR appears to be a complex NP involving two separate but related events.

Beside condition and consequence, Matsumoto (1997) describes the possible relations of the two events, including consequence and condition,[11] purpose and requisite,[12] requisite and purpose,[13] part and whole,[14] and event and unusual cause of opposite event.[15]

In the GR, as in the RR, the head noun neither evokes a frame and nor hosts the modifying clause. Therefore, it is not necessary for the modifying clause to play a role in the association of the two constituents. In both the RR and GR, the name of the role that the head noun occupies, such as an object of reading or an exchanged object, is not overtly expressed and needs to be found.

The COMP belongs to the Noun Host Type. In the example of the COMP in Table 2-1, the head noun *jijitsu* ('fact') evokes a 'fact' frame inviting the modifying clause *ageta* ('gave') to play a role in the frame. The role of the modifying clause concerns the content of the memory, and the hosting head noun labels the role as *jijitsu* ('fact'), encapsulating the hosted modifying clause. In the COMP, the modifying clause does not evoke a frame. Therefore, it is not necessary for the head noun to play a role in the association of the two constituents.

The head nouns of the COMP are content-taking nominals, the content of which is expressed by the modifying clause. Matsumoto (1997) describes three distinct semantic types for the head nouns of the COMP. They are communication, such as *denwa* ('phone call'), *kookoku* ('advertisement'), *shitsumon* ('question'), and *iken* ('opinion'); thought and feeling such as *yokubou* ('desire') and *gaman* ('endurance'); and other content-taking nouns such as *omoide* ('memory'), *uttae* ('plea'), *rikutsu* ('logic'), and *kettei* ('decision').

The CN belongs to the Clause and Noun Host Type. In the CN, each constituent evokes a frame and hosts the other. In the example of the CN in Table 2-1, the modifying clause *jiko-ga okita* ('accident'-NOM 'occurred') evokes 'accident occurred' frame. This frame provides the reason why the accident occurred, and the head noun *gen'in* ('cause'), that was invited to play a role in the frame, names rather than occupies the role. In this way, the modifying clause hosts the head noun and the association is made. The important characteristic of the manner in which the head noun is hosted by the modifying clause is that the head noun names, rather than expresses the content of, the role. The content of cause itself is not expressed but becomes clear when it is expressed by the rest of the sentence. In (2-7) below, where the rest of the sentence of the example of the CN in Table 2-1 is explicit, the cause of the accident is described as 'lack of sleep.'

(2-7) [jiko-ga okita] gen'in-wa suiminbusoku datta
accident-NOM occurred cause-TOP sleep+lack COP+PAST
The cause resulting from which the accident occurred was the lack of sleep.

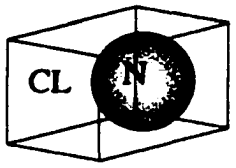
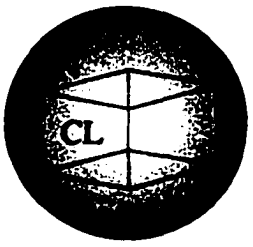
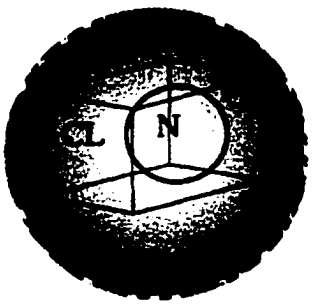
Reciprocally, the head noun *gen'in* ('cause') evokes a frame that involves a role in relation to what the head noun denotes, i.e., an effect. The content of the effect is expressed by the modifying clause *jiko-ga okita* ('accident'-NOM 'occurred'). In other words, the role (effect) in relation to the meaning of the head noun (cause) encapsulates the modifying clause. In this way, the head noun hosts the modifying clause, and the association is made.

Due to the evocation of a relational frame, head nouns of the CN have relational meaning. Head nouns are classified by Matsumoto (1997) according to their semantics. They are relational nouns such as *riyuu* ('reason'), *kekka* ('result'), *chokuzen* ('moment prior to'), *aida* ('space/ time between'), *yoko* ('next to'), *atari* ('space/ time around');

perception head nouns such as *oto* ('sound'), *benkyoo* ('study'); and quasi-relational head nouns such as *asa* ('morning'). The meanings of the head nouns are the names of the roles in the frame evoked by the modifying clauses.

Table 2-3 summarizes the differences among the four types in terms of hosting and hosted relations between the head noun and the modifying clause.

Table 2-3
Distinction among Four NMC Types by Frame Theory

NMC	Schematic Expression	Distinction
RR (Regular Relative) GR (Gapless Relative)	 N is hosted by CL.	Clause Host Type
COMP (Complement)	 CL is hosted (encapsulated) by N.	Noun Host Type
CN (Clause and Noun Host Type)	 N and CL reciprocally host each other. N, the smaller sphere in the center, is hosted by CL. N evokes a complementary idea (the larger sphere with broken line) that hosts (encapsulates) CL.	Clause and Noun Host Type

Note. N: head noun, CL: modifying clause

Summary of Differences among Four Types of NMC

From Gap and Frame theoretic viewpoints, the differences among the four types of NMC are clear. Gap theory makes a two-way distinction between the gap type (RR) and the non-gap type (GR, CN, and COMP) while Frame theory makes three-way distinctions among the Clause Host Type (RR and GR), the Clause and Noun Host Type (CN), and the Noun Host Type (COMP). In order to make distinctions among the RR, GR, CN, and COMP, both theories are required because Gap theory does not state the difference among three non-gap subtypes while Frame theory does not state the difference between the two Clause Host subtypes. This is summarized in Table 2-4.

Table 2-4
Distinction among Four NMC Types by Gap Theory and Frame Theory

NMC	Gap Theory	Frame Theory
RR (Regular Relative)	Gap Type	Clause Host Type
GR (Gapless Relative)	Non-Gap Type	
CN (Clause and Noun Host Type)		Clause and Noun Host Type
COMP (Complement)		Noun Host Type

The four-way distinction by de-relativization. Based on the claims made by Gap and Frame theories, a four way distinction is possible using the two criteria: a) whether de-relativization, i.e., forming a sentence by incorporating the head noun into the modifying clause, is possible, and b) if not possible, the different reasons why it is not possible.

Because as Gap theory states, the syntactic gap is coreferential with the head noun, the RR type can derive a well-formed sentence with the clausal verb and the head noun as its argument. For example, the example for the RR in Table 2-1 repeated below as (2-8) can be de-relativized to (2-9) by recovering the accusative case marker *o* for the head noun *shinbun* ('newspaper') without changing the original proposition denoted in Table 2-1. That is, "bought ((I/ you/ he/ she), newspaper, bookstore)."

(2-8) [hon'ya-de katta] shinbun
bookstore-at bought newspaper
The newspaper (I/ you/ he/ she) bought at the bookstore

(2-9) hon'ya-de shinbun-o katta
bookstore-at newspaper-ACC bought
(I/ you/ he/ she) bought newspaper at the bookstore.

On the other hand, the GR is not subject to de-relativization. As Gap theory suggests, there is no syntactic gap coreferential with the head noun in the GR. The head noun, rather than being an argument of unexpressed predicate, is an argument of an unexpressed predicate. For example, in the example of the GR repeated below as (2-10), the original predicate argument structure is something like: "sold ((I/ you/ he/ she), book) AND CONSEQUENTLY received ((I/ you/ he/ she), money)."

(2-10) [hon-o utta] okane
book-ACC sold money
The money (I/ you/ he/ she received as a consequence from) having sold the book

In this case, two predicates, 'sold' and 'received', are involved. Because of this, it is not possible to de-relativize this NMC to a single sentence with only the clausal verb and with the same predicate argument structure.

De-relativization of the CN is not possible, but for a different reason. The CN is the only type where the head noun "names" its own role in the frame evoked by the modifying clause. For example, the predicate argument structure of the example of the CN in Table 2-1 repeated below as (2-11) should be something like "occurred (accident, CAUSE)." The head noun is the name of the adjunct PP signaled by the upper case letters and not its content as in the case of 'accident' which occupies the external argument (subject) NP slot.

(2-11) [jiko-ga okita] gen'in
accident-NOM occurred cause
The cause resulting from which the accident occurred

When this type of NMC is converted to a sentence, while maintaining the original proposition, the resulting sentence is not quite well formed as in (2-12).

(2-12) ?jiko-ga aru gen'in-de okita
accident-NOM certain cause-with occurred
?The accident occurred with a certain cause.

The head noun 'cause' received the postpositional particle *de* ('with') and is a part of the sentence. However, *gen'in* ('cause') is the name of the argument in relation to the verb *okita* ('occurred'). As the indefinite demonstrative *aru* ('certain') modifying *gen'in* ('cause') indicates, the cause is not specified in this sentence. In other words, unlike the head nouns of the RR, the head noun of the CN does not participate in the proposition directly. Because the head noun of the CN is just a name, not the content, the resulting de-relativized sentence is awkward. In the absence of *aru* ('certain'), (2-12) is completely ungrammatical in Japanese.

De-relativization is, again, impossible for the COMP, for yet a different reason. In the COMP, the head noun does not carry a thematic role in relation with the clausal verb, and is the name of what is expressed by the modifying clause. In this case, the formulation of a sentence with the head noun as a part is impossible because the head noun is not an argument NP nor an adjunct PP of the clausal verb; instead, the head noun is a name of what the whole modifying clause means.

The four-way distinction of NMC subtypes based on possibility of de-relativization and the reason of inadequacy is summarized in Table 2-5.

Table 2-5
Distinction among Four NMC Types by De-Relativization

NMC	De-Relativization	Reason
RR	Yes	The head noun is syntactically related to the clausal verb.
GR	No	The head noun is an argument of an unexpressed predicate.
CN	No	The head noun labels rather than occupies the argument slots governed by the clausal verb.
COMP	No	The head noun is a name of what the modifying clause expresses.

NMC and English Clausal Modifier with a Nominal Head

The English parallel structure to the Japanese NMC is the clausal modifier with a nominal head in the form N[...]$_{CL}$, where the head noun precedes the clause. There are two subtypes of clausal modifiers with a nominal head: relative clause and complement with nominal head. The relative clause is a direct counterpart of RR, while the complement is a direct counterpart of COMP.

Example 2-13 is the English translation of the example of the RR in Table 2-1, and (2-14) is the English translation of the example of the COMP in Table 2-1.

(2-13) The newspaper that I bought at the bookstore

(2-14) The fact that I gave it to you

There are no equivalent syntactic counterparts in English for GR and CN. This is obvious from the English translation for the GR and the CN in Table 2-1 repeated below as (2-10) and (2-11), respectively. The English translations for the GR and the CN require elaborate paraphrases which are not found in Japanese. For example, for (2-10) the English translation contains 'receive as a consequence from' which is not explicitly mentioned in the original Japanese. As for (2-11) too, the English translation requires an expression such as 'resulting from' that is not included in the original Japanese.

(2-10) [hon-o utta] okane
book-ACC sold money
The money (I/ you/ he/ she received as a consequence from) having sold the book

(2-11) [jiko-ga okita] gen'in
accident-NOM occurred cause
The cause resulting from which the accident occurred

This situation, in which English lacks the two subtypes, is summarized in Table 2-6.

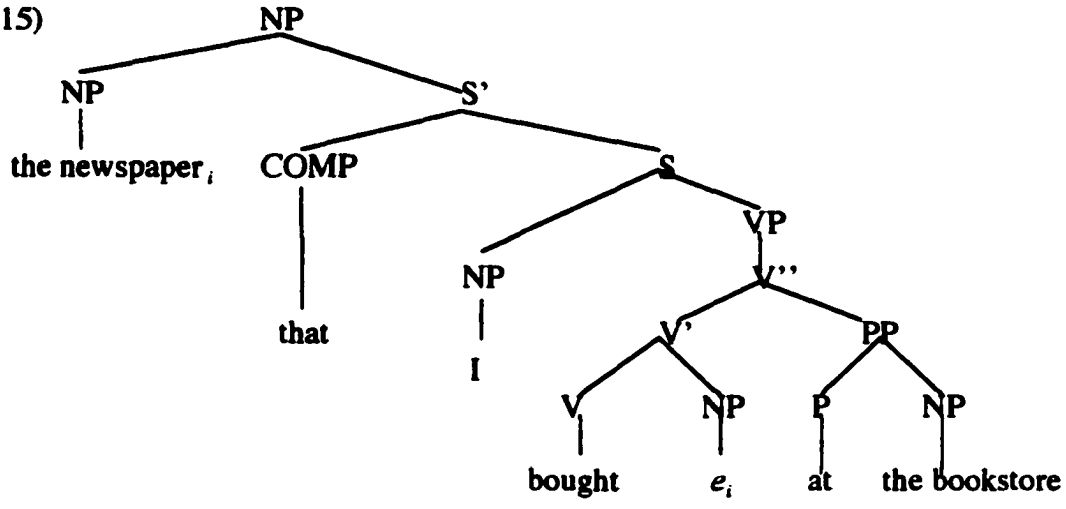
Table 2-6
Corresponding Construction Types between English Clausal Modifier with Nominal Head and Japanese NMC

English	Japanese
Relative Clause	RR
-	GR
-	CN
Complement	COMP

The distinction between these two subtypes in English can be made singly either by Gap theory or by Frame theory. Gap theory assumes that a relative clause contains a syntactic gap while a complement does not (e.g., Comrie & Horie, 1995).

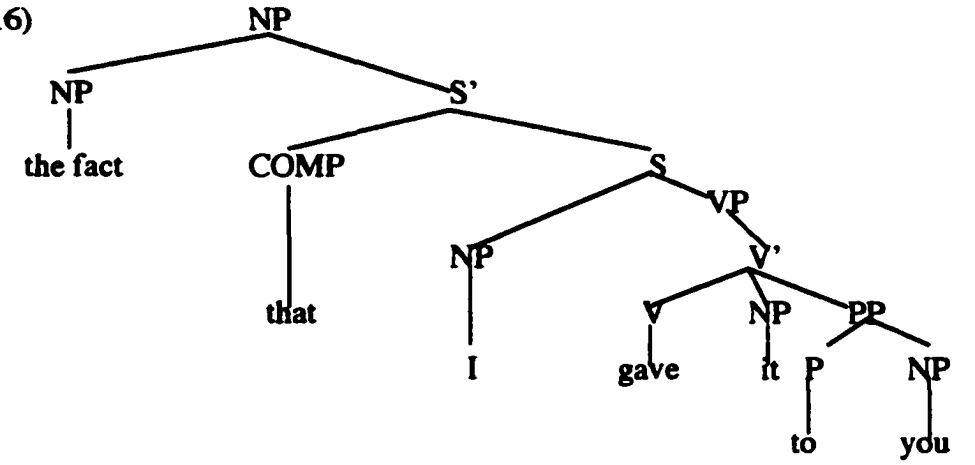
For example, in (2-13), an example of a relative clause, the head noun is coreferential with the gap posited in the modifying clause in the node of a direct object of the verb 'bought' illustrated by the tree (2-15).

(2-15)



On the other hand, a gap cannot be posited in the modifying clause of (2-14), an example of a complement with a nominal head, as the tree (2-16) illustrates.

(2-16)



All the nodes that are subcategorized for by the verb are filled. Therefore, it is not possible to posit a syntactic gap coreferential with the head noun in complements with nominal heads.

Frame theory explains that relative clauses are Clause Host Type where a head noun plays a role in the frame evoked by the modifying clause. On the other hand, complements with nominal heads are Noun Host Type in which the head noun does not participate in the frame that the modifying clause evokes because the modifying clause does not evoke a frame. Instead, the head noun evokes a content frame and encapsulates what is expressed by the modifying clause.

The distinction between relative clause and complement in English is made by either Gap theory or Frame theory, which is summarized in Table 2-7.

Table 2-7
Distinction among English Clausal Modifiers with Nominal Head by Gap and Frame Theories

English Clausal Modifier with Nominal Head	Gap Theory	Frame Theory
Relative Clause	Gap Type	Clause Host Type
Complement with Nominal Head	Non-Gap Type	Noun Host Type

Markedness

Two linguistic theories, Gap and Frame, draw distinctions among the four NMC types. In addition, the concept of *markedness* was employed in this study. Markedness

makes a two-way distinction: marked and unmarked. Markedness refers to properties, within a language and across languages, of a relationship among related structures, where one is unmarked and the other marked.

Determining which of the four construction types is marked with respect to other is problematic unless the criteria for markedness are well determined (Beck, in press). Givón (1984) and Battistella (1990) point out that the criterion is contextually restricted, independently of the defining properties of markedness. In this study, the context is Japanese noun-modifying construction, a natural class in which all the members look like $[\ldots]_{CL}N$. It is in this context that the criterion of markedness is required.

For example, Givón (1995, 1984) summarizes three major criteria as "structural complexity," "frequency distribution," and "cognitive complexity." The "structural complexity" criterion states the marked structure is more complex or larger than the unmarked. The "frequency distribution" criterion states that the marked structure is psychologically "figure" in relation to the unmarked counterpart which is "ground,"" the figure being cognitively more salient and thus less frequent, than the ground. The "cognitive complexity" criterion states that the marked category is cognitively more complex than the corresponding unmarked category in terms of processing time, attention and mental effort.

Among Givón's criteria, the structural complexity criterion is not applicable because the four construction types all seem equally complex or simple in having apparently the same form. As for the distribution criterion, it is not known which construction type is least frequently used in a specific genre. The cognitive complexity criterion is applicable because it relates to the difference in processing effort among the four NMCs. However, which type is more cognitively complex or more costly to process is not a criterion here; rather it is one of the questions that can be answered in the present experimental study. Therefore, Givón's criteria were not employed in this study.

White (1989) and Ellis (1994), among others, refer to the use of the concept of markedness in typological studies. The features common to most languages are unmarked, while those that are rare or specific to a particular language are marked. If typological analyses were available for clausal modification structures for many languages, it might be possible to designate which of the four construction types is

marked with respect to others. If one member is missing in most of the languages while the other is common in the context of clausal modifiers with nominal heads, it would be possible to define the former as marked with respect to the rest. For example, if the RR is common to most languages, and the GR to very few, the RR would be unmarked with respect to the GR. However, currently those data are unavailable. Therefore, the criterion motivated by typological studies was not employed.

Markedness definition by learnability theory. Manzini and Wexler (1987), motivated by learnability theory, proposed the subset approach to determine the markedness relation. In the present study, their method was adopted to classify NMCs. Manzini and Wexler (1987) calculated possible grammars in a subset/ superset relation as in Figure 2-1 below. Figure 2-1 depicts that Grammar Y can generate sentences that are a proper subset of those generated by Grammar X.

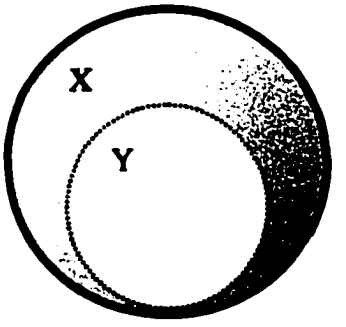


Figure 2-1. Subset grammar Y generates sentences that are a proper set of sentences that superset grammar X generates.

The sentences that belong to the white area (i.e., generated by subset grammar Y) are unmarked, while sentences belonging to the grey area (i.e., the sentences that superset grammar X generates but not subset grammar Y) are marked cases.

The markedness claim motivated by learnability theory in Manzini and Wexler (1987) is as follows. On the basis of positive evidence, the unmarked grammar that generates subset sentences is chosen by L1 acquirers, because, upon encountering linguistic data, the Subset Principle tells the learners to choose the most conservative grammar (subset setting, unmarked). On the basis of later positive evidence, then L1

acquirers would choose the setting that generates superset sentences (superset setting, marked).

In terms of NMC, the RR, the GR, the CN, and the COMP can be sorted into the two areas by constructing two hypothetical grammars: one that generates all types and the other that generates all but the GR. The first grammar includes the second. This inclusion relation is illustrated in Figure 2-2.

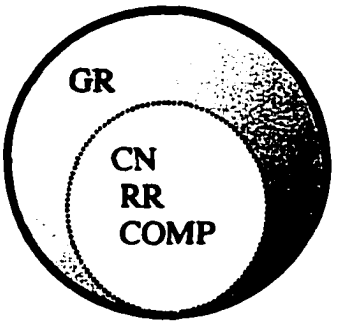


Figure 2-2. GR is marked with respect to CN, RR, and COMP.

The GR involves extra predication for interpretation.[16] For example, in the example of the GR in Table 2-1, the head noun *okane* ('money') is an argument of the unexpressed predicate such as 'received.' It becomes clearer when the propositional structure is elaborated by the two linked events as follows: "sold ((I/ you/ he/ she), book) AND CONSEQUENTLY received ((I/ you/ he/ she), money)." The underlined elements 'sold,' 'book,' and 'money' are explicit but 'received' is not. Also the relation between the two events "AND CONSEQUENTLY" is not explicit. In order to recover the hidden verb 'received,' pragmatic knowledge is involved while associating "sold ((I/ you/ he/ she), book)" and "money": the world knowledge or common sense that selling goods consequently leads to reception of cash rewards.

The other types, the RR, the CN, and the COMP do not involve an unexpressed predicate in order to link the modifying clause and the head noun. In other words, pragmatic knowledge is involved for the GR, but not for the RR, the CN, and COMP. The resources for combining the head noun and the modifying clause for all the subtypes of NMC are: baseline logical knowledge of relation including equation, knowledge of thematic relation, and pragmatic knowledge, as listed in Table 2-8.

Table 2-8

Resources Involved in Association of Modifying Clause and Head Noun of NMC

NMC	Baseline Logical Knowledge of Relation Including Equation	Knowledge of Thematic Relation	Pragmatic Knowledge
RR	√	√	
GR	√	√	√
CN	√	√	
COMP	√		

Knowledge of thematic relations is involved in the interpretation of all but the COMP. The head nouns of the RR, the GR, and the CN participate in a proposition; that is, they have a relation with the predicate in the proposition. On the other hand, the head nouns of the COMP do not; they are in appositive relation with or names of (thus encapsulating) the whole modifying clause.

In an example of the RR, the head noun carries a role of "object of buying" in relation to the clausal verb 'bought,' participating in the proposition with the verb. In the example of the GR, the head noun carries the role of "object of receiving," participating in the proposition with the hidden verb. In the example of the CN, the head noun names a role of "CAUSE" in relation to the modifying clause, indirectly participating in the proposition with the clausal verb 'occurred.' The head noun of the COMP does not participate in a proposition. Therefore, knowledge of thematic relation is not involved in construal of the COMP.

Baseline logical knowledge of relations is assumed to be involved in association of the modifying clause and the head noun of all types as a background resource; that is, whatever the type of construal, logical knowledge is at work. It is a foreground resource for the construal of the CN and the COMP. The head nouns of the CN evoke a relational frame that has the role for the event/ state complementary to the meaning of the head noun. Therefore, the knowledge of logical relations (cause–effect, reason–result, before–after, front–back, etc.) is involved. The head nouns of the COMP are names of what the modifying clause expresses. In other words, the meaning of the head noun and the meaning of the modifying clause are in the relation of equation. Therefore, the knowledge of logical equation is involved here.

According to Table 2-8, which summarizes the resources involved in the association of the two constituents, the interpretation of the GR involves the most

resources, then the RR and the CN, and the least resource for the COMP. The four NMC types are therefore generated by three grammars in subset condition as illustrated in Figure 2-3.

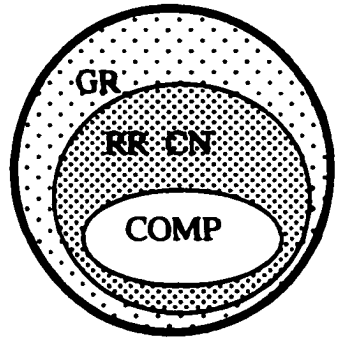


Figure 2-3. Three grammars that generate the RR, the GR, the CN, and the COMP are in subset relation. The superset grammar that generates GR generates all the types.

Based on the subset condition here, the GR is marked with respect to the RR, the CN, and the COMP. Also the GR, the RR, and the CN are marked with respect to the COMP. All together, the GR is marked with respect to the RR and the CN, which are marked with respect to the COMP. In any case, it is clear that the GR has definitely the marked status. It seems profitable, therefore, to view the markedness relations among NMCs as binary in order to highlight the dramatic manner in which the GR differs from the other three.

Therefore, in this study, the GR is considered marked with respect to the RR, the CN, and the COMP, as summarized in Table 2-9.

Table 2-9
Distinction among Four Types of NMC by Markedness

Marked	Unmarked
GR	RR, CN, COMP

Transfer

The fourth concept that was suspected to have an effect on distinguishing among the four NMC subtypes was *transfer*. When learners of Japanese encounter the four NMC subtypes, their way of processing is likely to show an influence of their experience in processing L1. Superficially similar NMCs may be distinguished due to this carry-

over habit from L1. This influence or carry-over effect in general is called *transfer* (cf. White, 1989; Gass, 1996, among others). In essence, a carry-over effect leads to earlier acquisition of L2 where features are comparable or similar between the two languages. Features that are not in common are acquired later. In terms of NMC, the assumption is that some subtypes are under a positive L1 influence while the rest are not. Which of the RR, the GR, the CN, and the COMP are acquired with positive influence from L1, and therefore, are easier to acquire than the others? The answer to this question depends on how the transfer effect takes place.

There are two positions as to exactly how transfer effect occurs. The first one involves a contrastive analytic understanding of the transfer effect. By contrasting L1 and L2, certain properties of L2 that are obviously similar and familiar to L1 should be under positive transfer while others, obviously different from and unfamiliar to L1, should be under negative transfer. The second position takes generative grammar as a starting point, where L2 acquisition is viewed as resetting from the L1 value to the correct L2 value of the same parameter. Transfer, if any, is understood as an initial L1 value for the parameter with which a specific feature of L2 is associated.

Each view on how transfer works predicts different ways to distinguish four subtypes of NMC by English JSLs.

Obvious transfer. From a contrastive analytic point of view, the linguistic units that are considered transferable are "obvious" (White, 1992, p. 221) and "visible" (White, 1992, p. 220) similarities and differences between L1 and L2.[17] They are obvious because regular classroom teachers can identify them without any detailed training in particular linguistic theories. An example of an obvious facilitating feature for teachers of Japanese with students of different L1 background, is the orthographic similarity between Japanese and Chinese characters. This gives Chinese students an enormous advantage over English L1 students (see also Ellis, 1994). An example of an obvious inhibiting feature is the definite article 'the' in English that applies to Japanese L1 learners of English as L2. Japanese lacks this class of definite article. Classroom teachers of English, when marking English composition assignments written by Japanese students can easily attribute errors to the fact that this functional category is missing and unfamiliar in Japanese, and therefore, not positively transferable.

In the context of NMC, there are typological studies, such as Comrie and Horie (1995),[18] which have looked at the relatively obvious superficial appearance of modifications with nominal head in English and Japanese. Comrie and Horie assume the RR and the COMP are equivalent with the English relative clause, and the complement clause with a nominal head, respectively. The relative clause in English appears to contain a gap while the complement in English apparently does not, and Japanese RR and COMP respectively seem to match the criterion. On the other hand, the CN and the GR do not contain a gap, and, therefore, they are something else. Since there are no other types of clausal modifiers with nominal heads in English other than the relative clause and the complement, the GR and the CN are missing in English.

The obvious transfer position, therefore, makes the following distinction among subtypes of NMC. By contrasting English and Japanese at the structural level, the four types are divided into two categories: familiar ones (the RR and the COMP) and unfamiliar ones (the GR and the CN) to English.

Table 2-10
Distinction among Four Types of NMC by Obvious Transfer

Familiar	Unfamiliar
RR, COMP	GR, CN

Transfer in Principles and Parameters theory. In research that relates to Universal Grammar (UG), by which any L1 acquisition is assumed to be constrained (e.g., White, 1989, 1996, 2000), L2 acquisition is considered a process of resetting the value of certain "parameters" to the appropriate value of the same parameter in L2. Parameters are part of UG and constrain variation among languages with different values. The effect of transfer, in this view, is that the learners initially set their L1 value of the same parameter for their target language.

In the context of NMC, the L1 English learners are assumed to apply their L1 setting for the parameter associated with NMC. What then is the English value for this parameter in charge of the properties of NMC?

In order to determine the L1 value L2 values for the parameter by which the properties of NMC are coded, the relationships among the members of NMC and among

their equivalents in English were considered. The method employed here is that the value of Japanese is first determined by the markedness relation among the four NMC members, then the value of L1 is to be determined by the relation of the equivalent structures of NMC in English.

First of all, as Figure 2-2 repeated below illustrates, the RR, the GR, the CN, and the COMP are generated by grammars in a subset condition. Because of this relation, the GR was determined to be marked with respect to the RR, the CN, and the COMP. This means that Japanese (L2) has both marked and unmarked members.

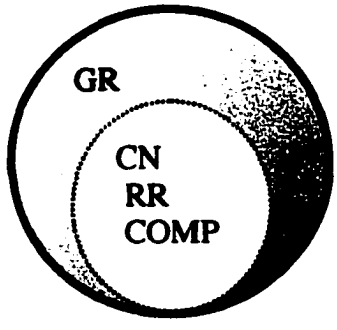


Figure 2-2. GR is marked with respect to CN, RR, and COMP.

On the other hand, there is the assumption that the RR and the English relative clause, and the COMP and the English complement are equivalents, and that the English equivalents for the GR and the CN are missing (cf. Table 2-6). This means that English has only unmarked members and no marked members, as Figure 2-4 illustrates.

Figure 2-4. Relative clause and complement are unmarked members. There are no marked members in English.

The claim by transfer in Principles and Parameters theory is that, initially, the learners choose the setting of L1. In this case, the L1 is the unmarked setting, which is the subset grammar. The subset grammar generates the CN, the RR, and the COMP in L2. That is, the English L1 learners of L2 Japanese initially acquire the CN, the RR, and the COMP. Because the CN is generated by subset grammar, the learners are supposed to acquire initially the CN as well, which obvious transfer does not predict to happen. Based on positive evidence, later they acquire the GR.[19] This distinction by transfer in Principles and Parameters theory, coupled with the markedness definition by the subset condition, is summarized in Table 2-11.

Table 2-11
Distinction among Four Types of NMC by Transfer in Principles and Parameters

Subset setting (Unmarked)	Not Contained in Subset setting (Marked)
RR, CN, COMP	GR

Markedness vs. transfer in Principles and Parameters theory. The distinction in Table 2-11 is exactly what markedness makes (cf. Table 2-9 for distinction among four types of NMC by markedness). Because English equivalents for NMC belong only to the subset grammar, it is impossible to separate the markedness claim (which distinguishes unmarked members from marked members) and the transfer claim of Principles and Parameters theory (which distinguishes L1 setting (i.e., unmarked/ subset) from L2 setting (i.e., marked/ superset)).

In this study, because the markedness definition by subset-superset relation is assumed, the claim of transfer on the grounds of Principles and Parameters theory is incorporated in the markedness claim. That is, there is one claim by markedness and one claim by obvious transfer.

Interpretation of Gap, Frame, Markedness, and Transfer

The purpose of this study was to find out if speakers of Japanese discriminate among the four types of NMC, and if so, whether they do so in ways predicted by the theories outlined above. Four concepts were suspected to be responsible for the

discrimination. Gap, embraced in Gap theory, distinguished gap type (RR) from non-gap type (GR, CN, and COMP). Hosting and hosted relations in Frame theory separated Clause Host Type (RR and GR), Noun Host Type (COMP), and Clause and Noun Host Type (CN). Markedness, as determined by the Subset Principle among subtypes of NMC, assigned marked status to the GR while unmarked status to the RR, the CN, and the COMP. The fourth concept, transfer, applicable to L2 acquisition, distinguishes the RR and the COMP (the familiar structures to English) from the GR and the CN (the missing structures in English). These concepts now need to be interpreted in processing terms.

Processing interpretation of Gap. The psycholinguistic interpretation of Gap theory rests on the claim that a syntactic gap generates multiple activation of its referent. (Bever & McElree, 1988; Nakayama, 1995; Mazuka, 1991; Yamashita, Stowe, & Nakayama, 1993). In the NMC, the head noun comes after the modifying clause; i.e., a gap and its referent are in a cataphoric relation (see the schematic expression in Table 2-2 for the positions of the gap and its antecedent head noun). Thus, it is impossible for the gap to be accessed before the referent NP has been encountered, unlike an English gap which follows, rather precedes, its antecedent NP. Mazuka (1991) also points out that it is impossible to posit a gap at the sentence location at which it exists during the on-line processing of Japanese sentences. It is always after the referent NP is received that one realizes, if at all, that there was a corresponding gap in the previous part of the sentence. Therefore, this psycholinguistic interpretation of gap may be problematic for Japanese NMCs (cf. Miyamoto & Kess, 1995).

In this present study, the presence of a gap, i.e., the presence of the coreferential relation of the head noun and its preceding gap due to their syntactic relation with the clausal predicate, was expected to facilitate parsing of the head noun. When the head noun is received, the hearer should realize that the NP is syntactically bound with previous linguistic material via its gap. Therefore, Gap theory suggests that the RR should be easier to process than the GR, the CN, and the COMP, summarized in Table 2-12. Both Japanese native speakers and English JSLs (Japanese as a second language learners) should be subjected to this prediction.

Table 2-12
Ease of Processing Prediction by Gap Theory for Japanese Native Speakers and English JSLs

Easy	Hard
RR	GR, CN, COMP

Processing interpretation of Frame. There have been no previous psycholinguistic studies on hosting and hosted relation as conceived in Frame theory. In the present study, a new interpretation was developed. The relation of the hosting element and hosted element was seen as ground and figure (cf. Talmy, 1988). This psychological interpretation suggests that the hosted element, i.e., the figure, may be captured as salient information, while the hosting element, i.e., ground, may be captured as less salient information. Based on this assumption, the hosted element (figure, more salient) was expected to be retained in memory better than the hosting element (ground, less salient).

The RR and the GR are Clause Host Types. That is, the head noun is hosted by the modifying clause; therefore, the head noun should be retained in memory better than the modifying clause. The COMP is a Noun Host Type. That is, the head noun hosts the modifying clause; therefore, the modifying clause should be retained in memory better than the head noun. Lastly, the CN is Clause and Noun Host Type. Both constituents host the other. Therefore, the retention level of both constituents should be equal. Table 2-13 summarizes the interpretation of Frame Theory. The ease of retention prediction should apply to both Japanese native speakers and English Japanese as a second language learners (English JSLs).

Table 2-13
Ease of Retention Prediction by Frame Theory for Japanese Native Speakers and English JSLs

NMC	Modifying Clause (CL)	Head Noun (N)	Retention
RR, GR	Hosting Information	Hosted Information	N > CL
CN			N = CL
	Hosted Information	Hosting Information	
COMP			N < CL

Processing interpretation of markedness. Independently from markedness definition criteria, markedness predicts that a marked member is acquired later than an

unmarked member (cf. White, 1989). Markedness, as adopted in the research on Universal Grammar (UG), is used to explain the order of acquisition in both L1 and non-primary language acquisitions. In any case, the explanation is that unmarked form is acquired first and the marked one is acquired later. As for processing predictions outside the researches on UG, Givón (1995) proposes, as one of the criteria of markedness, "cognitive complexity", which says that marked members tend to be "cognitively more complex" and require a processing cost such as "mental effort, attention demands or processing time."

In this study, the markedness contrast among subtypes of NMC is interpreted as corresponding to the ease of processing: the marked type (GR) being harder to process than unmarked types (RR, CN, and COMP). This interpretation should apply to both Japanese native speakers and English JSLs.

Table 2-14
Ease of Processing Prediction by Markedness for Japanese Native Speakers and English JSLs

Easy	Hard
RR, CN, COMP	GR

Processing interpretation of transfer. Under the contrastive analytic understanding of transfer (obvious transfer), the RR and the COMP in the target language are familiar to L1 while the GR and the CN are not. Therefore, the RR and the COMP should be easier to process than the GR and the CN for English JSLs. This is summarized in Table 2-15.

Table 2-15
Ease of Processing Prediction by Transfer for English JSLs

Easy	Hard
RR, COMP	GR, CN

Research Hypotheses

This study tested experimentally the following research hypotheses listed in Table 2-16.

Table 2-16
Research Hypotheses Related to Processing NMCs

Concept	Speaker Group	Hypotheses
Gap	Japanese L1 and English JSLs	Gap facilitates processing. The RR is a gap type, and the rest are non-gap types. The RR should be easiest to process.
Frame	Japanese L1 and English JSLs	The hosted information should be better remembered than the hosting information. For the RR and the GR (Clause Host Type), the head nouns should be easier to retain in memory than the modifying clauses. For the COMP (Noun Host Type), the modifying clauses should be easier to remember than the head nouns. For the CN (Clause and Noun Host Type) the two constituents should be equally easy to retain in memory.
Markedness	Japanese L1 and English JSLs	The marked member should be harder to process. Therefore, the GR (marked) should be harder to process than the RR, the CN, and the COMP (unmarked).
Transfer	English JSLs	For the second language learners, the familiar structures are easier to acquire than the unfamiliar structures. Therefore, the RR and the COMP should be easier to process than the GR and the CN for English JSLs.

Organization of the Experiments

The following three chapters describe a series of experiments that evaluated the research hypotheses. The three experiments were carried out in sequence. However, as summarized in Table 2-17, they are described in the opposite order in the following chapters for the puposes of presentation clarity.

In the first experiment, both Japanese native speakers and English JSLs read sentences containing NMCs on the computer screen. After this task, only English JSLs checked, in terms of awareness of the readings and the meanings of the vocabularies, the word check sheet (see Appendix 1 for the word check sheet and the scores by English JSLs) that lists the glosses used in the experiments. The word check sheet remained available for reference until the end of the last experiment. In the second experiment, only English JSLs translated orally the NMCs on the computer screen. Prior to the last experiment, both Japanese native speakers and English JSLs were interviewed for the background information (see Appendix 2 for summary of the interview). Both speaker

groups participated in the last experiment, which involved the rating tasks. This last experiment is described first in Chapter 3.

Table 2-17
The Order of Experiments and Chapters in This Volume

Time Flow	Experiment Number and Task	Participants	Chapter in This Volume
↓	3. On-Line Self- Paced Reading and Probe Recognition	Japanese Native Speakers English JSLs	5
	Word Check	English JSLs	
	2. Semi On-Line Translation	English JSLs	4
	Interview	Japanese Native Speakers English JSLs	
	1. Off-Line Rating	Japanese Native Speakers English JSLs	3

Notes

[1] This notation is the Frame theory equivalent of $[S\ NP]_{NP}$ used in Gap theory as noted in Chapter 1.

[2] Japanese is rigidly verb final (cf. Kuno, 1973). The sentential modifiers end with verbal elements.

[3] Japanese is ridigly head final. Modifiers are located prenominally whether or not the modifiers are sentential.

[4] Teramura (1984) uses the term "uchi no kankei" (internal relation) to refer to the relation of modifying clause and the head noun of Regular Relative. This refers to the relation in which the head noun is successfully associated with the verb with a case marking particle.

[5] "Pro" represents Null Anaphora (cf. Kameyama, 1985; Tsujimura, 1996). As English translation indicates, "pro" is like a pronoun and is normally interpreted by the context. It does not have phonetic content and expresses the intuition that the constituents, as long as they are subcategorized by the verb, are there. Japanese allows pro in subject NP node and any other subcategorized constituents' nodes. For example, the trees, (2-1), (2-3), (2-4), and (2-6), contain pro in subject NP node. The tree (2-6) contains pro in subject NP, direct object NP, and indirect objet NP nodes.

[6] Following Tsujimura (1996), the constituents with nouns taking *ga* (nominative marker), *o* (accusative marker), *ni* (dative marker), *no* (genitive marker), and *wa* (topic marker) are considered to be NP. Nouns taking other post positional particles such as *de* ('at' location marker) are considered to be PP. The first group of postpositional particles consists of grammatical markers that do not have semantic content. The second group of particles has semantic content: e.g., *made* 'until', *e* 'to', *to* 'with', *kara* 'from' and *de* 'at.'

[7] The distinction between argument NP and adjunct PP was made by Yamashita (1995). The same distinction was also made by Matsumoto (1997), who used non-syntactic terms such as core role and non-core role instantiated by the head noun in the modifying clause. The argument NP relative/ core role instantiated by the head noun in the modifying clause, v.s. adjunct PP relative/ non-core instantiated by the head noun in the modifying clause, are the two subcategories of RR.

[8] Teramura (1984) calls this type "tanraku" (short cut).

[9] Teramura (1984) call this relation "soto no kankei" (external relation) as opposed to "uchi no kankei" (internal relation) referring to the RR.

[10] McCawley (1972) also classifies relative clauses similarly. That is, there is a relative clause and a complement in Japanese. A clear case of a relative clause is the Regular Relative. Unclear cases of a relative clause include Gapless Relative and Clause and Noun Host Type.

[11] An example of the GR type with consequence and condition relation is:
mainichi no shokuji ga oishikunaru undoo
everyday POSS meal NOM delicious+become exercise
the exercise by doing which everyday meals become tasty

[12] An example of the GR type with purpose and requisite relation is:
chesu no geemu ni kanarazu katsu renshuu
chess POSS game at definitely win practice
the practice by doing which (you) win the game of chess without fail

[13] An example of the GR type with requisite and purpose relation is:
mae kara junbi ga dekiteita wakare
before from preparation NOM ready+COP+PAST separation
the separation for which the preparation had been done since before

[14] An example of the GR type with part and whole relation is:
saisho no go-hun de suji ga wakaru eiga
first POSS five-minutes with plot NOM become+understandable movie
the movie in the first five minutes of which the plot becomes understandable

[15] An example of the GR type with event and usual cause of opposite event is:
shiroi shatsu ga kuroku naru sentaku
white shirt NOM black become laundry
the laundry by doing which a white shirt becomes black

[16] It is not that only GR interpretation involves extra sentential knowledge. The interpretation of all types of NMC is ready to accept extra sentential knowledge; however, characteristically GR involves "extra predicate," which indicates that the head noun belongs to a separate event with separate predicate-argument structure. Matsumoto (1997) points out that the main properties of NMC are determined at the levels of semantics and pragmatics (i.e., extra sentential knowledge). For example, arguments can be missing without causing ungrammaticality in Japanese (i.e., Japanese is a pro-drop language), and this phenomenon is not limited to NMC. As a consequence of this property of Japanese, for some noun-modifying constructions, more than one interpretation could be possible. In the following example which is RR type, beside the argument coreferential with the head noun, another argument is missing in the modifying clause, resulting in two possible translations.

[aishita] otoko-ga kaettekita
loved man-NOM returned
The man who (somebody) loved returned.
The man who loved (somebody) returned.

The grammatical relation of the head noun with the clausal predicate (the subject of the verb or the object of the verb) is determined by discourse and pragmatic context.

In the following COMP example, again, multiple number of pros exist in the modifying clause. The interpretation of the referents of the pros depends on the context.

[ageta] jijitsu-wa nai
gave fact-TOP NEG
There is no fact that (somebody) gave (something) (to somebody).

Matsumoto (1997) provides parallel examples in Japanese and English and points out that English accepts only the interpretation of the head as a subcategorizing NP, while Japanese interpretation allows both subcategorizing NP interpretation and adverbial NP interpretation of the head noun. In the following example, the head noun *basho* (place) can be interpreted as either object or place in Japanese, but only object interpretation is accepted in English.

[Sakuma san-ga katta] basho-wa doko desu ka.
Mr. Sakuma-NOM bought place-TOP where COP Q
Where is the place (which) Mr. Sakuma bought?
Where is the place (in which) Mr. Sakuma bought (something)?

Where is the place Mr. Sakuma bought?

If shared world knowledge is used, the interpretation of the following RR type sentence is easy. In this case, the semantic of the head noun *kodomo* (child) triggers world knowledge about child, and selecting one interpretation over the other is easy.

[otsukai-o tanonda] kodomo-ga modoranai.
Errands-ACC asked child-NOM return+NEG
The child (I) asked to do errands is not back.
The child who asked (somebody) to do errands is not back.

Errands are usually given to children by adults, rather than the other way around. Therefore, the common sense allows single interpretation, i.e., the first interpretation.

CN interpretation equally involves extra sentential knowledge in the situation where arguments are missing in the modifying clause as in the following examples. The elements in the parentheses need to be contextually recovered.

[shinu] zenjitsu-ni koko-ni kita.
Die previous day -at here-to came
(He) came here on the day previous to the time when (he) died.

[machi-ni iku] tochuu, ame-ni hurareta.
Town-to go on.the.way rain-by rain-PASS-PAST
On my way to town, (I) got rained on.

Matsumoto lists various example of GR type, where construing is hard from the gloss if one does not know Japanese and Japanese culture. The followings are cited from Matsumoto (1997, p. 48). The translation in English for these examples illustrates that without extra sentential elements in parentheses, it is impossible to construe GR type. These extra sentential elements in the parentheses are mostly unexpressed predicates (in the first two examples). Some translation in English can be done without including the unexpressed predicates. However, a logical predicate that takes the head noun as an argument is easily found. The translation in italic is added which contains the extra predicate.

[[atama ga yoku-naru] hon]
head NOM good-become book
'the book (by reading which) ( ) head gets better'

[[genki ga deru] kuruma
energy NOM rise.up car
'the car (by driving/ owning which) ( ) energy rises'

[[yoru toire ni ike-naku-naru] hanashi]
night bathroom GOAL go.can-not-become story
'the story (because of which) ( ) cannot go to the bathroom at night'
'the story (after reaching which) ( ) cannot go to the bathroom at night'

[[toire ni ike-nai] komaasyaru]
bathroom GOAL go.can-not commercial
'commercials (because of which) ( ) cannot go to the bathroom'
'commercials (after watching which) ( ) cannot go to the bathroom'

[[gakkoo ga yasumini-natta] yuki]
school NOM closed-because snow
'the snow (because of which) the school was closed'
'the snow (after which fell) the school was closed'

[[paatii ni korare-nakatta] syukudai]
party GOAL come.can-did.not homework
'the homework (because of which) ( ) could not come to the party'
'the homework (which ( )had to do, consequently) ( ) could not come to the party

[17] Ellis (1994, p. 306) quotes Lado's (1957, p. 2) Contrastive Analysis Hypothesis:

> ...the student who comes into contact with a foreign language will find some features of it quite easy and others extremely difficult. Those elements that are similar to his native language will be simpler for him, and those elements that are different will be difficult.

[18] The point that Comrie and Horie (1995) make is that it is not appropriate to hold such syntactic dichotomy as English relative clause and complement for Japanese equivalents.

[19] According to learnability theory, on the other hand, when the learning needs to proceed from the superset grammar to the subset grammar, serious difficulty should be expected. The learners whose L1 contains the superset grammar should overgenerate the sentences that only the superset grammar generates but not the subset grammar in the absence of negative evidence (this point is made by White, 1993, among others). In the context of NMC, Japanese native speakers acquiring English as L2 are expected to overgenerate the GR and are expected to have a hard time acquiring not to generate the GR in English.

Chapter 3

Experiment 1

Off-Line Rating Tasks

To find out how the four NMC types are processed and distinguished by speakers of Japanese, both native speakers of Japanese and native speakers of English learning Japanese rated 20 grammatical Japanese sentences containing the four types of NMC. Two judgement criteria were given. First they rated the sentences in terms of *naturalness*, and then in terms of *ease of understanding for English speakers who were learning Japanese*. The results were expected to show intuition-based differences among the four types. The experiment focuses on the markedness and the transfer hypotheses. The other hypotheses, i.e., the gap hypothesis and the frame hypothesis are not relevant.

The three experiments were carried out in sequence, and this chapter discusses the last experiment (see Table 2-17 in Chapter 2 for the actual order of the experiments).

Objectives and Rationale of the Experiment

In order to test the research hypotheses: markedness and transfer, this experiment obtained two sets of data. The first set consisted of naturalness rating (NR) scores. The second was ease of understanding for English JSLs rating (EUR) scores. In the first judgement task 'naturalness rating' (NR), the participants were asked to focus on how natural the Japanese stimuli sounded. In the second judgement task, 'ease of understanding for English JSLs rating' (EUR), participants were asked to focus on their knowledge of Japanese and English.

The rationale of NR and EUR is that an intuitive sense of naturalness along with a sense of relative ease of understanding for English JSLs would allow the participants to draw distinctions among the four construction types. These off-line tasks were expected to allow the participants' conscious reflection on their L1 and other non-primary languages.

Two rating tasks were used, rather than one, to obtain a broader perspective on aspects of processing induced by different sets of instructions. The differences in the

rating scores among the four construction types were expected to provide evidence for relative processing differences among the four types.

Experimental Hypotheses

Hypotheses 1– 6 were tested in this experiment. These are listed in Table 3-1.

Table 3-1
Experimental Hypotheses Tested in Experiment 1

Measure	Japanese Native Speakers	English JSLs
NR	H1 Markedness Hypothesis for NR by Japanese Native Speakers Naturalness rating of GR sentences by Japanese native speakers should be lower than those of RR, CN, and COMP sentences. NR(RR), NR(CN), NR(COMP) > NR(GR)	H2 Markedness Hypothesis for NR by English JSLs Naturalness rating of GR sentences by English JSLs should be lower than those of RR, CN, and COMP sentences. NR(RR), NR(CN), NR(COMP) > NR(GR) H3 Transfer Hypothesis for NR by English JSLs Naturalness ratings of RR and COMP sentences by English JSLs should be higher than those of CN and GR sentences. NR(RR), NR(COMP) > NR(CN), NR(GR)
EUR	H4 Markedness Hypothesis for EUR by Japanese Native Speakers Ease of understanding rating of GR sentences by Japanese native speakers should be lower than those of RR, CN, and COMP sentences. EUR(RR), EUR(CN), EUR(COMP) > EUR (GR)	H5 Markedness Hypothesis for EUR by English JSLs Ease of understanding rating of GR sentences by English JSLs should be lower than those of RR, CN, and COMP sentences. EUR(RR), EUR(CN), EUR(COMP) > EUR (GR) H6 Transfer Hypothesis for EUR by English JSLs Ease of understanding ratings of RR and COMP sentences by English JSLs should be higher than those of CN and GR sentences. EUR(RR), EUR(COMP) > EUR(CN), EUR(GR)

Note. NR: Naturalness Rating, EUR: Ease of Understanding for English JSLs

Method

Participants

In this experiment, 23 Japanese native speakers who are learning English, and 11 English native speakers who are learning Japanese participated (see Appendix 2 for the participants' information). They did all parts of the experiment in one sitting.

Japanese native speakers. Twenty-three native speakers of Japanese, eight male and 15 female, living in the Edmonton area, participated. They had lived a part of their lives in Japan. Both parents of the 22 participants were native speakers of Japanese. One participant's father was an English native speaker who had died when the participant was an infant. He thus claimed his first language was Japanese, his mother's native tongue. One participant was born in an English-speaking country but had parents who were native speakers of Japanese. She had lived in Japan from the age of seven until in her thirties, and claimed she was a native speaker of Japanese. All the subjects had studied English formally for the first time in junior high school and had lived in English-speaking countries for at least 8 months. They functioned on a daily basis in English. Except for one participant, everyone had in addition to English, a third, fourth, or fifth language such as German, French, Korean, Russian, Spanish, Mandarin, or Latin. None spoke foreign languages, other than English, fluently. They were not trained teachers of Japanese. Fifteen were university students; two were studying linguistics. The rest were professionals. They volunteered to do the tasks in Experiment 1 and Experiment 3 in one sitting and were not offered payment.

English Japanese as a second language learners (English JSLs). Eleven English speaking, Japanese as a second language learners, five male and six female, of intermediate or advanced level, participated. They all claimed they were native speakers of English, and they had lived in either Canada or the United States for a good part of their lives. Their linguistic backgrounds were not simple. One participant's mother was a native speaker of Japanese, who said the participant had been very weak in acquiring Japanese compared to her other children who had been good at it. This participant conversed only in English with his family members and claimed he had learned Japanese at the university. Another participant's parents were Tamil speakers. However, the participant claimed her mother tongue was English because she understood only some

words in her parents' conversations at home. Another participant's father spoke Cantonese, but he had no contact with his father, and therefore claimed his first language was English, which his mother spoke natively, although he had lived in Hong Kong during his childhood. Only one of them had Japanese as a single second language. Others had other second languages prior to learning Japanese such as Spanish, French, German, and Cantonese in highschool. One spoke Spanish fluently, but others did not have fluency in a second language, other than Japanese. The English participants had all taken intermediate or advanced Japanese at college level or equivalent. Nine were students, and two were professionals. Ten had experience living in Japan for at least 11 months. The one who had not learned any other foreign languages was teaching introductory Japanese at the university. Two were training to be high school teachers of Japanese when they participated in the experiments. One had taken linguistics courses and had a background in linguistic analyses. All were volunteers but were given a $10.00 gift certificate from the University bookstore. They did all the tasks in Experiments 1-3 in one sitting.

Stimuli

Forty sentences that contain NMC were used and were represented schematically in (3-1).

(3-1) [Seg1] [Seg2] [Seg3] [Head Noun$_i$]$_{Seg4}$[Seg5] [Seg6] [Seg7].

Each consisted of seven segments ending with a period. Following Japanese punctuation convention, there were no spaces within the sentence. In (3-1), "Head Noun" indicates the location of the head noun of the NMC. The underline visibly marked the NMC, on which the participants focused for judgement. Square brackets were not shown.

Forty sentences consisted of ten sentences of each construction type (see Appendix 3 for sentences for the rating tasks). They were divided between two lists (see Appendix 3 for sentences belonging to List A and List B). Each list contained 20 sentences with 5 of each construction type. Each list had three distinct sentence orders. They were counterbalanced and presented in a randomized sequence. If a participant rated List A in Part A (naturalness rating), then he/she rated List B in Part B (ease of

understanding for English JSLs rating). Likewise, if a participant rated List B in Part A, then he/she rated List A in Part B.

Rather than using the full set of 40 sentences, half were used for each rating. This was because the list of 40 items was too long to be shown on a single sheet, and a single page was considered the optimum length for the rating task. It was also expected that the naturalness judgement in Part A might affect the ease of understanding judgement in Part B. That is, if one gives an item a value in terms of naturalness, the reused item might tend to receive the same value in the scale of ease of understanding. Therefore, the participants rated the different lists on two different scales.

The twenty sentences were presented on a sheet of paper (see Appendix 4 for the rating sheets). Beside each sentence were the Roman numbers '1' through '5.' '5' was to be circled if the item was the most natural/ the easiest to understand for English JSLs, '1' if the least natural/ the most difficult for English JSLs to understand, and '3' if more or less natural/ more or less easy for English JSLs to understand. A five point scale was adopted because the middle point was definable. In order to draw the participants' attention to NMC only, the portion of the modifying clause and the head noun of each item was underlined. Entire sentences were supplied to provide a natural context for the NMC.

The stimuli in this experiment were familiar to the participants because the forty sentences had been in Experiments 2 and 3.[1] Familiarity with the material and even with the NMC were not considered problematic. Because the naturalness judgements and ease of understanding for JSL judgements were intended to reveal the participants' conscious reflections on the NMC, they would be facilitated rather than inhibited by their familiarity with and knowledge of the materials and even awareness of the construction types.

No distracters were employed because distracters that could violate the pattern were not considered necessary for the participants to make fair judgements. All the items in the list had the structural pattern illustrated in (3-1).

Assessment of the stimuli. All sentences were assessed by an instructor of the Department of East Asian Studies to ensure they were comprehensible by Japanese learners at an intermediate (300 level university courses) level. The instructor confirmed

that the structures used in the experiment were initially introduced in the second semester of the introductory level of Japanese.

Procedure

Part A: Naturalness rating (NR) task. After a background interview (see Appendix 2 for the participants' information) which followed the first experiment for Japanese native speakers and the second experiment for English JSLs (see Table 2-17 in Chapter 2 for the order of the experiments), the Part A naturalness rating task was given. Each participant was given a sheet of paper with the instructions and the sentences to rate (see Appendix 4A for the naturalness rating sheet). Instructions were written primarily in English with Japanese words for 'most natural,' 'least natural,' and 'more or less natural' added beside the English words. The written instructions asked the participants to read through the sentences first, then to focus on the underlined portion of each sentence and assign 1 and 5, and, only after this was done, to rate the rest on the same scale.

This anchoring was necessary to prevent the participants from being indecisive and assigning all items at the midpoint, thus preventing any spread in judgements. Allowing the participants to choose any point, rather than requesting them to assign an equal number of points in the scale to the items was preferred because otherwise it could be too time-consuming and frustrating for the participants.

The researcher was present and observed how the participants did the task. When the participant was not following the instructions, the researcher reminded her/him to do so.[2]

When the participants asked what 'naturalness' meant, the researcher replied consistently: it means 'easy to say,' 'hear it often,' 'see it often,' and 'easy to the ear.'[3] This response was in English for native English speakers and in Japanese for native Japanese speakers. English JSLs were told to consult freely the vocabulary list that they had checked prior to the translation task (see Appendix 1 for word check sheet and the scores by English JSLs) or to ask the experimenter for unfamiliar words and anything other than rating scores. This task took less than 10 minutes. The rating sheet was put away, and Part B followed immediately.

Part B: Ease of understanding for English JSLs rating (EUR) task. When the participants had finished Part A naturalness rating task, they were given a sheet of paper having instructions on one side (see Appendix 4B for the ease of understanding for English JSLs rating sheet). These were in English except for the phrases 'the easiest for English speakers learning Japanese to understand,' 'the most difficult for English speakers learning Japanese to understand,' and 'more or less easy for English speakers learning Japanese to understand,' which were written in Japanese as well as English. The instructions stated that participants should not let the difficulty of words, kanji characters, or length of each sentence determine ease of understanding, but focus on only the underlined portion of sentences. The reverse side had a list of 20 sentences, which the participants had not seen in Part A. The participants were allowed to flip between both sides of the sheet. They were asked to anchor their response, and then to assign any numbers on the scale to any number of stimuli for the same reasons described in Part A.

The researcher was present while the participants did the task.[4] When the participant was not following the procedure, the researcher reminded her/him to observe the instructions.

The English JSLs were told to consult freely the word check sheet that they had seen prior to the translation task or to ask the experimenter any questions except concerning the scores. Enough time was given to ensure that the participants, especially English JSLs, would rate the sentences knowing what they meant. The task took less than 10 minutes. This experiment was the final one in the series.

Results

Statistical Analyses

Construction Type (four levels: RR, GR, CN and COMP) was the independent variable. The dependent variable was the rating score (1, 2, 3, 4, and 5). In the data analysis, one-way ANOVA for both analyses by participants (summing over difference among stimuli within a construction type) and analyses by item (summing over differences among participants) were employed. In the former analyses, Construction Type was treated as a repeated measure factor, while in the latter it was treated as a between-items factor. Consequently, because in ANOVA with participants as variables,

the same participant went through the treatments, causing the variance within the level of Construction Type to be more restricted, it was expected that analyses by items would yield more conservative results than the repeated measures ANOVA (analyses by participants).

A two-way ANOVA with Speaker Group (two levels: Japanese native speakers and English JSLs) as a between factor, was also done to find out if there were differences between Japanese native speakers and English JSLs. A one-way ANOVA with Judgement Scale (two levels: naturalness and ease of understanding for English JSLs) as a factor was conducted for each speaker group to determine if the different scales made an overall difference in the scores across the four construction types. A Spearman Rank Correlation was used with the two judgement scales as the ranking variables to determine if the underlying decision criteria were identical between the two judgement scales as an additional analysis for discussion.

Naturalness Rating (NR) by Japanese Native Speakers

The Japanese native speakers were asked to rate the sentences with four types of NMC according to the scale of naturalness (see Appendix 5A for the NR scores for each item by individual Japanese native speakers). It was expected that they would use their intuition of markedness and separate the four construction types accordingly, with the GR being less natural than other construction types (H1). Mean values of naturalness ratings by the Japanese native speakers for each construction type were calculated and assembled in Table 3-2.

Table 3-2
Mean Values, Standard Deviations, and Standard Errors by Participants for Naturalness Rating on a Scale of 1-5, 1 Being Least Natural and 5 Being the Most Natural, for Four Construction Types by 23 Japanese Native Speakers

Construction Type	Mean	S.D.	S.E.
CN	3.75	.60	.12
COMP	4.03	.60	.13
GR	2.44	.68	.14
RR	4.00	.60	.13

For this table and subsequent tables, mean tables were created based on the analyses by participants.

The rating of the GR was the lowest while the ratings of other construction types were higher and about the same. According to ANOVA with participants as variables, there was a main effect by Construction Type, $F(3, 66) = 41.13$, $p < .001$. Planned comparisons were done between every two means in Table 3-2, and their F-ratios were computed. The statistically significant differences in naturalness rating (NR) were present between the GR and every other construction type, $F_{GR, CN}(1, 22) = 62.97$, $p = .0001$, $F_{GR, COMP}(1, 22) = 92.49$, $p = .0001$, and $F_{GR, RR}(1, 22) = 86.53$, $p = .0001$. Other levels were not significantly different with each other, $F_{CN, COMP}(1, 22) = 2.83$, $p = .10$, $F_{CN, RR}(1, 22) = 1.86$, $p = .18$, and $F_{COMP, RR}(1, 22) = .10$, $p = .75$.

ANOVA with sentences as variables also suggested that there was a main effect by Construction Type, $F(3, 36) = 11.24$, $p < .0001$. The Tukey/ Kramer post hoc test also revealed that at $p < .05$, statistically significant differences were present between the GR and every other level, but not in other combination of levels. Therefore, both the analyses by participants and items suggest that the Japanese native speakers rated the GR lower than any other type.

These results support H1 the Markedness Hypothesis for NR by Japanese native speakers, which predicted that naturalness rating of the GR sentences by Japanese native speakers should be lower than those of the RR, the CN, and the COMP sentences.

Ease of Understanding for English JSLs Rating (EUR) by Japanese Native Speakers

After the naturalness rating task, another scale was given to Japanese native speakers, i.e., the scale of ease of understanding for English JSLs (see Appendix 5B for the EUR scores for each item by individual Japanese native speakers). These Japanese speakers were learning English as a second language and had a good command of English. They were thus asked to consult actively their knowledge of L2 to make a decision.

Table 3-3

Mean Values for Ease of Understanding for English JSLs Rating on a Scale of 1-5, 1 Being the Most Difficult and 5 Being the Easiest, for Four Construction Types by 23 Japanese Native Speakers

Construction Type	Mean	S.D.	S.E.
CN	3.52	.50	.11
COMP	3.43	.62	.13
GR	2.26	.58	.12
RR	3.43	.53	.11

As in the naturalness ratings, the mean value of ease of understanding for the GR was lower than any other level. ANOVA with the participants as variables suggested that Construction Type had the main effect, $F(3, 66) = 28.92$, $p < .0001$. Planned comparisons between every two levels were done, and there were statistically significant differences between the GR and every other level, $F_{GR, CN}(1, 22) = 63.81$, $p = .0001$, $F_{GR, COMP}(1, 22) = 54.50$, $p = .0001$, and $F_{GR, RR}(1, 22) = 54.50$, $p = .0001$. Other levels were not significantly different, $F_{CN, COMP}(1, 22) = .37$, $p = .55$, $F_{CN, RR}(1, 22) = .37$, $p = .55$, and $F_{COMP, RR}(1, 22) = .0001$, $p = 1.00$.

ANOVA with sentences as variables also indicated that Construction Type had a statistically significant effect, $F(3, 36) = 6.24$, $p = .002$. The statistically significant differences were found, according to Tukey/ Kramer post hoc test, at $p < .05$, between GR and every other level, and not between any other two levels.

Japanese native speakers rated the GR lower than any other construction type in terms of ease of understanding for English speakers learning Japanese as a second language. These results support H4 the Markedness Hypothesis for EUR by Japanese Native Speakers which predicted that ease of understanding for English JSLs rating of the GR sentences by Japanese native speakers should be lower than those of the RR, the CN, and the COMP sentences.

Japanese Native Speakers: Naturalness and Ease of Understanding for English JSLs

According to one-way ANOVA with sentences as variables and Judgement Scale as a factor, Judgement Scale had a significant effect, $F(1, 39) = 19.12$, $p < .0001$. Japanese native speakers overall rated higher according to the naturalness scale ($M = 3.56$, $SD = .96$, $SE = .15$) than according to the ease of understanding for English JSLs scale ($M = 3.16$, $SD = .89$, $SE = .14$). However, for each construction type, Japanese

native speakers only tended to rate higher on the basis of naturalness than on the basis of ease of understanding for English JSLs. The differences were not significant: $F_{RR}(1, 18) = 3.34$, $p = .08$, $F_{GR}(1, 18) = .14$, $p = .71$, $F_{CN}(1, 18) = .62$, $p = .44$, and $F_{COMP}(1, 18) = 4.18$, $p = .06$.

Spearman rank correlation coefficients were calculated between the rankings of the sentences between the two judgement scales within construction type (see Appendices 5A and 5B for ranking for each item by Japanese native speakers). If a significant correlation indicated the ranking of ten sentences did not differ across two judgement scales, it follows that the participants used a consistent decision criterion across naturalness and ease of understanding scales. If a significant correlation did not indicate that the ranking of ten sentences changed across two judgement scales, it follows that the participants were using different underlying decision criteria across the two judgement scales for the particular construction types.

There was a statistically significant correlation in ranking between the two overall judgement scales: $r_s = .77$, $p < .001$. However, a statistically significant correlation was found only for the GR, $r_{s\,GR} = .93$, $p = .005$ (see Figure 3-1 for consistency in ranking between the judgement scales for the GR). The correlations were not found for other construction types, $r_{s\,CN} = .59$, $p = .08$, $r_{s\,COMP} = .49$, $p = .14$ and, $r_{s\,RR} = .64$, $p = .06$ (Figures 3-2, 3-3, and 3-4 for ranking changes between the judgement scales for the CN, the COMP, and the RR). Only for the GR, did Japanese native speakers use a consistent decision criterion for both judgement tasks. For the other construction types, their decision criteria changed between the first and the second judgement scales.

The use of an identical criterion for the GR suggests Japanese native speakers did not know how to rate the GR in terms of ease of understanding for English speakers. It was obvious to the participants who spoke Japanese natively that the GR sentences were odd. They thought all the GR stimuli would be difficult for English JSLs to understand, so they rated them according to the naturalness scale, only they lowered the scores slightly but not significantly.

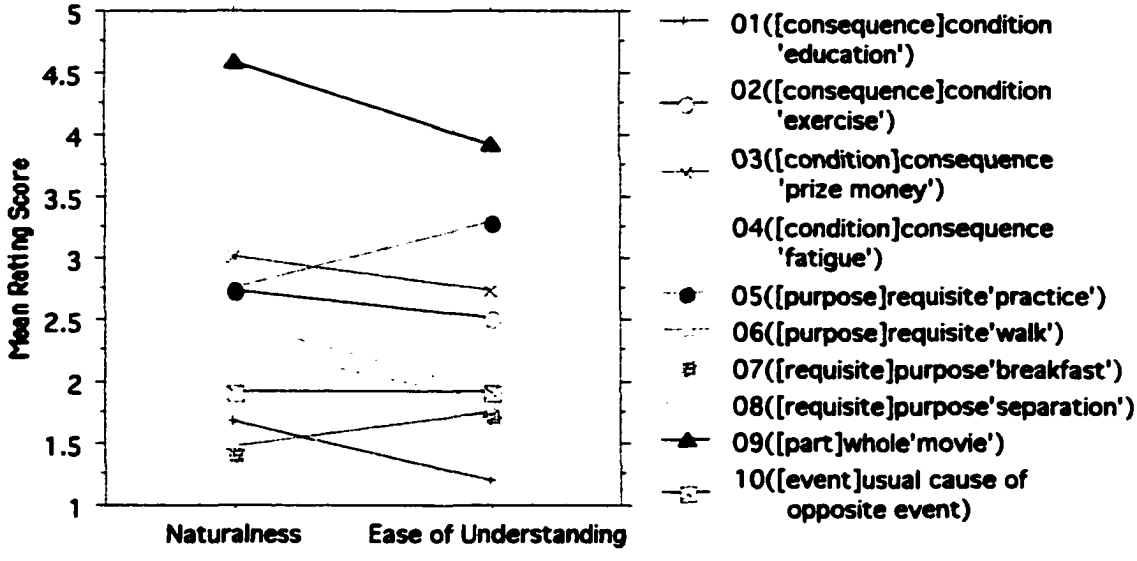


Figure 3-1. Rating scores for ten GR sentences by 23 Japanese native speakers on the scales of naturalness and ease of understanding for English JSLs. For each sentence, the semantic relation between the meaning of the modifying clause and the head noun is shown. The meaning of the head noun is within single quotes. Rankings of the sentences are significantly correlated between the naturalness scale and the ease of understanding for English JSLs scale.

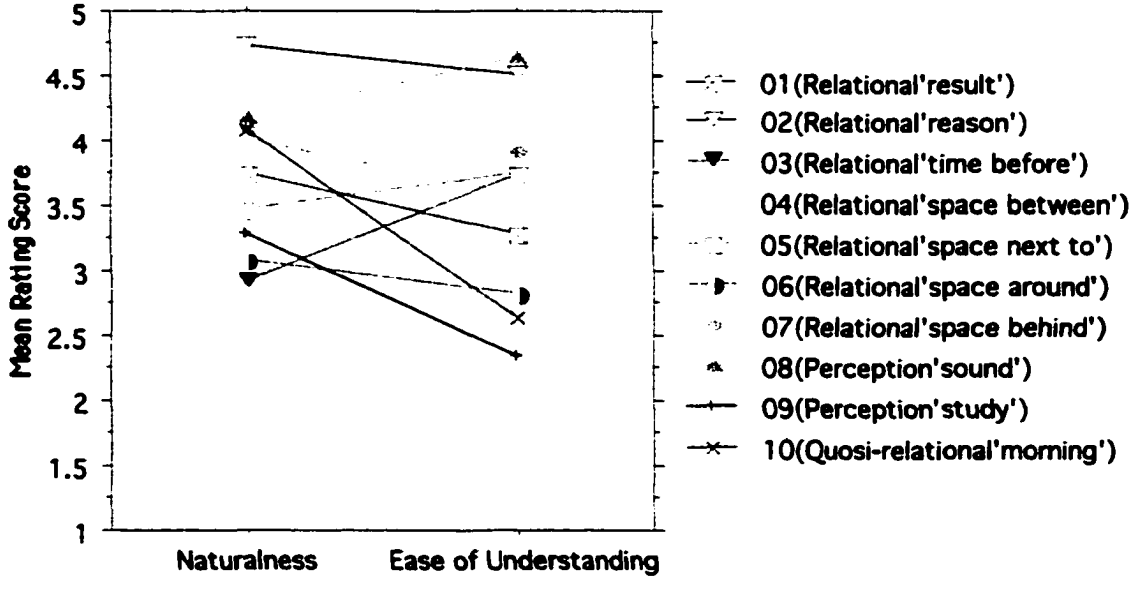


Figure 3-2. Rating scores for ten CN sentences by 23 Japanese native speakers on the scales of naturalness and ease of understanding for English JSLs. For each sentence, the semantics of the head noun is shown. The meaning of the head noun is within single quotes. The rankings of the sentences are not correlated between the naturalness scale and the ease of understanding for English JSLs scale.

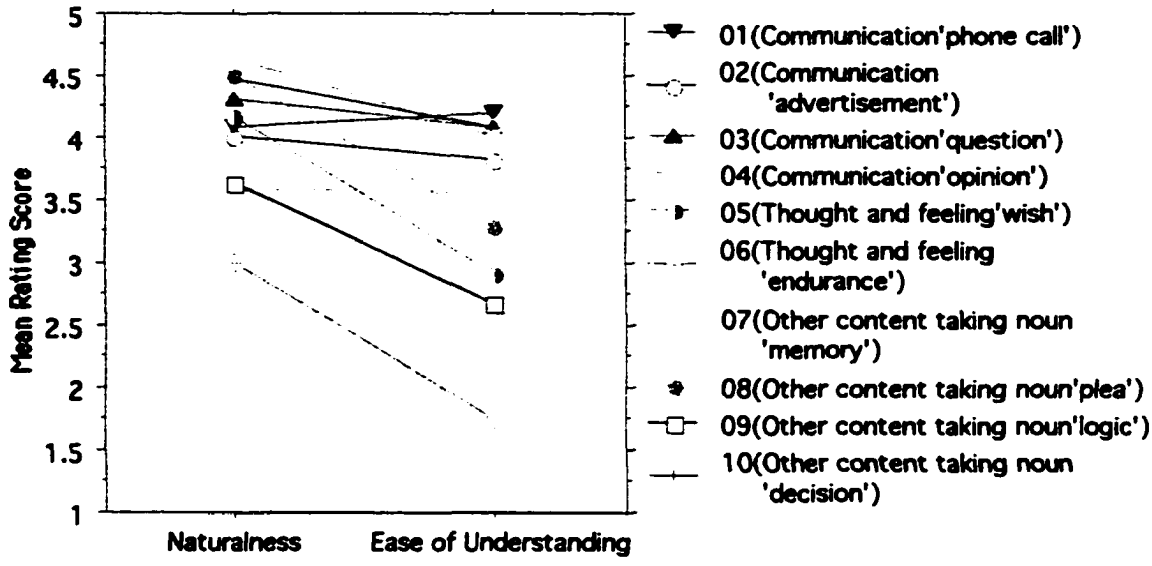


Figure 3-3. Rating scores for ten COMP sentences by 23 Japanese native speakers on the scales of naturalness and ease of understanding for English JSLs. For each sentence, the semantics of the head noun is shown. The meaning of the head noun is within single quotes. Ranking of the sentences are not correlated between the naturalness scale and the ease of understanding for English JSLs scale.

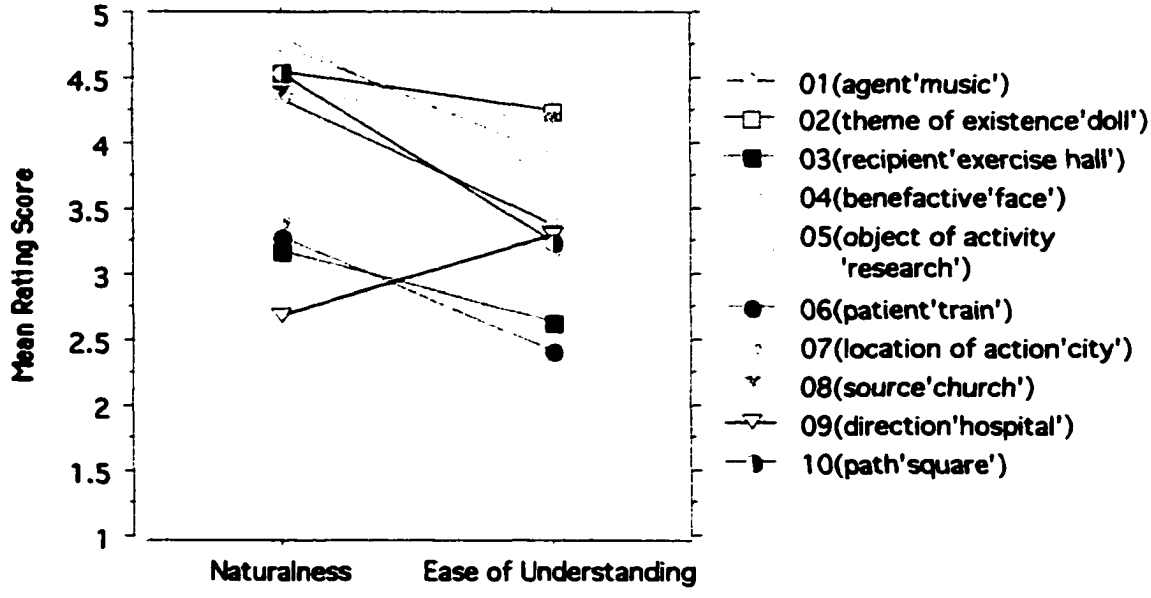


Figure 3-4. Rating scores for ten RR sentences on the by 23 Japanese native speakers on the scales of naturalness and ease of understanding for English JSLs. For each sentence, the thematic role that the head noun plays in relation with the clausal verb is shown. The meaning of the head noun is within single quotes. The rankings of the sentences are not correlated between the naturalness scale and the ease of understanding for English JSLs scale.

There were significant changes in ranking between the judgement scales for the RR, the CN, and the COMP, with a tendency toward lower scores on the scale of ease of understanding than on the scale of naturalness. Whatever the cause, the nature of naturalness differed from the nature of ease of understanding in case of the RR, the CN, and the COMP.

Most importantly, the fact that the criteria on two scales matched only for the GR and not for other types indicates the GR was treated differently from other types. That there was a overall significant ranking correlation between the judgement scales and that the GR was singly responsible for the overall correlation are strong evidence that Japanese native speakers clearly grouped the GR out of other subtypes. This, in addition to the lowest rating score for the GR, suggests that Japanese speakers knew the GR was different from other construction types.

Naturalness Rating (NR) by English JSLs

English-speaking, Japanese as a second language learners were asked to rate the sentences with different types of NMC on the scale of naturalness (see Appendix 5C for the NR scores for each item by individual English JSLs). If the participants were sensitive to processing resource differences or the necessity of finding an unexpressed predicate, they should find the GR to be the least natural among others (H2). If they relied on the structural familiarity of their L1, the RR and the COMP, equivalent of English relative clause and complement with nominal head, should be rated higher than the GR and the CN, which are missing in L1 (H3).

The mean values of the rating were assembled in Table 3-4.

Table 3-4
Mean Values for Naturalness Rating on a Scale of 1-5, 1 Being Least Natural and 5 Being the Most Natural, for Four Construction Types by 11 English Japanese as a Second Language Learners

Construction Type	Mean	S.D.	S.E.
CN	3.61	.64	.19
COMP	3.22	.64	.19
GR	2.98	.58	.18
RR	3.40	.68	.21

The GR was rated lowest. The CN was rated highest, and the RR and the COMP were rated in this order between the CN and the GR. Repeated measures ANOVA with participants as variables indicated that a statistically significant effect was made by Construction Type, $F(3, 30) = 3.24$, $p = .04$. Planned comparisons were done between every two levels. There was a statistically significant difference only between the CN and the GR, $F_{CN.\,GR}(1, 10) = 8.96$, $p = .006$. The differences between other levels were not significant, $F_{CN.\,COMP}(1, 10) = 3.45$, $p = .07$, $F_{CN.\,RR}(1, 10) = .96$, $p = .33$, $F_{COMP.\,GR}(1, 10) = 1.29$, $p = .27$, $F_{COMP.\,RR} = .76$, $p = .39$, and $F_{GR.\,RR}(1, 10) = 4.04$, $p = .05$.

ANOVA with sentences as variable indicated that there was no effect by Construction Type, $F(3, 36) = 2.34$, $p = .09$. The Tukey/ Kramer post hoc test suggested that there were no statistically significant differences between any levels.

English JSLs found the CN the most natural and the GR the least natural. The fact that the GR was rated lowest supports H2, and the fact that the CN was rated highest rejects H3.

H2, the Markedness Hypothesis for NR by English JSLs, was supported which predicted that the naturalness rating of the GR sentences by English JSLs should be lower than those of the RR, the CN, and the COMP sentences. The data showed that the GR was scored the lowest.

H3, the Transfer Hypothesis for NR by English JSLs, was not supported. This hypothesis predicted that the naturalness ratings of the RR and the COMP sentences by English JSLs should be higher than those of the CN and the GR sentences. Analyses by participants suggested that NR(CN) was significantly higher than NR(GR), with NR (RR) and NR(COMP) between them. This pattern does not support the hypothesis.

Ease of Understanding for English JSLs Rating (EUR) by English JSLs

English JSLs were asked to make active use of their knowledge of L1 to make judgements on the ease of understanding for English JSLs (see Appendix 5D for the EUR scores for each item by individual English JSLs). The mean values for different construction types are in Table 3-5.

Table 3-5

Mean Values for Ease of Understanding for English JSLs Rating on a Scale of 1-5, 1 Being the Most Difficult and 5 Being the Easiest, for Four Construction Types by 11 English Japanese as a Second Language Learners

Construction Type	Mean	S.D.	S.E.
CN	3.15	.52	.16
COMP	2.96	.69	.21
GR	2.47	.53	.16
RR	3.36	.54	.16

The GR was again rated the lowest. The RR was considered easiest to understand, followed by the CN and the COMP in that order.

Repeated measures ANOVA with participants as variable suggested that there was a statistically significant effect by Construction Type, $F(3, 30) = 5.16$, $p = .005$. Planned comparisons were done between two levels, and F-ratios were computed. The significant differences were present between the GR and all other levels, $F_{GR.RR}(1, 10) = 14.21$, $p = .0007$, $F_{GR.CN}(1, 10) = 8.10$, $p = .008$, and $F_{GR.COMP}(1, 10) = 4.31$, $p = .05$. Other differences were not significant, $F_{CN.COMP}(1, 10) = .59$, $p = .45$, $F_{CN.RR}(1, 10) = .85$, $p = .36$, and $F_{COMP.RR}(1, 10) = 2.86$, $p = .10$.

ANOVA with sentences as variable indicated there was a main effect by Construction Type, $F(3, 36) = 4.04$, $p = .01$. The Tukey/ Kramer post hoc test suggested that at $p < .05$, there was a statistically significant difference between the GR and the RR but not between other levels.

Both analyses by participants and items suggest that the RR was easier than the GR to understand for English JSLs. This finding supports both H5, the Markedness Hypothesis for EUR by English JSLs which predicted the pattern of EUR(RR), EUR(CN), EUR(COMP) > EUR(GR) and H6, the Transfer Hypothesis for EUR by English JSLs which predicted the pattern of EUR(RR), EUR(COMP) > EUR(CN), EUR(GR). However, the fact that the analyses by participants suggested that EUR(GR) was significantly lower than any other construction types gives more support to H5, the Markedness Hypothesis.[5]

English JSLs: Naturalness and Ease of Understanding for English JSLs

The results from the ease of understanding for English JSLs rating yielded more statistical significance than the results from the naturalness rating. In the analyses of

naturalness rating scores, only ANOVA with participants as variable yielded one statistically significant difference between the CN and the GR. On the other hand, in the analyses of ease of understanding rating scores, both analyses by participants (suggesting that the GR was the lowest of all construction types) and analyses by items (suggesting that the RR was significantly different from the lowest GR) yielded significant effects. English JSLs had a clearer idea about the ease of understanding for English JSLs than about naturalness of NMC. It is understandable that the second language learners do not have clear sense of naturalness in their L2. Active use of L1 knowledge is a stronger judgement principle for English JSLs.

A one-way ANOVA with Judgement Scale as a factor revealed that, overall, English JSLs rated higher on the scale of naturalness ($M = 3.30$, $SD = .58$, $SE = .09$) than on the scale of ease of understanding for English JSLs ($M = 2.99$, $SD = .65$, $SE = .10$), $F(1, 39) = 13.40$, $p = .0007$. However, Judgement Scale did not have statistically significant effect for the ratings of each construction type: $F_{RR}(1, 18) = .05$, $p = .08$, $F_{GR}(1, 18) = 4.20$, $p = .06$, $F_{CN}(1, 18) = 2.69$, $p = .12$, and $F_{COMP}(1, 18) = .99$, $p = .33$.

A Spearman Rank Correlation was used to determine if a significant change existed in ranking of sentences between the two judgement scales (see Appendices 5C and 5B for ranking for each item by English JSLs). There was a statistically significant correlation in overall ranking between the two judgement scales: $r_s = .62$, $p < .0001$. Statistically significant correlations were found for the CN and the COMP between the judgement scales, $r_{s\,CN} = .82$, $p = .01$ and $r_{s\,COMP} = .71$, $p = .03$ (see Figures 3-5 and 3-6 for consistent ranking across two judgement scales for CN and COMP). The correlation was not significant for the GR and the RR, $r_{s\,GR} = .19$, $p = .58$ and, $r_{s\,RR} = .33$, $p = .33$ (see Figures 3-7 and 3-8 for ranking change between two judgement scales for RR and GR).

Only for the CN and the COMP, did the English JSLs use the same underlying decision criterion on both the scale of naturalness and on the scale of ease of understanding for English JSLs; for the RR and the GR, the decision criteria were not consistent.

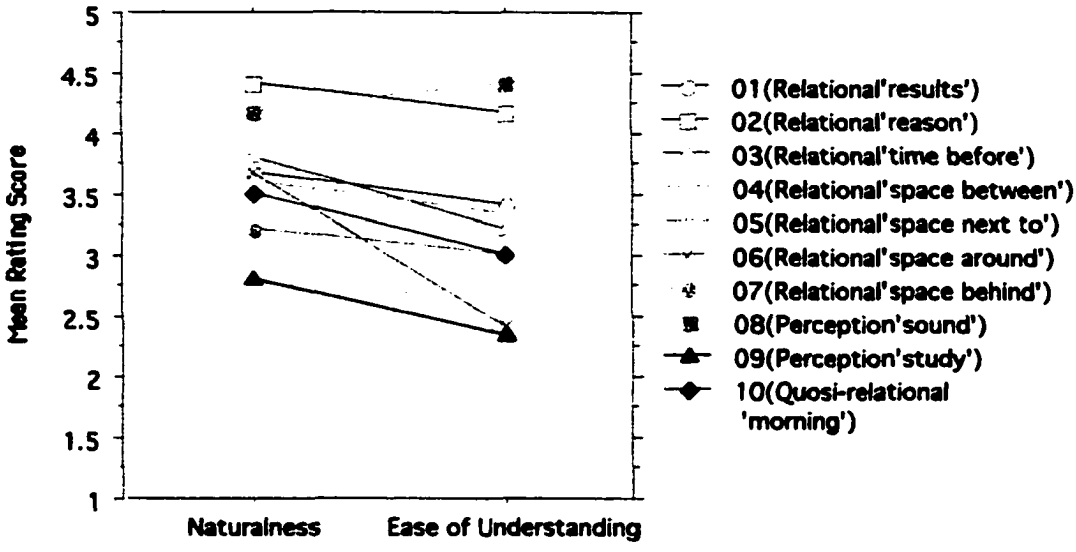


Figure 3-5. Rating scores for ten CN sentences by 11 English Japanese as a second language learners on the scales of naturalness and ease of understanding for English JSLs. For each sentence, the semantics of the head noun is shown. The meaning of the head noun is within single quotes. Ranking of the sentences are significantly correlated between the naturalness scale and the ease of understanding for English JSLs scale.

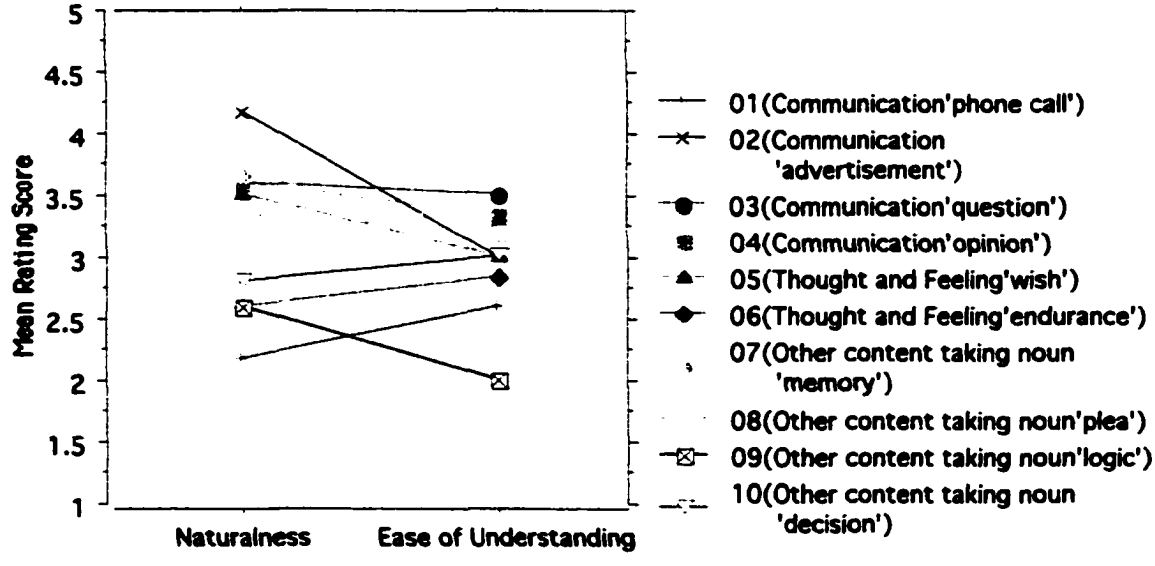


Figure 3-6. Rating scores for ten COMP sentences by 11 English Japanese as a second language learners on the scales of naturalness and ease of understanding for English JSLs. For each sentence, the semantics of the head noun is shown. The meaning of the head noun is within single quotes. Ranking of the sentences are significantly correlated between the naturalness scale and the ease of understanding for English JSLs scale.

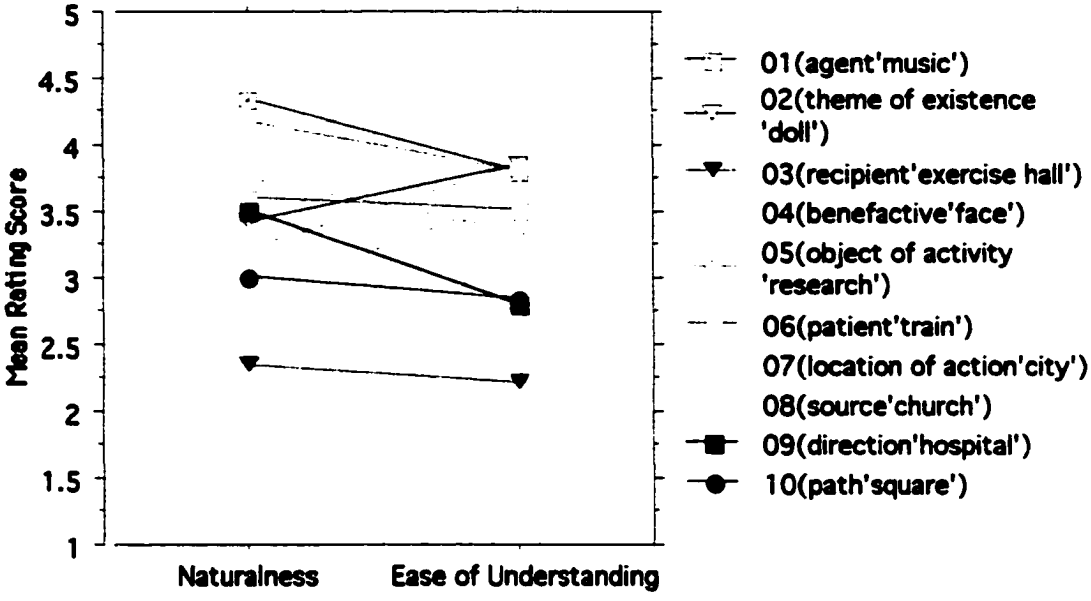


Figure 3-7. Rating scores for ten RR sentences on the by 11 English Japanese as a second language learners on the scales of naturalness and ease of understanding for English JSLs. For each sentence, the thematic role that the head noun plays in relation with the clausal verb is shown. The meaning of the head noun is within single quotes. Ranking of the sentences are not correlated between the naturalness scale and the ease of understanding for English JSLs scale.

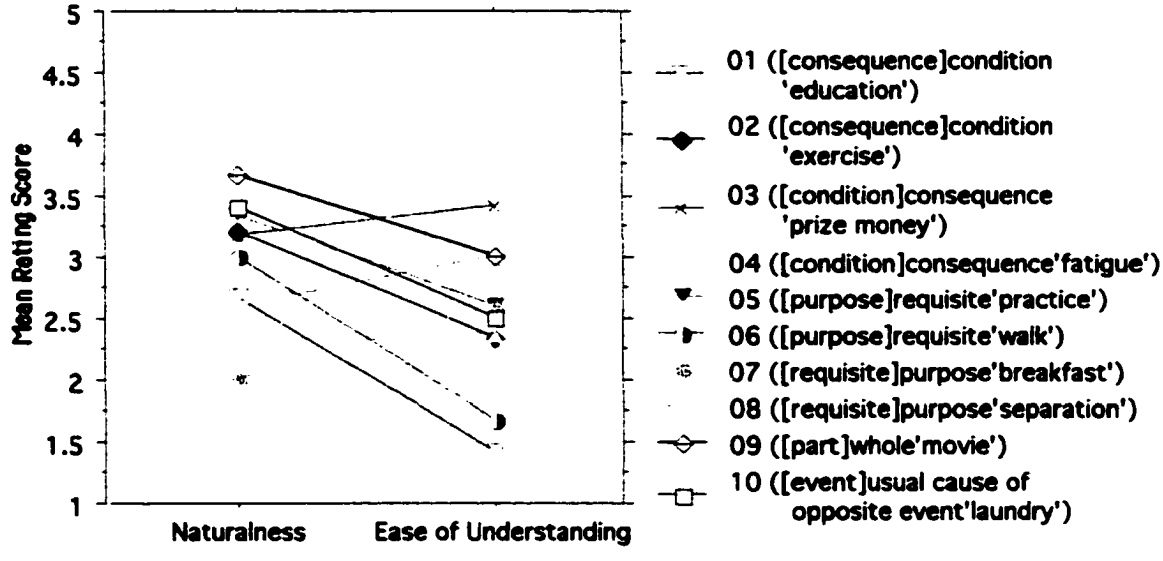


Figure 3-8. Rating scores for ten GR sentences by 11 English Japanese as a second language learnes on the scales of naturalness and ease of understanding for Englis JSLs. For each sentence, the semantic relation between the meaning of the modifying clause and the head noun is shown. The meaning of the head noun is within single quotes. Ranking of the sentences are not correlated between the naturalness scale and the ease of understanding for English JSLs scale.

Japanese Native Speakers vs. English JSLs

The speaker group difference between the overall scores was not expected because the scores were anchored at the time of assigning scores; the participants were asked to first assign '1' and '5' to one sentence each before they started to assign the scores '1' through '5' to all the sentences in the list. It was expected that the interactions between Speaker Group and Construction Type would be found for the scores of each judgement scale.

Ease of understanding rating. The Speaker Group did not make a significant effect, $F(1, 32) = 2.26$, $p = .14$ (Figure 3-9). No significant interaction between Construction Type and Speaker Group was found, $F(3, 96) = 2.42$, $p = .07$.

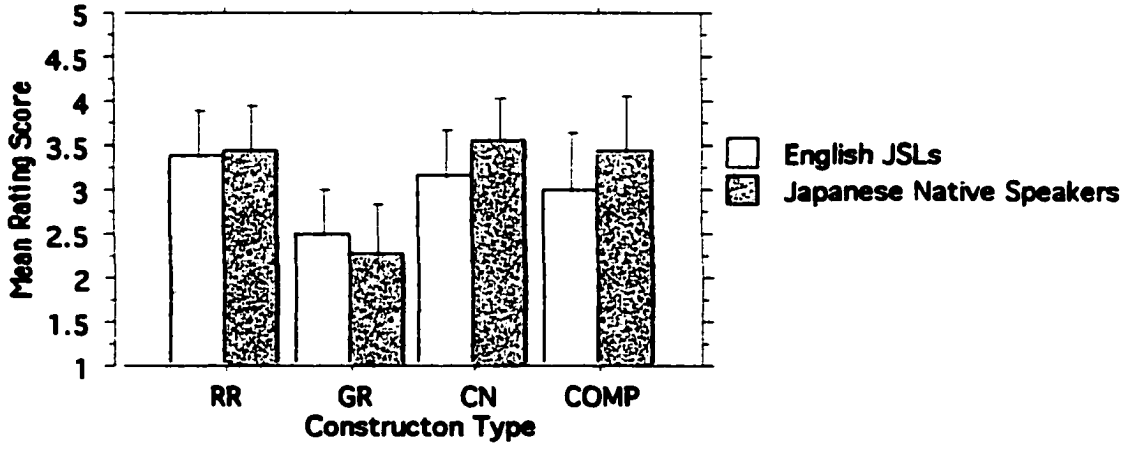


Figure 3-9. Ease of understanding for English JSLs rating by 11 English Japanese as a second language learners and 23 Japanese native speakers with ten sentences for each construction type (Error bars: ± 1 standard deviation). "1" was the most difficult to understand for English JSLs, and "5" was the easist to understand for English JSLs.

T-tests showed no significant differences between speaker groups for any construction types: $df = 9$, $t_{RR} = 2.03$, $p = .07$, $t_{GR} = -.99$, $p = .35$, $t_{CN} = 2.12$, $p = .06$, and $t_{COMP} = 2.03$, $p = .07$.

Naturalness rating. The Speaker Group did not have a significant effect, $F(1, 32) = 2.31$, $p = .14$. However, there was a significant interaction between Construction Type and Speaker Group, $F(3, 96) = 7.30$, $p = .0002$ (Figure 3-10).

For each construction type, a *t*-test was conducted between the two speaker groups. For the COMP, the GR, and the RR, the difference in rating scores was

significant between Japanese native speakers and English JSLs: $df = 9$, $t_{COMP} = 3.89$, $p = .004$, $t_{GR} = -2.51$, $p = .03$, and $t_{RR} = 2.43$, $p = .04$, but not significant for the CN, $t_{CN} = .91$, $p = .39$. Japanese native speakers rated significantly higher for the RR and the COMP, and lower for the GR than English JSLs; however, they rated equally for the CN.

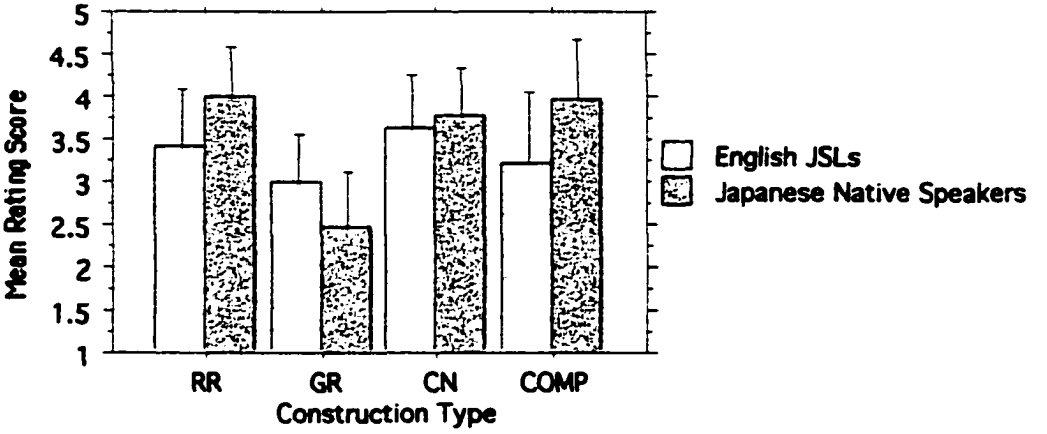


Figure 3-10. Naturalness rating by 11 English Japanese as a second language learners and 23 Japanese native speakers with ten sentences for each construction type (Error bars: ± 1 standard deviation). "1" was the least natural, and "5" was the most natural.

As for the speaker group differences, EUR patterns by English JSLs and Japanese native speakers were very similar (see Figure 3-9) while the patterns of naturalness rating were different (see Figure 3-10). Presuming that English JSLs did not have a clear sense of naturalness in their L2, it is to be expected that naturalness ratings between two speaker groups did not match. According to naturalness scale, the following pattern was found: equal ratings for the CN, lower ratings for the GR by Japanese native speakers than English JSLs, and higher ratings for the RR and the COMP by Japanese native speakers than English JSLs. Under the circumstances, where the ratings were anchored and consequently no overall speaker group differences in either scale were found, these speaker group differences can be explained as follows.

Above all, these speaker group differences do not illustrate any processing characteristics of the speaker groups but can be ascribed to two factors. First, English JSLs did not have a good sense of naturalness, so they tended to assign intermediate scores, making the distribution of the scores narrow. Secondly, Japanese native speakers had a clearer sense of naturalness (both analyses by participants and items showed that

the GR was lower than the rest, and nothing else was suggested), so they assigned the distinctively low scores to the GR and the higher scores to the rest, creating a broader spread among their scores compared to English JSLs.

The narrower spread of the scores by English JSLs than by Japanese native speakers had the following consequences. First, the narrower spread made the most highly scored CN by English JSLs to be as high as the third highest CN, which clusters with the highest two, by Japanese native speakers. Secondly, it made the lowest GR by English JSLs significantly higher than the lowest GR by Japanese native speakers. Thirdly, it made significant differences between the third highest COMP by English JSLs and the highest COMP by Japanese native speakers and between the second highest RR by English JSLs and the second highest RR by Japanese native speakers.

Summary of the Results

For both judgement scales, Japanese native speakers rated the GR significantly lower than any other construction type. They used the same decision criterion for rating the GR and different decision criteria for the RR, the CN, and the COMP on two judgement scales. GR's lowest rating scores and the correlation between the two judgement scales support the special marked status of GR.

English JSLs' rating patterns were different from Japanese native speakers. English JSLs found the CN more natural than the GR (only the participants analyses but not the items analyses), and found the RR easier than the GR (both analyses by participants and items) and the GR more difficult than any other types (only the participants analyses but not the items analyses). The fact that the RR and the COMP were in the middle of the naturalness scale rather than at the top of it and the fact that the CN was not more difficult to understand than the RR and the COMP rejects the Transfer Hypothesis. The results support the Markedness Hypothesis better because the rating scores of GR were consistently lowest. They used consistent decision criteria for rating the CN and the COMP stimuli and inconsistent decision criteria for rating the RR and the GR stimuli. Compared to Japanese native speakers' results, the results from English JSLs call for interpretation.

Overall, both Japanese native speakers and English JSLs rated lower on the scale of ease of understanding for English JSLs than on the scale of naturalness.

On the scale of ease of understanding for English JSLs, there were no significant differences between the scores by Japanese native speakers and by English JSLs for each construction type. However, on the scale of naturalness, Japanese native speakers and English JSLs rated the CN equally, but Japanese native speakers rated the RR and the COMP higher and the GR lower than English JSLs. These between judgement scales and between speaker group differences were not believed to be attributable to Construction Type.

The results are summarized in Table 3-6.

Table 3-6
Summary of the Results in Experiment 1: Rating Tasks

Measure	Japanese Native Speakers	English JSLs
NR	NR(COMP)> NR(GR) NR(RR) > NR(GR) NR(CN) > NR(GR) [both participants analyses and items analyses]	NR(CN) > NR(GR) [participants analyses only]
EUR	EUR(RR) > EUR(GR) EUR(CN) > EUR(GR) EUR(COMP) > EUR(GR) [both participants analyses and items analyses]	EUR(RR) > EUR(GR) [both participants analyses and items analyses] EUR(CN) > EUR(GR) EUR(COMP) > EUR(GR) [participants analyses only]
Rank Correlation	$NR(RR, GR, CN, COMP)_r$ c/w $EUR(RR, GR, CN, COMP)_r$ $NR(RR)_r$ nc/w $EUR(RR)_r$ $NR(GR)_r$ c/w $EUR(GR)_r$ $NR(CN)_r$ nc/w $EUR(CN)_r$ $NR(COMP)_r$ nc/w $EUR(COMP)_r$	$NR(RR, GR, CN, COMP)_r$ c/w $EUR(RR, GR, CN, COMP)_r$ $NR(RR)_r$ nc/w $EUR(RR)_r$ $NR(GR)_r$ nc/w $EUR(GR)_r$ $NR(CN)_r$ c/w $EUR(CN)_r$ $NR(COMP)_r$ c/w $EUR(COMP)_r$
Between NR and EUR	NR(RR, GR, CN, COMP) > EUR(RR, GR, CN, COMP) NR(RR) = EUR(RR) NR(GR) = EUR(GR) NR(CN) = EUR(CN) NR(COMP) = EUR(COMP)	NR(RR, GR, CN, COMP) > EUR(RR, GR, CN, COMP) NR(RR) = EUR(RR) NR(GR) = EUR(GR) NR(CN) = EUR(CN) NR(COMP) = EUR(COMP)
Between Speaker Groups	$NR(RR, GR, CN, COMP)_{\text{Japanese Native Speaker}} = NR(RR, GR, CN, COMP)_{\text{English JSL}}$ $NR(RR)_{\text{Japanese Native Speaker}} > NR(RR)_{\text{English JSL}}$ $NR(GR)_{\text{Japanese Native Speaker}} < NR(GR)_{\text{English JSL}}$ $NR(CN)_{\text{Japanese Native Speaker}} = NR(CN)_{\text{English JSL}}$ $NR(COMP)_{\text{Japanese Native Speaker}} > NR(COMP)_{\text{English JSL}}$	

	$EUR(RR, GR, CN, COMP)_{\text{Japanese Native Speaker}} = EUR(RR, GR, CN, COMP)_{\text{English JSL}}$ $EUR(RR)_{\text{Japanese Native Speaker}} = EUR(RR)_{\text{English JSL}}$ $EUR(GR)_{\text{Japanese Native Speaker}} = EUR(GR)_{\text{English JSL}}$ $EUR(CN)_{\text{Japanese Native Speaker}} = EUR(CN)_{\text{English JSL}}$ $EUR(COMP)_{\text{Japanese Native Speaker}} = EUR(COMP)_{\text{English JSL}}$

Note. c/w: correlates with, nc/w: does not correlate with, NR: naturalness rating, EUR: ease of understanding for English JSLs rating.

The applicability of the concepts embodied in the markedness and transfer hypotheses for off-line processing of NMCs was tested in this experiment. NR, EUR, and ranking correlation results from Japanese native speakers clearly supported the Markedness Hypothesis. Japanese native speakers distinguished GR from CN, COMP, and RR; CN, COMP, and RR were internally indistinguishable for them.

NR and EUR results from English JSLs gave more support to the Markedness Hypothesis than the Transfer Hypothesis. It is apparent that the interpretation of English JSLs' rating and correlation patterns involve more than the concepts of markedness and transfer. English JSLs were able to distinguish among NMC subtypes more than Japanese native speakers, suggesting that factors other than the sense of markedness were involved in English JSLs' processing.

The processing sensitivities that cannot be explained by the concepts of markedness or transfer will be identified in the last chapter with the results from other experiments.

This experiment employed an off-line task allowing the participants to reflect on their knowledge of Japanese and English. In the following chapter, the semi on-line experiment is described. This translation task under time constraint was expected to capture aspects of processing that the off-line task could not.

Notes

[1] Experiments 1-3 were conducted in sequence in the order of Experiment 3, Experiment 2, and Experiment 1. This chapter describes Experiment 1, i.e., the last experiment.

[2] For example, the participants tended to assign numbers from the top of the list without finding the items for 1 and 5. When that was happening, the experimenter asked the participants to find one item to assign 1 and the other item to assign 5.

[3] Three participants out of 23 Japanese native speakers and one participant out of 11 English JSLs asked what 'natural' meant.

[4] One Japanese native speaker asked if 'difficult to learn' meant 'long explanation for English JSLs.' The researcher agreed.

[5] In both judgement scales, the GR was scored the lowest by English JSLs. This clearly supports the markedness hypotheses. The other explanation for this result, based on the same grounds as markedness, is that English JSLs found the GR sentences difficult to comprehend even prior to judging the GR sentences in terms of the two scales. That is, English JSLs rated the GR sentences lowest because they were hard to comprehend rather than they were less natural or difficult to understand for English JSLs themselves. This is supported by the results from the translation task, where the translation accuracy of the GR was the lowest. The GR sentences were hard to comprehend and took longer than the time allowed, and English JSLs could not provide appropriate translation for the GR compared to the stimuli of other construction types. The lowest translation accuracy supported the marked status of the GR with respect to the others.

Chapter 4

Experiment 2

Semi On-Line Translation Task under Time Constraint

In this experiment, English JSLs (Japanese as second language learners) read and translated four types of NMC into English under a time constraint. It was expected that accuracy of translation and forms of correct translation would indicate English JSLs' sensitivity to the four types of NMC.

Accuracy of translation was expected to correlate with ease of comprehending the four types of NMC. Markedness and transfer were expected to be relevant to the levels of comprehension ease, while the other hypotheses, i.e., gap and frame hypotheses, are not relevant.

Japanese native speakers were not included because their performance in translating NMCs to English would reflect their proficiency in English rather than their comprehension of Japanese NMCs.

Objectives and Rationale of the Experiment

English JSLs were asked to read a Japanese sentence on the computer screen and translate orally the material in the NMC within 40 seconds. Readings and English translation were recorded. Two data sets were obtained: the scores for translation (translation accuracy: the ratio of the number of correct translations over the sum of correct and incorrect translations) and correct responses.

The first data set was used to test the hypotheses which both make predictions about the success rate of comprehension of the different construction types. The Markedness Hypothesis predicts that the GR, i.e., the marked type, should be harder to process than the unmarked members; therefore, the RR, CN, and COMP should be easier to comprehend than the GR. The Transfer Hypothesis predicts that the familiar RR and COMP should be easier to process than the unfamiliar GR and CN; therefore, the RR and the COMP should be easier to comprehend than the GR and the CN, and this should be reflected in translation accuracy.

Two stages were potentially involved in this task from the perspective of the participants. English JSLs comprehended the material and then expressed the idea in English. Both hypotheses make predictions about the first stage, i.e., comprehending NMCs. The Markedness Hypothesis claims that marked structures should be harder to comprehend, so comprehension of GR should be harder because of its markedness status. The Transfer Hypothesis claims that knowledge of L1 is used to comprehend L2, so comprehension of the RR and the COMP should be easier than the GR and CN because their equivalents exist in L1. The first data set was used for testing the hypotheses.

The second data set was used to determine the ease of the second stage, i.e., the different degrees of ease of translation among the four construction types. Neither the Transfer nor the Markedness hypothesis make predictions on how well the English JSLs should express the understood idea in English. The Transfer Hypothesis does not predict how effectively the L1 can be used to express an idea conveyed by L2. How the English language could express the marked structures with respect to the unmarked structures of Japanese is not relevant to the Markedness Hypothesis.

It was considered likely that once the English JSLs comprehended the material (consisting of relatively simple or uncomplicated propositions), expressing it in English should be less costly because it is done in their L1. Because the second component (expression) is trivial when compared to comprehension, the level of success in translating NMCs should reflect ease of comprehension rather than ease of expression.

However, it was also anticipated that translation accuracy might reflect ease of translating rather than ease of comprehending the NMCs. Therefore, ease of translation was independently measured in two ways: in terms of the forms and in terms of the propositional structures of the correct translation. The second data set was used for this purpose.

Fundamentally, the intention of the experiment was to test comprehension. In addition, ease of expressing the stimuli in English was also measured.

First, the kinds of English forms in the correct translations were analyzed. The assumption was that the more methods available to express certain types of NMC in English, the easier the particular NMC type should be to translate. Secondly, the predicate-argument structures expressed in the translation were compared with those of

the original stimuli. Fewer translations showing a change in the original predicate-argument structure of certain NMC types were assumed to correspond to greater ease in translating the NMC.

Accuracy of translation and ease of translation,[1] independently measured in these tasks, were then compared. The rankings among the four construction types in terms of the accuracy of translation and the ease of expressing (forms and propositional changes observed in the correct translation) were not expected to correlate with each other. Translation accuracy was not expected to be a reflection of the ease of translation but, rather, is a reflection of the ease of comprehension. The forms were also expected to show how NMC subtypes are interrelated rather than distinguished in terms of the method used to express them in English.

A time constraint was imposed to prevent all the translations from being always correct. The time constraint was also necessary to ensure that the output forms were the most readily available forms in the mind of the users rather than the results of thorough editing, which was not of interest in this study.

Experimental Hypotheses

Hypotheses 7 and 8 are formulated on translation accuracy (TA) in Table 4-1. Hypothesis 7 was predicted by the Markedness Hypothesis, and Hypothesis 8 was predicted by the Transfer Hypothesis.

Table 4-1
Experimental Hypotheses Tested in Experiment 2

Measure	English JSLs
TA	H7 Markedness Hypothesis for TA by English JSLs For English JSLs, TA of GR sentences should be lower than those of RR, CN and COMP sentences. TA(RR), TA(CN), TA(COMP) > TA(GR) H8 Transfer Hypothesis for TA by English JSLs For English JSLs, TA of RR and COMP sentences should be higher than those of GR and CN. TA(RR), TA(COMP) > TA(GR), TA(CN)

Note. TA: translation accuracy

These experimental hypotheses each make predictions about the success of comprehension, i.e., how well each type of NMC should be comprehended. As for the forms of translation output, there were no experimental hypotheses. The forms were examined and generalizations were attempted.

Method

Participants

Eleven English-speaking Japanese as a second language learners (English JSLs) who participated in the first experiment (see Experiment 3, Chapter 5) continued as participants in Experiment 2 (see "Participants" Chapter 2 and Appendix 2).

Stimuli

Forty sentences used in the rating tasks (Experiment 1 in Chapter 3) were used.[2] These were also a part of the stimuli used in the self-paced reading and probe recognition tasks (Experiment 3 in Chapter 5). There were 10 sentences with the following pattern for each construction type as in (4-1).

(4-1) _____Head Noun*.....

In (4-1), the modifying clause is underlined. "Head Noun" indicates the location of the head noun. In the presentation on the computer screen, there were no underlines. Following the convention of Japanese punctuation, spaces were not used inside the sentence. Authentic Japanese orthography, as in Experiments 1 and 3, was used. The same material used in the self-paced reading and probe recognition tasks, which preceded this experiment, was used because it was assumed that translation accuracy would not be affected by familiarity with the material.

An asterisk, marking the end of the NMC in each sentence, was clearly shown on the screen. The participants were asked to translate up to the asterisk, i.e., the noun modifying clause and the head noun. The entire sentence was presented so that participants could see all parts to provide a context for the NMC.[3] The segment reading task, in which the computer screen provides only one segment at a time, was not adopted because participants would not remember what they had read previously while producing

the English translation. Distracters with other syntactic forms were not used because accuracy of translating NMCs should not be affected by translating the sentences with a repeating grammatical pattern, i.e., sentences that always start with an NMC.

Forty sentences, ten for each Construction Type, were randomized and counter-balanced in terms of Construction Type. It was believed that since there were only 40 trials, the performances would not be affected by primacy and recency effects. Therefore, the order of presentation of the sentences was identical for all participants.

Procedure

The computer was used to enforce a time limit for each item. The oral translation method, rather than a pencil and paper method, was employed to save time. The pilot study with the pencil and paper method and without a time constraint suggested that when the participants freely spent time to translate, they eventually tended to come up with an appropriate translation for every item, causing a ceiling effect. The present test was designed to reveal the relative difficulties of certain construction types.

Word test. After the self-paced reading and probe recognition experiment (described in Chapter 5), the English JSLs were given a list of Japanese words with kana and English gloss counterparts (see Appendix 1 for the word check sheet and the scores by individual English JSLs). All the vocabulary in the translation task was provided, and words were listed in the order of presentation in the experiment. Participants were asked to check off the words they could read and translate. This was to help them become familiar with the vocabulary list which could be referred to until the end of the last experiment.

Instructions. Participants received oral instructions about the next task with the aid of the computer screen (see Appendix 6 for the instruction for the translation task). The emphasis on oral over computer guided instruction provided participants a break from looking at the computer screen, since the previous task involved a one-hour reading task using the computer.

Each participant was asked first to read the stimulus aloud in Japanese to assure s(he) looked at the entire sentence. They were asked to provide within 40 seconds an oral translation of each part only up to the asterisk. An instructor of Japanese at East Asian

Studies, University of Alberta, estimated that one minute would be the appropriate amount of time for the students to translate each sentence as a part of a written examination. The more severe time limit of 40 seconds was chosen, because the participants were to translate only the first portion of each sentence—the portion critical for the purpose of this experiment.

Participants were given a couple of practice examples, and these responses were monitored with the researcher present. They were then asked if they would mind the researcher sitting through the session. If the participant preferred doing the experiment alone, the tape recorder was started and the researcher left.[4] Otherwise, the researcher stayed in the room while the responses were taped.

Target sentences and on-line dictionary. One target sentence at a time was presented in 14 point font at the center of the computer screen. At the top left corner of the screen, the Japanese vocabulary used in each stimulus, the readings in hiragana and the corresponding English gloss, were presented at the same time in 12 point font.[5] The rationale behind providing this on-line dictionary was to examine how the participants construed the noun-modifying constructions rather than how well they knew the Japanese words.

Trial sequence. In each trial, participants did the following:

1) read the stimuli aloud,

2) gave an oral translation of the material up to the asterisk, consulting the dictionary on the screen if necessary, and

3) hit the space bar to go on to the next trial.

If 1) and 2) were not done within 40 seconds, the screen automatically changed to the next trial. The participants received a warning at 30 seconds and 35 seconds (both visually under the target sentence in 24 font size and aurally), which was recorded along with translation. This sequence is summarized below in Table 4-2.

Table 4-2

Sequence of a Translation Trial

Time (Sec.)	Activities on the Screen	Comment
0	[At the center of the screen] 1	A number starting with '1' is presented at the center of the screen as an eye fixation point for 1 second.
1	[At the left top corner] 2 to 5 words (Japanese words with English meaning) as an on-line dictionary [At the centre where the number was presented] A Japanese sentence to be translated	A Japanese sentence and corresponding gloss remained on the screen for 40 seconds. If the participant hit the bar key any time during the period where the gloss and the sentence were on the screen, the screen changed to the next trial starting with the number as an eye fixation point.
30	***"Ten More Seconds Left"***	The warning sign, "Ten More Seconds Left," appeared with a correct beep under the sentence and disappeared in 4 seconds.
35	***"Five More Seconds Left"***	The warning sign, "Five More Seconds Left," appeared with a correct beep under the sentence and disappeared in 3.5 seconds.
38.5 40	***"Time Is Up"***	The warning sign, "Time Is Up," appeared with a done beep under the sentence and disappeared in 1.5 seconds simultaneously with the on-line dictionary and the sentence.

'Psyscope' (Cohen, MacWhinney, Flatt, & Provost, 1993) was used to run the trials.

This experiment took approximately 30 minutes.

Results

Data Analyses

The score '1' was assigned if the translation was correct, and '0' if it was incorrect (see Appendix 7 for the scores for each translation). To assure scores reflected ability to comprehend NMCs of each construction type rather than ability to express the Japanese material in English, four criteria (see below) were used. If all the four criteria were satisfied, the score '1' was given. If even one criterion was not satisfied, the score of '0' was given. When there was no response, '0' was assigned. However, the criteria allowed translations in which some words were imprecise but conveyed similar meanings. The criteria also forgave ungrammatical responses caused by obvious performance errors.

Evaluation procedure. The following four scoring criteria were used.

(A) The meaning of the head noun was recognized correctly. The meaning of the head noun did not have to take the form of a noun.

(B) The meaning of the head noun was the head in the translation. When the translation took the form of a noun phrase, the meaning of the head noun was reflected in the head noun in the translation. When the translation took the form of a prepositional phrase, the meaning of the head noun was reflected in the preposition.

(C) The head and the modifying clause were recognized as having a syntactic or semantic relationship.

(D) The predicate in the modifying clause and the head noun were connected and made correct sense.

The first two criteria dealt with the translation of the head noun. (A) was used to allow prepositions as well as nouns to be the head for the translation (e.g., both 'prior to' and 'the moment prior to' satisfied this criterion). (B) rejected predicative structures containing the meaning of the head noun. When the meaning of the head noun in Japanese sentences was recognized, it had to be reflected in the meaning of the head in the translation (e.g., 'donating money for the gym' was not acceptable while 'the gym that I donated the money for' was, when 'the gym' was the head noun in the stimuli).

The third and fourth criteria dealt with associating the modifying clause and the head noun. (C) stated that the constituents had to be connected (e.g., 'practicing without

fail for the chess game' satisfied this criterion because the head 'practicing' and the rest of the material are associated by the prepositions, while 'the separation since long ago the preparation' did not because a connection between the head 'the separation' and the following material is not expressed). Once the association was recognized, (D) was used to screen out the phrases that made sense but did not contain the meaning that the predicate in the stimuli conveyed (e.g., 'practicing without fail for the chess game' sounds good but failed to satisfy this criterion because the predicate in the original stimulus is not recognized, while 'practice for definitely winning a game of chess' was accepted because it contains the predicate 'win').

These criteria were important for arriving at an objective and appropriate assessment of correct and incorrect responses. Initially, the responses were analyzed by these separate four criteria, but none provided significant insights. Therefore, these criteria were collapsed and subsequent analyses were based on the score of either '1' (correct) of '0' (incorrect).

Statistical Analyses

Construction Type (four levels) was the independent variable. The data were analyzed by a one-way ANOVA for both analyses by participants (summing over differences among stimuli) and by items (summing over differences among participants).

In the analyses by participants, Construction Type was treated as a repeated measure factor, while in the items analyses it was treated as a between-items factor. In other words, because in the ANOVA, with participants as variables, all the participants received the same treatments, causing the variance within the level of Construction Type to be more restricted, it was expected that the analyses by participants would always yield more significant results than the items analyses.

Translation Accuracy

After assigning the score of '1' or '0' following the evaluation procedure, the scores were tabulated and the mean score for each construction type was calculated, which yielded Table 4-3.

Table 4-3

Mean Values, Standard Deviations, and Standard Errors by Participants for Translation Accuracy for Four Construction Types with 10 Sentences Each for Construction Type by 11 English Japanese as a Second Language Learners

Construction Type	Mean	S.D.	S.E.
CN	.64	.23	.07
COMP	.72	.36	.11
GR	.47	.35	.11
RR	.60	.36	.11

Note. If a translation was correct, each sentence received '1.' If a translation was incorrect, it received '0.'

It was clear that the score for the GR was the lowest, and the score for the COMP was highest, with the CN and RR in between. The English JSLs provided the most accurate translation for the COMP, the least accurate for the GR. The CN and the RR were intermediate.

Analyses by participants showed an effect by Construction Type, $F(3, 30) = 7.35$, $p = .0008$. Planned comparisons were done for every two levels of Construction Type. There were significant differences between the GR and the other types: $F_{GR, CN}(1, 10) = 9.44$, $p = .005$, $F_{GR, COMP}(1, 10) = 21.23$, $p = .0001$, and $F_{GR, RR}(1, 10) = 5.71$, $p = .02$. The difference was also significant between the COMP and the RR, $F_{COMP, RR}(1, 10) = 4.92$, $p = .03$. The differences were not significant between the CN and the RR, and between the CN and the COMP: $F_{CN, RR}(1, 10) = .47$, $p = .5$, and $F_{CN, COMP}(1, 10) = 2.36$, $p = .14$.

However, the one-way ANOVA with sentences as variables showed only a tendency for the effect of Construction Type, $F(3, 36) = 2.76$, $p = .06$. The Tukey/Kramer post hoc test showed, at the $p < .05$ level, there was a significant difference between translation accuracy of the COMP and GR sentences, but not between other construction types.

That is, ranking of the four construction types according to translation accuracy was: TA(COMP) > TA(CN) > TA(RR) > TR(GR). Participants analyses suggested: TA(COMP), TA(CN), TA(RR) > TA (GR), and TA(COMP) > TA(RR). TA(COMP) and TA(CN), and TA(CN) and TA(RR) were indistinguishable. Items analyses suggested only: TA(COMP) > TA(GR). TA(COMP), TA(CN), and TA(RR) were internally indistinguishable, and TA(CN), TA(RR), and TA(GR) were internally indistinguishable.

The translation accuracy scores of the CN, COMP and RR were combined, and compared to those of GR in a single-df ANOVA. Both participants analyses ($df = 1$, $F = 16.89$, $p = .0003$) and items analyses ($df = 1$, $F = 6.33$, $p = .02$) showed significant differences between TA(COMP, CN, RR) and TA(GR). This supports the Markedness Hypothesis.

Recall that the goal of this experiment was to test the predictions of the Transfer and the Markedness Hypotheses. The Transfer Hypothesis predicted that translation accuracy of RR and COMP should be higher than those of CN and GR. The results supported the relation between COMP and GR. However, the results did not support any other part of this hypothesis. The Markedness Hypothesis, on the other hand, predicted that translation accuracy of GR should be lower than COMP, CN, and RR, but did not predict the differences among those three types. The results supported a relation between COMP and GR. However, participants analyses also suggested a difference between COMP and RR, which was not predicted by the Markedness Hypothesis.

The significantly lower TA(GR) compared to TA(COMP) was suggested by analyses by participants and by items. This was predicted both by the Markedness and Transfer Hypotheses. Therefore, both hypotheses were partially supported.

However, the Markedness Hypothesis was better supported because the participants analyses (but not the items analyses) suggest that the TA(GR) was lower than any other type, matching the exact prediction of the Markedness Hypothesis. Neither participants nor items analyses separated COMP and RR from CN and GR, the prediction by the Transfer Hypothesis.

Analyses of Forms of Correct Responses

Based on the assumption that the ease of translating the ideas conveyed by different NMCs was directly proportional to the number of forms used in the responses, the forms in the correct responses were analyzed. These forms were created within a very severe time constraint and were assumed to be an unedited product. The output forms were examined, and then generalizations about the strategies used to associate the heads and the modifiers were formulated.

The focus was on how the relation between the head and the following complement was signaled. Six strategies were recognized that differ in the scale of signaling the relation: from a strategy where no element between the head and the following modifier exists to signal the relation, to one in which the head itself signals the relation with the modifier. The strategies were:

Strategy 1, 'Relation Unspecified,' is where there was no overt element signaling the relation between the head noun and the modifier. A typical example is the English complement with nominal head (as a translation of COMP stimuli), in which 'that,' as complementizer, intervenes between the two constituents without signaling the relation.

Strategy 2, 'Apposition,' is where the elements between the head noun and the modifier signaled a relation of equation, such as 'saying that,' 'which says,' and 'with regard to,' which was exclusively associated with translation of COMP stimuli. The difference between the 'that' complementizer in Strategy 1 and the apposition establishing phrases in Strategy 2 is that the phrases in Strategy 2 encode that the head noun and the modifier are in appositive relation while 'that' as a complementizer in Strategy 1 does not.

Strategy 3, 'Relative Clause' is where the relation is not specified overtly by any elements intervening between the two constituents, but the relation is grammatically coded by the subject/ object of a verb or the object of a preposition. Examples are 'music that has been used to comfort hurt people's heart' (a translation of a RR stimulus), 'the breakup that I have been preparing for a long time' (a translation of a GR stimulus) and 'the church from which the bride and the groom come out[6]' (a translation of a RR stimulus).

Strategy 4, 'Wh Adverb,' is where 'where/ when/ why' intervene between the head noun and the modifier to signal the relation between the head noun and the modifier. Some examples are: 'movie where you figure out the plot in the first five minutes' (a translation of a GR stimulus), 'the sound when the buses pass the main street' (a translation of a CN stimulus) and 'the reason why I didn't go to the piano lesson' (a translation of a CN stimulus).

Strategy 5, 'Preposition/ Prepositional Phrase,' is where varieties of relations are expressed by prepositions or prepositional phrases. Some examples are: 'of' as in 'an

advertisement of selling a used piano,' 'the result of eating too much at the restaurant yesterday,' 'the sound of the bus passing through main street' (translations of a CN stimulus) and 'prize of becoming a champion' (a translation of a GR stimulus).

Strategy 6, 'Prepositional Head,' is where the head itself is signaling the relation in the form of prepositions or in the form of nouns in combination with prepositions. Examples are 'before the plane to Asia took off,' 'on the back side of the big building built,' and 'due to the fact I overate at yesterday's restaurant' (translations of a CN stimulus).

The correct responses (which were assigned '1') for each construction type were examined and classified according to the six strategies. It was expected that the more strategies available, the easier it would be to translate the material of a given construction type.

Forms of correct translation of COMP. Table 4-4 summarizes the forms used in the translation of ten COMP stimuli. It should be noted that the translated English form did not necessarily take the form of complement with nominal head, which was assumed to be an equivalent construction type of COMP. Out of 79 correct responses, only six cases used a complement with nominal head. Out of those six responses, four occurred with the head noun *iken* ('opinion') and two occurred with the head noun *ronri* ('logic'). Apparently not all COMP type head nouns take the complement introduced by 'that' complementizer in English. For example, while 'opinion' can take a complement introduced by 'that' as shown in Table 4-4, 'phone call' cannot be a head noun taking a complement that tells the content of the phone call, mediated by 'that' complementizer.

Table 4-4
Summary of Forms and Frequency of Translation Responses for COMP by 11 English JSLs

Head Noun	# of correct	Forms
'phone call' *denwa*	9	HN saying that [2], HN which tells[1], HN to the effect that [1], HN about Ving[1], HN of Ving[1], HN Ving[1], HN alerting NP[1], HN regarding Ving[1]
'advertisement' *kookoku*	9	HN that says[2], HN RR [2], HN for Ving[2], HN about Ving [1], HN regarding NP[1], HN with regard to NP[1]
'question' *shitsumon*	8	HN about Cl [3], HN which asks if Cl [1], HN asking if Cl[1], HN of whether Cl [1], HN of asking whether Cl [1], HN as to Cl[1]
'opinion' *iken*	7	HN that COMP [4], HN which says Cl[1], HN expressing that Cl[1], HN of Cl[1]

'wish' *yokuboo*	8	HN to V[6], HN of Ving[1], HN of Cl[1]
'patience' *gaman*	6	HN to V[3], HN Ving[2], HN for Ving[1]
'memory' *omoide*	9	HN of Ving[8], HN that I have about Ving[1]
'plea' *uttae*	6	HN to V[3], HN worrying to V[1], HN requesting V[1], HN calling for N [1]
'logic' *rikutsu*	7	HN which/that says[3], HN (that) COMP [2], HN of Ving[1], HN of Cl [1]
'decision' *kettei*	10	HN to V[9], HN of Ving[1]

Note. HN: head noun, V: verb, COMP: complement clause, Ving: gerund, PP: prepositional phrase. The number in the pair of square brackets indicates the frequency of the form. If all the participants provided a correct translation, the number of correct responses for each item should be 11.

The correct responses for COMP were sorted according to the strategies (see Appendix 8A for the correct translations for COMP according to the strategies). It was found that the English translations of the Japanese COMP NMC involved all the strategies except for Strategies 4 'Wh Adverb' and 6 'Prepositional Head,' summarized in Table 4-5.

Table 4-5
Strategies in Correct Translation for 10 COMP Stimuli by 11 English JSLs

	Strategy 1 Relation Unspecified	Strategy 2 Apposition	Strategy 3 Relative Clause	Strategy 4 Wh Adverb	Strategy 5 Preposition/ Prepositional Phrase	Strategy 6 Prepositional Head
COMP	Yes	Yes	Yes	No	Yes	No

Forms of correct translation of CN. It was assumed that there is no English structure equivalent to CN. Nonetheless, several forms are available to create cohesion between the head noun and the modifying clause, which are summarized in Table 4-6.

Table 4-6
Summary of Forms and Frequency of Translation Responses for CN by 11 English JSLs

Head Noun	# of correct	Forms
'result' *kekka*	9	the result of Ving[6], as a result of the fact that Cl [1], due to the fact that Cl [1], the result of NP [1]
'reason' *riyuu*	11	the reason why Cl[6], the reason for Ving[3], the reason of Ving[1], the reason Cl [1]
'moment prior to' *chokuzen*	10	before Cl[2], right before Cl[2], just a/the moment before Cl[2], moment prior to Sbj Ving[2], just before NP[1], the moment prior to NP[1]
'space between' *aida*	3	between N RC [1], the space between Sbj Ving[1], in between N RC[1]

'space next to' *yoko*	7	beside N RC[1], beside Sbj Ving[1], by the side of N RC[1], to the side of N RC [1], the side Sbj Ving[1], the side of N RC[1], the side where Cl[1]
'space around' *atari*	8	around the place where Cl[2], somewhere around Cl [2], the area where Cl[2], somewhere around with Cl [1], somewhere Cl[1]
'space behind' *uragawa*	5	behind where Cl[1], behind N RC[1], on the backside of N RC[1], backside of N RC[1], backside of Ved N[1]
'sound' *oto*	8	the sound/the noise of Sbj Ving[5], the noise Sbj Ving[1], the sound from N RC[1], the sound when Cl[1]
'study' *benkyoo*	6	The study/ hard work to V[2], studying to V[1], study for Ving[1], the study of Ving [1], a study RC[1]
'morning' *asa*	2	the morning of having stayed[2]

Note. RC: relative clause, V: verb, Ving: gerund, NP: noun phrase,Ved: verb in passive form, PP: prepositional phrase, Sbj: subject of the following verb. The number in the pair of square brackets indicates the frequency of the form. If all the participants provided a correct translation, the number of correct responses for each item should be 11.

The responses were classified according to the strategies (see Appendix 8B for correct translation for CN according to the strategies). Translating the CN was possible using all the strategies except for 'Apposition,' as summarized in Table 4-7. The CN does not have a structural equivalent in English, but many strategies are available in English to express the material denoted by the CN.

Table 4-7
Strategies in Correct Translation for 10 CN Stimuli by 11 English JSLs

	Strategy 1 Relation Unspecified	Strategy 2 Apposition	Strategy 3 Relative Clause	Strategy 4 Wh Adverb	Strategy 5 Preposition/ Prepositional Phrase	Strategy 6 Prepositional Head
CN	Yes	No	Yes	Yes	Yes	No

Forms of correct translation of RR. More structurally direct mapping was observed in the translation of the RR; that is, RR was translated into English in the form of a relative clause as indicated by Table 4-8. Out of 66 correct responses, 51 took the form of a relative clause.

Table 4-8
Summary of Forms and Frequency of Translation Responses for RR by 11 English JSLs

Head Noun	# of correct	Forms
'music' *ongaku*	7	HN RC[7]
'doll' *ningyoo*	9	HN RC[7], HN inside(reduced relative)[2]
'gym'	3	HN RC[3]

doojoo		
'face' *kao*	10	HN RC[5], HN where Cl[1], HN Ved(reduced relative)[3], HN with Sbj Ved [1]
'research' *kenkyuu*	6	HN RC[6]
'train' *densha*	7	HN RC[7]
'city' *toshi*	7	HN where Cl[7]
'church' *kyookai*	6	HN where Cl[4], HN from RC [2]
'hospital' *byooin*	4	HN toward/ to which Cl[3], HN where Cl[1]
'square' *hiroba*	7	HN RC[6], HN where Cl[1]

Note. HN: head noun, RC: relative clause, V: verb, Ved: verb in passive form, PP: prepositional phrase. The number in the pair of square brackets indicates the frequency of the form. If all the participants provided a correct translation, the number of correct responses for each item should be 11.

The strategies used to express the RR stimuli were 3 'Relative Clause,' 4 'Wh Adverb,' and '5 'Preposition/ Prepositional Phrase,' as summarized in Table 4-9.

Table 4-9
Strategies in Correct Translation for 10 RR Stimuli by 11 English JSLs

	Strategy 1 Relation Unspecified	Strategy 2 Apposition	Strategy 3 Relative Clause	Strategy 4 Wh Adverb	Strategy 5 Preposition/ Prepositional Phrase	Strategy 6 Prepositional Head
RR	No	No	Yes	Yes	Yes	No

Forms of correct translation of the GR. Lastly, the GR, for which a structural counterpart does not exist in English, was dominantly expressed by a relative clause in English as Table 4-10 shows.

Table 4-10
Summary of Forms and Frequency of Responses for GR

Head Noun	# of correct	Forms
'study' *gakumon*	3	HN RC[3]
'exercise' *undoo*	4	HN RC[3], HN of Ving[1]
'prize money' *shookin*	6	HN for Ving[5], HN of Ving[1]
'fatigue' *tsukare*	6	HN from Ving[5], HN of Ving[1]
'practice' *renshuu*	7	HN RC[3], HN for Ving[1], HN of Ving[1], HN to V[1], HN in order to V[1]

'walk' *sanpo*	2	HN RC[2]
'breakfast' *choosboku*	5	HN RC[5]
'separation' *wakare*	5	HN RC[5]
'movie' *eiga*	8	HN where Cl[6], HN RC[2]
'laundry' *sentaku*	6	HN RC[3], HN where Cl[1], HN of N RC[1], HN N[1]

Note. HN: head noun, RC: relative clause, V: verb, Ving: gerund. The number in the pair of square brackets indicates the frequency of the form. If all the participants provided a correct translation, the number of correct responses for each item should be 11.

The relative clause was used in 26 out of 52 responses. Non relative clause forms were most common in responses where 'prize money' and 'fatigue' were the head nouns.

The responses were analyzed according to the strategies (see Appendix 8D for correct translation for GR according to strategies). Expressing the GR stimuli involved Strategies 1, 3, 4, and 5, which are summarized in Table 4-11.

Table 4-11
Strategies in Correct Translation for 10 GR Stimuli by 11 English JSLs

	Strategy 1 Relation Unspecified	Strategy 2 Apposition	Strategy 3 Relative Clause	Strategy 4 Wh Adverb	Strategy 5 Preposition/ Prepositional Phrase	Strategy 6 Prepositional Head
GR	Yes	No	Yes	Yes	Yes	No

Summary of strategies and comparison with translation accuracy. Table 4-12 summarizes the strategies used for translating each type of NMC.

Table 4-12
Strategies in Correct Translation for CN, COMP, GR, and RR with 10 Stimuli for Each Construction Type by 11 English JSLs

	Strategy 1 Relation Unspecified	Strategy 2 Apposition	Strategy 3 Relative Clause	Strategy 4 Wh Adverb	Strategy 5 Preposition/ Prepositional Phrase	Strategy 6 Prepositional Head
CN	Yes	No	Yes	Yes	Yes	Yes
COMP	Yes	Yes	Yes	No	Yes	No
GR	Yes	No	Yes	Yes	Yes	No
RR	No	No	Yes	Yes	Yes	No

The greatest number of strategies are available for the CN (1, 3, 4, 5, and 6), slightly less are available for the COMP (1, 2, 3, and 5) and for the GR (1, 3, 4, and 5), and the least for the RR (3, 4, 5). That is, in English the CN should be the easiest type to express, and the RR should be the most difficult, while the COMP and the GR are intermediate.

The relative ease of expression measured by the number of available English forms do not correlate with the ease of comprehension measured by translation accuracy, as Table 4-13 indicates. Thus, as far as could be determined through this analysis, translation accuracy indicates comprehension level.

Table 4-13
Relative Ease of Expression Measured by Number of Strategies and Ease of Comprehension Measured by Translation Accuracy

Measure	Relative Ease
Ease of Expression Measured by Number of Strategies	CN> COMP,GR > RR
Ease of Comprehension Measured by Translation Accuracy	COMP > CN> RR >GR

Based on Table 4-13, the relations among construction types in terms of the available English structures to express them can be illustrated in Figure 4-1 below.

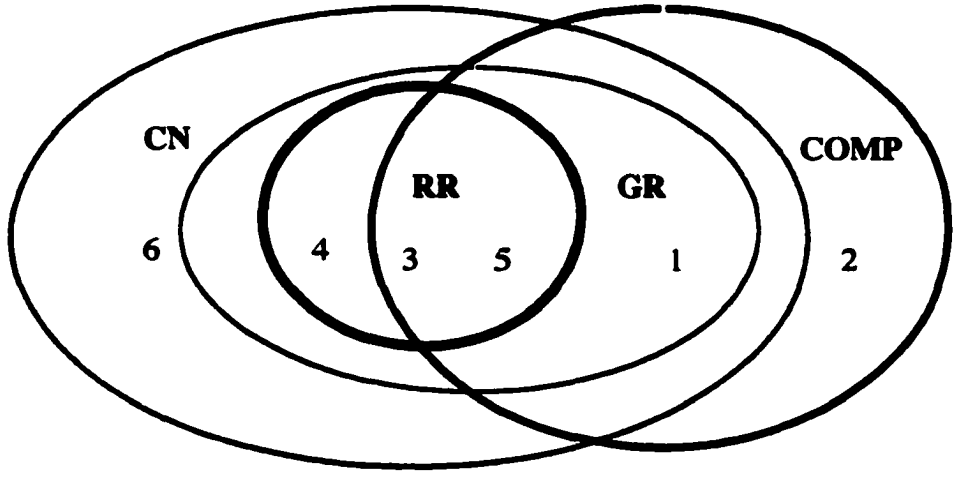


Figure 4-1. Interconnection among NMC types in terms of the strategies to express them in English. 1: Relation Unspecified, 2: Apposition, 3: Relative Clause, 4: Wh Adverb, 5: Preposition/ Prepositional Phrase, 6: Prepositional Head.

It is clear that in terms of the six strategies, none of the construction types is independent. They all share some strategies. The RR is a subset of the GR. They share Strategies 3 Relative Clause (the relation of the head and the modifier is specified by the predicate-

argument relation), 4 Wh Adverb (the relation is expressed by wh-words), and 5 Preposition/ Prepositional Phrase (the relation is specified by prepositions or prepositional phrases). The RR and the GR are subsets of the CN strategies. Besides 3, 4, 5 and 1 Relation Unspecified, Strategy 6, Prepositional Head, is available for the CN. Available strategies for the CN and the RR and the GR are partially shared by COMP. The COMP has special status because Strategy 2, Apposition, is solely owned by the COMP. The CN has special status due to the fact that Strategy 6 is unique to the CN.

In sum, the strategies available in English to express the Japanese NMC suggest that the four NMC types are interrelated categories. Expressing the GR, which is considered to lack an equivalent construction type in English among clausal modifiers with nominal heads, utilizes similar strategies as those used to express the RR. The CN, which also lacks an equivalent construction type in English, takes advantage of more strategies than any other type.

When the number of available strategies is interpreted as indicating the relative ease of translating the different construction types, the CN is easiest to translate, the COMP and the GR are intermediate, and the RR is the hardest. The result of the translation accuracy (TA) suggested that TA(COMP) was highest, while TA(GR) was lowest. Translation accuracy, expected to be a function of ease of comprehension, does not correlate with the number of available structures in English, which is assumed to relate to ease of expressing. That is, translation accuracy is not a measure for ease of translation.

Predicate-Argument Structures in the Correct Responses

Another measure which should indicate ease of expression was whether the original predicate-argument structures in the stimuli are changed in the translations. It should be easier to express the material if a literal translation is possible under time constraint. The assumption is that the more changes made in the original predicate-argument structure in the resulting translations, the harder it should be to express them.

A closer look at each response indicated that the COMP, CN, and RR translations involve less reorganization of the argument structures expressed in the stimuli than the GR. In other words, from the translators' point of view, more "literal" translations were

provided for the COMP, CN, and RR than for the GR. This is understandable because the GR, which lacks an equivalent construction type in English, requires pragmatic knowledge for construal, by which the unexpressed predicate is recovered. Consequently, the translation was expected to contain the recovered predicates which created different predicate structures from the original Japanese stimuli.

On the other hand, no such prediction should be made for the COMP, CN, and RR. However, not only the translations of the GR, but in fact some translations of all construction types contained a reorganization of the original predicate-argument structures, the most of which, as expected, did occur with the GR.

Predicate-argument structures in the RR translations. The RR, the regular relative, is the only type where the original predicate-argument structure involves both the clausal verb and the head noun. The head noun is an argument within the clausal predicate. Consequently, de-relativization is possible. For example, (4-2) is de-relativizable to (4-3) indicating the head noun is an argument of the clausal predicate.

(4-2) [hon'ya-de katta] shinbun
bookstore-at bought newspaper
The newspaper (I/ you/ he/ she) bought at the bookstore

(4-3) hon'ya-de shinbun-o katta
bookstore-at newspaper-ACC bought
(I/ you/ he/ she) bought newspaper at the bookstore.

In (4-2), the original predicate structure is 'bought ((I/ you/ he/ she), newspaper)' where the argument 'I/ you/ he/ she' is not explicit. The head noun 'newspaper' is an argument of the verb 'bought.'

In the 66 correct responses, there were only two cases where the original predicate structures in the stimuli were changed (see Appendix 9A.).

Predicate-argument structures in the COMP translations. For COMP, the head noun and the modifying clause are in an appositive relation. The head noun does not play a role in the modifying clause as it does in RR. Therefore, the original predicate structure in question is the one that the modifying clause alone expressed without the head noun. In (4-4) below, the original predicate structure is 'gave ((I/ you/ he/ she), (it),

(you/him/her))' where none of the arguments is explicit. The head noun *jijitsu* ('fact') is not included, unlike the situation in the RR.

(4-4) [ageta] jijitsu
gave fact
The fact that (I/ you/ he/ she) gave (it) (to you/him/her)

For COMP, there were three cases out of 79 where the original predicate-argument structure was changed (see Appendix 9B). In all three cases, the relation of the head noun with the modifying clause was established in the form of a relative clause, by which the original head noun was somehow incorporated as an argument of the clausal predicate.

For COMP, three out of 79 correct translations involved a change in the original predicate-argument structure. Otherwise, the participants did not have to change the basic propositional meanings to express them in well-formed English.

Predicate-argument structures in the CN translations. In CN, the Clause and Noun Host Type, the proposition with the clausal verb as a predicate does not involve the head noun as the argument NP. In (4-5) below, the original predicate structure is 'occurred (accident, CAUSE),' where the head noun *gen'in* ('cause') is a name of the argument slot, as indicated by upper case, not the argument itself, such as 'accident.'

(4-5) [jiko-ga okita] gen'in
accident-NOM occurred cause
The cause resulting from which the accident occurred

In CN, there was only one case out of 69 correct responses that went through the reorganization (see Appendix 9C).

The number of the changes in the original argument structures with CN was quite low, indicating that the participants did not have difficulty in expressing the material by changing the propositional content for the purpose of composing well-formed English.

Predicate-argument structures in the GR translations. The last construction type is GR, where the head noun does not play an argument role in the modifying clause but does play an argument role within the unexpressed predicate. The original predicate structure in question, as in the case of COMP and CN, refers to the proposition expressed

by the modifying clause alone, without the head noun. In (4-6) below, the original predicate structure is 'sold ((I/ you/ he/ she), book))' where 'I/ you/ he/ she' is not explicit.

(4-6) [hon-o utta] okane
book-ACC sold money
The money (I/ you/ he/ she received as a consequence from) having sold the book

The head noun *okane* ('money') is not a part of this predicate-argument structure. That is, there is no predicate-argument relation between the head noun and the clausal verb. Instead, 'money' is an argument of an unexpressed verb such as 'receive', and together they form another proposition such as 'receive ((I/ you/ he/ she), money).' Therefore, (4-6) can be viewed as an NMC with two separate propositions with different predicates. This property is unique to GR, while COMP and CN denote one proposition in which the head noun does not play an argument role.

Because of the involvement of two events with different verbs in the GR, it was expected that the translation of GR should be prone to the restructuring of the original propositional content. In fact, out of 52 correct responses, 25 showed changes in the original predicate structures.

However, despite the view that an unexpressed predicate, in which the head noun is an argument, is necessary for comprehension, not all the English translations contained a change in the original argument structure. Twenty-seven out of 52 translations were possible without explicitly expressing the understood verb.

Table 4-14 summarizes the number of responses containing changes of the original predicate-argument structures according to the construction types. The percentage of the number of reorganization cases for each construction type indicates that the GR is largest (48.08%), followed by the COMP (3.80%), then the RR (3.03%), and the smallest is the CN (1.45%). Chi-square tests suggested that there was a relationship between Construction Type and absence and presence of reorganization of the original predicate-argument structures, X^2 (3, N = 266) = 83.48, $p < .0001$.

Table 4-14

Observed Frequencies of Responses Containing Change of Original Predicate-Argument Structures and Responses Not Containing Change for Each Construction Type by 11 English JSLs

NMC Type	Change of Original Predicate-Argument Structure	No Change of Original Predicate-Argument Structure	Total Correct Response
CN	1 (1.45)	68 (98.55)	69 (100)
COMP	3 (3.80)	76 (96.20)	79 (100)
GR	25 (48.08)	27 (51.92)	52 (100)
RR	2 (3.03)	64 (96.97)	66 (100)
Total	31 (11.64)	235 (88.35)	266 (100)

Note. The figures in the parentheses are percentage when sum of each row is 100%.

Summary of responses with change of original predicate-argument structure and comparison with translation accuracy. There were considerably more changes to original structures in the translations of the GR than in other types. This means that translations of the GR were less literal than in other types, and consequently, the GR was harder to express than the others. With the measure of translation accuracy, the GR was also more difficult to comprehend than any other type (according to the participants analyses). Therefore, in this case, the most difficult type to comprehend corresponded to the most difficult type to express (Table 4-15). Consequently, it is possible to argue that TA (GR) was lowest because expressing it in English, rather than comprehending it, was difficult.

Table 4-15

Relative Ease of Expression Measured by Number of Change in Original Predicate-Argument Structure and Ease of Comprehension Measured by Translation Accuracy

Measure	Relative Ease
Ease of Expression Measured by Number of Change in Original Predicate-Argument Structure	CN, RR, COMP > GR
Ease of Comprehension Measured by Translation Accuracy	COMP > CN> RR >GR

However, the hierarchies of relative ease among other types did not quite match. According to translation accuracy, COMP was easiest to process with some difference from RR (participants analyses). According to the number of the changes in the original predicate-argument structure in the translation, COMP, CN, and RR were equally easy to express in English. Therefore, translation accuracy, which should reflect the rate of comprehension, is not a function of ease of expression, measured by the number of the changes in the original predicate-argument structures in the translation.

Summary of the Results

Translation accuracy (TA) was highest for the COMP stimuli and lowest for the GR stimuli. The analyses by participants, but not the analyses by items, suggested that TA(GR) was lower than any other types, and that the TA(CN) and TA(RR) were somewhere in the middle with a significant difference between the COMP and the RR but not between the COMP and the CN.

The results of the translation accuracy analysis did not correlate with ease of translation, which was measured on the basis of the number of possible English forms by which the Japanese materials were translated and by the number of occurrences of new predicate structures different from the original predicate structures in Japanese NMC.

The results of the experiment are summarized in Table 4-16.

Table 4-16
Summary of the Results in Experiment 2: Translation Task

Measure	English JSLs
TA	TA(COMP) > TA(GR) TA(COMP, CN, RR) > TA(GR) [both analyses by participants and items] TA(CN) > TA(GR) TA(RR) > TA(GR) TA (COMP) > TA (RR) [participants analyses only]
Number of English Forms	CN > COMP, GR > RR
Number of Reorganization in Predicate-Argument Structure	GR > COMP, RR, CN

Note. TA: translation accuracy

During semi on-line comprehension, English JSLs found the COMP the easiest and the GR the hardest to comprehend. The Markedness Hypothesis, which is motivated by the concept of processing resource domains, better explains the results than the Transfer Hypothesis, which is motivated by the notion that familiar structures are easier to process than unfamiliar ones. The results of translation accuracy by English JSLs indicated more than the effect of markedness. The data require further interpretation, which will be presented in the last chapter.

So far, the data from both off-line and semi on-line tasks by English JSLs suggest that markedness is at work. English JSLs process NMCs under the influence of different

resource domains required for processing NMC subtypes. This is also consonant with the results from the off-line tasks by Japanese native speakers.

In the following chapter, on-line tasks are described in which both Japanese native speakers and English JSLs were engaged in on-line reading and probe recognition. It was expected that the results of on-line tasks would shed light on the different aspects of Japanese speakers' ability to distinguish among the four apparently similar construction types which the semi on-line translation was not able to show.

Notes

[1] Length of NMCs (modifying clause and its head noun), length of the sentences, and number of non-hiragana characters (kanji and katakana, which could cause more difficulty in reading) that belong to NMCs and the whole sentences were also suspected to correlate with accuracy of translation and ease of translation.

Means of the number of characters in NMC (with standard deviations in parentheses) for CN, COMP, GR, and RR were 14.30 (2.31), 16.40 (1.84), 15.90 (1.85), and 14.30 (2.00), respectively. The means differed significantly, $F(3, 36) = 2.93$, $p = .05$. NMC of COMP was significantly longer than CN, $p = .03$. NMC of COMP was also significantly longer than RR, $p = .03$. Means of the number of non-hiragana characters in NMC (with standard deviations in parentheses) for CN, COMP, GR, and RR were 6.40 (2.32), 6.60 (2.41), 6.90 (3.18), and 6.10 (2.18), respectively. The difference among the construction types was not significant, $F(3, 36) = .17$, $p = .91$. Means of the number of characters for each sentence for CN, COMP, GR, and RR were 28.20 (2.74), 29.50 (1.78), 30.30 (2.41), and 28.60 (2.59), respectively. The means did not differ significantly, $F(3, 36) = 1.52$, $p = .22$. Means of the number of non-hiragana characters for each sentence for CN, COMP, GR, and RR were 9.10 (2.77), 9.00 (2.26), 9.80 (3.82), and 9.00 (2.21), respectively. The means did not differ among different construction types significantly, $F(3, 36) = .19$, $p = .91$.

In sum, the number of characters included in the modifying clause and the head noun for COMP was longer than those of CN and RR. The length of NMC did not have an effect in translation accuracy or in ease of translation. The most accurately translated type was COMP, which was not predicted by the most number of characters of COMP. The least number of forms was associated with RR, and the most number of reorganization of the original predicate-argument structures was associated with GR. These difficulties in expressing did not correlate with the number of characters in the stimuli.

[2] This set of stimuli as well as the rest used in Experiment 1 was assessed by an instructor of Japanese at East Asian Studies to certify that the students in intermediate level can understand them.

[3] Without the rest of the sentence, the interpretation of one CN clause in the stimuli was ambiguous. NMC with 結果*kekka* (result) as a head can yield COMP interpretation (the result that is....) as well as CN interpretation (as a result of/ from...).

[4] Three out of 11 participants asked the experimenter to leave.

[5] There were two to five glosses at a time. The on-line dictionary provided all the vocabulary to make sure the participants could find the meanings of the words they did not know.

[6] Relative clauses introduced by prepositions were treated as relative clauses, although prepositions intervene between the head noun and the modifier.

Chapter 5

Experiment 3

On-Line Self-Paced Reading and Probe Recognition Tasks

The relevance of Gap, Frame, markedness, and transfer in processing the four types of noun modifying constructions (NMCs) was examined in this experiment.

Two types of Japanese speakers participated: native speakers of Japanese who were acquiring English, and English speaking learners of Japanese as a second language (English JSLs). Participants with L2 experience were used because it was expected that conscious training in language learning would make them sensitive to the subtypes of NMC. The two types of speakers were studied with the expectation that they would differentiate the subtypes in different ways.

An on-line method was employed so that conscious reflection by the participants was suppressed (cf. the off-line and the semi on-line experiments described in Chapter 3 and Chapter 4). This approach encouraged an intuitive, rather than a considered and reflective, response in native speakers of Japanese while processing in that their knowledge of the other acquired language(s) should be suppressed. For native speakers of English, English processing strategies should be utilized while processing Japanese more than if they were processing off-line.

This experiment was conducted as the first in a series of three experiments (see Table 2-17 in Chapter 2 for the sequence of experiments).

Objectives and Rationale of the Experiment

Three sets of data were collected to test the research hypotheses. The first data set consisted of overall reading times (ORT) for 40 sentences of seven segments each. Ten sentences each of the four NMC types were used. The second data set included the reading times for segments immediately following the head noun (transition reading time: TRT). The segment immediately following the head noun, rather than the segment containing the head noun, was considered the syntactically critical region because, in a self-paced reading task, it is during the presentation of this segment that readers realize the NMC has finished.[1] The third data set consisted of the probe recognition times (PRT)

for two kinds of words: the head noun and the noun in the modifying clause. After the last segment, the participants were presented with a probe word. If the word was included in the sentence just read, the participants were to hit the 'yes' key; if not, they were to hit the 'no' key. PRT was the length of time between the presentation of the probe word and the response of 'yes' or 'no.' Faster recognition indicated better retention of the word.

The rationale for ORT is that it should indicate inherent reading difficulty of the four NMCs with the marked type harder to read, and the transferable type easier.

TRT should also indicate the level of difficulty in processing the segment in the syntactically critical area, i.e., the segment within the marked type should be harder to process, and the segment of the transferable type should be easier to read. In addition, TRT should show the ease of parsing the segment due to its corresponding gap.

Lastly, PRT should show the hosting and hosted relation which forms a frame under the assumption that the hosted information (figure) is more salient than the hosting information (ground), thereby the hosted information easier to recognize. If Clause Host Type (RR and GR), the head noun (HN), being hosted, should be faster to recognize than the noun in the modifying clause (NCl). If Noun Host Type (COMP), the noun in the modifying clause, being hosted, should be faster to recognize than the head noun. If Clause and Noun Host Type (CN), since both constituents are reciprocally hosting and hosted, the two nouns should be equally easy to retain in memory. In addition, PRT should show the effect of a gap under the assumption that the word bound by a gap is more activated than a word that is not. Therefore, the recognition time of the head noun of the gap type should be shorter.

Experimental Hypotheses

The experimental hypotheses tested in this experiment are listed in Table 5-1 along with the corresponding measurements and the speaker groups.

Table 5-1
Experimental Hypotheses Tested in Experiment 3

Hypotheses		Measurement			Speaker Group	
Concept	Prediction	ORT	TRT	PRT	Japanese Native Speaker	English JSL
Gap	CN, COMP, GR > RR		√	√	√	√
Frame	(NCl, RR) > (HN, RR) (NCl, GR) > (HN, GR) (NCl, CN) = (HN, CN) (HN, COMP) > (NCl, COMP)			√	√	√
Markedness	GR > CN, COMP, RR	√	√		√	√
Transfer	CN, GR > COMP, RR	√	√			√

Note. ORT: overall reading time, TRT: transition reading time, PRT: probe recognition time, HN: head noun, NCl: noun in the modifying clause

As could be seen in Table 5-1, Gap Theory predicts that for both speaker groups, for TRT and PRT tasks, CN, COMP, and GR should be more difficult than RR. Frame Theory predicts that for both speaker groups, for PRT task, recognizing the noun in the modifying clause should be more difficult than the head noun for RR and GR, recognizing the nouns in those two syntactic locations should be equally easy for CN, and recognizing the head noun should be more difficult than the noun in the modifying clause for COMP. The prediction by the concept of of markedness is that, for both speaker groups, in terms of ORT and TRT tasks, GR should be harder than CN, COMP, and RR. Lastly the concept of transfer predicts that CN and GR should be more difficult than COMP and RR.

Method

Participants

Japanese native speakers who are learning English and English native speakers learning Japanese were participants and were the same as those described in Experiment 1 (Chapter 3) and Experiment 2 (Chapter 4) (see Appendix 2 for the participants' information and the section on participants in Chapter 3).

Stimuli

The stimuli included 80 target and 80 distracter sentences and sentence fragments. The targets included 10 pairs of sentences for each of the four construction types, i.e., RR, GR, CN and COMP. Distracters were included to prevent participants from recognizing or creating response patterns which would bias the data (see Appendix 10 for the complete set of stimuli). A subset of the stimuli was used in Experiment 1 and Experiment 2. Since this experiment was conducted prior to Experiments 1 and 2, the participants were not familiar with the stimuli at the time of the experiment.

Target stimuli. For each construction type, ten pairs of target stimuli, seven segments[2] in length, were prepared with half set up as in [a] and the other half as in [b] in (5-1).

(5-1) [a] [Seg1] [Seg2] [Seg3] [Head Noun$_i$]$_{Seg4}$[Seg5] [Seg6] [Seg7]
[b] [Seg1] [Seg2] [Seg3] [Noun$_j$]$_{Seg4}$ [Seg5] [Head Noun$_k$]$_{Seg6}$[Seg7]

In (5-1), "Head Noun" indicates the location of the head noun. Both members of each pair contained a noun modifying clause (underlined), but its location differed. In version [a],[3] the first three segments formed the modifying clause, and the fourth contained the head noun. In version [b], the third, fourth, and fifth segments formed the modifying clause, and the sixth contained the head noun. A noun in the fourth segment in both versions [a] and [b] was used as a probe, which appeared after the last segment of the sentence disappeared from the screen.

In a pair of targets, members were controlled semantically and functionally in order to maximize the distinction within the pair as the location of the modifying clause only. First, the Head Noun$_i$ in [a] and the Noun$_j$ in [b] belonged to the same semantic field and were high frequency words.[4] Their frequency was controlled to ensure equal familiarity within a pair, since they were used as probes, and reaction time to the probes could be biased by familiarity. Secondly, since the head noun in [a] was controlled in terms of frequency, high frequency words were chosen also for the head noun in [b] (Head Noun$_k$) to keep both NMCs equally easy to process. Third, the Head Noun$_i$, Noun$_j$, and the Head Noun$_k$ were inanimate. This control was necessary because the head

nouns of the RR and GR are not restricted to inanimate nouns, as are those of the CN and COMP.

Mixtures of hiragana, katakana, kanji, Roman letters, and Roman numbers were used to make the sentences look natural. One segment was normally two to six characters long except for one pair of CN stimuli. In this exceptional pair, the fourth segment of the [a] and [b] versions was only one character long, i.e., 朝*asa* (morning) and 夜*yoru* (evening). These two nouns function as adverbials and do not take an adverbial particle. Since the use of particles with these types of nouns causes ungrammaticality, this exception needed to be accepted. Choosing longer nouns was not possible because of semantic and functional restrictions.

The number of characters in the probes was controlled within each pair; e.g., if the number of characters of an [a] version probe was two, then the [b] version was also two.[5] The character set (i.e., hiragana, katakana, kanji, etc.) was also uniform within a pair.

Distracters. In addition to the 80 targets, 80 distracters were prepared. The 40 distracters were set up as in [c] and 40 as in [d] in (5-2).

(5-2) [c] [Seg1] [Seg2] [Seg3] $[\text{Noun}_i]_{\text{Seg4}}$ [Seg5] [Seg6] [Seg7]
[d] [Seg1] [Seg2][Seg3][Seg4] ([Seg5] ([Seg6] ([Seg7])))

Forty of the first type (version [c] sentences) were similar to the targets in having seven segments. They included a high frequency noun in the fourth segment. The noun in the fourth segment also belonged to the same semantic field as the corresponding nouns in the fourth segments of both types of target stimuli (see Appendix 11 for nouns in the fourth segments in each of [a], [b], and [c]). High frequency words and words in the same semantic field were chosen from the National Research Institute (1962). The restrictions on length and kinds of characters used for creating the segments and the probes were the same as those used in creating [a] and [b]. However, the [c] versions were dissimilar to the [a] and [b] versions in that some structural variation was allowed in the [c] versions, but crucially they did not contain NMCs.[6]

Forty [d] versions were as dissimilar as possible to the other versions. They varied in length, and there were ten each of four, five, six, and seven segment-long

stimuli. Half (20) were incomplete sentences. This was to discourage the participants from predicting the end of the stimulus and preparing themselves for the probe. As well as [c] versions, 40 [d] versions contained a variety of elementary structures, such as found in introductory Japanese textbooks, to encourage English JSLs who might otherwise find the task too challenging.

Probes. The probes presented after the last segments of the 80 target stimuli ([a] and [b] versions) were designed to receive a 'yes' response. Probes presented after the last segments of 80 distracters ([c] and [d] versions) were 'no' probes in that probe words had not been included in the stimuli. The probes for the [c] and [d] versions were selected from introductory Japanese textbooks to ensure that L2 learners could provide a valid 'no' response. The span of 'no' probes was five characters or less and consisted of hiragana, katakana, and kanji.

To avoid a familiarity effect, 'yes' probes were used only in the fourth segments of the corresponding stimuli. In other words, the participants responded with 'yes' because they had seen the word only in the stimulus just read.

Statements. For 40 stimuli and probes out of 160,[7] after the presentation of the probe, a short English statement was presented on the screen, and to this the participants responded 'yes' or 'no.' This was to ensure that participants would read the sentences rather than memorize the presented words, or shapes of the words, for the probe recognition task. If the statement was true for the stimulus just read, the expected response was 'yes'; if false, 'no.' For half the statements a 'yes' response was expected, and a 'no' response was expected in the remainder. Only a quarter of the stimuli had corresponding English statements because answering a true or false question each time was too time consuming.

Assessment of the stimuli. All stimuli and probes were assessed by an instructor of the Department of East Asian Studies to ensure they were comprehensible by Japanese learners at an intermediate (300 level university courses) level.

Procedure

Each individual was asked to sit at the laptop computer in the laboratory at the university or in the participant's residence or workplace. Instructions[8] (see Appendix 12

for the instructions for self-timed reading and probe recognition tasks) appeared on the computer screen primarily in English and with the researcher present. On the screen, Japanese translations were added occasionally for clarification for Japanese native speakers. A short practice session followed. At the end of the practice, the participants saw on the computer screen and heard from the researcher that they could take a break mid-way through the computer session. This information was to make the participants use the official break rather than taking breaks at other times during the self-paced reading task.

Questions from the participants were answered in the participant's native tongue. Once a participant stated he/she understood the instructions, he/she was left alone in the room to start the trials. The end of the session was signaled by a message on the screen. The participants told the experimenter when they were done.

For each trial:

1) A segment was read and then the space bar was hit using a thumb to move on to the next segment,

2) After the last segment, a probe word was read and responded to, with 'yes' ('p') or 'no' ('q') with the right and left index fingers, respectively.[9]

3) For 40 trials out of 160, the participants read the English statement, and replied 'yes' ('p') or 'no' ('q').

4) For the rest of the 120 trials, where the participants did not do 3), they saw the instruction: "Hit 'g' to go on." Then the participants used their left index finger to hit 'g' key, which made them look down at the keyboard to find the key because the left index finger was normally used to hit 'q' key. This occasional action of looking down was to provide a break from looking at the screen and, consequently, to help participants to focus more comfortably.

The text was presented at 24 point font. Probes, delimited by two asterisks, were presented in the center of the 6 x 7.5 inch computer screen. The stimuli were randomized.

'Psyscope' (Cohen et al., 1993) was used to run the trials. The task took an average of 30 minutes for native Japanese speakers and 60 minutes for native English speakers.

Results

Transforming Data

All response times by the participants that were more than two standard deviations beyond the mean were given the values at exactly two standard deviations beyond the mean. For example, if a participant's mean score was 550 and the standard deviation was 200, any scores above 950 were converted to exactly 950 for this participant. Five percent of all responses were in this category.

Overall reading time (ORT) was an average of the reading times[10] of segments 2-7 of version [a] sentences. The reading time of the first segment was excluded because the reading time of the first segment was much longer than the rest of the segments. Because it was the first segment, it is likely that the participants did not parse it.

One of the problems that became apparent in the earlier analyses was that there was a very high variation in terms of reponse times, particularly among English JSLs.[11] This is perhaps to be expected because although the participants were screened, they did bring quite a variety of ability to the test. In order to control this variety so that the variable under investigation can be easily observed, participants' raw scores were converted to z-scores so that each participant served as his/her control. An individual's overall reading time of version [a] sentences (means of segment reading time across segments 2-7) was used as the individual mean. Then the standard deviation among segment reading times of segments 2-7 was computed, yielding z-scores. Z-scores of the segment immediately following the head noun were used as TRT (transition reading time). For Japanese native speakers, untransformed TRT from version [a] sentences were used.

The responses of 'no,' when 'yes' was the correct response, were eliminated from the analyses for probe recognition times (PRT).[12] Only correct 'yes' responses were considered, and incorrect 'no' responses were not included because 'no' responses are known to be inherently longer than 'yes' responses; therefore, including 'no' responses would contaminate the results. Responses taking more than 1500 milliseconds were considered unreliable and not included in the analyses.[13] This restriction was made because it was likely that the longer the pause before hitting 'yes' or 'no,' the more likely the participants were not focusing on the task.

PRT of two syntactic locations within each construction type were compared rather than across construction types because it was possible that nouns of certain construction types were inherently more difficult to recognize. By comparing PRT of two different syntactic locations of the same construction type, this inherent difference in probe nouns associated with certain NMC types was minimized.

Statistical Analyses

Construction Type (four levels) was the independent variable. The data were analyzed by a one-way ANOVA for both analyses by participants (summing over difference among stimuli) and analyses by items (summing over differences among participants). In the participants analyses, Construction Type was treated as a repeated measure factor, while in the items analyses it was treated as a between-items factor. In other words, because in the ANOVA with participants as variables, all the participants received the same treatments which naturally caused the variance within the level of Construction Type to be more restricted, it was expected that participants analyses would always yield more significant results than items analyses.

A two-way ANOVA, i.e., comparing data from two speaker groups, was not used because the predictions that the hypotheses made did not concern the differences in performances between the two speaker groups and because it was assumed that Japanese native speakers would read and recognize the stimuli faster than the English JSLs.

Overall Reading Times (ORT) by Japanese Native Speakers

It was expected that ORT would show the relevance of markedness in processing NMCs by Japanese native speakers. Shorter ORT indicates ease of processing NMCs. The Markedness Hypothesis was tested, which predicted that ORT(GR) should be shorter than ORT of any other type because GR is the marked subtype. Other hypotheses, i.e., the Gap and Frame Hypotheses were not tested because the assumption was that ORT was not sensitive to the possible existence of gap or frame.

The mean reading times for sentences representing each of the types were approximately the same (Table 5-2). According to the ANOVA with participants as variables, the effect of construction type was not significant, $F(3, 66) = .84$, $p = .48$.

Table 5-2

Mean Values (milliseconds), Standard Deviation, and Standard Errors by Participants for Overall Reading Times of Four Construction Types for 23 Japanese Native Speakers

Construction Type	Mean	S.D.	S.E.
CN	534	162	34
COMP	535	172	36
GR	549	182	38
RR	537	170	36

For this table and subsequent tables, mean tables were created based on the analyses by participants.

Items analyses (analyses of variance summing over the participants' differences) indicated that Construction Type did not have an effect, $F(3, 36) = .44$, $p = .73$. It was suspected that ORT(GR) could be significantly larger than ORTs of other types combined. Therefore, ORT of CN, COMP and RR were combined, and compared to the largest ORT of GR in a single-df ANOVA. Neither participants analyses ($F = 2.41$, $p = .13$) nor items analyses ($F = 1.27$, $p = .27$) suggested significant difference between ORT(GR) and ORT (CN, COMP, RR).

These results did not support the Markedness Hypothesis that the overall reading times of the GR sentences by Japanese native speakers would be greater than those of the RR, CN and COMP sentences.

Overall Reading Times (ORT) by English JSLs

It was expected that markedness and transfer might play a role in the reading times of seven segments by English JSLs. Other hypotheses, i.e., the Gap and Frame Hypotheses, were not tested because the assumption was that ORT should not be influenced by gap or frame.

English JSLs also spent about the same time reading the four types of sentences (Table 5-3). The effect of Construction Type was not statistically significant, $F(3, 30) = 2.34$, $p = .09$, according to participants analyses. Items analyses showed no significant effect by Construction Type, $F(3, 36) = .39$, $p = .76$. Since ORT(GR) seemed larger than ORTs of other types, ORT of CN, COMP and RR were combined, and compared to the largest ORT of GR in a single-df ANOVA. Participants analyses suggested that

ORT(GR) was significantly larger than ORT(CN, COMP, RR), $F = 6.74$, $p = .01$; however, items analyses suggested no difference, $F = 1.14$, $p = .29$.

Table 5-3
Mean Values (milliseconds) for Overall Reading Times of Four Construction Types for 11 English Japanese as a Second Language Learners

Construction Type	Mean	S.D.	S.E.
CN	1743	542	163
COMP	1723	454	137
GR	1814	539	162
RR	1727	515	155

These results did not support the Transfer Hypothesis, which predicted that ORTs of the CN and GR sentences would be greater than those of the RR and COMP sentences for English JSLs, was also not supported. On the other hand, the results supported the Markedness Hypothesis, which predicted that the overall reading times of the GR sentences by English JSLs should be greater than those of the RR, CN and COMP sentences.

In both the Japanese native speakers and the English JSLs, ORT did not show clear differences among the four construction types. The paradigm of ORT may not have worked because the reading material of seven segment in length allowed residual effects, such as conscious reflection by the participants, to contaminate the data.

Transition Reading Times of the Segment Immediately Following the Head Noun (TRT) by Japanese Native Speakers

The reading times of the segment immediately following the head noun (TRT) were to reflect the level of difficulty associated with processing different types of NMC. The Markedness and Gap Hypotheses were tested. If markedness plays a role, the marked subtype (GR) should be harder to process than other types (RR, CN, and COMP), which should correlate with a longer TRT for the GR, and a shorter TRT for other subtypes. If, on the other hand, there is a gap, the head noun of the RR that has its gap in the modifying clause should be easier to process than the head nouns of the GR, CN, and COMP. Consequently, TRT(RR) should be shorter than TRT of other subtypes. TRT was not considered to indicate the existence of frame in processing NMCs; therefore, the Frame Hypothesis was not tested.

The average reading time of that segment from version [a] sentences was tabulated (Table 5-4). The Japanese native speakers spent the longest time reading the segment of GR than any other types. The TRT of the CN and the RR were the next, and TRT of the COMP was shortest. The standard error of the means for the GR was noticeably larger, indicating that greater variance in response existed for this stimulus type.

Table 5-4
Mean Values (milliseconds) for Transition Reading Times of Four Construction Types by 23 Japanese Native Speakers

Construction Type	Mean	S.D.	S.E.
CN	543	179	37
COMP	509	168	35
GR	596	243	51
RR	541	174	36

According to participants analyses, Construction Type had the main effect, $F(3, 66) = 5.52$, $p = .002$. A planned comparison was done regarding the means in Table 5-4, two at a time, and their F-ratios were computed. The statistically significant difference in TRT lies between the GR and each of the construction types: $F_{CN, GR}(1, 22) = 6.01$, $p = .02$, $F_{COMP, GR}(1, 22) = 16.08$, $p = .0002$, and $F_{GR, RR}(1, 22) = 6.31$, $p = .01$. The differences were not statistically significant between other levels, $F_{CN, COMP}(1, 22) = 2.43$, $p = .12$, $F_{CN, RR}(1, 22) = .005$, $p = .94$, and $F_{COMP, RR}(1, 22) = 2.22$, $p = .14$.

A one-way analysis of variance with sentences as variables was also done to test the effect of Construction Type on TRT. A similar effect was observed. Construction Type had a statistically significant effect, $F(3, 36) = 3.12$, $p = .04$.

The Tukey/ Kramer post hoc test revealed that at $p < .05$, a statistically significant difference in TRT occurred only between the COMP and the GR. The differences between TRT(CN) and TRT(GR), and TRT(RR) and TRT(GR) were not significant in contrast to the participants analyses. That is, TRT(GR) was significantly longer than the TRT(COMP), but TRT(CN) and TRT(RR) was somewhere in between but without significant difference.

In sum, both analyses by participants and items showed: TRT(GR) > TRT (COMP). In addition, participants analyses but not items analyses showed TRT(GR) > TRT(CN) and TRT(GR) > TRT(RR). These results support the Markedness Hypothesis

assertion that the reading times of the segment immediately following the head noun of the GR sentences by Japanese native speakers should be greater than those of RR, CN and COMP sentences.

These results do not support the Gap Hypothesis that for Japanese native speakers, the reading times of the segment immediately following the head noun of RR sentence should be shorter than those of GR, CN and COMP sentences.

If everything was equal among stimulus sentences except for the independent variable, the overall reading time should differ just as much as the differences in the reading times of the fifth segment. However, overall reading times were identical across the sentences of different construction types. This means that there were other differences in individual segment reading times besides the fifth segment reading time. Therefore, it is important to look at the reading times of each segment. Segment reading times for the second through seventh segments are illustrated in Figure 5-1 below.

In addition to the effect on Segment 5, according to the repeated measures

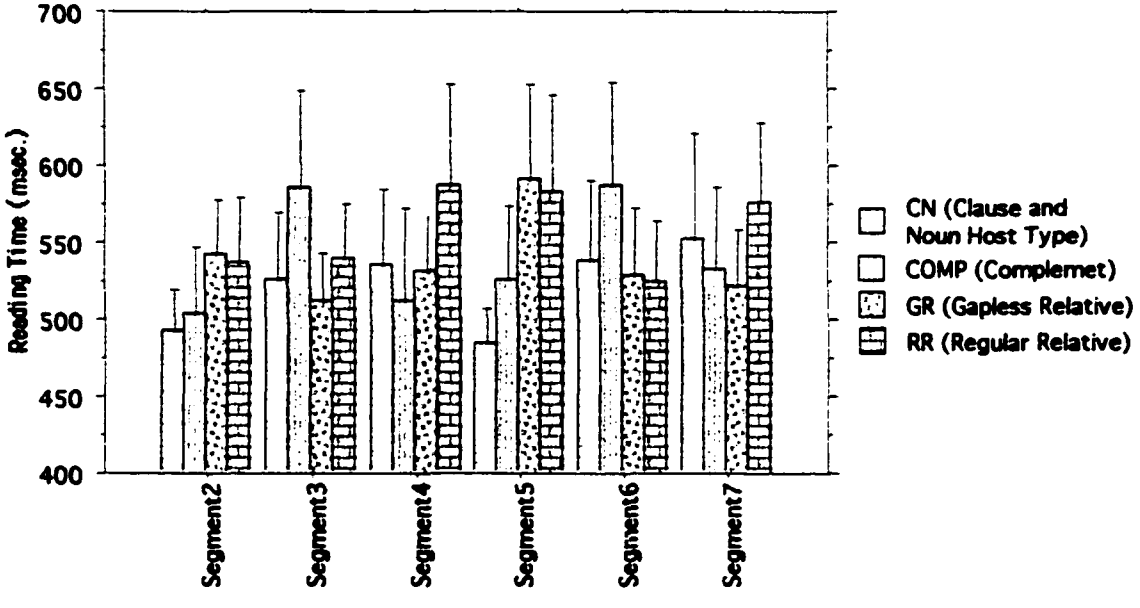


Figure 5-1. Segment reading time for 23 Japanese native speakers (Error bars: ± 1 standard deviation). Reading times for each segment were taken between the presentation of the segment and the signal (space bar) to go on to the following segment.

ANOVA when the participants were viewed as variables, Construction Type had an effect on Segment 2 reading time, $F(3, 66) = 4.14$, $p = .01$. There were no other statistically significant effects by Construction Type (except on Segment 5 reading time),

$F_{Segment\ 3}(3, 66) = 1.12$, $p = .35$, $F_{Segment\ 4}(3, 66) = 1.10$, $p = .36$, $F_{Segment\ 6}(3, 66) = 1.18$, $p = .32$, $F_{Segment\ 7}(3, 66) = .36$, $p = .78$. However, according to analyses of variance with sentences as variables, the statistical differences were only in Segment 5 reading times, $F(3, 36) = 3.12$, $p = .04$, although there was a slight difference in Segment 2 reading times, $F(3, 36) = 2.72$, $p=.06$.

The fact that analyses by both participants and items showed an effect by Construction Type on Segment 5 reading time is strong evidence that manipulation of the fifth segment reading times was indeed due to Construction Type.

Table 5-5 lists the mean reading times of the second segment and shows that TRT(GR) is longest followed by TRT(RR). TRT(CN) is shortest and TRT(COMP) is slightly longer. A post hoc comparison was done among the means in Table 5-5, two at a time, and their F-ratio computed. The statistically significant difference in Segment 2 reading time lies between CN and GR, $F_{CN.\ GR}(1, 22) = 11.39$, $p = .001$, CN and RR, $F_{CN.\ RR}(1, 22) = 9.08$, $p = .004$, COMP and GR, $F_{COMP.\ GR}(1, 22) = 6.92$, $p = .01$, and COMP and RR, $F_{COMP.\ RR}(1, 22) = 5.15$, $p = .03$. The differences were not statistically significant between other levels, $F_{CN.\ COMP}(1, 22) = .55$, $p = .46$ and $F_{GR.\ RR}(1, 22) = .13$, $p = .72$. Apparently the longest two TRTs, GR and RR, are significantly longer than the shortest, CN and COMP.

Table 5-5
Mean Values (milliseconds) for Segment 2 Reading Times of Four Construction Types by 23 Japanese Native Speakers

Construction Type	Mean	S.D.	S.E.
CN	492	149	31
COMP	503	155	32
GR	542	180	37
RR	537	178	37

Some explanation is necessary regarding the longer second segment reading time in the GR and RR than in the CN and COMP. Above all, the effect of Construction Type on Segment 2 reading time happened because of the stimuli rather than manipulation of construction types with the stimuli. In the stimuli, both its relation with the first segments (the preceding segment) and its relation with the third segment (the following segment), where the clausal predicate was received, were considered. Close examination of the stimuli revealed two possible causes, which may in part contribute to the apparent

effect by Construction Type in the second segment reading times.

First of all, it is possible that a longer reading time was incurred when the segment was the end of a meaningful unit. The rationale for this is that participants knew they had received the element ending the meaningful unit, and slowed down. In this case, in the GR and RR (with longer reading times) but not in the CN and COMP (with shorter reading times), the second segment may have clearly marked the end of the meaningful unit.

The second segment can mark the end of a meaningful chunk when the first segment modifies the element in the second. For example, in one of the RR stimuli, the first segment was *kireina* ('pretty'), and the second *garasu-no hako-ni* ('glass'-POSS 'box-'LOC); here 'pretty' and 'glass' modify 'box.' In one of GR stimuli, the first segment was *hajimeno* ('first') and the second *gohunkan-de* ('five minutes'-'with'); here 'first' modifies 'five minutes.' Two of ten RR stimuli had this relation. Three other RR stimuli had a coordinate relation between the first and the second segment such as *kisha-to/ patokaa-ga* ('reporter'-'and'/ 'patrol ca'r- NOM),[14] in which the second segment contained the last coordinated item. Altogether among ten RR stimuli, five were constructed so that the second segment marked the end of the meaningful unit. Six GR stimuli had that relation. In total, out of 20 (10 each), there were eleven stimuli containing this relation, which could have slowed down the reading time of the second segment in RR and GR stimuli.

Out of 20 (10 each), three in the CN and five in the COMP also had this relation between the first and the second segments. The modifying and modified relation between the first and second segment could have been partly responsible for the longer reading times of the second segments for the GR and the RR than the CN and the COMP.

Secondly, it is possible that a shorter reading time was incurred when the segment was in the midst of syntactic parsing. In the CN and COMP (with the shorter reading time), but not in the GR and RR (with the longer reading time), when participants received the second segment, they might have known they needed to receive more to reach the end of the syntactic unit, so they proceeded quickly to the following segment. Where adverbials in the first segment modify the verbs of the third segment, and the argument of the verbs is in the second, the participants received the adverbial and

processed the second segment in anticipation of receiving the verb modified by the adverbial. However, the anticipated verb was not in the second segment, the participants, in the middle of the parsing, hurried on to receive the third segment, causing shorter Segment 2 reading times, causing shorter Segment 2 reading times.

For example, in one CN stimulus, the first segment was *waiwaito* ('noisily'), and the second was *shoogakusei-ga* ('elementary student'- NOM), where 'noisily' modifies the verb in the third segment. Three stimuli in the CN set, three in the COMP set, one in the RR, and two in the GR set contained this relation. This relation was more often found in the CN and COMP combined than in the GR and the RR. Thus, adverbials in the first segment followed by the argument NP in the second segment have helped participants to give faster reading times for the second segments of the CN and the COMP than for the GR and RR.

These explanations for differences in reading times in the second segment are perhaps inconclusive. However, there is no reason to attribute differences in Segment 2 reading times to Construction Type.

Transition Reading Times of the Segment Immediately Following the Head Noun (TRT) by English JSLs

The concepts of markedness, gap, and transfer were expected to play a role in the reading times of the segment immediately following the head noun of NMCs. If markedness is a factor, TRT of the marked member, i.e., the GR, should be longer than the TRT of any other type because comprehending the GR involves the largest domain of resources. If there is a gap, which facilitates processing, the TRT of the RR (the gap type) should be shorter than the TRT of the non-gap types. If transfer is a factor, the TRT of the members familiar from L1, i.e., RR and COMP, should be shorter than the TRT of unfamiliar members, i.e., CN and GR.

Transition reading times (TRT) by English JSLs were expressed as z-scores. By definition, the average score for all segment reading times by a participant is zero. Since there were no individual differences, analyses by participants were not appropriate. Only ANOVA with sentences as variables were considered reliable.

Mean z-score values for each construction type (Table 5-6) indicate that English JSLs read the COMP segments fastest (-.56), spent the longest time on the CN segments (.17), and intermediate on GR (-.12) and RR (-.23). ANOVA with sentences as variables showed Construction Type had the main effect, $F(3, 36) = 3.67$, $p = .02$.

Table 5-6
Mean Values (Z-Score) for Transition Reading Times of Four Construction Types for 11 English Japanese as a Second Language Learners with 10 Sentences for Each Construction Type

Construction Type	Mean	S.D.	S.E.
CN	.17	.48	.15
COMP	-.56	.44	.14
GR	-.12	.45	.14
RR	-.23	.59	.19

The Tukey/Kramer post hoc test showed a difference in TRT between the CN and the COMP ($p < .05$) but not between combinations of other construction types.

The English JSLs read the CN segments significantly more slowly than the COMP segments, indicating that English JSLs found the CN type harder to read than the COMP type. The TRT of GR and RR were between the highest CN and the lowest COMP, without significant differences.

A close look at the reading times for Segment 5 indicates that the order of the z-scores from the four Construction Types was, from highest to lowest, CN > GR > RR > COMP, with a statistically significant difference only between CN and COMP. Because the lowest two are familiar types in English, the participants' L1, and the highest two are unfamiliar types in L1, the effect of transfer was suspected.

The means of the highest two, CN and GR, were combined and those of the lower two, RR and COMP, were combined, and single-df ANOVA was done. There was a difference between these two combined means ($F = 7.15$, $p = .01$). The TRT of RR and COMP combined was significantly lower than the TRT of CN and GR combined. This supports the Transfer Hypothesis, which predicted TRT(CN), TRT(GR) > TRT(RR), TRT(COMP).

The results do not support the Markedness Hypothesis which predicted that for English JSLs, the reading times of the segment immediately following the head noun of GR sentences should be longer than those of RR, CN and COMP sentences. The results

do not support the Gap Hypothesis that the TRT of the GR should be longer than the TRT of any other type.

If everything was equal among the four construction types, other than construction type, the ORT should differ as much as the TRT differs among the construction types. However, ORT did not show differences among construction types. It was suspected that the reading times of other segments were a function of Construction Type. Therefore, the overall reading pattern was examined.

Figure 5-2 shows the overall reading pattern by English JSLs. To each segment reading time, ANOVA with sentences as variables was applied.[15] An effect by Construction Type existed only in Segment 5 reading time, $F_{Segment2}(3, 36) = .04$, $p = .99$, $F_{Segment3}(3, 36) = 2.49$, $p = .08$, $F_{Segment4}(3,36) = 2.31$, $p = .09$, $F_{Segment6}(3, 36) = .97$, $p = .42$, $F_{Segment7}(3, 36) = 1.00$, $p = .40$. Finding an effect in the reading times of the fifth segment supports the content in that differences in reading times were indeed caused by the manipulating Construction Type.

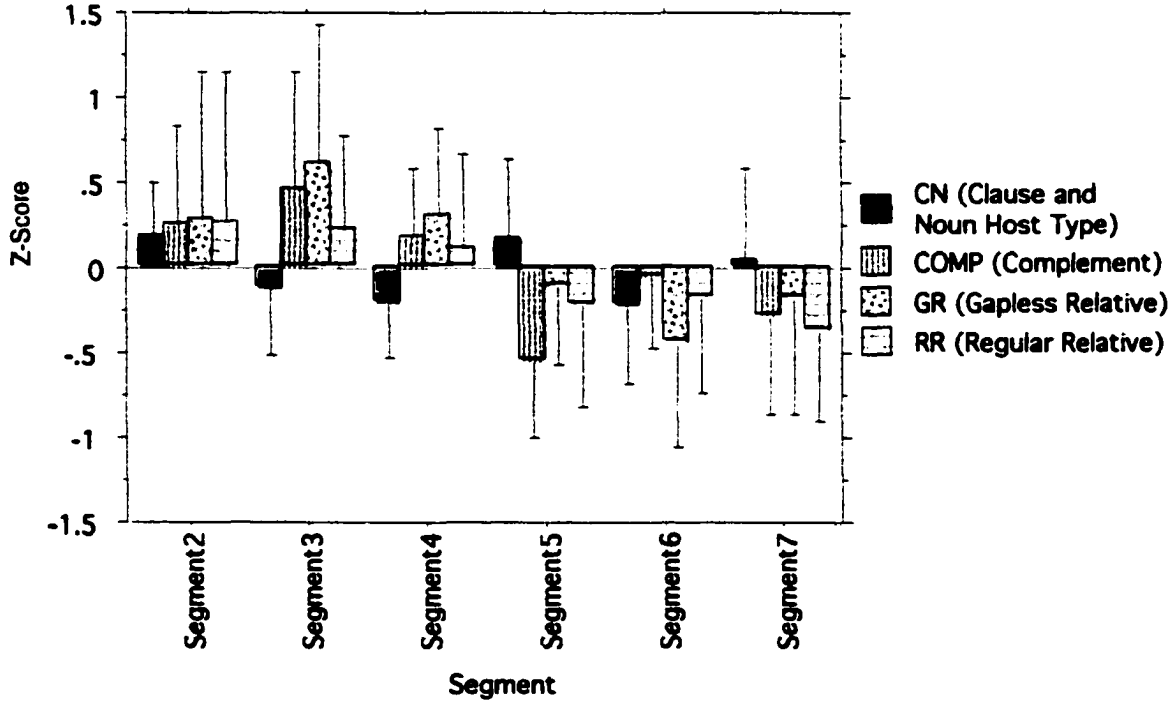


Figure 5-2. Segment reading time z-scores for 11 English Japanese as a second language learners (Error bars: ± 1 standard deviation). Reading times for each segment were taken between the presentation of the segment and the signal (space bar) to go on to the following segment. An individual participant's average reading time for all sentences was used to transform each score to a z-score. By definition, the sum of z-scores is zero.

Probe Recognition Times (PRT) by Japanese Native Speakers

PRT was expected to indicate the retention level for the probes. When the retention level is high, PRT should be small. When the retention level is low, PRT should be large. The PRTs of the two nouns within a construction type, the head noun and the noun in the modifying clause, were compared. Both nouns appeared in the fourth segment. If construction type does not have an effect, the retention level of the two nouns should be the same.

The Frame Hypothesis predicted that if frame plays a role in processing the NMC, the noun hosted by the frame should be retained better than the noun which is a part of the hosting material. Therefore, the PRT of the RR and the GR head nouns (hosted/ figure) should be smaller than the PRT for the noun in the modifying clause (hosting/ ground), the PRT of the COMP head nouns (hosting/ ground) should be longer than the PRT for the noun in the modifying clause (hosted/ figure), and PRT for the head noun of the CN (hosting/ ground, hosted/ figure) and the noun in the modifying clause (hosted/ figure, hosting/ ground) should be the same because the two constituents of CN mutually host each other.

On the other hand, the Gap Hypothesis predicted that only the head noun of the RR should be recognized faster than the noun in the modifying clause because the RR head noun bears syntactic relation with the modifying clause via its corresponding gap. With other construction types, this facilitation of recognition of the head noun should not happen because the head nouns of the other types are not comprehended with the facilitation by syntax.

Markedness was not tested here because PRT was not expected to indicate overall levels of processing ease for the different NMC types.

The overall pattern in PRT by the Japanese native speakers is illustrated in Figure 5-3 and the mean recognition times are listed in Table 5-7.

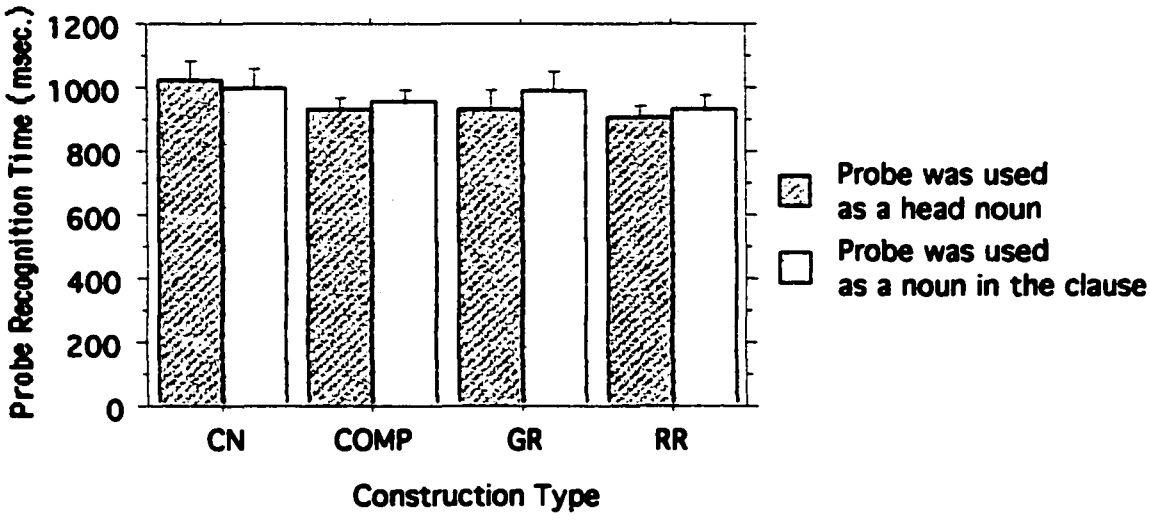


Figure 5-3. Probe recognition time for 23 Japanese native speakers with two syntactic locations of probe words in four Construction Types (Error bars: ± 1 standard deviation). Scores above 1500 milliseconds were eliminated.

Figure 5-3 shows little difference between the recognition of the nouns of different syntactic locations. Overall, the COMP, the GR, and the RR show similar pattern: the PRT of the head noun probes is shorter than the PRT for the probe originating in the modifying clause. Only the CN shows an opposite pattern in recognition time; i.e., the PRT of the head noun probe was longer than the PRT of the probe originating from the modifying clause.

Table 5-7

Mean Values and Mean Difference (milliseconds) between Probe Recognition Times of Four Construction Types and Two Syntactic Locations (Head Noun or Noun in the Modifying Clause) of Probe Words for 23 Japanese Native Speakers

Construction Type	PRT of Head Noun	PRT of Noun in Modifying Clause	Difference	S.D.	S.E.
CN	1028	1013	15	100	21
COMP	943	962	-18	82	17
GR	935	1010	-75	71	15
RR	914	937	-23	94	20

Participants analyses for the GR showed a significant difference in the PRT between the two probe syntactic locations, $F_{GR}(1, 22) = 21.88$, $p = .0001$. The differences between recognition times of two syntactic locations were not significant for

other types, $F_{CN}(1, 22) = .54$, $p = 47$, $F_{COMP}(1, 22) = 1.16$, $p = .29$, and $F_{RR}(1, 22) = 1.32$, $p = .26$.

However, items analyses indicated no differences between the PRT of two syntactic locations for any of the construction types: $F_{CN}(1, 18) = 1.09$, $p = .31$, $F_{COMP}(1, 18) = 1.66$, $p = .21$, $F_{GR}(1, 18) = 3.90$, $p = .06$, and $F_{RR}(1, 18) = 1.65$, $p = .22$.

In sum, Japanese native speakers recognized the GR head noun probes significantly faster than the GR probes in the modifying clause: PRT(NCl, GR) > PRT(HN, GR). This significance became a tendency ($p = .06$) when participants' variance was summed. Japanese native speakers recognized both kinds of probes equally quickly for all types.

This special status of the GR needs to be accounted for cautiously with respect to the experimental method used here. It is possible that the paradigm may have biased the data toward less memory retention of the noun in the modifying clause than of the head noun, independent of Construction Type. In this experiment, the probe recognition times of the head noun and the noun in the modifying clause were compared within a construction type. Those nouns were present in the fourth segment as (5-1) illustrates.

(5-1) [a] [Seg1] [Seg2] [Seg3] [Head Noun$_i$]$_{Seg4}$[Seg5] [Seg6] [Seg7]
[b] [Seg1] [Seg2] [Seg3] [Noun$_i$]$_{Seg4}$[Seg5] [Head Noun$_k$]$_{Seg6}$[Seg7]

The modifying clause is underlined. "Head Noun" in [a] marks the position of the head noun which was used as a probe. "Noun" in [b] marks the position of the noun in the modifying clause which was used as a probe. It was initially assumed that the appearance of the probe nouns in the same segment in both [a] and [b] versions would ensure that only Construction Type would play a role in memory retention of those nouns. However, the two nouns in question carried different properties as a function the stimulus design. This might have affected the degree of memory retention.

In (5-1), version [a] sentences take the form of closure. The modifying clause was located at the beginning of each stimulus and the head noun was used as probe. On the other hand, version [b] sentences had the modifying clause embedded in the middle where the noun in the clause was used as probe. Closed structures are easier to process (see Prideaux, 1982), and the data do show that version [b] sentences took longer to

read.[16] Thus, overall reading time seemed to be a function of closure/ nonclosure. Therefore, this processing burden associated with center embedding sentences ([b] sentences which provided probes originated from the noun in the modifying clause) might have caused the noun in the subordinate clause (in [b] sentences with center embedding structure) to be harder to retain than the head noun (in [a] sentences with closure) across Construction Types.

However, recognition times of the noun in the modifying clause and the head noun across construction types overall did not differ, $F(1, 6) = .64$, $p = .45$. This implies that the recognition times of the noun in the fourth segment in [a] and [b] sentences were the same. Therefore, although the location of the embedded clause played a role in overall reading time, probe recognition time was a function of Construction Type rather than a function of the location of the embedded clause.

For GR, the PRT of the probe which was used as a head noun was shorter than the PRT of the probe which was used as a noun inside the modifying clause. This increased difficulty in recognizing the noun used in the subordinate clause was not found with other types. Apparently, reading the GR type was more difficult than reading the other types. That is why the noun in the subordinate clause was harder to recognize than the noun in the main clause.

These results also do not support the Frame Hypothesis, which predicted the pattern of: PRT(NCl, RR) > PRT(HN, RR), PRT(NCl, GR) > PRT(HN, GR), PRT(HN, CN) = PRT(NCl, CN), and PRT(HN, COMP) > PRT(NCl, COMP).

These results do not support the Gap Hypothesis, which predicted the following pattern of PRT: PRT(NCl, RR) > PRT(HN, RR), PRT(NCl, GR) = PRT(HN, GR), PRT(NCl, CN) = PRT (HN, CN), and PRT(NCl, COMP) = PRT (HN, COMP).

However, the fact that the noun in the subordinate clause of GR was harder to recognize than the head noun, while no such contrast was found in other types, suggests that the GR sentences were harder to process than the sentences of other types. This finding matches the prediction by the Markedness Hypothesis: GR is harder to process.

Probe Recognition Times (PRT) by English JSLs

An overall representation of probe recognition times by English JSLs is illustrated in Figure 5-4 and the mean values are listed in Table 5-8. A smaller PRT indicates higher retention of the probe in memory.

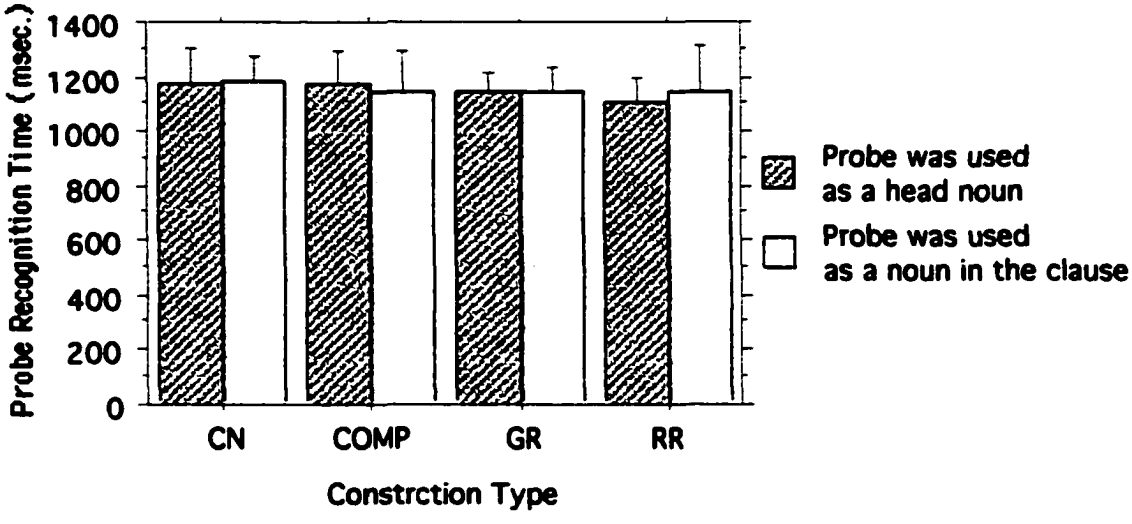


Figure 5-4. Probe recognition time for 11 English as a second language learners with two syntactic locations of probe words in four Construction Types (Error bars: ± 1 standard deviation). Scores above 1500 milliseconds were eliminated.

Table 5-8
Mean Values and Mean Difference (milliseconds) between Probe Recognition Times of Four Construction Types and Two Syntactic Locations (Head Noun or Noun in the Modifying Clause) of Probe Words for 11 English Japanese as a Second Language Learners

Construction Type	PRT of Head Noun	PRT of Noun in Modifying Clause	Difference	S.D.	S.E.
CN	1214	1254	-40	67	24
COMP	1275	1182	93	104	37
GR	1183	1188	-5	126	44
RR	1161	1264	-103	90	32

Frame theory predicted that the hosted probe should be retained in memory better than the hosting probe. Consequently, the hosted probe should be recognized faster than the hosting probe. That is, the head noun probe should be recognized faster than the probes of the noun in the modifying clause of the RR and the GR. This pattern should be opposite for the COMP, and the head noun probe and the probe of the noun in the

modifying clause should be recognized equally fast for the CN.

Gap theory predicted that the head noun, if bound by its corresponding gap in the modifying clause, should be activated more than the noun in the modifying clause, which does not have a gap in the sentence. The noun with its gap should be more activated, and consequently, its retention should be higher than the noun without a gap. Therefore, the PRT of the head noun probe of the RR, the gap type, should be smaller than the PRT of the noun in the modifying clause of its own. Because there is no gap in the other construction types, the PRT of the head noun probe and PRT of the noun in the modifying clause, both of which appeared at the same location in the sentences, should not be different for the CN, the COMP, and the GR.

According to Figure 5-4, English JSLs apparently recognized the probes from two different sources equally fast for the CN and GR. However, for the COMP, the PRT for the head noun probe was larger than the probe of the noun in the modifying clause, while the RR showed the opposite pattern.

Analyses by participants indicated the syntactic location of the probes did not make a difference for CN, $F_{CN}(1, 9) = .15$, $p = .70$, and GR, $F_{GR}(1, 8) = .009$, $p = .93$. The syntactic location of the probes made a difference for COMP, $F_{COMP}(1, 7) = 6.47$, $p = .04$ and RR, $F_{RR}(1, 8) = 14.42$, $p = .005$. Items analyses indicated that the syntactic location of probes did not have an effect on PRT of any construction types; $F_{CN}(1, 18) = .02$, $p = .90$, $F_{COMP}(1, 18) = .33$, $p = .57$, $F_{GR}(1, 17) = .001$, $p = .97$, and $F_{RR}(1, 18) = .45$, $p = .51$.

In sum, the English JSLs recognized the probes of two syntactic locations equally quickly for the CN and GR. The English JSLs recognized the RR head noun probes faster than the probes from the modifying clause and recognized the COMP probes from the modifying clause faster than the head noun probes (PRT(NCl, RR) > PRT(HN, RR), PRT(HN, COMP) > PRT(NCl, COMP) (participants analyses but not items analyses).

Overall, these results do not support the Frame Hypothesis, which predicted the pattern of: PRT(NCl, RR) > PRT(HN, RR), PRT(NCl, GR) > PRT(HN, GR), PRT(HN, CN) = PRT(NCl, CN), and PRT(HN, COMP) > PRT(NCl, COMP). Partially, the results match this prediction, but only for the PRT patterns of the RR and the COMP.

Overall, these results also do not support the Gap Hypothesis, which predicted the following pattern of PRT: PRT(NCl, RR) > PRT(HN, RR), PRT(HN, GR) = PRT(NCl,

GR), PRT(HN, CN) = PRT (NCl, CN), and PRT(HN, COMP) = PRT (NCl, COMP). Partially, the results match this prediction, but only for the PRT pattern of the RR.

Why did the participants analyses show an effect of syntactic location for the RR and the COMP, but not for the CN and the GR? A possible explanation is that transfer caused the PRT effect in only RR and COMP. It could be that the unfamiliar structures such as the CN and the GR were more difficult to read, thus allowing errors to contaminate the measurement from the task. Due to this larger residual, the data did not show any patterns between the PRT of two syntactic locations for the CN and the GR types. On the other hand, English JSLs read the RR and the COMP stimuli with less difficulty, and the PRT data yielded significant patterns controlled by Construction Type.

As the explanation for the TRT results suggests, it is likely English JSLs were under a positive effect of transfer while reading the RR and the COMP material; therefore, it is also likely that they were under the effect while recognizing the probe words presented after reading the sentences.

The way in which English JSLs discriminated between the RR and the COMP could be due to their habit of discriminating equivalent structures in L1. If English JSLs read English sentence with the relative clause and the complement with a nominal head and did a similar probe recognition task, yielding the same pattern as found here, it could be taken as support that the discrimination pattern came from L1 processing. However, such data are not readily obtainable.

Summary of the Results

The results concerning ORT indicated no statistical significance for Japanese native speakers. The method of reading seven segments created considerable noise that might have obscured the patterns that the measurements were expected to reveal. The ORT results for English JSLs showed the pattern of ORT(GR) > ORT(CN, COMP, RR). The TRT by Japanese native speakers showed that they read the segment immediately following the head noun of the GR more slowly than COMP (both analyses by participants and items). TRT of RR and CN were between TRT(GR) and TRT(COMP) with significant difference from TRT(GR) (participants analyses). TRT by English JSLs showed that English JSLs spent longer reading the segment immediately following the

head noun of CN than COMP (analyses by items). The results of PRT by Japanese native speakers showed that the head noun was easier to recognize than the noun from the modifying clause of GR (participants analyses only). PRT by English JSLs indicated that the head noun of RR is easier to recognize than the noun from the modifying clause of RR, while the head noun of COMP is harder to recognize than the noun from the modifying clause of COMP (participants analyses only). PRT for CN and GR, the unfamiliar subtypes, did not yield statistical significance while PRT for RR and COMP, the familiar subtypes, did.

The results of the experiment are summarized in Table 5-9.

Table 5-9
Summary of the Results from Experiment 3: Self-Paced Reading and Probe Recognition Tasks

Measure	Japanese Native Speakers	English JSLs
ORT	No significance	ORT(GR) > ORT(CN, COMP, RR) [participants analyses only]
TRT	TRT(GR) > TRT (COMP) [both participants and items analyses] TRT(GR) > TRT(RR) TRT(GR) > TRT (CN) [participants analyses only]	TRT(CN) > TRT(COMP) TRT(CN, GR) > TRT(RR, COMP) [items analyses] (participants analyses were not done because the data were transformed to z-scores)
PRT	PRT(NCl, GR) > PRT(HN, GR) [participants analyses only]	PRT(NCl, RR) > PRT(HN, RR) PRT(HN, COMP) > PRT(NCl, COMP) [participants analyses only]

Note. ORT: overall reading time, TRT: transition reading time, PRT: probe recognition time, HN: head noun, NCl: noun in the modifying clause

The applicability of the concepts embodied in Frame and Gap theories and in markedness and transfer for on-line processing of NMC was tested in this experiment. Japanese native speakers' TRT and PRT results supported the Markedness Hypothesis.[17] No other hypotheses were supported by the results from Japanese native speakers. As for English JSLs, ORT results supported the Markedness Hypothesis, TRT results supported the Transfer Hypothesis, and PRT results supported the partial prediction by the Gap Hypothesis (regarding RR), the partial prediction by the Frame Hypothesis (regarding RR and COMP), and the Transfer Hypothesis.[18]

Overall, the pictures that emerge from this chapter are consistent with those obtained from the results from the off-line rating and semi on-line translation tasks in the

previous chapters. Markedness seems to be a constant factor. Especially for Japanese native speakers, the markedness was the only observed effect. For English JSLs, the transfer effect was observed in the result from the on-line tasks, among others.

In the next chapter, this convergence is discussed explicitly, and generalizations are offered regarding how Japanese native speakers and English JSLs differentiate and process NMC subtypes. The adequacy of linguistic analyses and principles are also evaluated.

*Note added post defense:

Although Table 5-4 was used to test the Markedness and the Gap Hypotheses, it was found subsequent to the defense of this thesis that this table contained errors and does not correspond to Figure 5-1. Ultimately these errors do not affect the way the hypotheses were evaluated or the main conclusion of this thesis.

Notes

[1] Similar observations are made in Yamashita, Stowe, and Nakayama (1993).

[2] In this experiment, a segment boundary was determined by the unit of meaning which forms a constituent. When the argument of the verb was involved, the segment consisted of a noun phrase followed by the grammatical particle, which forms a natural meaningful unit.

[3] Forty version [a] sentences were used in Experiment 1 and Experiment 2 described in Chaptera 3 and 4 in this volume.

[4] Nouns belonging to the same semantic field and being high in frequency were documented in National Research Institute (1962) and National Language Research Institute (1964). Words in the same semantic fields are basically synonyms; if not synonymous, they were close to each other by word association. High frequency words are the 700 most frequently used words in 90 recent magazines.

[5] Five exceptions had to be allowed due to restrictions such as frequency, availability of words in the same semantic field, and L2 learners' estimated knowledge of words and kanji characters. They are: 都市*toshi* (city), which consists of two kanji, and ふるさと*hurusato* (hometown), which consists of four hiragana, of RR: 別れ*wakare* (separation), which consists of one kanji and one hiragana, and 見送り*miokuri* (seeing off), which consists of two kanji and one hiragana, of GR: 洗たく*sentaku* (laundry), which consists of one kanji and two hiragana, and そうじ*sooji* (cleaning), which consists of three hiragana, of GR: がまん*gaman* (endurance), which consists of three hiragana, and 努力*doryoku* (effort), which consists of two kanji, of CN: and 思い出*omoide* (memory), which consists of two kanji and one hiragana, and 体験*taiken* (experience), which consists of two kanji, of COMP. These exceptions had to be allowed due to restrictions such as frequency, availability of words in the same semantic field, and L2 learners' estimated knowledge of words and kanji characters. However, compensation was kept minimal.

[6] One exception is: クエスチョン/マークは/英語の/疑問を/あらわす文/にだけ/使われる (As for the question mark, it is used only for an English sentence which expresses a question), where a slash indicates a segment boundary. As underlined English translation shows, RR type noun modifying construction was

employed. This compensation was made due to restricting the noun [redacted]*gimon* (question) in the fourth segment to be high frequency word and synonymous with the nouns in the fourth segments of corresponding [a] and [b] versions. The compromise was minimum enough to ensure the status of neutral control; first, the modifying clause in this exception is less than two segments, which is different from the three segment long target clauses, and, secondly, the head noun falls in the fifth segment, unlike [a] versions where the head nouns falls in the fourth segment, and [b] versions where the head nouns falls in the sixth segment.

[7] Out of 40 statements, 19 were associated with the target (version [a] and [b]) sentences. 11 were associated with version [c] sentences while 10 were associated with version [d] sentences. Out of 19 statements associated with the target sentences, 6 were presented after RR probes, 4 after GR probes, 6 after CN probes, and 3 after COMP probes. The reason why the number of statements were not evenly distributed among construction types or across versions is that making clear true or false statement for some sentences was easier than other sentences (which prevented even distribution of statements across types and versions), and the effort was made to make the true statements and false statements as clear as possible for both Japanese native speakers and English JSLs.

[8] Prior to the instruction, participants were asked to answer the questions on the computer screen by hitting the key on the laptop: 1. Participant number, which the experimenter provided, 2. Participant's name, which the participants arbitrarily picked, 3. Age, and 4. Gender. The participants were expected to adjust the brightness of the screen and to get used to the key of the laptop by this brief typing session.

[9] When the participants hit by mistake an irrelevant key, the trial was over, and they went on to the next trial.

[10] The reading times, i.e., the time between the presentation of the material (by segment) and the input of space bar in order to receive the next segment, were recorded. For example, the reading time of Segment 3 means the time between the presentation of the material of Segment 3 and the participants' hitting the space bar in order to receive the material of Segment 4.

[11] A word test was given after the reading task and before the translation task. One hundred and six Japanese words used in the sentences of [a] version were given with the readings and English equivalents (see Appendix 1). The participants were asked to provide check marks if they knew both the readings and the translation. Average was 62.8%, the highest being 97.2% and the lowest being 20.6%. The individual scores were 20.6%, 35.5%, 32.7%, 36.4%, 60.7%, 63.6%, 79.4%, 85.0%, 88.8%, 90.7%, and 97.2%.

[12] The number of errors in probe recognition task when the expected response was 'yes' is shown in the following table. The first row is participant numbers. The second and the third rows are the number of incorrect 'no' response to 40 [a] and 40 [b] probes, for which the expected response was 'yes.'

Japanese Participant #	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11
a	0	0	1	1	0	0	0	0	1	0	0
b	1	0	5	0	0	2	0	0	0	6	0

Japanese Participant #	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23
a	1	0	3	2	2	0	0	0	2	0	2	2
b	2	0	6	2	0	1	0	0	1	1	3	1

English Participant #	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11
a	2	8	3	2	10	1	16	21	10	0	2
b	1	7	1	3	6	2	2	8	5	0	0

[13] The numbers of response out of 80 less than 1500 milliseconds in recognition time by Japanese native speakers are shown in the table below.

Japanese Participant #	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11
# of response < 1500 msec.	67	70	61	76	69	52	75	64	77	68	58

Japanese Participant #	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23
# of response < 1500 msec.	77	66	39	76	60	78	77	76	71	74	64	69

The number of responses less than 1500 milliseconds for each English JSLs is shown in the table below. The values in the third row are the number of probes that the participants have actually responded. When the participants mistakenly hit the invalid keys during the presentation of the segments, the current trial was cancelled. If all the trials were properly done, the participants received 80 "a" and "b" probes. Due to the mechanical problem with the computer, the number of probe Responses collected from E7 is considerably lower than the others.

English Participant #	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11
# of response < 1500 msec.	15	12	41	28	14	52	0	3	59	32	67
# of response received	80	77	80	80	80	79	52	80	80	80	80

[14] '/' indicates the location of the segment border.

[15] ANOVA with participants as variables was not used here because by definition of the standardized score, no variance exists among participants.

[16] Overall reading time for [b] version sentences is greater than [a] version sentences for Japanese native speakers. For CN, ORT of [b] sentences was significantly greater than ORT of [a], $F(22,1) = 6.15$, $p = .02$. For COMP, ORT of [b] was greater than ORT of [a], but the difference was not statistically significant, $F(22, 1) = 1.71$, $p = .21$. For GR, ORT of [b] was significantly greater than ORT of [a], $F(22,1) = 5.94$, $p = .02$. For RR, ORT of [b] was significantly greater than ORT of [a], $F(22,1) = 10.28$, $p = .004$.

[17] There is another set of data from the on-line experiment that might support Japanese native speakers' sensitivity to markedness. The participants gave responses to the statements that appeared after the probes for a quarter of the stimuli. The responses were either 'p' key meaning 'yes' or 'q' key meaning 'no.' If the statement was true of the sentence they just read, the correct response was 'p,' while if the statement was not true of the sentence just read, the correct response was 'q.' The following tables show frequencies of the different types of responses for 'p' statements and 'q' statements, respectively. The number of statements was not evenly distributed across construction types. In addition, some trials were discarded in the middle of the segment reading due to the illegal key input. Therefore, not all the statements were answered.

Observed Frequencies of 'P'(Yes) and 'Q'(No) Input for 'P' Statements ('P' was the Correct Response) Associated with Four NMC Types by 23 Japanese Native Speakers

Construction Type	Correct 'P'	Incorrect 'Q'	Total
CN	55(79.71)	14(20.29)	69(100)
COMP	40(86.96)	6(13.05)	26(100)
GR	37(80.44)	9(19.57)	46(100)
RR	57(83.82)	11(16.18)	68(100)
Total	189(82.53)	40(17.47)	229(100)

Note. The figures in the parentheses are percentage when sum of each row is 100%. X^2 (3, N = 229) = 1.23, p =.75.

The table above summarizes the distribution of responses to 'p' statement (i.e., the expected correct response was 'p'). There is not correlation between the type of response and Construction Type, X^2 (3, N = 229) = 1.23, p =.75.

Observed Frequencies of 'P'(Yes) and 'Q'(No) Input for 'Q' Statements ('Q' was the Correct Response) Associated with Four NMC Types by 23 Japanese Native Speakers

Construction Type	Incorrect 'P'	Correct 'Q'	Total
CN	7(10.29)	61(89.71)	68(100)
COMP	0(0)	22(100)	22(100)
GR	8(17.37)	38(82.61)	46(100)
RR	3(4.41)	65(95.50)	68(100)
Total	18(8.82)	186(91.18)	204(100)

Note. The figures in the parentheses are percentage when sum of each row is 100%. X^2 (3, N = 204) = 8015, p =.04.

Because the distribution of incorrect 'p' responses and correct 'q' responses by Japanese native speakers is dependent on Construction Type, X^2 (3, N = 204) = 8015, p =.04, Post Hoc cell contribution test was done (see the table below). It was found out that the GR contributes to the discrepancy of distribution the most.

Post Hoc Cell Contributions for Construction Type and Type of Response (Incorrect 'P'/ Correct 'Q') of Observed Frequencies of 'P'(Yes) and 'Q'(No) Input for 'Q' Statements ('Q' was the Correct Response) Associated with Four NMC Types by 23 Japanese Native Speakers

Construction Type	Incorrect 'P'	Correct 'Q'
CN	.52	-.52
COMP	-1.55	1.55
GR	2.33	-2.33
RR	-1.57	1.57

Japanese native speakers made proportionally more mistakes for 'q' statements associated with GR. They were supposed to respond with 'q'(no) key, but mistakenly they responded with 'p'(yes) key. That fact that Japanese JSLs had a harder time providing no responses only to GR may be attributed to its marked status.

[18] In addition to segment reading times and probe recognition times, true ('p' key) or false ('q' key) input for the statements were recorded. One quarter of the stimuli were followed by the statement, which was presented after the response to the probe.

Responses to 'p' statements and 'q' statements were separately analyzed. It was found that the number of mistakes in responses, which could suggest the level of understanding of the stimuli by English JSLs, does not suggest any difficulties associated with a particular construction type.

Observed Frequencies of 'P'(Yes) and 'Q'(No) Input for 'P' Statements ('P' was the Correct Response) Associated with Four NMC Types by 11 English Japanese as a Second Language Learners

Construction Type	Correct 'P'	Incorrect 'Q'	Total
CN	25(78.13)	7(21.88)	32(100)
COMP	15(71.43)	6(28.57)	21(100)
GR	13(65.00)	7(35.00)	20(100)
RR	26(78.79)	7(21.21)	33(100)
Total	79(74.53)	27(25.47)	106(100)

Note. The figures in the parentheses are percentage when sum of each row is 100%. X^2 (3, N = 106) = 1.60, p =.66.

Observed Frequencies of 'P'(Yes) and 'Q'(No) Input for 'Q' Statements ('Q' was the Correct Response) Associated with Four NMC Types by 11 English Japanese as a Second Language Learners

Construction Type	Incorrect 'P'	Correct 'Q'	Total
CN	7(21.88)	25(78.13)	64(100)
COMP	4(40.00)	6(60.00)	10(100)
GR	1(5.00)	19(95.00)	20(100)
RR	4(12.50)	28(97.50)	32(100)
Total	16(17.02)	78(82.98)	94(100)

Note. The figures in the parentheses are percentage when sum of each row is 100%. X^2 (3, N = 94) = 6.78, p =.08.

For English JSLs, the distribution of correct and incorrect responses for 'p' statements and 'q' statements was not a function of Construction Type. That is, English JSLs did not make more mistakes due to Construction Type. The result from this verification task does not provide evidence for the sensitivity in processing NMC by English JLSs. On the other hand, the semi on-line translation task clearly showed different levels of comprehension more. TRT, which is the fifth segment reading time before English JSLs received the entire sentence, captures different aspects associated with processing NMCs.

Chapter 6
General Discussion

The goals of this thesis, as stated in Chapter 1, were fourfold. They were:

1. To characterize the four subtypes of NMC syntactically and semantically;
2. To investigate experimentally how Japanese native speakers differentiate and process such structures;
3. To investigate experimentally how non-native speakers differentiate and process such structures;
4. To evaluate the competing analyses and principles which have been offered for such structures, using evidence from 2 and 3.

The first goal was met by Chapter 2, where different principles for analysis of NMCs were presented. The Gap, Frame, Markedness, and Transfer Hypotheses were formulated. The second and the third goals were met by Chapters 3, 4, and 5, where the experiments that tested the hypotheses were described. In this final chapter, all the results are brought together, and the fourth goal, i.e. evaluation of the hypotheses, in the context of the discussions based on the experimental results, is met.

What Is Fundamental?

The results from the experiments across tasks and across speaker groups consistently show the emergence of a common processing sensitivity. Both Japanese native speakers and English JSLs process NMCs under the influence of the domain of processing resources that form subset relations. In fact, for the native speakers, as far as the experimental results are concerned, their NMC processing sensitivity can be characterized only by the resource domains, which was predicted based on the Markedness Hypothesis.

Ternary Markedness

The resource domains involved in processing NMCs are reviewed in Table 6-1. Table 6-1 (used as Table 2-8 in Chapter 2) shows the three resource domains relevant to

generating different NMC types. These resource domains are in subset relations, forming ternary markedness, as illustrated by Figure 6-1.

Table 6-1
Resources Involved in Association of Modifying Clause and Head Noun of NMC

NMC	Baseline Logical Knowledge of Relation Including Equation	Knowledge of Thematic Relation	Pragmatic Knowledge
RR	√	√	
GR	√	√	√
CN	√	√	
COMP	√		

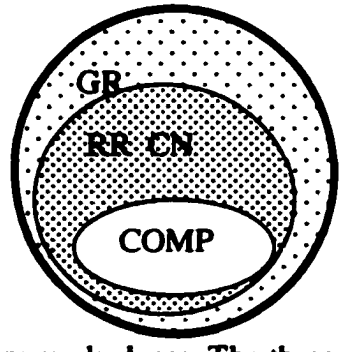


Figure 6-1. Ternary markedness: The three grammars that generate the GR, the RR, the CN, and the COMP are in subset relations.

Interpretation of a COMP requires only logical knowledge, particularly logical knowledge of an equation, which is baseline knowledge. The head noun is in equation with the content of the modifying clause. The relation between the modifying clause and the head noun is not thematic because the head noun is not an argument of the clausal predicate. The head noun names the role played by the modifying clause. Baseline logical knowledge is used for comprehending all subtypes of NMCs as Table 6-1 shows.

In addition to baseline logical knowledge, interpretation of a RR requires knowledge of the thematic relation because the head noun carries a thematic role with relation to the clausal predicate. Knowledge of thematic relations allows the assignment of a thematic role to the head noun by the clausal predicate.

Another type in this domain is CN. Interpretation of a CN requires knowledge of the thematic relation and logical knowledge of the relation. The head noun names a role in relation with the clausal predicate, and the role is in the thematic domain of the clausal verb; therefore, thematic knowledge is involved in recognizing the name in this domain.

On the other hand, the modifying clause plays the role of an entity logically related to the meaning of the head noun; therefore, baseline logical knowledge is involved here.

Lastly, a GR requires pragmatic knowledge as well as thematic knowledge and logical knowledge for comprehension. GR is a NMC type that denotes two events, somehow related. One of the events involves the head noun as an argument with an unexpressed predicate. The other event is denoted by the modifying clause. In order to combine the modifying clause and the head noun of GR, the unexpressed predicate must be searched for. Pragmatic resources are involved to find this hidden predicate and to connect two events. Thematic knowledge is required too because the head noun is an argument of the unexpressed predicate.

Binary Markedness

Both Japanese native speakers and English JSLs were sensitive to ternary markedness. Ternary markedness is a finer version of binary markedness, in which GR, the member that only the most superset grammar can generate, is assigned the marked status while others are unmarked. Both Japanese native speakers and English JSLs were also sensitive to binary markedness, as in Figure 6-2.

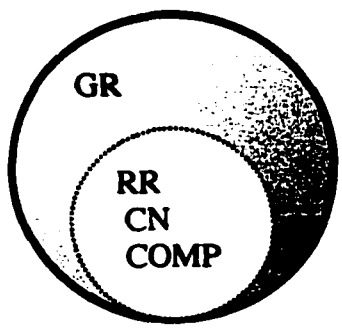


Figure 6-2. Binary markedness: GR is marked with respect to RR, CN, and COMP.

These two kinds of markedness sufficiently account for processing sensitivity of Japanese native speakers when they process NMCs. The concept of markedness also explains a part of the English JSLs's processing sensitivities; however, the English JSLs were more analytical about the different relationship between the two constituents of NMC subtypes.

What Is Different between Japanese Native Speakers and English JSLs?

The difference between the two speaker groups is that Japanese native speakers are only sensitive to the markedness relation among the subtypes, while English JSLs are sensitive not only to the markedness relation but also to how the two constituents of NMC are combined.

Japanese Native Speakers

The off-line NR and EUR. **During the off-line rating tasks, Japanese native speakers rated the GR lowest in both naturalness and ease of understanding for English JSLs scales (analyses by both participants and items). That is, Japanese native speakers separate the GR from other NMC subtypes due to the GR's processing feature which involves an unexpressed predicate. This is evidence for sensitivity to binary markedness.**

The correlation between two rating scales. **In addition, the off-line rating data indicated that the underlying decision criteria for naturalness and ease of understanding for English JSLs matched when they rated the GR sentences, while naturalness and ease of understanding were treated differently when the participants rated the RR, the CN, and the COMP. Having knowledge of English grammar in their second language, Japanese native speakers had separate judgement criteria for ease of understanding for English JSLs from their sense of naturalness, except when they rated the GR stimuli.**

The GR was singled out here, and this supports Japanese native speakers' sensitivity to binary markedness. That is, Japanese native speakers were sensitive to the fact that the GR is marked with respect to the RR, the CN, and the COMP due to the special status of the GR, i.e., involving superset processing resources. In other words, during off-line processing, for Japanese native speakers, the three unmarked members RR, CN, and COMP were indistinguishable in that task.

The on-line PRT. **Binary markedness was at work also during the on-line probe recognition task. The noun in the modifying clause of the GR was harder to recognize than the head noun of the GR (analyses by participants only), while there were no recognition time differences between the nouns of two syntactic locations of other types. Apparently processing the GR was harder than processing unmarked types, which caused difficulty in recognizing the noun in the subordinate clause of the GR. Japanese native**

speakers, therefore, were able to discriminate the four NMC subtypes by binary markedness. That is, the GR is different from the CN, RR, and COMP.

The on-line TRT. The TRT results, which constituted the last data set collected from Japanese native speakers, indicated ternary markedness in addition to binary markedness. The pattern of the TRT corresponds to the three domains of resources required to parse the construction; i.e., the greater superset domain required, the longer the TRT used.

The TRT of the GR was greatest (according to the participants analyses), and this supports binary markedness. The TRT(GR) was greatest because the grammar requires the largest resources; it requires pragmatic knowledge in addition to knowledge of thematic relations and logical relations.

The TRT of the COMP was the least, and significantly lower than the GR (analyses by both participants and items), because in order to find cohesion between the modifying clause and the head noun of the COMP, logical knowledge of the equation, the smallest domain of resources, is required. Lastly, the TRT of the RR and the TRT of the CN were between the TRT of the GR and the TRT of the COMP. Members of the RR and CN are generated by the intermediate grammar. That is, logical knowledge (equation and relation) and thematic knowledge are required to understand the members of RR and CN.

The results from the TRT suggest that Japanese native speakers are sensitive to ternary markedness as well as binary markedness. Japanese native speakers were able to isolate GR and COMP, but CN and RR were inseparable.

Summary of Japanese native speakers' processing sensitivities. The Japanese native speakers' discrimination patterns suggest that they process NMCs under the effect of markedness. This was strikingly binary during off-line comprehension and both binary and ternary during on-line comprehension. Markedness was the only observed effect. This supports the statement by Kellerman (1983) that native speakers have a sense of markedness in their L1.

There was no supporting evidence from Japanese native speakers' results for the Gap and Frame theories, which claim that different principles of relation apply to the two constituents of NMCs.

English JSLs

The off-line ratings results. Off-line rating patterns, by both ease of understanding and naturalness, consistently showed the lowest scores for the GR. This suggests English JSLs were sensitive to binary markedness. Binary markedness separated the GR from the CN, RR, and COMP. The ranking among the CN, RR, and COMP, however, suggests another sensitivity that English JSLs had, but that Japanese native speakers did not.

The off-line EUR. In terms of ease of understanding rating (RR > CN > COMP > GR), the RR was easier than the GR to understand (the analyses by both participants and items). There were no differences between EUR (CN) and EUR (COMP), which fell between EUR (RR) and EUR (GR). In the competition among the RR, the CN, and the COMP, in which the RR placed ahead enough of the CN and the COMP to be significantly higher than the lowest GR, the major decision role was played by the sensitivity to the syntactic relation between the head noun and the modifying clause.

First, the RR was rated highest due to its special status, i.e., that the head noun is a part of the sentence with the clausal predicate. The RR is the only type that allows de-relativization (see Table 2-5 in Chapter 2). That is, the head noun of the RR is syntactically related (either an argument NP or an adjunct PP) to the clausal verb. English JSLs found this crucial for understanding this structure.

From a Gap theoretic point of view, in other words, English JSLs could sense there was a gap in the modifying clause via which the head noun is related to the modifying clause. The fact that the RR was rated highest in ease of understanding for English JSLs rating suggests the validity of the Gap Hypothesis for English JSLs.

The head nouns of the CN and the COMP, on the other hand, do not have such properties. In the first place, unlike the RR, the head nouns and the modifying clauses of the CN and the COMP do not have syntactic relations, which totally disallows the possibility of de-relativization. Secondly, in terms of the manner in which the head noun participates in the proposition that the modifying clause denotes, unlike the RR, the CN head nouns name rather than occupy the argument slots in the proposition with the

clausal predicate. Unlike the RR, the COMP head nouns are names of the propositions that the modifying clauses denote, and, therefore, do not participate in the proposition.

The off-line NR. In terms of the naturalness rating, again GR was rated lowest supporting binary markedness. The CN was rated highest, and was significantly more natural than the GR (the analyses by participants but not the analyses by items).

The significant role in the competition among the RR, the CN, and the COMP driven by the intuition of naturalness was played by the semantics of the head noun. When the scale of naturalness was presented to English JSLs, they appeared to reject the involvement of syntax and to rely upon the use of the word meaning for the construal of NMC.

The RR was out of the competition because the modifying clause and the head noun have a syntactic relation. This syntactic relation was a strong guiding principle for understanding, but English JSLs found this involvement of syntax unnatural.

The CN and the COMP were perceived more natural than the RR because syntax is not involved in construal of the CN and the COMP. Between the CN and the COMP, where the CN won, English JSLs examined the meaning of the head nouns in this off-line task. English JSLs analyzed the meanings of the head nouns in discriminating NMCs. What made the CN more natural than the COMP was that, crucially, the head nouns of the CN are relational nouns.

In the stimuli, for example, the head nouns include the following ten words: *kekka* ('result'), which entails a cause, *riyuu* ('reason'), which entails a consequence, *chokuzen* ('the time immediately before'), which entails an event that follows, *aida* ('the space between'), which entails two existing entities on both sides, *yoko* ('the space beside'), which entails the entity adjacent to which something exists, *atari* ('the space around'), which entails an entity surrounded by space, *uragawa* ('the space behind'), which entails the entity having a back side, *oto* ('sound'), which entails the source of the sound, *benkyoo* ('study'), which entails the purpose for the endeavor, and *asa* ('morning'), which entails the night before.

The meaning of these head nouns all logically entail a relational concept, and the modifying clause denotes the content of the entailed relational concept (see Table 2-3 for the schematic expression of the CN). With entailment, the meaning of the head nouns

relates with the modifying clause. Syntax was not necessary. In this way, the CN provided the sense of being the most natural.

On the other hand, the head nouns of the COMP are not relational. Rather, they are content taking, and thus, by equation, the head noun and the meaning of the modifying clause are related. For example, in the stimuli, the head nouns include the following ten words: *denwa* ('phone call'), *kookoku* ('advertisement'), *shitsumon* ('question'), *iken* ('opinion'), *yokubou* ('wish'), *gaman* ('endurance'), *omoide* ('memory'), *uttae* ('plea'), *rikutsu* ('logic'), and *kettei* ('decision'). These head nouns are not semantically relational, unlike the head nouns of the CN.

Thus, the CN was perceived to be the most natural because, rather than the rules of grammar or the notion of equation that the speaker should utilize, construal of the CN is driven by entailment that meaning of the word conveys. English JSLs were sensitive to the semantics of the head nouns, specifically that the head nouns entailed relational concepts.

The correlation between two rating scales. The ranking correlation showed that the CN and COMP sentences were rated consistently across the scales, while the RR and GR sentences were not. That is, English JSLs grouped the four construction types into two: the CN and the COMP, and the RR and the GR. Something was different between the two groups, and English JSLs were sensitive to it.

This grouping reveals that English JSLs were sensitive to the types of NMC; particularly, in this case, the manner in which the head noun participates in the proposition of the NMC. The head nouns of the RR and the GR participate directly in the propositions as arguments. They both fill in the argument slots; the RR head noun is an argument of the clausal predicate and the GR head noun is an argument of an unexpressed predicate. On the other hand, the head nouns of the CN and the COMP are not. They are both names. The CN head noun is a name of an argument; it does not occupy the argument slot but simply names the slot. The COMP head noun is a name of the meaning of the whole modifying clause. English JSLs were sensitive to how the head nouns are incorporated in the proposition of NMC, and this was shown in the grouping of the four NMC types.

Summary of the off-line EUR and NR results from English JSLs. The off-line experiment results suggested four types of sensitivities: 1) binary markedness, 2) syntactic relation (gap) between the constituents, 3) semantic status of the head noun in relation to the modifying clause, and 4) membership status of the head noun in the proposition of NMC.

The semi on-line TA . The semi on-line translation accuracy results (COMP > CN > RR > GR) suggest English JSLs' sensitivity to ternary markedness and to the status of the head noun in the proposition of NMC, which was also observed in the off-line correlation results.

Both analyses by participants and items suggest that TA(COMP) was significantly higher than TA(GR). TA(COMP, CN, RR) was significantly higher than TA(GR) which suggests the function of binary markedness. TA(CN) and TA(RR) were ranked in this order without differences (but TA(COMP) and TA(RR) were different, according to the analyses by participants), revealing the effect of ternary markedness. Translation accuracy was highest for COMP because comprehending COMP involves the least processing domain, lowest for GR because comprehending GR involves the most processing domain, and CN and RR were intermediate because comprehending CN and RR involves intermediate processing domain.

The results also indicated that the TA(COMP) and TA(CN) were not different (in both the participants analyses and the items analyses). This cannot be explained by ternary markedness, where COMP and CN are different in terms of markedness status. What separated CN from RR and grouped it with COMP? Again, as they were during off-line rating tasks, English JSLs were sensitive to the head noun's membership status in the proposition of NMC.

The direct participation of the head noun as an argument in the proposition seems more costly than labeling the slot for the argument in the proposition. The head noun of the CN is a name of a participant in the proposition, while the head noun of the RR is a part of the content of the argument in the proposition. This separated the CN from the RR and drew the CN close to the COMP because the head noun of the COMP is also a name.

Summary of the semi on-line TA results from English JSLs. In sum, the semi on-line results suggested the effect of ternary markedness and membership of the head noun in the proposition of the NMCs.

The on-line self-paced reading and probe recognition results. The results from on-line experiments provides support for the Transfer Hypothesis and other sensitivity in addition to binary and ternary markedness.

The on-line ORT and PRT. The ORT results (ORT(GR) > ORT(CN, COMP, RR) (analyses by participants only)) again supported the role of binary markedness. The PRT results (PRT(NCI, RR) > PRT(HN, RR), PRT(HN, COMP) > PRT(NCI, COMP)) revealed a transfer effect. PRT patterns for the familiar types, RR and COMP, were opposite, supporting partial predictions by the Gap and Frame Hypotheses. It is premature to state that English JSLs are sensitive to gap and frame since only a part of each hypothesis was supported. However, the results illustrate English JSLs' sense of clear distinction between RR and COMP.

The on-line TRT. To explain the TRT results from English JSLs (CN > GR > RR > COMP), the results from the semi on-line translation task (COMP > CN > RR > GR) were used for comparison. The results of translation accuracy indicated that English JSLs' comprehension level was significantly lower for the GR and highest for the COMP (both analyses by participants and items). The comprehension level for the CN was also as high as COMP.

First of all, the shortest TRT(COMP) and highest TA(COMP) suggest that during the on-line reading task, it is likely that English JSLs understood the material of COMP relatively easily; thus, the TRT(COMP) was short, and the TA(COMP) was high. Secondly, the fact that the TA(CN) was as high as the highest TA(COMP) and longest TRT(CN) suggests that during the on-line reading task, English JSLs spent the longest time reading the fifth segment of the CN sentences. They did this until they reached the point of understanding of the material up to the segment and then hit the space bar to go on.

On the other hand, the lowest TA(GR) and the second longest TRT(GR), which was shorter than TRT(CN), suggest that during the on-line reading task, English JSLs did not understand the GR material. They did not quite understand the GR sentences, but

rather than trying to understand them as they did with the CN sentences, they gave up and hit the bar to go on. The fact the TRT(GR) and the TRT(RR) were the same suggests that English JSLs treated the fifth segment of the GR and of the RR in the same way. Particularly, the GR material was not understood while the RR material was; however, they were read in the same manner.

With the implication of the TA results regarding the level of comprehension at the fifth segment, the TRT results by English JSLs can be explained by the combination of these factors: 1) the number of roles that construal of NMC types involves, 2) ternary markedness, and 3) transfer (RR and COMP are familiar, while CN and GR are unfamiliar in L1).

The number of roles that construal of NMC types involves. In terms of the number of roles that the head nouns play in order to relate themselves with the modifying clause, the four types of NMC can be classified into two, in terms of the number of roles carried by the head noun. COMP belongs to the first class, where one role is involved. Two constituents are related in the way that the head noun names the role that the modifying clause plays. RR and GR also belong to the first class, where one role is involved. The head noun carries a thematic role in relation to the clausal verb (RR) or in relation to the unexpressed verb (GR), respectively. In COMP, the job that the head noun performs is naming, while in RR and GR, it is carrying a thematic role. The type of job is different, but one role is played by the head noun, either naming or carrying.

CN belongs to the second class, where two roles are involved. The head noun names a role in relation to the clausal verb, and the head noun also names a role in logical relation to what the modifying clause means. This is summarized in Table 6-2.

Table 6-2
Roles Played by Head Nouns in Relating the Head Noun and Modifying Clause of Four NMC Types

NMC	Number of Roles	Comments
COMP	1	Head noun names the role that the modifying clause plays
RR	1	Head noun carries a thematic role in relation with the clausal verb.
GR	1	Head noun carries a thematic role in relation with the unexpressed verb.
CN	2	Head noun names the role in relation with the clausal verb. Head noun also a names the role complementary to the meaning of the modifying clause.

Ternary markedness. Table 6-3 combines Table 6-1, which describes ternary markedness, and Table 6-2, for convenience of explanation for the results of the TRT.

Table 6-3
Resources Involved in Association of Modifying Clause and Head Noun and Number of Roles Head Noun Plays to Relate Head Noun and Modifying Clause of Four NMC Types

NMC	Domain of Resources	Number of Roles
COMP	-Baseline logical knowledge	1
RR	-Baseline logical knowledge -Knowledge of thematic relation	
GR	-Baseline logical knowledge -Knowledge of thematic relation -Pragmatic knowledge	
CN	-Baseline logical knowledge -Knowledge of thematic relation	2

The COMP stimuli were easy to read because comprehending the COMP type of NMC requires the smallest domain of resources, i.e., logical knowledge of equation. In terms of number of roles for construal, on the other hand, COMP involves one role, and so do RR and GR. However, comprehending RR and GR requires a larger domain of resources than comprehending COMP. The association of the two constituents of RR involves baseline logical knowledge and knowledge of thematic relations, while GR involves pragmatic knowledge in addition to what is involved in RR comprehension. That explains how COMP elicited the shortest TRT.

English JSLs spent the longest time reading CN. This can be explained by its special status, which involves two roles for construal. Only the CN head nouns do two

jobs. One is to name the role in the event described by the modifying clause, and the other is to name the role complementary to the event described by the modifying clause. In terms of domains of resources, CN and RR should be treated the same way. However, RR involves one role, while CN involves two. This is how CN achieved the longest TRT.

The TRT(RR) and the TRT(GR) did not differ. In terms of number of roles, GR and RR are equal. In terms of ternary markedness, the GR involves a larger domain of resources than the RR. However, it is likely English JSLs did not access pragmatic resources and did not understand the GR material, as suggested by the lowest TA(GR). Under the time constraint, English JSLs were reading the fifth segment with the resources of thematic knowledge and baseline logical knowledge, which are called for in both RR and GR. This makes the competition even between the RR and the GR on the basis of both number of roles and domain of resources. These participants did not quite understand the GR material; however, understanding of the involvement of one role carried by the head noun drove their reading, in a way similar to the RR material, which made them hit the space bar to go on.

Transfer. Lastly, English JSLs may not have accessed pragmatic resources for GR, and this is likely due to transfer. Japanese native speakers were sensitive to ternary markedness as were English JSLs. Japanese native speakers, therefore, spent the longest time reading the GR material and accessed pragmatic resources in order to construe the head noun. However, English JSLs did not spend the longest time reading GR material to access pragmatic resources (TRT(CN) was the longest, and TRT(GR) and TRT(RR) were the second longest), which ternary markedness does not explain. English JSLs' sensitivity to the number of roles in the construal of NMCs, which explains the longest TRT(CN), does not explain why they did not access pragmatic resources, either. Transfer may have been a direct factor for English JSLs' not accessing pragmatic resources.

In other words, English JSLs recognized the RR and the COMP because these are similar to the English relative clause and complement structures. In order to parse the head noun of the RR and the COMP, these participants did not need to access the domain of pragmatic knowledge. When they came across the unfamiliar types, the CN and the GR, they were not able to access the resource of pragmatics for the purpose of parsing the

head noun. The CN head noun was parsable without pragmatic resources, but parsing the GR was impossible.

Summary of the on-line ORT, PRT, and TRT results from English JSLs. The on-line results revealed the relevance of the following four factors: 1) binary and ternary markedness, 2) the number of roles that construal of NMC types involves, 3) transfer, and 4) distinction between RR and COMP.

Summary of English JSLs' processing sensitivities. The English JSLs' discrimination patterns suggest that they process NMCs under the effect of markedness (binary and ternary), syntactic relation (gap) between the constituents, semantic status of the head noun in relation to the modifying clause, membership status of the head noun in the proposition of NMC, number of roles that the head noun plays for construal, transfer, and distinction between RR and COMP. As well as Japanese native speakers, English JSLs were sensitive to markedness relation among the NMC types. Obviously, English JSLs were more analytical about the relation between the head noun and the modifying clause.

Where Do the Differences Come from?

There are three major differences between Japanese native speakers and English JSLs. The first is, native speakers of Japanese are subject to markedness to the extent that they appear to be insensitive to the relationship between the head noun and modifying clause. The second is that English JSLs are more sensitive to the relation between the two constituents. These two points were clearly made by the results discussed above.

Thirdly, between ternary and binary markedness, Japanese native speakers showed clear sensitivity to binary markedness more than English JSLs did. In the off-line rating data from Japanese native speakers, by both analyses by participants and items, the GR was significantly different from the CN, RR, and COMP, among which there were no distinctions. Also in the on-line reading and probe recognition tasks, although the effect was weaker than in the results from the off-line tasks, Japanese native speakers treated the GR differently from the others. On the other hand, English JSLs' sensitivity to binary markedness was either eclipsed by sensitivity to syntax and

semantics (as in the results from the NR and EUR ratings and the TA) or weak (as in the results from the ORT, where the GR was significantly longer than the combined averages of the CN, COMP, and RR, by participants analyses only).

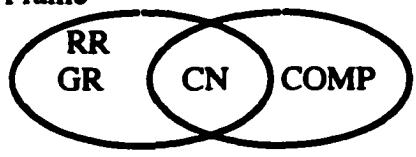
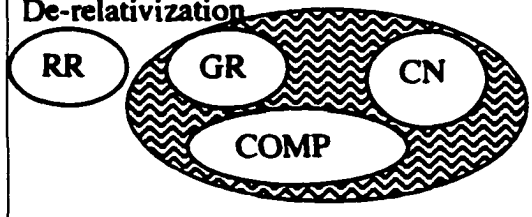
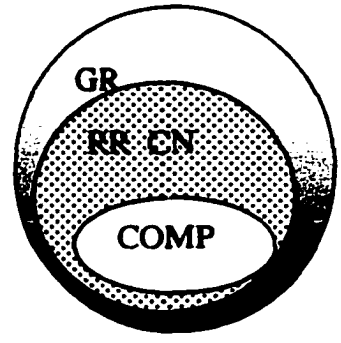
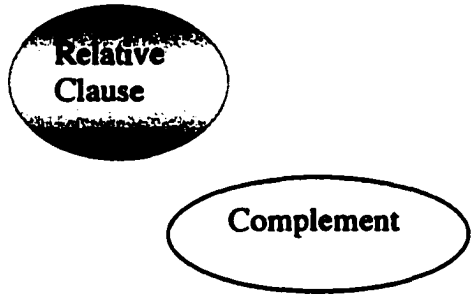
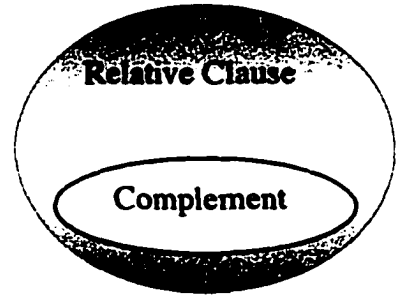
The first two points suggest that L2 learners are more analytical about the grammar of L2 than the native speakers. Below an explanation for such differences is attempted, based on grammatical properties of the NMC types and their English equivalents.

Why are Japanese native speakers insensitive and English speakers more sensitive to the relation between the constituents?

The possible source for the first and the second differences may be the differing suite of NMC construction types for Japanese native speakers and NMC equivalents for English JSLs. The difference between the suites are describable from two perspectives: the internal relation between the modifying clause and the head noun and the resource domain differences among NMC types as reflected in Table 6-4.

Table 6-4

Suite of Four NMC Construction Types in Terms of Relation between Head Noun and Modifying Clause and Domain of Resources for Processing NMCs

L1	Relation between Head Noun and Modifying Clause	Domain of Resource (Markedness Relation)
Japanese	Frame  Gap  De-relativization 	
English		

NMC types in the mind of Japanese native speakers. The suite of NMCs in Japanese constitute a spectrum. From a Frame theoretic point of view, the RR and the GR (Clause Host Type) are located on one end, the COMP (Noun Host Type) at the other end, and the CN (Clause and Noun Host Type) is intermediate. These three categories have an intersecting relation with the Clause and Noun Host Type in an area of overlap.

From a Gap theoretic point of view, the RR is a gap type, while other three are non-gap types without means to distinguish among them. According to de-relativization criteria, the RR can be de-relativized, while the other three cannot. These three are distinguishable only if another criterion is applied, i.e., the reason why they are not de-relativizable (see the section on the four-way distinction by de-relativization in Chapter

2). In any case, the four types of NMC are not mutually exclusive under the aegis of a single principle.

In addition, the four subtypes are nested according to the second factor, i.e., the resources involved in forming cohesion between the modifying clause and the head noun. The requirement for baseline logical knowledge is shared by all the types. The requirement for knowledge of thematic relations is shared by RR, CN, and GR. The RR, only type that Gap theory and de-relativization isolates, is inseparable from the CN because they are both generated by a grammar having a common resource domain.

NMC equivalents in the mind of English speakers. On the other hand, English has only two categories, i.e., relative clause and complement, in the spectrum of equivalent structures. This distinction is a yes/no type of distinction in that presence/ absence of gap (Gap theory) or hosting/ hosted head noun (Frame theory) matters. In other words, these two types are mutually exclusive. In terms of the resource domain, the relative clause and complement structures are in a super-sub set relation. However, there are only two categories here. One (relative clause) belongs to the superset domain, and the other (complement) belongs to the subset domain. The distinction is exclusive.

Source of (in)sensitivity. That native speakers of Japanese are subject to markedness to the extent that they appear to be insensitive to the relationship between the head noun and modifying clause, is due to that Japanese native speakers are intimately familiar with the four categories, all of which are superficially identical and inseparable in terms of the internal relations between the modifying clause and the head noun. Therefore, they did not rely on the internal relations between the constituents to distinguish them. With this weakened sensitivity to relations, they relied on external factors, namely the domain of processing resources, which fundamentally affected processing the NMCs.

Finally, what makes English JSLs more sensitive, in addition to markedness to the relation between the two constituents can be explained as follows. Compared to Japanese NMCs, the relative clause and complement are mutually exclusive categories grammatically (i.e., in terms of internal relationship between the head noun and the modifying clause). In the absence of the other categories, the two categories are distinguishable in terms of resource domains. English JSLs, having these discreet

equivalent categories, were naturally sensitive to the internal organization of NMCs while being affected by the processing resource domain differences.

Why do Japanese native speakers have a clearer idea of binary markedness?

The last major difference between the speaker groups is that Japanese native speakers, more than English JSLs, are above all sensitive to binary markedness. Why do Japanese native speakers have a more clear-cut intolerance toward the GR than English JSLs? A possible explanation is based on the concept of markedness again. That is, it is possible that the GR is marked with respect to the RR, the CN, and the COMP, not only because it requires the largest domain of resources for construal, but also in terms of another markedness contrast. That is, the increased burden for the GR by Japanese native speakers was caused by the doubly marked status of the GR while for English JSLs the GR is only singly marked.

GR is doubly marked in Japanese. First of all, the GR is marked with respect to the RR, the CN, and the COMP because only the superset grammar that involves pragmatic resources can generate the GR. The incorporation of the head noun into the modifying clause of the GR is impossible with subset grammar, which uses both thematic and logical knowledge. On the other hand, with the subset grammar, the construal of the RR, the CN, and the COMP, is possible.

In addition to this resource domain contrast, in Japanese grammar, the GR is marked with respect to the RR, the CN, and the COMP by another contrasting property. This contrast is made evident by the difference in the direction of the operation to combine the two constituents. This contrast is made as follows.

In Japanese, sentences with missing arguments, *pros*, are grammatical as long as the predicates are present (see the description of Gap theory in Chapter 2). *Pro* could occur across the subtypes of NMC.[1] With respect to this, the situation in the GR is complementary, specifically, in the sense that the head noun is an argument whose predicate is missing. While processing the RR, the CN, the COMP, and also the GR may involve searching for the referent of *pro* based on the overtly expressed predicate, construal of the GR must involve searching for the predicate to which the argument (the head noun) belongs.

In processing terms, perhaps there is a connection between searching for missing arguments and searching for missing predicates, because these two operations are in principle complementary. The difference resides in the direction of the operation.

In searching for the referent of *pro*, the frame (cf. Matsumoto, 1997) is overtly expressed by the predicate; based on the provided frame, the referent of *pro*, i.e., one of the participants in the frame, is searched for. In other words, this operation starts from the whole (the frame) and ends with the part (the participant). On the other hand, in the searching for the predicate while the argument is present, one of the participants of the frame is provided; based on the participant, the frame is searched for. This operation starts from the part (the participant) and ends with the whole (the frame). The distinctive feature in this pair of operations is the direction of operation. The domain of processing resources is not the distinctive feature in this case.

When there are naturally contrasting units, one unit could be the "normal," making the other "non-normal." If finding the referent of *pro* with the presence of the predicate treated as "normal," then finding a missing predicate when given the argument (as in the GR) should be "non-normal." What gives one operation (where the argument is present but the predicate is missing/ from part to whole) the marked status, while giving the complementary operation (where the arguments are missing but the predicate is present/ from whole to part) the unmarked status? Obviously, the whole provides more cues than the part for the purpose of searching for missing elements. The more available cues there are facilitated the ease of finding the referent. Searching for the referent of *pro* is easier because the frame provides stronger cues; therefore, it is normal (unmarked), while searching for the predicate is harder because the participant provides fewer cues than does the frame; therefore searching for the predicate is not-normal (marked).

GR is singly marked in English. Japanese L1 speakers internalized this markedness relation (*pro* is normal/ missing predicate is not), while English JSLs had not. In L1 English grammar, only one of the two contrasting operations exists, and thus the contrast does not exist.[2] Consequently, the markedness relation does not exist.

English lacks *pro* (Miyamoto & Kess, 1995) but allows PRO, a non-overt subject NP of non-finite clause, to occur as in (6-1) and (6-2) below.

(6-1) The Japanese people were happy [PRO to meet the new baby princess].

(6-2) [PRO to hear any good news] was much appreciated.

In (6-1), the referent of PRO is 'the Japanese people' determined by the grammar. In other words, the PRO is obligatorily controlled by the subject NP in the main clause 'the Japanese people.' On the other hand, in (6-2), the referent of PRO is either determined by the context or pragmatics, or left unassigned; in other words, PRO is optionally controlled (Haegeman, 1994). In both cases, the predicate of which PRO is an argument is overtly expressed. In (6-1), PRO is an external argument of 'meet,' and in (6-2), PRO is an external argument of 'hear.'

However, the contrasting operation, i.e., finding the predicate while the argument is present, as found in processing the GR, is missing in English. Therefore, the markedness contrast does not hold in L1 English. This lack of contrast in L1 caused English JSLs to be less sensitive to the markedness relation between the operations that exist in Japanese. Or, in the interlanguage of English JSLs, the GR is marked only once, due to the subset processing resource relation among NMC subtypes, but not due to the contrast between the operations for missing elements. In other words, English JSLs did know the special necessity of pragmatic resources for incorporating the head noun into the modifying clause in the GR; the GR is recognized as a marked case here. However, they had not quite acquired the reverse operation involved in construal of the GR because, in their L1, the contrast between the normal and its reverse operations does not exist; the GR failed to be recognized as marked here.

Evaluation of the Claims

Four research hypotheses were offered in this thesis. They were the Gap, Frame, Markedness, and Transfer Hypotheses. According to the findings, they are individually evaluated as follows.

Gap Theory

The Gap Hypothesis stated that the presence of a gap should facilitate processing. The coreferential relation between the gap and the head noun indicates a syntactic

relation between the head noun and the modifying clause. The RR is a gap type, while the rest are non-gap types. Because of the syntactic relation, which should facilitate processing, the NMC of the RR was predicted to be easier to process.

Supporting evidence was found in the results from the off-line rating task by English JSLs. English JSLs found the RR the easiest type to understand. There was no supporting evidence for the gap analysis by Japanese native speakers.

There are ample psycholinguistic data (see Miyamoto & Kess, 1995 for a review of such experiments) showing that English native speakers seem to detect a gap during on-line comprehension of English sentences in the form of double activation of its referent. So far, psycholinguistic experiments on Japanese gap structures have shown negative or ambiguous results (e.g., Nakayama, 1995; Yamashita, Stowe, & Nakayama, 1993; Mazuka, 1991). The present study provides further support for the claim that Japanese native speakers do not process a gap, either on-line or off-line.

The present study does provide evidence that English speakers learning Japanese utilize syntactic knowledge, in reading Japanese sentences. Syntax does facilitate processing for English speakers' Japanese sentence processing. They rated RR sentences as the easiest sentences to understand for English speaking learners of Japanese.

However, this work does not provide evidence for on-line gap processing by English speakers reading Japanese. English speakers did exhibit a distinction between the RR and COMP according to the on-line probe recognition results. However, it is not clear whether they were differentiated by the hosting and hosted relation or by both the presence and absence of a gap and of the hosting and of the hosted relation.

Frame Theory

The Frame Hypothesis stated that the hosted information should be remembered better than the hosting information. The assumption was that the hosted information and the hosting information establish a relation between figure and ground. Figure should be more salient than ground. Therefore, for the RR and the GR (Clause Host Type), the head nouns (i.e., the hosted elements) should be easier to retain in the memory than nouns in the modifying clauses (i.e., the hosting elements). For the COMP (Noun Host Type), the nouns in the modifying clauses should be easier to remember than the head nouns.

For the CN (Clause and Noun Host Type), the two constituents should be equally easy to retain in memory because they reciprocally both are host and are hosted.

The PRT results from Japanese native speakers provide no support for the Frame Hypothesis. The PRT results from English JSLs do not entirely support the Frame Hypothesis. Support was found only for the RR and the COMP, the structurally familiar types. Therefore, this study does not provide clear support for the Frame Hypothesis.

Markedness

The Markedness Hypothesis stated that the marked member should be harder to process. Therefore, the GR should be harder to process than the RR, the CN, and the COMP (because of binary markedness), or among the unmarked (RR, CN, and COMP), RR and CN are more marked than COMP (via ternary markedness).

There was evidence to support this claim by both Japanese native speakers and English JSLs. Ternary markedness was supported only by the results of on-line tasks while binary markedness was supported by the results of both on and off-line tasks. The study provides psychological validity of a markedness relation among four NMC subtypes defined by the domains of processing resources that form subset relations.

Transfer

The Transfer Hypothesis stated that for second language learners, familiar structures are easier to acquire than unfamiliar ones. Therefore, the RR and the COMP should be easier to process than the GR and the CN for English speakers learning Japanese. Supporting evidence was found in the results from the on-line tasks but not from the semi on- and off-line tasks. English JSLs recognized the RR and the COMP as familiar to their L1 under a time constraint. When time was given to allow reflection on the part of the participants, however, transfer was not observed.

The Transfer Hypothesis in this study was formulated under the assumption that the RR and the COMP are familiar because the RR is equivalent to the English relative clause and the COMP is equivalent to the English complement structure. However, when what is transferable is considered to be a markedness parameter setting (see the section of transfer in principles and parameters theory in Chapter 2), rather than structural

familiarity, the English parameter setting is a subset setting (which generates English relative clauses and complements, i.e., RR, COMP and CN), and acquiring Japanese as L2 means changing the parameter setting from a subset setting to superset setting (in order to generate GR in addition to RR, COMP, and CN). In this case, if transfer is at work, the subtypes that the subset grammar can generate are equally easy to process. That is, RR, COMP and also CN are equally easy to process. GR, which only the superset grammar can generate, should be harder to process. The prediction under this view of transfer is identical with the prediction by binary markedness.

The (binary) Markedness Hypothesis was more consistently supported by the results from non on-line tasks. That is, when English JSLs were given enough time to process the sentences at their leisure, they showed an awareness of a binary markedness relation, which separates the subtypes that the subset (L1) grammar can generate from the subtype that the superset grammar (Japanese), but not the subset grammar, can generate.

Considering that the Transfer Hypothesis (see the section of obvious transfer in Chapter 2) was supported more consistently by the results from the on-line experiment, this study shows the tendency that obvious transfer was at work at the level of on-line processing while transfer in principle and parameter theory was at work at the level of non on-line processing.

What Do the Different Tasks Reveal?

In the experiments with the second language learners, it was found that the variances among items as well as among participants were extremely high. The on-line tasks especially involved experimental noise such as individual differences and conscious reflection on the participants' side. The probe recognition task was a hard task for English JSLs. When only responses less than 1500 milliseconds were considered, only 4% of one participant's PRT responses were considered in contrast to 84% of another participant's, indicating vast variance among participants. The TRT had to be transformed to z-scores to eliminate differences among participants.

In order to maximize the effect of Construction Type and to minimize the individual differences among stimuli and among participants, more control over the process of creating the stimuli and selecting the participants might be necessary.

As for the control over creating stimuli, ideally, exact wordings with minimal differences, as in Bever & Sanz (1997), or identical semantic roles for NP's at the same position across the stimuli with minimal differences as in Yamashita, Stowe, and Nakayama (1993), are desired. However, such control was not possible in the present study. The formation of the stimuli, allowing four different construction types as an independent variable while restricting wordings and semantic roles of every NP of the same position of the sentence, was not possible.

In addition, the English speaking participants each had different lengths of exposure to a Japanese speaking environment. Some English JSLs were faster and better readers than others. In addition to their willingness to participate, the only other requirement was for them to have taken intermediate university or equivalent courses in Japanese.

For future studies, an experimental design that minimizes or cancels out the errors from variability among responses is desirable. For example, grouping the participants by a proficiency test and selecting easy enough material for each group might reduce the variance among the responses. In order to do so, many more English JSLs need to be asked to participate (enough to be screened), and the right set of vocabularies for each level of proficiency need to be chosen.

With Japanese native speakers, the finding is that Japanese are so intimately familiar with the relevant structures that their performance in these tasks does not reveal the differences among the NMCs. This is so strikingly clear that it is totally unclear how Japanese native speakers process different types of NMCs. Syntax, for example, does not seem to play a role since no evidence for a gap strategy was found. Different framing relations between the constituents did not matter to them. Different parameters capable of describing Japanese speakers' process of comprehension need to be developed for empirical testing in the future.

Notes

[1] See footnote 16 in Chapter 2 for the examples of the use of *pro* in NMC. In order to find the referent of *pro*, pragmatic resources are required. That is, it is not only processing the GR that requires pragmatic

resources when interpretation of *pro* is involved. However, in order to construe the head noun of the GR, pragmatic resources are required while construing the head nouns of other types does not involve them.

[2] The parallel situation is found in the order of the main clause (MC) and the subordinate clause (SC) in English and Japanese. In English, both orders are allowed (MC+SC and SC+MC) showing complementary pattern. On the other hand, in Japanese only one order is possible (SC+MC). Prideaux (1989) and Prideaux and Hogan (1993) argue that in English SC+MC is marked while MC+SC is marked and that the marked order is associated with certain discourse functions. Because only one order is possible in Japanese grammar, the contrast found in English is not found in Japanese.

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Appendix 1. Word Check Sheet and the Scores by 11 English JSLs

These are words that you may or may not know the readings/ meanings of. There were in the computer session.
Please check if you do know both the meanings and readings of the words/ expressions.

Experimental Name

√		√		√	
	傷 (きず) つく:to be hurt		散歩 (さんぽ) :walk		花よめ (はなよめ) :bride
	なぐさめる:to comfort		金持ち (かねもち) :the rich		花むこ (はなむこ) :bridegroom
	昔 (むかし) :a long time ago		貧乏人 (びんぼうにん) :the poor		あたり一面 (いちめん) :all over the place
	大切 (たいせつ) にする: to treasure		成功 (せいこう) する:to success		建つ (たつ) :to build
	運動 (うんどう) :exercise		都市 (とし) :city		裏側 (うらがわ) :back side
	このごろ:recently		賞金 (しょうきん) :prize		続ける (つづける) :to continue
	関心 (かんしん) :interest		普通 (ふつう) :rare, ordinary		研究 (けんきゅう) :research
	関心が強 (あつ) まる:to attract interest		寄ふする:to donate		終わる (おわる) :to end
	ざっし:magazine		道場 (どうじょう) : dojo, gym		前 (まえ) から:since a while ago
	横 (よこ) :side		感謝 (かんしゃ) :gratitude		準備 (じゅんび) :arrangement
	遊ぶ (あそぶ) :to play		直前 (ちょくぜん) :a moment prior		別れ (わかれ) :separation
	遊び場 (あそびば) :play ground		約束 (やくそく) :promise		思った (おもった) ほど:as (I) thought
	増やす (ふやす) :to increase		息をする (はたす) :to keep		忍耐:endurance
	訴える (うったえる) :petition, appeal		きのう:yesterday		作家 (さっか) :author
	集会 (しゅうかい) :congress		寝る (ねる) :to sleep		世の中 (よのなか) :society
	とどく:to reach		つかれ:fatigue		役 (やく) にたつ:to be useful
	気 (き) がつく:to notice		両目 (りょうめ) :both eyes		一員 (いちいん) :member
	不幸 (ふこう) :unhappiness		ズキズキする:to throb with pain		必ず (かならず) :without fail
	学問:education, learning		化粧 (けしょう) :cosmetics		練習 (れんしゅう) :practice
	働く (はたらく) :to work, to labour		欲望 (よくぼう) :urge, desire		何度 (なんど) も:many times
	燃える (もえる) :to disappear		走る (はしる) :to run		意見 (いけん) :opinion
	わいわい:noisily		燃える:to burn		箱 (はこ) :box
	集まる (あつまる) :to assemble		かけ抜ける:to run through		郵便 (ゆうびん) :snail mail
	あたり:somewhere		広場 (ひろば) :square		急ぐ (いそぐ) :to hurry
	探す:to search		とりこわす:to demolish		遅れる (おくれる) :to be late
	ぼうし:cap		大通り (おおどおり) :main street		理屈 (りくつ) :logic
	見つかる (みつかる) :to be found		めいわく:nuisance		後 (あと) :after
	中古 (ちゅうこ) :second hand		起きる (おきる) :to get up		認める (みとめる) :to approve
	広告 (こうこく) :advertisement		用意 (ようい) :preparation		泊まる (とまる) :to stay overnight
	食 (た) べすぎる:to overeat		建 (た) てかえ:rebuilding		小川 (おがわ) :a stream
	結果 (けっか) :result		決定 (けってい) :decision		流れる (ながれる) :to flow
	決勝戦 (けっしょうせん) :final		はだか:naked		記者 (きしゃ) :reporter
	勝つ (かつ) :to win		思い出 (おもいで) :memory		パトカー:patrol car
	先 (さき) ほど:a moment ago		理由 (りゆう) :reason		向かう (むかう) :to go toward
	ところ:place		説明 (せつめい) :explanation		けが人 (にん) :the injured
	電話 (でんわ) がかかる:a phone call comes		しかたがない:cannot be helped		あふれる:to overflow
	睡眠 (すいみん) :sleep		すじ:plot		

Participant#	%
E1	60.7
E2	36.4
E3	79.4
E4	85.0
E5	32.7
E6	88.8
E7	35.5
E8	20.6
E9	90.7
E10	63.6
E11	97.2
Average	62.8

Appendix 2.
The Participants' Information

2A. Japanese Native Speakers

Participant No.	Gender	Parents' First Language(s)	Other Second Languages	Duration of Living in English Speaking Country	Profession
J1	F	Japanese	Russian	1y.1mo.	student
J2	M	Japanese	Korean	1y.10mo.	doctor
J3	M	Japanese	German	1y.3mo.	researcher
J4	M	Japanese	German	4y.6mo.	student
J5	F	Japanese	French, Mandarin	6y.6mo.	student
J6	F	Japanese	French, German	2y.	student
J7	M	English (father) Japanese (mother)	Spanish, Latin, French	2y.	student
J8	F	Japanese	French	2y.1mo.	student
J9	F	Japanese	Russian, Korean, Mandarin	1y.6mo.	student
J10	M	Japanese	Korean, German, French	2y.6mo.	student
J11	F	Japanese	French	5mo.	engineer
J12	M	Japanese	German, French, Korean	20y.	professor
J13	F	Japanese	Russian, French	5y.	student
J14	F	Japanese	French	30y.	translator
J15	F	Japanese	Korean	8mo.	student
J16	F	Japanese	Russian, German	3y.	Ikebana master
J17	F	Japanese	German, French	35y.	scientist
J18	F	Japanese	French	12y.	student
J19	F	Japanese	-	2y.	student
J20	M	Japanese	German, Korean	1y.6mo.	student
J21	F	Japanese	French	3y.	student
J22	F	Japanese	French, Mandarine	8y.	student
J23	M	Japanese	German	6mo.	student

Note. y.: year(s), mo.: month(s)

2B. English JSLs

Participant No.	Gender	Parents' First Language(s)	Other Second Languages	History of Study in Japanese	Duration of Living in Japan	Profession
E1	F	English	Spanish, French	4y. (university)	11mo.	student
E2	F	English	French	3y.2mo. (university)	0	student
E3	F	English	French, German, Spanish	5y. (university)	2y.	student
E4	M	English	French	7y. (university)	11mo.	student
E5	M	English	French	3y.3mo. (university)	1y.	administrator
E6	F	English	-	3y. (highschool) 3y. (university)	3y.4mo.	student
E7	M	English	Cantonese	1y. (university) 3y. (private lesson)	3y.	engineer
E8	F	Tamil	French	3y. (university)	11mo.	student
E9	M	English (father) Japanese (mother)	French	2y. (university)	1y.6mo.	student
E10	M	English	French	3y. (university)	1y.1mo.	student
E11	M	Cantonese (father) English (mother)	Cantonese	3y. (highschool) 3y.6mo. (university)	1y.	student

Note. y.: year(s), mo.: month(s)

Appendix 3. Sentences for Rating Tasks and List

Trial#	Version	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6	Segment 7	List
RR1	a	傷ついた	人の心を	なぐさめる	音楽は	昔から	大切に	されている	A
		[injured	person's mind-ACC	confort]	*music* -TOP	from old time	treasure	do+PASS+PROG	
		The music [that comforts people's scared mind] has been treasured for ages.							
RR2	a	きれいな	ガラスの箱に	入っている	人形は	カナダから	船便で	来たらしい	B
		[pretty	glass box-in	enter-be]	doll-TOP	Canada-from	sea mail-by	came+seem	
		The doll [that is in the pretty glass box] seems to have come from Canada by sea.							
RR3	a	いくらか	お金を	きふした	道場から	お礼の	カードが	とどいた	A
		[somewhat	money-ACC	donated]	practice hall-from	gratitute-'s	card-NOM	arrived	
		A thank you card arrived from the practice hall [to which (I) donated some money].							
RR4	a	化粧を	あつく	ぬった	顔は	遠くから	見るほうが	きれいだ	B
		[cosmetics-ACC	thickly	pasted]	face-TOP	distance-from	watch-more-NOM	pretty-COP	
		The face where cosmetics is thickly pasted] looks prettier from the distance.							
RR5	a	五年前から	一人で	続けてきた	研究が	やっと	終わろうと	している	A
		[five years ago	alone	continued]	research-NOM	finally	trying to end	doing	
		The research [that (I) have continued by myself for five years] is finally trying to end.							
RR6	a	学生のころ	安いので	よく使った	電車が	古くなって	どんどん	消えていく	B
		[student-'s+time	cheap+because	often+used]	train-NOM	old+became	steadly	disappears	
		The trains [that (I) used often because of the low price] became old and are disappearing steadly.							
RR7	a	金持ちも	貧乏人も	成功する	都市なんて	どこを	さがしても	ないと思う	A
		[rich-also	poor-also	succeed]	city-TOP	anywhere	search-even if	non existent-think	
		(I) think the city [where both rich and poor succeed] is nowhere.							
RR8	a	花よめと	花むこが	出てきた	教会は	あたり一面	白い花が	かざってある	B
		[bride-with	bridegroom-NOM	exited]	church-TOP	everywhere	white flower-NOM	decorated-be	
		The church [(from which) the bride and the groom exited] is decorated with white flowers everywhere.							
RR9	a	記者と	パトカーが	向かった	病院は	すでに	けが人で	あふれていた	A
		[reporter-and	patrol car-NOM	went forward]	hospital-TOP	already	injured-with	overflew-be	
		The hospital that the reporter and the patrol car went to] was overflown with the injured already.							
RR10	a	小さいころ	毎日のように	通った	広場が	とりこわされ	パーキングに	なった	B
		[young+time	everyday+like	passed]	*square* -NOM	demolished+and	parking lot-to	became	
		The square [that (I) passed almost every day when (I) was young] was demolished and became a parking lot.							

GR1	a	自分でも	気がつかず	不幸になる	学問は	すぐにでも	やめて	働くべきだ	A
		[self-by-even	without noticing	unhappy+become]	*learning* -TOP	soon+even	quit+and	work+must	
		(You) shoud even right away quit that learning [by doing which you become unhappy without noticing by yourself] and work.							
GR2	a	毎日の	食事が	おいしくなる	運動に	このごろ	関心が	集まっている	B
		[everyday-'s	meal-NOM	tasty+become]	*exercise* -to	recently	interest-NOM	collect+be	
		Recently the interests collects to the exercise [by doing which everyday meal becomes tasty].							
GR3	a	バイオリンの	コンテストで	一番になった	賞金は	そのころは	5ドルが	普通だった	A
		[violin-'s	contest-at	champion+became]	*prize* -TOP	those days	$5.00 -NOM	ordinary-was	
		The prize [that (you got when) you won the championship in violin contest] is in those days mostly five dollars.							
GR4	a	昨日から	ぜんぜん	眠れなかった	つかれで	両目が	ズキズキ	している	B
		[yesterday-from	entirely	slept+POSS-not]	*fatigue* -with	both eyes-NOM	ache	do+be	
		With the fatigue [that (I) suffer from not at all having been able to sleep since the night before], (my) both eyes are aching.							
GR5	a	チェスの	ゲームに	必ず勝つ	練習とは	何度も	ゲームを	することだ	A
		[chess-'s	game-at	definitely+win]	*practice* -TOP	many times	game-ACC	do+NMRZ+COP	
		The practice [(by doing which) you can definitely win the games of chess] is to play the games many times.							
GR6	a	夜から	朝まで	睡眠がとれる	散歩は	一時間では	とうてい	短かすぎる	B
		[night-from	morning-till	sleep-NOM take]	*walk* -TOP	one hour-with-TOP	too far	too short	
		The walk [(by doing which you) can take a sleep from night till morning] is far too short if (it is) only one hour long.							
GR7	a	起きてから	用意を	しなくていい	朝食なら	必要なので	いろいろと	知っている	A
		[get up- and	preparation-ACC	do-not-may]	*breakfast* -TOP	since necessary	this and that	know	
		(I) know out of necessity several breakfast [that I do not have to do preparation for as I get up].							
GR8	a	ずっと前から	準備が	できていた	別れが	思ったほど	うまく	いかなかった	B
		[long ago-from	preparation-NOM	ready+was]	*separation* -NOM	as (I) expected	well	could not do	
		The separation [(for) which the preparation had been ready for a long time] did not go as well as (I) expected.							
GR9	a	始めの	五分間で	すじがわかる	映画は	まったく	見る気に	ならない	A
		[first	five minutes-with	plot-NOM clear]	*movie* -TOP	at all	watch+feelings	become+NOT	
		(I) don't feel like watching the movie at all [that within the first five minutes, (I) understand the plot (of)].							
GR10	a	まっ白の	ワイシャツが	黒くなる	洗たくを	するなら	だれかに	たのむといい	B
		[pure white	dress shirt-NOM	black+become]	*laundry* -ACC	do+if	somebody-to	ask+if+good	
		If (you) do the laundry [by which white dress shirt becomes black], (it would be) better if (you) ask somebody else.							

CN1	a	きのう	レストランで	食べすぎた	結果	授業に	行けなく	なった	A
		[yesterday	restaurant-at	overate]	*result*	school-to	go+cannot	came	
		As a result from having overeaten at the restaurant yesterday, (I'm) not eble to go to school.							
CN2	a	ピアノの	レッスンに	行かない	理由を	わざわざ	説明しても	しかたがない	B
		[piano-'s	lesson-to	go not]	*reason* -ACC	especially	explain-even	cannot be helped	
		There is no point of explaining the reason why (you) do not go to the piano lesson							
CN3	a	アジアに	飛行機が	出発する	直前に	弟との	約束を	果たした	A
		[Asia-for	airplane-NOM	depart]	*just before* -at	brother-with-'s	promise-ACC	fulfilled	
		(I) was able to keep the promise with my younger brother just before the time the airplane departed for Asia.							
CN4	a	二台の	白い車が	走っている	あいだを	黒い犬が	ほえながら	かけぬけた	B
		[two-'s	white car-NOM	run-PROG]	*space between* -ACC	black dog-NOM	barking	ran through	
		A black dog ran barking through the space between the two white car running.							
CN5	a	おじいさんが	雑誌を	読んでいる	横でも	大学生は	ビデオで	遊んでいた	B
		[grandfather-NOM	magazine-ACC	read-PROG]	*side* -at-even	university students-T	video-with	play+PROG+PAST	
		Even beside the place where a grandfather was reading a magazine, university students were playing with the video.							
CN6	a	わいわいと	小学生が	集まっている	あたりを	さがせば	ぼうしは	見つかる	A
		[loudly	elementary children-	gather-PROG]	*surroundings* -ACC	search-COND	hat-TOP	find-can	
		If (we) search for the hat around the area where the elementary students are gathering loudly, it will be found							
CN7	a	大きな	ビルが	建った	裏側に	うつくしい	さくらが	咲いている	B
		[big	building	be+built+PAST]	*backside* -at	beautiful	cherry blossoms-NO	bloom-PROG	
		The beautiful cherry blossoms are blooming behind the place where the big building was built.							
CN8	a	バスが	大通りを	通る	音は	近所には	たいへん	めいわくだ	A
		[bus-NOM	main street-ACC	pass]	*sound* -TOP	neighbor-for-TOP	very	nuisance-COP	
		The sound of the bus passing the main street is such a nuisance for the neighbor.							
CN9	a	世の中で	役にたつ	一員になる	勉強を	若いうちに	しっかりと	することだ	B
		[world-'s	helpful	member-become]	*study* -ACC	young-within	steadly	do+NMZR+COP	
		Do the study while young to become a helpful member of the world.							
CN10	a	ひさしぶりに	京都に	泊まった	朝	小川が	流れるのが	聞こえてきた	A
		[after the interval	Kyoto-at	stayed]	*morning*	streams-NOM	flow+NMZR-NOM	hear-came	
		In the morning after I stayed in Kyoto after a long interval, the sound of streams came to be heard.							

COMP1	a	テニスの	決勝戦で	勝ったという	電話が	先ほど	母の所に	かかってきた	A
		[volleyball-'s	final-at	won-QT]	*phone call* -NOM	while ago	mother's place-to	call-came	
		The phone call that ( ) won the volleyball final was sent to my mother's place while ago.							
COMP2	a	中古の	ピアノを	売るという	広告が	たくさん	家まで	とどいている	A
		[second handed-'s	piano-ACC	sell-QT]	*advertisement* -etc	plenty	house-to	reached	
		Plenty of things including advertisement that (someone) sells a second hand piano came to the house.							
COMP3	a	クリスマスの	プレゼントは	あるかという	質問ばかり	するから	子供は	いやだ	B
		[Christmas-NOM	present-TOP	exist-whether-QT]	*question* -only	do-because	children-TOP	tiresome	
		Children are tiresome because (they) ask only questions whether there are Christmas gifts.							
COMP4	a	女だったら	家にいる	べきだという	意見を	会話の	始めに	聞いた	B
		[women-be-if	house-at stay	should-COP-QT]	*opinion* -ACC	conversation-'s	beginning-at	heard	
		(I) heard the opinion that if you are women, you should stay home at the beginning of the conversation.							
COMP5	a	どうしても	部屋の中を	見たいという	欲望を	おさえて	主人を	待った	A
		[at any cost	room's inside-ACC	watch-want-QT]	desire-NOM	resisting	lord-ACC	wait-PAST	
		(I) waited for the lord while resisting this desire that (I) want to see inside the room at any cost.							
COMP6	a	いやでも	同じ作品を	読み続ける	がまんが	できれば	作家に	なれるだろう	B
		[like it or not	same book-ACC	read-continue]	*endurance* -NOM	can do-if	writerr-to	become-maybe	
		If (you) can stand the endurance of reading the same book like or not, you can probably become a writer.							
COMP7	a	雪の上で	はだかで	遊んだ	思い出を	いつか	書きたいと	思っている	A
		[snow's surface-at	naked	played]	memory-ACC	someday	write-want-QT	think	
		(I am) thinking of someday writing out the memory of playing on the snow naked.							
COMP8	a	子供たちの	遊び場を	増やせという	訴えが	やっと	議会まで	とどいた	A
		[children-'s	playground-ACC	increase-QT]	*plea* -NOM	finally	council-to	reached	
		The petition that the children's playground should be increased finally reached the council.							
COMP9	a	急げば	急ぐほど	遅れるという	理屈が	３年も	後になって	認められた	B
		[hurry-if	hurry-even	delay-QT]	*logic* -NOM	three years-even	later-become	probed	
		The logic that the harder you hurry, the more behind you get was probed three years later.							
COMP10	a	図書館の	建てかえを	するという	決定しか	今のところ	知らされて	いない	B
		[library-'s	rebuilding-ACC	do-QT]	*decision* -only	so far	known	not	
		Only the decision that the rebuilding of the hospital will be done has been known so far.							

Appendix 4. Rating Sheet

4A. Naturalness Rating Sheet

Name (your experimental name):_____

Please look through the following 20 sentences. Then find one sentence with the most "natural" underlined portion (最も自然な下線部) and rate it as 5 (とても自然). Then find one sentence with the least "natural" underlined portion (自然ではない下線部) and rate it as 1 (自然ではない). After you have done this essential step, rate the rest of the underlined portions on the same scale from 1-5, with 3 being more or less natural (まあまあ自然). **Concentrate on the underlined portion of each sentence.** Remember to rate the sentence with the least natural and the sentence with the most natural underlined part first, 1 and 5 respectively. You can use "1" and "5" again after the initial rating step.

	Least				Most
1.きのうレストランで食べすぎた結果授業に行けなくなった。	1	2	3	4	5
2.テニスの決勝戦で勝ったという電話が先ほど母のところにかかってきた。	1	2	3	4	5
3.金持ちも貧乏人も成功する都市なんてどこをさがしてもないと思う。	1	2	3	4	5
4.バイオリンのコンテストで一番になった賞金はそのころは5ドルが普通だった。	1	2	3	4	5
5.中古のピアノを売るという広告がたくさん家までとどいている。	1	2	3	4	5
6.アジアに飛行機が出発する直前に弟との約束を果たした。	1	2	3	4	5
7.五年前から一人で続けてきた研究がやっと終わろうとしている。	1	2	3	4	5
8.チェスのゲームに必ず勝つ秘訣とは何度もゲームをすることだ。	1	2	3	4	5
9.バスが大通りをとおる音は近所にはたいへんめいわくだ。	1	2	3	4	5
10.どうしても部屋の中を見たいという欲望をおさえて主人を待った。	1	2	3	4	5
11.いくらかお金をきふした道場からお礼のカードがとどいた。	1	2	3	4	5
12.起きてから用意をしなくていい朝食なら必要なのでいろいろと知っている。	1	2	3	4	5
13.子供たちの遊び場を増やせという訴えがやっと議会までとどいた。	1	2	3	4	5
14.記者とパトカーが向かった病院はすでにけが人であふれていた。	1	2	3	4	5
15.わいわいと小学生が集まっているあたりをさがせばぼうしは見つかる。	1	2	3	4	5
16.自分でも気がつかず不幸になる学問はすぐにでもやめて働くべきだ。	1	2	3	4	5
17.ひさしぶりに京都に泊まった朝,小川が流れるのが聞こえてきた。	1	2	3	4	5
18.傷ついた人の心をなぐさめる言葉は昔から大切にされている。	1	2	3	4	5
19.雪の上ではだかで遊んだ思い出をいつか書きたいと思っている。	1	2	3	4	5
20.始めの五分間ですじがわかる映画はまったく見る気にならない。	1	2	3	4	5

4B. Ease of Understanding for English JSLs Rating Sheet (page 1 of 2)

Please look through the following 20 sentences on the back of this page and think about how difficult the sentences would be to understand for a speaker of English who is learning Japanese. Please don't make your judgement on the basis of vocabulary. Take into consideration the entire sentence rather than the individual words.

For example, compare the two sentences (a) and (b).

(a)その先生は結婚してからも生徒たちに好かれているようです。

(The teacher, even after getting married, seems to be liked by the pupils.)

(b)小渕首相、現自民党党首は一般に党内議員に信頼されている。

(Prime minister Obuchi, the present head of Liberal Democratic Party, is trusted by the congressmen within the party in general.)

Compared to (a), (b) contains obviously more difficult words and more difficult kanji characters. However, overall, the two sentences are similar in overall structure, and neither is more difficult than the other. Now compare (a) with (c).

(c)結婚を理由に仕事をやめさせられた女性が先生になった。

(The woman, who was caused to resign her job due to marriage, became a teacher.)

Although sentence (c) contains words no more difficult than the words in sentence (a), and (c) is even slightly shorter than (a), (c) seems more difficult than (a) to understand, and seems more difficult for an English speaker to understand this Japanese.

On the back of this sheet, there are 20 Japanese sentences. First look through the sentences. Then pay attention only to the underlined part of the sentences and ignore the rest. Find the easiest sentence for the speakers of English who are learning Japanese to understand (英語を話す人にとって最もわかりやすい文) and rate it as 5 (highly understandable for English speakers 英語を話す人にとってたいへんわかりやすい), then find the most difficult sentence to understand for the speakers of English (英語を話す人にとって非常にわかりにくい文) and rate it as 1 (very difficult to understand for speakers of English 英語を話す人にとって非常にわかりにくい). Rate the rest of the sentences on the same scale from 1 -5, with 3 being more or less easy for the English speakers to understand (英語を話す人にとってまあまあわかりやすい).

Now please tell Satomi whether you understand these instructions.

Turn to the back of this page and start rating. **Remember to rate the most difficult and the easiest sentences first, 1 and 5 respectively.** Pay attention only to the underlined parts.

4B. Ease of Understanding for English JSLs Rating Sheet (page 2 of 2)

Name (your experimental name):_____

	Difficult				Easy
1.きれいなガラスの箱に入っている人形はカナダから船便で来たらしい。	1	2	3	4	5
2.化粧をあつくぬった顔は遠くから見るほうがきれいだ。	1	2	3	4	5
3.学生のころ安いのでよく使った電車が古くなってどんどん消えていく。	1	2	3	4	5
4.花よめと花むこが出てきた教会はあたり一面白い花がかざってある。	1	2	3	4	5
5.小さいころ毎日のようにとおった広場がとりこわされパーキングになった。	1	2	3	4	5
6.毎日の食事がおいしくなる運動にこのごろ関心が集まっている。	1	2	3	4	5
7.きのうからぜんぜん眠れなかったつかれで両目がズキズキしている。	1	2	3	4	5
8.夜から朝まで睡眠がとれる散歩は一時間ではとうてい短かすぎる。	1	2	3	4	5
9.ずっと前から準備ができていた別れが思ったほどうまくできなかった。	1	2	3	4	5
10.まっ白のワイシャツが黒くなる洗たくなら私の母がいつもやってきた。	1	2	3	4	5
11.ピアノのレッスンに行かない理由をわざわざ説明してもしかたがない。	1	2	3	4	5
12.二台の白い車がたっているあいだを黒い犬がほえながらかけぬけた。	1	2	3	4	5
13.おじいさんがざっしを読んでいる横でも大学生はビデオで遊んでいた。	1	2	3	4	5
14.大きなビルが建った裏側にうつくしいさくらが咲いている。	1	2	3	4	5
15.世の中で役にたつ一員になる勉強を若いうちにしっかりとすることだ。	1	2	3	4	5
16.クリスマスのプレゼントはあるかという質問ばかりするから子供はいやだ。	1	2	3	4	5
17.女だったら家にいるべきだという意見を会話の始めに聞いた。	1	2	3	4	5
18.いやでも同じ作品を読み続けるがまんができれば作家になれるだろう。	1	2	3	4	5
19.急げば急ぐほど遅れるという理屈が３年も後になって認められた。	1	2	3	4	5
20.図書館の建てかえをするという決定しか今のところ知らされていない。	1	2	3	4	5

Appendix 5. Rating Scores by Individual Participants and Ranking for Each Item

5A. Naturalness Rating by 23 Japanese Native Speakers

Items		Naturalness Rating by Japanese Native Speakers (J1-J11)										
Type	S#	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11
RR	1		4	4		4	5	3		4		3
RR	2	5			4				4		4	
RR	3		2	1		2	4	4		4		4
RR	4	5			5				5		4	
RR	5		5	5		5	4	5		5		3
RR	6	4			2				2		3	
RR	7		3	4		2	5	4		2		2
RR	8	5			5				4		5	
RR	9		2	1		5	3	3		2		2
RR	10	5			3				5		5	
GR	1		1	2		2	1	3		1		2
GR	2	2			3				1		1	
GR	3		4	5		5	1	1		2		2
GR	4	2			1				2		2	
GR	5		2	2		1	2	3		1		2
GR	6	1			2				1		1	
GR	7		1	1		1	2	1		1		1
GR	8	2			2				2		1	
GR	9		5	5		4	5	5		5		4
GR	10	1			3				1		3	
CN	1		2	3		5	5	4		2		4
CN	2	5			5				4		5	
CN	3		1	2		1	4	3		4		2
CN	4	5			5				4		4	
CN	5	2			3				4		4	
CN	6		2	3		3	4	4		1		3
CN	7	5			4				4		4	
CN	8		4	5		5	5	3		5		5
CN	9	5			3				4		1	
CN	10		2	5		5	5	2		4		4
COMP	1		4	4		4	5	5		4		3
COMP	2		2	5		3	5	4		3		3
COMP	3	5							4		5	
COMP	4	5			3				5		5	
COMP	5		2	4		5	4	4		5		3
COMP	6	5			3				3		2	
COMP	7		4	4		5	2	4		2		4
COMP	8		5	5		5	4	5		4		3
COMP	9	5			3				2		3	
COMP	10	5			3				4		2	

Items		Naturalness Rating by Japanese Native Speakers (J12-J23)													
Type	S#	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23	Mean	Rank
RR	1		5		5					5	5		5	4.3	6
RR	2	4		5		5	5	5	5			4		4.5	3
RR	3		3		4					4	1		5	3.2	9
RR	4	5		5		5	5	5	5			4		4.8	1
RR	5		5		5					5	5		5	4.8	1
RR	6	4		1		4	4	5	5			2		3.3	8
RR	7		4		4					4	5		2	3.4	7
RR	8	4		1		5	5	5	4			5		4.4	5
RR	9		3		2					1	3		5	2.7	10
RR	10	3		5		5	5	5	5			4		4.5	3
GR	1		1		1					1	1		4	1.7	8
GR	2	2		5		5	2	2	5			2		2.7	6
GR	3		1		5					5	4		1	3	2
GR	4	1		4		1	2	3	5			2		2.3	5
GR	5		2		3					5	5		5	2.8	3
GR	6	1		2		3	2	1	1			1		1.5	9
GR	7		1		1					1	1		5	1.4	10
GR	8	2		3		4	3	1	4			3		2.5	4
GR	9		5		4					5	3		5	4.6	1
GR	10	2		3		1	1	4	1			1		1.9	7
CN	1		2		5					3	5		5	3.8	6
CN	2	5		5		5	5	5	4			4		4.7	1
CN	3		4		2					5	2		5	2.9	10
CN	4	2		5		5	5	3	3			3		4	5
CN	5	3		2		4	5	3	4			4		3.5	7
CN	6		3		3					2	4		5	3.1	9
CN	7	3		5		5	5	4	4			2		4.1	3
CN	8		3		5					5	4		1	4.2	2
CN	9	4		5		3	4	3	2			2		3.3	8
CN	10		4		5					3	5		5	4.1	3
COMP	1		2		4					5	4		5	4.1	6
COMP	2		4		5					5	4		5	4	7
COMP	3	4		3		4	5	5	3			5		4.3	4
COMP	4	5		5		5	5	5	3			5		4.6	1
COMP	5		5		5					5	3		5	4.2	5
COMP	6	2		4		3	2	3	2			4		3	10
COMP	7		4		5					2	2		5	3.6	8
COMP	8		5		5					5	3		5	4.5	2
COMP	9	5		1		3	5	5	4			4		3.6	8
COMP	10	5		5		5	5	5	5			5		4.5	2

5B. Ease of Understanding for English JSLs Rating by 23 Japanese Native Speakers

Items		Ease of Understanding for English JSLs Rating by Japanese Native Speakers (J1-J11)										
Type	S#	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11
RR	1	3			3				3		3	
RR	2		3	5		4	4	5		5		1
RR	3	4			1				3		3	
RR	4		3	5		4	5	4		3		5
RR	5	3			3				4		4	
RR	6		2	4		1	3	3		3		1
RR	7	4			5				2		3	
RR	8		4	5		3	4	5		3		4
RR	9	4			3				4		3	
RR	10		2	3		3	3	5		3		3
GR	1	2			1				1		1	
GR	2		2	1		4	2	3		1		5
GR	3	4			2				1		2	
GR	4		1	2		2	2	1		2		2
GR	5	2			5				2		2	
GR	6		1	1		3	1	2		1		2
GR	7	1			1				1		1	
GR	8		2	3		4	3	3		1		1
GR	9	3			4				5		4	
GR	10		2	2		3	1	3		2		1
CN	1	3			2				3		4	
CN	2		4	5		4	4	4		4		5
CN	3	4			4				3		3	
CN	4		2	5		5	4	2		5		3
CN	5		2	5		2	3	4		5		3
CN	6	3			3				3		3	
CN	7		2	4		5	4	4		5		2
CN	8	5			4				4		5	
CN	9		2	4		2	2	3		1		3
CN	10	3			2				2		4	
COMP	1	4			5				3		4	
COMP	2	3			3				5		5	
COMP	3		4	3		4	4	3		3		5
COMP	4		5	3		4	3	4		4		4
COMP	5	2			1				3		4	
COMP	6		2	2		2	1	3		2		2
COMP	7	3			3				4		3	
COMP	8	1			3				4		4	
COMP	9		3	2		4	3	3		2		1
COMP	10		4	5		4	4	5		4		5

Items		Ease of Understanding for English JSLs Rating by Japanese Native Speakers (J12-J23)													
Type	S#	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23	Mean	Rank
RR	1	5		5		4	2	2	3			4		3.4	5
RR	2		5		4					5	5		5	4.3	1
RR	3	1		1		1	5	3	5			2		2.6	9
RR	4		3		4					5	3		1	3.8	4
RR	5	4		5		5	5	2	4			4		3.9	3
RR	6		2		2					2	3		3	2.4	10
RR	7	2		1		4	4	3	5			2		3.2	8
RR	8		3		4					5	5		5	4.2	2
RR	9	1		3		4	4	5	3			2		3.3	6
RR	10		4		3					4	3		3	3.3	6
GR	1	2		1		1	1	1	1			1		1.2	10
GR	2		2		3					3	2		2	2.5	4
GR	3	1		5		5	3	1	4			2		2.7	3
GR	4		2		2					2	1		3	1.8	7
GR	5	3		5		4	4	3	2			4		3.3	2
GR	6		1		2					2	1		4	1.8	7
GR	7	3		3		3	1	2	2			1		1.7	9
GR	8		1		1					1	2		1	1.9	5
GR	9	4		4		4	5	3	2			5		3.9	1
GR	10		2		2					2	2		1	1.9	5
CN	1	2		4		2	4	3	4			5		3.3	7
CN	2		5		5					4	5		5	4.5	2
CN	3	4		5		5	4	4	3			2		3.7	6
CN	4		2		4					4	5		2	3.6	5
CN	5		3		4					5	5		4	3.8	4
CN	6	2		4		3	2	1	4			3		2.8	8
CN	7		5		3					4	5		4	3.9	3
CN	8	5		5		5	3	5	5			5		4.6	1
CN	9		2		2					3	2		2	2.3	10
CN	10	5		2		1	2	2	4			2		2.6	9
COMP	1	4		5		4	5	3	4			5		4.2	1
COMP	2	3		2		5	5	2	5			4		3.8	5
COMP	3		5		5					4	4		5	4.1	2
COMP	4		4		2					5	5		5	4	4
COMP	5	3		3		5	5	1	1			4		2.9	8
COMP	6		1		1					1	3		1	1.8	10
COMP	7	2		3		5	5	2	5			4		3.5	6
COMP	8	3		5		4	3	2	3			4		3.3	7
COMP	9		4		3					5	1		1	2.7	9
COMP	10		4		3					4	2		5	4.1	2

5C. Naturalness Rating by 11 English JSLs

Items		Naturalness Rating by 11 English JSLs												
Type	S#	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Mean	Rank
RR	1	4		4		4		4		5		5	4.3	1
RR	2		3		5		1		3		5		3.4	6
RR	3	3		2		2		3		2		2	2.3	10
RR	4				5		4		3		3		3.8	3
RR	5	5		3		3		4		5		5	4.2	2
RR	6		4		5		2		4		3		3.6	4
RR	7	3		2		4		2		5		1	2.8	9
RR	8		3		3		2		3		5		3.2	7
RR	9	4		2		4		4		5		2	3.5	5
RR	10		2		5		3		3		2		3	8
GR	1	2		2		3		3		3		3	2.7	8
GR	2		3		4		4		2		3		3.2	4
GR	3	4		3		4		1		5		2	3.2	4
GR	4		4		1		4		2		2		2.6	9
GR	5	4		1		4		4		4		3	3.3	3
GR	6		2		4		5		2		2		3	6
GR	7	1		2		3		2		3		1	2	10
GR	8		3		5		2		2		2		2.8	7
GR	9	3		5		3		4		4		3	3.7	1
GR	10		3		4		4		4		2		3.4	2
CN	1	4		3		4		5		5		1	3.7	4
CN	2		5		5		2		5		5		4.4	1
CN	3	4				4		3		4		4	3.8	3
CN	4		3		4		2		4		5		3.6	6
CN	5		4		4		3		2		3		3.2	8
CN	6	4		3		4		2		5		4	3.7	4
CN	7		2		4		3		3		4		3.2	8
CN	8	5		4		3		5		4		4	4.2	2
CN	9		4		3		2		4		1		2.8	10
CN	10	5		3		3		4		5		1	3.5	7
COMP	1	3		3		1		4		1		1	2.2	10
COMP	2	4		5		4		3		4		5	4.2	1
COMP	3		5		5		2		2		4		3.6	3
COMP	4		3		5		2		4		4		3.6	3
COMP	5	4		3		2		3		4		5	3.5	5
COMP	6		3		4		3		2		1		2.6	8
COMP	7	4		3		5		3		5		2	3.7	2
COMP	8	2		4		4		2		3		5	3.3	6
COMP	9		1		4		2		3		3		2.6	8
COMP	10		3		5		2		1		3		2.8	7

5D. Ease of Understanding for English JSLs Rating by 11 English JSLs

Items		Ease of Understanding for English JSLs Rating by 11 English JSLs												
Type	S#	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	Mean	Rank
RR	1		2		4		4		5		4		3.8	1
RR	2	4		3		3		3		5		5	3.8	1
RR	3		2		2		2		2		3		2.2	10
RR	4	3		2		5		4		1		5	3.3	7
RR	5		3		4		4		3		5		3.8	1
RR	6	3		3		4		4		4		3	3.5	6
RR	7		2		4		3		5		4		3.6	5
RR	8	2		5		3		3		5		5	3.8	1
RR	9		3		4		3		2		2		2.8	8
RR	10	2		2		4		2		3		4	2.8	8
GR	1		2		1		2		1		1		1.4	10
GR	2	4		3		1		3		1		2	2.3	5
GR	3		4		2		3		4		4		3.4	1
GR	4	5		3		3		2		2		3	3	7
GR	5		2		4		3		2		2		2.6	2
GR	6	1		1		2		3		1		2	1.7	9
GR	7		3		4		3		2		1		2.6	2
GR	8	3		2		1		2		2		4	2.3	5
GR	9		3		4		4		2		2		3	7
GR	10	3		2		4		3		1		2	2.5	4
CN	1		3		4		2		3		5		3.4	3
CN	2	5		3		5		5		2		5	4.2	2
CN	3		5		2		3		2		4		3.2	5
CN	4	4		3		4		3		2		4	3.3	4
CN	5	4		3		1		5		4		1	3	6
CN	6		1		4		3		2		2		2.4	8
CN	7	4		2		1		3		3		1	2.3	9
CN	8		3		4		5		5		5		4.4	1
CN	9	2		2		2		2		3		3	2.3	9
CN	10		4		4		1		2		4		3	6
COMP	1		3		4		2		2		2		2.6	9
COMP	2		3		3		2		5		2		3	5
COMP	3	3		2		5		3		3		5	3.5	1
COMP	4	4		2		2		3		4		5	3.3	1
COMP	5		3		5		2		2		3		3	5
COMP	6	3		2		2		2		4		4	2.8	8
COMP	7		3		2		2		5		4		3.2	3
COMP	8		3		3		2		3		5		3.2	3
COMP	9	1		1		3		2		1		4	2	10
COMP	10	3		4		2		1		4		4	3	5

Appendix 6. Instructions for Experiment 2: Translation Task

Activities on the screen	What the experimenter says and *does*	What the participant does
	In this session, you are asked to translate Japanese sentences. You will see the brief appearance of a number followed by Japanese sentence. *Start the screen.*	Looks at the computer screen and listens to the instructions
Appearance of "1"	You will see briefly the number, followed by the Japanese sentence, which you are to translate into English. *Prompt the presentation of the gloss and the sentence. Point at the sentence.* First, read the entire sentence in Japanese aloud. Secondly think aloud and provide an oral translation of only the portion up to the star *. The important task here is to provide the translation of the portion of the sentence from the beginning to the star only. In case you do not know the words, the words and the meanings are provided at the left corner of the screen. *Point at the gloss at the left top corner.* You have 40 seconds to translate. This may be a severe time constraint. What I need to know is how difficult the sentences are, not how well you can translate.	
Gloss at the left top corner, the sentence to translate in the centre		
The screen remains.		
The screen remains (i.e., gloss and the sentence stays) until the second example appears.		
Below the sentence, "Ten More Seconds Left" appears with a correct beep. It remains.	30 seconds later, you will see under the Japanese sentence "Ten More Seconds Left." *Present 'Ten More Seconds Left."*	
"Ten More Seconds Left" disappears, and 'Five More Seconds Left" appears instead with a correct beep. It remains.	When only five more seconds are left, you will see 'Five More Seconds Left" again under the sentence to translate. *Present "Five More Seconds Left."*	
"Five More Seconds Left" disappears, and "Time Is Up" appears with a done beep. It remains.	When time is up, you will see "Time Is Up" under the sentence. *Present "Time Is Up."*	
	Then the screen will change to the next	

Appearance of "2" "2" in one second disappears, and the gloss at the left top corner and a sentence to translate in the centre appear. The screen remains. The screen changes to the next example with rest beep. Presentation of "3" Gloss at the left top corner, a sentence to translate in the center In 30 seconds, "Ten More Seconds Left" appears with a correct beep below the sentence, which remains for 4 seconds. In 35 Seconds, "Five More Seconds Left" appears with correct beep below the sentence, which remains for 3.5 seconds. Right after "Five More Seconds Left" disappears, "Time Is Up" with a done beep appears at the same position, which disappears simultaneously with the gloss and the Japanese sentence in 1.5 seconds. "Are you ready" message	example. *Prompt the second example.* Now can you translate this sentence and say the English translation aloud? It is possible it may not take 40 seconds to finish translating the sentence. Or you might think the sentence is too weird or difficult to translate. In those cases you may wish to go faster to the next sentence. Hit the space bar to go to the next sentence before the time limit of 40 seconds. Please hit the space bar and translate the third example. *Ask the participant to hit the space bar.* *If the participant is able to translate in less than 40 seconds, suggest he/she hits the space bar. If it takes longer than 40 seconds, tell him/her that it is really OK because what is supposed to be observed is how difficult the sentence is.* Do you have any questions? You will translate 40 Japanese sentences. If you can go faster, hit the space bar to go to the next sentence faster. Otherwise, the screen will change automatically. All you need to do is to look at the screen and translate the sentence. *Start the tape recorder. Ask the participant to hit the space bar to start the translation task.*	Read the second example in Japanese. Think aloud and translate the portion from the beginning to the * of the sentence orally. Hit the space bar. Read the sentence and translate up to *. If the translation is done in less than 40 seconds, the participant hits the space bar which finishes with a rest beep the screen with the third example. If the translation takes longer, the participant will see the warning signs of how many more seconds left on the screen. Ask questions if necessary.

Appendix 7. Translation and the Scores for 40 NMCs by 11 English JSL

(~10more sec.warning ring, !5 more sec.warning ring, /time's up ring, *done ring by the participant)

CN1	Appeared as 9th sentance to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the result of eating too much at the restaurant yesterday*	1	1	1	1	1
E2	yesterday~the cost !/	0	0	0	0	0
E3	the result of overeating at the restaurant yesterday*	1	1	1	1	1
E4	as a result of the fact that I ate too much at the restaurant yesterday*	1	1	1	1	1
E5	the result of yesterday's restaurant overeating result of~yesterday's restaurant!/	1	1	1	1	1
E6	the results of eating too much yesterday in a restaurant*	1	1	1	1	1
E7	the restaurant that I ate too much at yesterday~!/	0	0	0	0	0
E8	the result of eating overeating~ yesterday in a restaurant!/	1	1	1	1	1
E9	due to the fact I overate at yesterday's restaurant*	1	1	1	1	1
E10	the results of eating too much at the restaurant yesterday*	1	1	1	1	1
E11	the results of eating too much at the restaurant yesterday*	1	1	1	1	1

CN2	Appeared as 26th sentance to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the reason why I didn't go to the piano lessons*	1	1	1	1	1
E2	the reason why I didn't~ go to the piano lessons!/	1	1	1	1	1
E3	reason for not going to the piano lesson*	1	1	1	1	1
E4	the reason why I didn't go to my piano lesson*or actually the reason why I didn't go to my piano lesson	1	1	1	1	1
E5	the reason~ for not going to piano lessons!/	1	1	1	1	1
E6	the reason why I don't go to the piano lesson*	1	1	1	1	1
E7	piano lesson I didn't come reason~ the reason I didn't come to the piano lessons!/	1	1	1	1	1
E8	the reason why I didn't go the reason why I don't go to my piano~ lesson!/	1	1	1	1	1
E9	the reason why I didn't go to the piano lesson*	1	1	1	1	1
E10	the reason for not going to the piano lesson*	1	1	1	1	1
E11	the reason of not going to the piano lesson*	1	1	1	1	1

CN3	Appeared as 16th sentance to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	more prior to the plane taking off for Asia*	1	1	1	1	1
E2	~I just the moment before the plane/ left for Asia	1	1	1	1	1
E3	just before the departure of~the plane in Asia!*	1	1	1	1	1
E4	right before the airplane departed for Asia*	1	1	1	1	1
E5	!the airplane left a moment ago Asian /plane left a moment ago	0	0	0	0	0
E6	before the plane to Asia took off*	1	1	1	1	1
E7	before I left/ for Asia	1	1	1	1	1
E8	~the moment prior to the plane departing for! Asia/	1	1	1	1	1
E9	right before the plane going to Asia took off*	1	1	1	1	1
E10	the moment prior to the plane's departure for Asia*	1	1	1	1	1
E11	right before just a moment before the plane to Asia took off take off*	1	1	1	1	1

CN4	Appeared as 20th sentance to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	while two white cars were running~, right, while two white cars running!*	0	1	1	1	0
E2	two white cars~ while two white cars are running! a black dog/	0	1	1	1	0
E3	between the two white cars that are running*	1	1	1	1	1
E4	during the time two white cars were passing*	0	1	1	1	0
E5	!/	0	0	0	0	0
E6	between the space between the two the racing the two white cars racing or racing two white cars*	1	1	1	1	1
E7	~the two cars two white !cars were running down the street/	0	0	0	0	0
E8	~two white cars! the time two white cars are running/	0	1	1	1	0
E9	in between the two, in between the two cars that were running, they were actively moving~*	1	1	1	1	1
E10	while the two white cars were running*	0	1	1	1	0
E11	while there are two white cars running by while there are two cars running*	0	1	1	1	0

CN5	Appeared as 3rd sentance to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	like old man~so the old man the magazine the old man !was reading on his side, while on the side/	1	0	0	0	0
E2	grandfather reads newspapers~ magazines!/	0	0	0	0	0
E3	the side grandfather reading the newspaper, oh magazine*	1	1	1	1	1
E4	beside old guy reading a magazine*	1	1	1	1	1
E5	grandfather~is reading mazzginesion the side this makes no sense/	1	0	0	0	0
E6	beside the elderly man~ who was reading a magazine!*	1	1	1	1	1
E7	grandfather see read a magazine that grandfather read~ beside! Beside the grandfather/	1	0	1	0	0
E8	~by a side of old men who are reading magazines!/	1	1	1	1	1
E9	to the side of the grand, old guy who is reading the magazine*	1	1	1	1	1
E10	the side or area where the grandfather old man was reading the magazine*	1	1	1	1	1
E11	next to the old gentleman reading the magazine*	1	1	1	1	1

CN6	Appeared as 7th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	noisy so somewhere around elementary the noisy the noisy elementary school kids are gathered~°	1	1	1	1	1
E2	with noisy elementary students~/	0	0	0	0	0
E3	noisily that elementary students somewhere around with the elementary students are gathered~°	1	1	1	1	1
E4	around the place where a bunch of elementary students are gathering and playing°	1	1	1	1	1
E5	I found~a hat was found somewhere! around where elementary students noisily gathered/	1	1	1	1	1
E6	the area where~the the area where elementary students were!gathered noisily°	1	1	1	1	1
E7	~noisy noisily!elementary students gathered/	0	0	0	0	0
E8	elementary school students~ were assembled noisily somewhere!/	0	0	0	0	0
E9	around the place where the elementary school students are having fun°	1	1	1	1	1
E10	the area where noisy elementary school children are gathered°	1	1	1	1	1
E11	somewhere the students gathered noisily somewher ~elementary students gathered noisily°	1	1	1	1	1

CN7	Appeared as 29th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	behind the big building, um, yeah I guess°	1	1	1	0	0
E2	~/	0	0	0	0	0
E3	back side~! the backside of the large building/	1	1	1	0	0
E4	behind where the big building was built°	1	1	1	1	1
E5	backside~ built backside the big bill!/	1	1	0	0	0
E6	the the back of the big building°	1	1	1	0	0
E7	the big building ~ built !the big building that was built on the backside backside of the big building/	1	1	1	1	1
E8	the backside~ of the building the building !that was built	1	1	1	1	1
E9	behind the big building that was just built°	1	1	1	1	1
E10	backside of the big building, the big built building°	1	1	1	1	1
E11	on the backside of the huge building, ~on the backside! of the huge building/	1	1	1	0	0

CN8	Appeared as 22nd sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the sound of the bus going through the main street°	1	1	1	1	1
E2	~the!the sound of the bus on main street/	1	1	1	0	0
E3	the noise of the bus passing through main street or passing on main street°	1	1	1	1	1
E4	the sound of buses passing on the main audry°	1	1	1	1	1
E5	a passing sound a sound which passes~ the bus sound on the street!/	1	1	1	0	0
E6	the sound of the bus passing the the main street°	1	1	1	1	1
E7	~the bus going down !the street/	0	0	0	0	0
E8	~the sound when the buses pass the main street!/	1	1	1	1	1
E9	the sound from the buses that are on the main street°	1	1	1	1	1
E10	the noise that the bus passing down the main street°	1	1	1	1	1
E11	the noise of the bus passing through the main street°	1	1	1	1	1

CN9	Appeared as 33rd sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	society so member of the society so if you want to become a member useful member of the society you have to study I guess°	1	0	0	0	0
E2	~/	0	0	0	0	0
E3	studying to become a useful member of society°	1	1	1	1	1
E4	the study or hard work to become a useful member of society°	1	1	1	1	1
E5	~lone, a member studies as useful to society/	1	0	1	0	0
E6	a study which ~will allow one to become a member! and is useful/ in society	1	1	1	1	1
E7	~to be useful to be a useful member of to become ! a useful member of the society/	0	0	0	0	0
E8	~study to become a useful member of society!/	1	1	1	1	1
E9	if I do work that would help me become a member of the society°	1	0	1	1	0
E10	study for becoming a useful member of the society°	1	1	1	1	1
E11	the study of becoming a useful member of the study°	1	1	1	1	1

CN10	Appeared as 39th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	after a long time of not being in Kyoto! I stayed over night then in the morning! I guess°	1	0	1	1	0
E2	after the long while! the morning the morning /we stayed overnight in Kyoto	1	0	0	0	0
E3	the morning that I stayed in Kyoto after in a very long time°	1	1	1	0	0
E4	the morning I stayed in Kyoto after some years°	1	1	1	0	0
E5	~the morning of having stayed in Kyoto!after a long time/	1	1	1	1	1
E6	the morning that I stayed over in Kyoto~after a long interval°	1	1	1	0	0
E7	a long time ago~ in Kyoto !stayed over night/	0	0	0	0	0
E8	after long~ interval the morning! I stayed overnight in Kyoto	1	0	0	0	0
E9	the first time that in a long time that I stayed in Kyoto the next morning°	1	0	0	0	0
E10	the morning that I stayed in Tokyo for the first time in a while, not Tokyo, Kyoto°	1	1	1	0	0
E11	the morning the after the morning of having stayed in Tokyo the morning of having stayed in Kyoto overnight after a long time°	1	1	1	1	1

COMP1	Appeared as 10th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the final, a phone call--regarding the tennis final, regarding I guess winning the tennis finals*	1	1	1	1	1
E2	--I/	0	0	0	0	0
E3	phone call saying that someone won a final tennis match*	1	1	1	1	1
E4	a phone call to the effect that someone won the tennis final*	1	1	1	1	1
E5	--!phone call winning tennis match/	1	1	1	1	1
E6	the telephone call saying that someone saying someone won the tennis match--*	1	1	1	1	1
E7	I/	0	0	0	0	0
E8	--phone call which tells about winning the tennis! final/	1	1	1	1	1
E9	the phone call alerting the victory that they had in tennis--*	1	1	1	1	1
E10	the phone call about winning the tennis final*	1	1	1	1	1
E11	the phone call of winning the tennis championship*	1	1	1	1	1

COMP2	Appeared as 8th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	second hand piano, advertisement about regarding second hand piano for sale--*	1	1	1	1	1
E2	about the advertisement about selling the piano--has reached/	1	1	1	1	1
E3	the advertisements for selling second hand pianos*	1	1	1	1	1
E4	advertisement with regard to the sale of used piano*	1	1	1	1	1
E5	advertisement advertising second hand pianos reached-- reaching many homes!/	1	1	1	0	0
E6	the advertisements for which the advertisement for selling a used piano--*	1	1	1	1	1
E7	second hand piano--advertisement for second hand piano!/	1	1	1	0	0
E8	an advertisement-- which sells second hand piano!/	1	1	1	1	1
E9	advertisement that say that they are selling old pianos, second hand pianos actually*	1	1	1	1	1
E10	advertisement that sell second hand pianos*	1	1	1	1	1
E11	the advertisement that says there are second hand pianos for sale*	1	1	1	1	1

COMP3	Appeared as 13th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	questions about are there are going to be Christmas presents or not*	1	1	1	1	1
E2	questions about Christmas presents--I/	1	1	1	0	0
E3	questions about of questions about Christmas--presents*	1	1	1	0	0
E4	a question for questions as to whether there are Christmas presents*	1	1	1	1	1
E5	questions about what if there are Christmas presents--I/	1	1	1	1	1
E6	question about whether there are Christmas presents*	1	1	1	1	1
E7	christmas present --questions about a!Christmas present/	1	1	1	0	0
E8	the question which asks-- if there are Christmas presents!/	1	1	1	1	1
E9	questions, keep on asking if the Christmas presents are there, if you have Christmas presents*	1	1	1	1	1
E10	question of whether questions of whether or not there were Christmas presents*	1	1	1	1	1
E11	the question of asking whether there are Christmas presents*	1	1	1	1	1

COMP4	Appeared as 35th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	an opinion expressing that woman must be in the house*	1	1	1	1	1
E2	--about about! the beginning about the conversation/	0	0	0	0	0
E3	the opinion that if you are woman you should be in the house*	1	1	1	1	1
E4	the opinion that if you are woman you need to stay in the house*	1	1	1	1	1
E5	--woman in a home! /beginning	0	0	0	0	0
E6	the opinion which says that if you are a woman you should be in the house*	1	1	1	1	1
E7	--women in homes! /	0	0	0	0	0
E8	--!the opinion of women being in the house/	1	1	1	0	0
E9	the opinion that women has to stay in the house*	1	1	1	1	1
E10	opinion that if you are women you should stay in the home*	1	1	1	1	1
E11	the opinion of woman the opinion of if being a woman one should stay home*	1	1	1	1	1

COMP5	Appeared as 19th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	no matter what--I have a desire, the desire to see!inside the room/	1	1	1	1	1
E2	--I/	0	0	0	0	0
E3	the the wish of no matter how much you want to see--the room*	1	1	1	1	1
E4	my desire to see the inside of the room no matter what*	1	1	1	1	1
E5	no matter how much you-- see a messy room! no matter how much you see/ the middle of the room/	0	0	0	0	0
E6	my wish to see--to see inside the room!at any cost/at any circumstances*	1	1	1	1	1
E7	in the middle of the room--I/	0	0	0	0	0
E8	the urge rise there-- is the urge! to see inside the room/	1	1	1	1	1
E9	the urge to see inside the room incredible urge*	1	1	1	1	1
E10	the desire to absolutely see the inside of the room no matter what--*	1	1	1	1	1
E11	the desire or the desire of one way of another seeing the inside of the room wanting to see the inside of the room*	1	1	1	1	1

COMP6	Appeared as 32nd sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	even hum, so the patience~ to or endurance to read to keep on reading the same! thing the same yeah thing/ yacky	1	1	1	1	1
E2	~I/	0	0	0	0	0
E3	the patience continuing patience continuing~ patience reading the same! thing even though it's not very good/	1	1	1	1	1
E4	the patience or endurance to keep reading the same work of literature even if it is really annoying*	1	1	1	1	1
E5	~I/	0	0	0	0	0
E6	the patience to keep reading the same~the same piece even though! it's unpleasant*	1	1	1	1	1
E7	/	0	0	0	0	0
E8	I/	0	0	0	0	0
E9	even though I dislike it if I continue reading*	0	0	0	0	0
E10	endurance for or the patience for~ reading bad writing! must be the same as reading good*	1	1	1	1	1
E11	to endure reading to endure~ to endure the continuous reading of the same !work even though/	1	1	1	1	1

COMP7	Appeared as 25th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the memory that I have about playing naked in the snow, on top of the snow*	1	1	1	1	1
E2	~playing on the on the I remember!playing on the snow/	1	0	1	1	0
E3	memories of playing naked on the snow*	1	1	1	1	1
E4	my memory of playing naked on the snow*	1	1	1	1	1
E5	!memories of playing in the snow/	1	1	1	1	1
E6	the memory of playing on top of the snow naked*	1	1	1	1	1
E7	snow about the snow! playing memories/	1	1	0	0	0
E8	~!the memory of playing naked in the snow/	1	1	1	1	1
E9	the memories of playing on top of the snow naked*	1	1	1	1	1
E10	the memories of playing in the snow naked*	1	1	1	1	1
E11	the memories of playing naked on the snow*	1	1	1	1	1

COMP8	Appeared as 4th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	~kids so the playground with kids!or something increasing , the petition to increase/the playground that kids are playing	1	1	1	1	1
E2	the children's playground~ they are wanting! regarding children's playground/	0	0	0	0	0
E3	the petition calling for increasing children's playground*	1	1	1	1	1
E4	petition to increase the number of playground for children*	1	1	1	1	1
E5	~children's playground!petitions for children't playground/	1	1	1	0	0
E6	the petition~to increase the number of! children's playground*	1	1	1	1	1
E7	!children's playground/	0	0	0	0	0
E8	~I/	0	0	0	0	0
E9	a petition worrying to increase the number of the playgrounds for kids~*	1	1	1	1	1
E10	the petition requestin the increase in the playgrounds for children~*	1	1	1	1	1
E11	the complaint of children's playground increasing*	1	1	1	0	0

COMP9	Appeared as 38th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	~logic !that says to be late or/ hurry	1	1	1	1	1
E2	~I/	0	0	0	0	0
E3	~the logic of being late no matter how much you hurry!/*	1	1	1	1	1
E4	the logic or fact that the more you hurry the later you get~*	1	1	1	1	1
E5	~the more !you hurry/ the logic	1	0	0	0	0
E6	reasoning which says that the more you hurry the more you are late~*	1	1	1	1	1
E7	/	0	0	0	0	0
E8	~the more you hurry! the more/	0	0	0	0	0
E9	the logic you only hurry as much as you need to hurry*	1	1	1	1	1
E10	logic that says the more you hurry the more tired the later you become*	1	1	1	1	1
E11	the logic of the logic of the more you rush~ you will become late the logic of the more you rush the more you late*	1	1	1	1	1

COMP10	Appeared as 24th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the decision to rebuild the library~*	1	1	1	1	1
E2	the decision to rebuild the library~I know is now!/	1	1	1	1	1
E3	the decision to rebuild the library*	1	1	1	1	1
E4	the decision to rebuild the library*	1	1	1	1	1
E5	rebuilding of the library~ decision the decision to rebuild the library!/	1	1	1	1	1
E6	the decision to rebuild the library*	1	1	1	1	1
E7	~the library rebuilding of the library!/	0	0	0	0	0
E8	the decision to~ rebuild the library!/	1	1	1	1	1
E9	the decision to rebuild the library*	1	1	1	1	1
E10	the decision to rebuild the library*	1	1	1	1	1
E11	the decision of the decision of rebuilding the library*	1	1	1	1	1

GR1	Appeared as 5th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	~by yourself! even yourself you notice your unhappiness/	0	0	0	0	0
E2	~!/	0	0	0	0	0
E3	~even yourself not realizing~ education becoming unhappy/	1	0	1	0	0
E4	~!the study that makes me unhappy even/ half my nose in	1	1	1	1	1
E5	!/	0	0	0	0	0
E6	~learning which!/*	1	0	0	0	0
E7	your own feeling!/	0	0	0	0	0
E8	~!/	0	0	0	0	0
E9	instead of taking education that ~does not make you happy*	1	1	1	1	1
E10	education that causes you~ not to notice suffering/causes one* not to notice suffering	1	1	1	1	1
E11	the education, ~! the education/	1	0	0	0	0

GR2	Appeared as 2nd sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	meal, with everyday meals, I guess with exercise everyday meals become delicious~!/	1	0	1	1	0
E2	everyday~people/every day meal/	0	0	0	0	0
E3	everyday meal exercise of making everyday meal tasty*	1	1	1	1	1
E4	exercises that make your everyday meal taste good*	1	1	1	1	1
E5	~lexercising everyday/	1	0	0	0	0
E6	exercise which makes everyday meals~more tasty*	1	1	1	1	1
E7	everyday~ meals are/better if you exercise/	1	0	1	1	0
E8	everyday meals that become delicious exercise~!/	1	0	0	0	0
E9	tasty exercise~everyday snack! becomes exercise becomes more tasty/	1	0	1	0	0
E10	the exercise or practice of making everyday practice~ of making delicious meal*	1	0	1	0	0
E11	exercise exercise that makes meal more delicious every day*	1	1	1	1	1

GR3	Appeared as 14th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the person, who I guess the champion~ the prize for the champion for the violin contest!*	1	1	1	0	0
E2	the first prize~ for the violin contest! at that times is/ I think five dollars	1	1	1	0	0
E3	at the violin contest the prize money for having been number one~*	1	1	1	1	1
E4	the prize for or prize for being first place at the violin contest*	1	1	1	1	1
E5	the prize for coming first in the piano contest~!/	1	1	1	1	1
E6	first prize in a violin contest~*	1	1	1	0	0
E7	a violin at the violin contest~ if you are first ! The first prizes/	1	0	0	0	0
E8	the first prize of the violin contest!/	1	1	1	0	0
E9	the prize money for getting the first in the violin concert*	1	1	1	1	1
E10	the prize for taking the first place in the violin contest*	1	1	1	1	1
E11	the prize money or the prize of becoming the champion or winnin the prize money of becoming the champion of the violin contest~!*	1	1	1	1	1

GR4	Appeared as 17th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the fatigue from not sleeping at all last night*	1	1	1	1	1
E2	since yesterday I didn't get any sleep and~ both my eyes are bothering!/	0	0	0	0	0
E3	not being able to tired not being able to sleep at all since yesterday*	1	0	0	0	0
E4	the fatigue I have been feeling since yesterday I couldn't sleep at all*	1	1	1	0	0
E5	no sleep~ yesterday so eyes are very wearyshowing fatigue!/	1	0	0	0	0
E6	tiredness from not being able to sleep at all since yesterday*	1	1	1	1	1
E7	from yesterday I didn't sleep at all~ so I was tired! /	1	0	1	1	0
E8	~tiredness from! not sleeping at all yesterday from yesterday/	1	1	1	1	1
E9	because I wasn't able to sleep the from being exhausted from not being able to sleep the night before*	1	1	1	1	1
E10	the exhaustion from not sleeping at all not being able to sleep at all yesterday*	1	1	1	1	1
E11	the fatigue of not getting enough sleep at all yesterday*	1	1	1	1	1

GR5	Appeared as 34th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the practice in order to definitely win the chess game*	1	1	1	1	1
E2	to win~ the chess game! /	0	0	0	0	0
E3	practicing to definitely win in the chess for the chess game*	1	1	1	1	1
E4	practice that would let you win every chess game*	1	1	1	1	1
E5	practicing without fail~ for the chess game!/	1	1	1	0	0
E6	a practice which will allow a allow winning a chess game without fail*	1	1	1	1	1
E7	to ensure ~to win the chess game!practice/	1	0	0	0	0
E8	~!chess/	0	0	0	0	0
E9	the practice you need to do to win in chess*	1	1	1	1	1
E10	practice for definitely winning a game of chess*	1	1	1	1	1
E11	the practice of being the practice the practice of winning chess without failure~*	1	1	1	1	1

GR6	Appeared as 11th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	from night until morning~sleep from night until morning, to be able to sleep!something about/	0	0	0	0	0
E2	from~ morning night from morning!/	0	0	0	0	0
E3	from~night to moring sleepwalking!/	0	0	0	0	0
E4	a leasurely walk that will let you sleep from morning from night to morning*	1	1	1	1	1
E5	~taking a walk after! waking up/after last night	1	0	0	0	0
E6	the walk which allows~sleeping from night to morning!*	1	1	1	1	1
E7	/	0	0	0	0	0
E8	~last night to morning sleep!/	0	0	0	0	0
E9	~from the night to day !they sleep walkers/	0	0	0	0	0
E10	~!/	0	0	0	0	0
E11	the walk, ~!/	1	0	0	0	0

GR7	Appeared as 23rd sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the breakfast wait from the time I wake up~without preparing breakfast, it is!OK not to prepare breakfast/ from waking up	1	0	1	1	0
E2	from getting up after getting up we prepare~breakfast!/	1	0	1	1	0
E3	from waking up not having~it's OK not to do!or having to prepare/	0	0	0	0	0
E4	breakfast that I don't really have to prepare right after I get up*	1	1	1	1	1
E5	~preparing it's good to be! good to prepare get up and prepare/breakfast	1	0	1	0	0
E6	the breakfast which I don't have to prepare~after getting up*	1	1	1	1	1
E7	from the time I wake !up / some preparation	0	0	0	0	0
E8	~after waking do not prepare! a good breakfast/	1	0	1	0	0
E9	breakfast that you don't have to prepare right after you wake up*	1	1	1	1	1
E10	breakfast that does not need preparation once you wake up*	1	1	1	1	1
E11	~the breakfast that doesn't have to be prepare after! waking up/	1	1	1	1	1

GR8	Appeared as 31st sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the separation~ so since long time ago ! the preparations/	1	0	0	0	0
E2	certainly before~!/	0	0	0	0	0
E3	from the preparation~ done from while ago the seperating preparation! done from while ago*	1	0	1	0	0
E4	the separation for which I have been planning since a long time ago*	1	1	1	1	1
E5	~separation the!the separation or separated long time ago/	1	0	0	0	0
E6	the the parting which I have been preparing~for sometime!*	1	1	1	1	1
E7	~from before! since from before/	0	0	0	0	0
E8	~!/	0	0	0	0	0
E9	the separation that have I prepared from way before*	1	1	1	1	1
E10	the breakup that I have been preparing for a long time*	1	1	1	1	1
E11	departing which was prepared all alone from before since while ago*	1	1	1	1	1

GR9	Appeared as 27th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the~in the movie where you can understand the plot within!the first five minutes*	1	1	1	1	1
E2	~five minutes at the !beginning of the movie/	1	0	1	0	0
E3	a movie we understand the plot within the first five minutes*	1	1	1	1	1
E4	movies where you can get the plots within the first five minutes*	1	1	1	1	1
E5	the first five minutes of the plot in the movie~was understood very !is understood/	1	0	1	0	0
E6	a movie where the plot can be understood in the first five minutes*	1	1	1	1	1
E7	first five minutes~ the movie ! /	1	0	0	0	0
E8	~the movie where I could understand the plot in five minutes/	1	1	1	1	1
E9	the movie that I don't understand the plot for the first five minutes*	1	1	1	1	1
E10	movies where you figure out the plot in the first five minutes*	1	1	1	1	1
E11	the film where by the plot is understood in the first five minutes*	1	1	1	1	1

GR10	Appeared as 37th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	pure white shirt that got blacken in the laundry*	1	0	1	1	0
E2	before ~laundry!the laundry/	1	0	0	0	0
E3	doing the laundry of a white pure white shirt that became black~*	1	1	1	1	1
E4	laundry that makes a perfectly white shirt go black*	1	1	1	1	1
E5	pure white shirt becomes~black !the laundry is for shirt/	1	0	0	0	0
E6	washing~washing!s completely white shirt that /has turn black	1	1	1	1	1
E7	a completely white shirt~ became black! in a wash/	1	0	1	1	0
E8	~washing that makes pure white! T shirts black become black/	1	1	1	1	1
E9	~the dirty shirts that are supposed to be white!*	0	0	0	0	0
E10	laundry process that turns pure white shirts black*	1	1	1	1	1
E11	the laundry where my white shirt~ had become black*	1	1	1	1	1

RR1	Appeared as 1st sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	music that has been used to comfort, hurt people's hearts--music that has been used !to comfort hurt people's hearts/	1	1	1	1	1
E2	~I/	0	0	0	0	0
E3	music that comforts the hearts of people who are hurt*	1	1	1	1	1
E4	music that can sooth the soles of injured people or wounded people*	1	1	1	1	1
E5	*[did not finish reading the stimulus]*	0	0	0	0	0
E6	music which sooth the hurt heart of people*	1	1	1	1	1
E7	~the person! Person's heart to be/	0	0	0	0	0
E8	I/	0	0	0	0	0
E9	song that comforts a person with a scar in their hearts*	1	1	1	1	1
E10	the music of or the music that soothe the hearts of injured people*	1	1	1	1	1
E11	the music that comforts hearts of people that are hurt*	1	1	1	1	1

RR2	Appeared as 36th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	beautiful oh, in a beautiful glass box the um the doll came~ from Canada, yeah, the doll, the Canadian! so the doll that's in the beautiful glass/ box	1	1	1	1	1
E2	~put inside the pretty glass box!the doll that was put inside the glass/box	1	1	1	1	1
E3	the doll in the doll inside of the pretty glass box*	1	1	1	1	1
E4	the doll that's in the pretty glass box*	1	1	1	1	1
E5	doll in a box the doll which is put in a box! a glass a nice glass/	1	1	1	1	1
E6	the doll which was inside the pretty glass box*	1	1	1	1	1
E7	beautiful glass box in which~ there is a doll/	1	0	1	1	0
E8	~fineide the pretty glass box the doll/	1	0	0	0	0
E9	the beautiful doll inside the glass box*	1	1	1	1	1
E10	the doll that pretty doll that are in a glass box*	1	1	1	1	1
E11	the doll that is inserted into or placed in the beautiful glass box*	1	1	1	1	1

RR3	Appeared as 15th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the gym the training place, where~there were money no matter how much money!donated to dojo, the gym,the training place/	1	0	1	1	0
E2	when donating money~for the gym!/	1	0	1	1	0
E3	the~the gym that donated however much money!*	1	1	1	0	0
E4	the dojo that I donated a bunch or money or some money to*	1	1	1	1	1
E5	the dojo !the dojo which donated money or not how much/	1	1	1	0	0
E6	the training place to which I donated a sum of money~*	1	1	1	1	1
E7	~no matter how much !money /	0	0	0	0	0
E8	~how much money is !donated to the training place/	1	0	1	1	0
E9	the dojo that you rent money to, donated money to*	1	1	1	1	1
E10	~I/	0	0	0	0	0
E11	~I/	0	0	0	0	0

RR4	Appeared as 18th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	~the face that is not wearing any make that is already!had make up taken off face with no make up on it/	1	1	1	1	1
E2	applying face cosmetics to the face~I/	1	0	1	1	0
E3	a face ~where make-up heavily applied!cosmetics heavily applied/*	1	1	1	1	1
E4	faces thickly laid on with cosmetics*	1	1	1	1	1
E5	the face which is made up with make-up~!*	1	1	1	1	1
E6	a face which a face which has make-up applied thickly~*	1	1	1	1	1
E7	if you use cosmetics on your~ face face that has cosmetics on it!/	1	1	1	1	1
E8	a face applied with makeup~I/	1	1	1	1	1
E9	face plastered with make-up*	1	1	1	1	1
E10	face with cosmetics applied*	1	1	1	1	1
E11	the face that has very thick make-up*	1	1	1	1	1

RR5	Appeared as 30th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the research for the past five from since the five years we started five years ago~ alone one person continuing the research!*	1	0	1	1	0
E2	~it seems that before five years!/	0	0	0	0	0
E3	the research that's being continuing by one person or person's own from five years ago*	1	1	1	1	1
E4	the research I kept doing alone since five years ago another word for five years*	1	1	1	1	1
E5	the research the completed research--lone person continued the research/five years	1	0	1	1	0
E6	the research which I have continued for five years by myself*	1	1	1	1	1
E7	five years ago~ by myself! / continue	0	0	0	0	0
E8	the research has continued~ for five years ago by one person!/	1	0	1	1	0
E9	the research that I have done myself for five years*	1	1	1	1	1
E10	that the research that the person has been doing alone continuing alone for the last five years*	1	1	1	1	1
E11	the research which I have continued, the research that is continued by oneself from five years ago*	1	1	1	1	1

RR6	Appeared as 6th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	because it was cheap during student days because it was cheap during my student days the trains that I used~°	1	0	1	1	0
E2	students' students who~ use cheap trains/	1	0	1	1	0
E3	the train I often used when I was a student because it was cheap°	1	1	1	1	1
E4	the train that I used a lot because it was cheap when I was a student°	1	1	1	1	1
E5	~students using cheap trains often is happening less and less/	1	0	1	1	0
E6	the trains which I used which I used in my student days because they were inexpensive~°	1	1	1	1	1
E7	~students ! /	0	0	0	0	0
E8	the train that I used often~ because when I was students it was cheap!/	1	1	1	1	1
E9	the train that you used because it was cheap during your students years°	1	1	1	1	1
E10	the train that students used often because it was very cheap or student days~ the train that often used during my students time because it was cheap°	1	1	1	1	1
E11	the train the train that I used often because it was cheap when I was a student/	1	1	1	1	1

RR7	Appeared as 12th sentence to be translated	Criteria				
	Response	A	B	C	D	Score
E1	successful~city where there are people are rich andleven poor/	1	1	1	0	0
E2	~the rich and the poor! both the rich and the poor succeed/	0	0	0	0	0
E3	cities where both rich and the poor succeed~°	1	1	1	1	1
E4	a city where the rich and the poor succeed°	1	1	1	1	1
E5	~wealthy people alsolsucceed in the city/	1	0	1	1	0
E6	a city where either the rich or the poor could succeed or can succeed°	1	1	1	1	1
E7	rich people and~ poor people! To succeed to succeed in the city/	1	0	1	1	0
E8	a city where both rich and poor succeed!/	1	1	1	1	1
E9	you won't find a city where everyone succeeds°	1	1	1	1	1
E10	cities where both the rich and the poor succeed°	1	1	1	1	1
E11	cities where both poor and rich succeed°	1	1	1	1	1

RR8	Appeared as 28th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the bride and bridegroom coming out from the church, so the bride and bridegroom coming our from the church°	1	0	1	1	0
E2	~the bride and groom left the church! /white flowers	1	0	1	1	0
E3	the church where the bride and groom come out of°	1	1	1	1	1
E4	the church into which, the church from which~ the bride and the groom emerged°	1	1	1	1	1
E5	!the bride and the groom left the church/ all over the place	1	0	1	1	0
E6	the church the church from which the bride and the groom come out or emerge~°	1	1	1	1	1
E7	bride and groom/	0	0	0	0	0
E8	~the bride and the groom! depart and come to the church/	1	0	1	0	0
E9	the church where the bride and the bridegroom came out°	1	1	1	1	1
E10	the church where the bride and the bridegroom came out°	1	1	1	1	1
E11	the church where the bride and the bridegroom came out°	1	1	1	1	1

RR9	Appeared as 40th sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the reporter and the patrol car~ going toward the hospital°	1	0	1	1	0
E2	~with the patrol carlwith the reporter/is going toward the hospital	1	0	1	1	0
E3	the hospital~ facing toward the reporterland the patrol car/	1	1	1	0	0
E4	the hospital the hospital toward which the reporter and the police cars were headed°	1	1	1	1	1
E5	!hospital/	1	0	0	0	0
E6	the hospital to which the the reporters and the patrol cars were headed°	1	1	1	1	1
E7	the reporter ! with the patrol car went toward the hospital/	1	0	1	1	0
E8	!patrol car goes toward hospital/	1	0	1	1	0
E9	the hospital to which the reporters and the police cars were going to°	1	1	1	1	1
E10	the hospital that the reporters and the patrol cars arrive at°	1	1	1	0	0
E11	the hospital the hospital where the reporters and the patrol cars are heading towards are going towards~°	1	1	1	1	1

RR10	Appeared as 21st sentence to be translated	Criteria				
JSL#	Response	A	B	C	D	Score
E1	the square that I used to pass through every day when I was small°	1	1	1	1	1
E2	~leveryday /	0	0	0	0	0
E3	a square that when I was small passed through every day°	1	1	1	1	1
E4	the square that I went through or passed everyday when I was a kid°	1	1	1	1	1
E5	~!passway building the square everyday/	1	0	0	0	0
E6	the square I took everyday as a child°	1	1	1	0	0
E7	~everyday looks like everyday!/	0	0	0	0	0
E8	~the square I passed! everyday when I was young/	1	1	1	1	1
E9	when I was really small the field that I always passed everyday°	1	1	1	1	1
E10	the the square that I passed almost every day near during my childhood times°	1	1	1	1	1
E11	the square where I passe by everyday when I was young the squre I passed by almost everyday when I was little°	1	1	1	1	1

Appendix 8. Correct Translation According to Strategies

8A. Correct Translation for COMP According to Strategies

Strategy 1 Relation Unspecified	The opinion that if you are woman you should be in the house The opinion that if you are woman you need to stay in the nouse The opinion that women has to stay in the house Opinion that if you are women you should stay in the home The logic that the more you hurry the later you get The logic you only hurry as much as you need to hurry The desire to see inside the room My desire to see the inside of the room no matter what My wish to see inside the room at any cost The urge to see inside the room ("used twice") The desire to absolutely see the inside of the room no matter what Endurance to keep on reading the same thing Endurance to keep reading the same work of literature The patience to keep reading the same piece The petition to increase the playground that kids are playing Petition to increase the number of playground for children The petition to increase the number of children's playground The decision to rebuild the library ("used nine times") The decision of rebuilding the library Phone call winning tennis match The patience reading the same thing To endure reading of the same work
Strategy 2 Apposition	Phone call saying that someone won a final tennis match The telephone call saying that someone won the tennis match The phone call alerting the victory that they had in tennis Questions asking if the Christmas presents are there An opinion expressing that woman must be in the house A petition worrying to increase the number of the playgrounds for kids The petition requesting the increase in the playgrounds for children The petition calling for increasing children's playground A phone call regarding winning the tennis finals Advertisement regarding second hand piano for sale Phone call which tells about winning the tennis final Advertisement that say that they are selling old pianos The advertisement that says there are second hand pianos for sale The question which asks if there are Christmas presents The opinion which says that if you are a woman you should be in the house Logic that says to be late or hurry Reasoning which says that the more you hurry the more you are late Logic that says the more you hurry the more later you become A question as to whether there are Christmas presents A phone call to the effect that someone won the tennis final Advertisement with regard to the sale of used piano
Strategy 3 Relative	An advertisement which sells second hand piano Advertisement that sell second hand pianos

Clause	The memory that I have about playing naked in the snow
Strategy 4 Wh Adverb	-
Strategy 5 Preposition/ Prepositional Phrase	The phone call of winning the tennis championship Question of whether or not there were Christmas presents The question of asking whether there are Christmas presents The opinion of if being a woman one should stay home The desire of one way of another seeing the inside the room The wish of no matter ho much you want to see the room Memories of playing naked on the snow My memory of playing naked on the snow Memories of playing in the snow The memory of playing on top of the snow naked The memory of playing naked in the snow The memories of playing on top of the snow naked The memories of playing in the snow naked The memories of playing naked on the snow The logic of being late no matter how much you hurry The logic of the more you rush you will become late The patience for reading bad writing The advertisement for selling second hand pianos The advertisement for selling a used piano The phone call about winning the tennis final The advertisement about selling the piano Questions about there are going to be Christmas presents or not Questions about what if there are Christmas presents Questions about whether there are Christmas presents
Strategy 6 Prepositional Head	-

8B. Correct Translation for CN According to Strategies

Strategy 1 Relation Unspecified	The reason I didn't come to the piano lessons The side grandfather reading the newspaper The noise that the bus passing down the main street (The) study or hard work to become a useful member of society Study to become a useful member of society Studying to become a useful member of society
Strategy 2 Apposition	-
Strategy 3 Relative Clause	A study which will allow one to become a member and is useful in society
Strategy 4 Wh Adverb	The reason why I didn't go to the piano lessons ("used twice") The reason why I didn't go to my piano lesson ("used twice") The reason why I don't go to the piano lesson The reason why I didn't go to the piano lesson The side where the grandfather was reading the magazine The area where elementary students were gathered noisily The area where noisy elementary school children are gathered

	Somewhere the elementary students gathered noisily The sound when the buses pass the main street
Strategy 5 Preposition/ Prepositional Phrase	The result of eating too much at the restaurant yesterday The result of overeating at the restaurant yesterday The results of eating too much yesterday in a restaurant The result of overeating yesterday in a restaurant The results of eating too much at the restaurant yesterday ("used twice") The result of yesterday's restaurant overeating The reason of not going to the piano lesson The side of old men who are reading magazines The sound of the bus going through the main street The sound of buses passing on the main audry The sound of the bus passing the main street The noisc of thc bus passing through main strcct The noise of the bus passing through the main street The morning of having stayed in Kyoto after a long time The morning of having stayed in Tokyo overnight after a long time Thc rcason for not going to piano lcssons The reason for not going to the piano lesson The reason for not going to the piano lesson Study for becoming a useful member of the society The sound from the buses that are on the main street
Strategy 6 Prepositional Head	Just the moment before the plane left for Asia Just a moment before the plane to Asia took off The moment prior to the plane departing for Asia The moment prior to the plane's departure for Asia The space between the two white cars racing Somewhere around the noisy elementary school kids are gathering Somewhere around where elementary students noisily gathered Somethere around with the elementary students are gathered The backside of the building that was built Backside of the big built building As a result of the fact that I ate too much at the restaurant yesterday Due to the fact I overate at yesterday's restaurant By a side of old men who are reading magazines To the side of the old guy who is reading the magazine The study of becoming a useful member of the society Before the plane to Asia took off Before I left for Asia Between the two white cars that are running In between the two cars that were running Beside the elderly man who was reading a magazine Beside old guy reading a magazine Around the place where a bunch of elementary students are gathering Around the place where the elementary school students are having fun Behind where the big building was built Behind the big building that was just built On the backside of the big building built

	Right before the airplane departed for Asia Right before the plane going to Asia took off More prior to the plane's departure for Asia Just before the departure of the plane in Asia

8C. Correct Translation for RR According to Strategies

Strategy 1 Relation Unspecified	-
Strategy 2 Apposition	-
Strategy 3 Relative Clause	Music that has been used to comfort hurt people's hearts Music that comforts the hearts of people who are hurt Music that can sooth the soled of injured people Music which sooth the hurt heart of people Song that comforts a person with a scar in their hearts The music that sooth the hearts of injured people He music that comforts hearts of people that are hurt The doll that's in the beautiful glass box The doll that was put inside the glass box The doll that's in the pretty glass box The doll which is put in a glass box The doll which was inside the pretty glass box Pretty doll that are in a glass box The doll that is inserted into or place in the beautiful glass box The beautiful doll inside the glass box* The doll inside of the pretty glass box* The dojo that I donated some money to The dojo that you donated money to The training place to which I donated a sum of money** The face that is not wearing any make The face which is made up with make-up A face which has make-up applied thickly Face that has cosmetics on it The face that has very thick make-up A face applied with make-up* Face plastered with make-up* Faces thickly laid on with cosmetics* The research that's being continuing by one person The research I kept doing alone since five years ago The research which I have continued for five years by myself The research that I have done myself for five years The research that the person has been doing along for last five years The research that is continued by oneself from five years ago The train I often used when I was a student because it was cheap The train that I used a lot because it was cheap when I was a student The trains which I used in my student days because they were inexpensive The train that I used often because when I was a student it was cheap The train that you used because it was cheap during your students years The train that students used often because it was very cheap The train that I used often because it was cheap when I was a student The church from which the bride and the groom emerged** The church from which the bride the groom come out** The hospital toward which the reporter and the police cars were headed**

	The hospital to which the reporters and the patrol cars were headed** The hospital to which the reporters and the police cars were going to** The square I used to pass through every day when I was small The square that when I was small passed ghrough every day The square that I went through or passed everyday when I was a kid The square I passed everyday when I was young The field that I always passed everyday The square that I passed almost every day during my childhood times
Strategy 4 Wh Adverb	A face where make-up heavily applied Cities where both rich and the poor succeed A city where the rich and the poor succeed A city where either the rich or the poor could succeed A city where both rich and poor succeed A city where everyone succeeds Cities where both the rich and the poor succeed Cities where both poor and rich succeed The church where the bride and the bridegroom came out of The church where the bride and the bridegroom came out ("used three times") The hospital where the reporters and the patrol cars are heading towards The square where I pass by every day when I was young
Strategy 5 Preposition/ Prepositional Phrase	Face with cosmetics applied
Strategy 6 Prepositional Head	-

Note. *These two responses were understood as reduced relatives. **'The preposition 'to' introduces relative clause in this reponse. Because 'to' is a part of the verb phrase in the modifying clause, this reponse was understood as a relative clause.

8D. Correct Translation for GR According to Strategies

Strategy 1 Relation Unspecified	Practicing to definitely win in the chess game
Strategy 2 Apposition	-
Strategy 3 Relative Clause	Education that does not make you happy Education that causes you not to notice suffering The study that makes me unhappy even half my nose in Exercises that make your everyday meal taste good Exercise which makes everyday meals more tasty Exercise that makes meal more delicious every day Practice that would let you win every chess game A practice which will allow winning a chess game without fail The practice you need to do to win in chess A leasurely walk that will let you sleep from night to morning The walk which allow sleeping from night to morning Breakfast that I don't really have to prepare right after I get up The breakfast which I don't have to prepare after getting up Breakfast that you don't have to prepare right after you wake up The breakfast that doesn't have to be prepared after waking up Breakfast that does not need preparation once you wakeup The separation for which I have been planning since a long time ago*

	The parting which I have been preparing for sometime The separation that have I prepared from way before The breakup that I have been preparing for a long time Departing which was prepared all along from before since while ago A movie we understand the plot within the first five minutes The movie that I don't understand the plot for the first five minutes Laundry that makes a perfectly white shirt go black Washing that makes pure white T-shirt become black Laundry process that turns pure white shirts black Washing a completely white shirt that has turn black**
Strategy 4 Wh Adverb	The movie where you can understand the plot within the first five minutes Movies where you can get the plots within the first five minutes A movie where the plot can be understood in the first five minutes The movie where I could understand the plot in five minutes Movie where you figure out the plot in the first five minutes The film where by the plot is understood in the first five minutes The laundry where my white shirt had become black
Strategy 5 Preposition/ Prepositional Phrase	Exercise of making everyday meal tasty The prize of becoming the champion The fatigue of not getting enough sleep at all yesterday The practice of winning chess without failure A laundry of a pure white shirt that became black The prize money for having been number one The prize for being first place at the violin contest The prize for coming first in the piano contest The prize money for getting the first in the violin contest The prize for taking the first place in the violin contest Practice for definitely winning a game of chess The fatigue from not sleeping at all last night Tiredness from not being able to sleep at all since yesterday Tiredness from not sleeping at all from yesterday Being exhausted from not being able to sleep the night before The exhaustion from not sleeping at all yesterday The practice in order to definitely win the chess game
Strategy 6 Prepositional Head	-

Note. *'The preposition 'to' introduces relative clause in this reponse. Because 'for' is a part of the verb phrase in the modifying clause, this reponse was understood as a relative clause. **The head 'washing' and the modifier 'a completely white shirt that has turn black' are not related by relative clause in this case. However, 'a completely shite shirt' and 'washing' are related via grammatical relation, which is a characteristics of the relation between the head noun and the modifying clause in English relative clause; therefore, this reponse was classified as a case of relative clause.

Appendix 9. Correct Translation for Each Item

9A. Responses for Translation of RR Stimuli and Analyses for the Responses Involving Change in the Original Predicate-Argument Structures (in bald face)

Head Noun	*Case marker that the head noun carries in relation with the clausal predicate** (thematic role) Argument Relative/ Adjunct PP Relative**	Stimuli and Responses
'music' *ongaku*	*GA* (agent) Argument Relative	Stimulus: [comforts hurt person's mind] music Responses: **Music that has been used to comfort hurt people's hearts** Music that comforts the hearts of people who are hurt Music that can sooth the soles of injured people Music which sooth the hurt heart of people Song that comforts a person with a scar in their hearts The music that sooth the hearts of injured people He music that comforts hearts of people that are hurt
'doll' *ningyoo*	*GA* (theme of existence) Argument Relative	Stimulus: [exists in pretty glass box] doll Responses: The doll that's in the beautiful glass box The doll that was put inside the glass box The doll that's in the pretty glass box The doll which is put in a glass box The doll which was inside the pretty glass box Pretty doll that are in a glass box The doll that is inserted into or place in the beautiful glass box The beautiful doll inside the glass box The doll inside of the pretty glass box
'exercise hall' *doojoo*	*NI* (recipient) Argument Relative	Stimulus: [(I) donated some money] exercise hall Responses: The dojo that I donated some money to The training place to which I donated a sum of money The dojo that you donated money to
'face' *kao*	*NI* (benefactive) Argument Relative	Stimulus: [cosmetics is thickly applied] face Responses: The face that is not wearing any make The face which is made up with make-up A face which has make-up applied thickly Face that has cosmetics on it The face that has very thick make-up A face where make-up heavily applied A face applied with make-up Face plastered with make-up Faces thickly laid on with cosmetics Face with cosmetics applied

'research' *kenkyuu*	*O* (object of activity) Argument Relative	Stimulus: [since five years ago (I) have continued alone] research Responses: The research that's being continuing by one person The research I kept doing alone since five years ago The research which I have continued for five years by myself The research that I have done myself for five years The research that the person has been doing along for last five years The research that is continued by oneself from five years ago
'train' *densha*	*O* (patient) Argument Relative	Stimulus: [during student days (I) often used because it was cheap] train Responses: The train I often used when I was a student because it was cheap The train that I used a lot because it was cheap when I was a student The trains which I used in my student days because they were inexpensive The train that I used often because when I was a student it was cheap The train that you used because it was cheap during your students years **The train that students used often because it was very cheap** The train that I used often because it was cheap when I was a student
'city' *toshi*	*DE* (location of action) Adjunct PP Relative	Stimulus: [both the rich and the poor succeed] city Responses: Cities where both rich and the poor succeed A city where the rich and the poor succeed A city where either the rich or the poor could succeed A city where both rich and poor succeed A city where everyone succeeds Cities where both the rich and the poor succeed Cities where both poor and rich succeed
'church' *kyookai*	*KARA* (source) Adjunct PP Relative	Stimulus: [the bride and the groom came out] church Responses: The church where the bride and the bridegroom came out of The church where the bride and the bridegroom came out ("used three times") The church from which the bride and the groom emerged The church from which the bride the groom come out
'hospital' *byooin*	*E* (direction) Adjunct PP Relative	Stimulus: [the reporter and the patrol car headed toward] hospital Responses: The hospital toward which the reporter and the police cars were headed The hospital to which the reporters and the patrol cars were headed The hospital to which the reporters and the police cars were going to The hospital where the reporters and the patrol cars are heading towards

'square' *hiroba*	*O* (path) Adjunct PP Relative	Stimulus: [(I) passed every day when young] square Responses: The square I used to pass through every day when I was small The square that when I was small passed through every day The square that I went through or passed everyday when I was a kid The square I passed everyday when I was young The field that I always passed everyday The square that I passed almost every day during my childhood times The square where I pass by every day when I was young

Note. The pair of square brackets indicates the location of the modifying clause. The underline marks the head noun. The pair of parentheses indicates the element that was not overtly expressed in the stimuli. The obvious non linguistic element such as 'uh' and 'um' and repetition and rephrasing in the responses are eliminated here. The complete written transcript of the stimuli including incorrect reponses is in Appendix 7. *The classification of the head noun is based on Matsumoto (1997). **The distinction of Argument Relative/ Adjunct PP Relative is based on Yamashita (1995).

Analyses for the RR responses involving change in the original predicate-argument structures. The first case is where 'music' was the head noun of the RR (**Music that has been used to comfort hurt people's hearts**). In the stimuli 'the music that comforts the hurt person's mind', the original structure was 'comfort (music, hurt person's mind).' This predicate- argument structure was changed with a new verb 'use' as 'music that has been used to comfort hurt people's hearts' where a new verb 'use' was employed and which took 'music' as direct object.

The second case is where 'train' was the head noun of the RR (**The train that students used often because it was very cheap**). The original structure 'use ((I), train),' in which 'I' was not explicit, was changed to 'use (students, train),' in which the originally missing subject was recovered by the most plausible expression 'students' yielding 'the train that students used often because it was very cheap.' In this case, the structure is not quite changed; only the lexical item was changed.

9B. Responses for Translation of COMP Stimuli and Analyses for the Responses Involving Change in the Original Predicate-Argument Structures (in bald face)

Head Noun	Semantics of Head Noun*	Stimuli and Responses
'phone call' *denwa*	Communication	Stimulus: [saying** (someone) won the tennis finals] phone call Responses: Phone call saying that someone won a final tennis match The telephone call saying that someone won the tennis match Phone call which tells about winning the tennis final A phone call to the effect that someone won the tennis final The phone call about winning the tennis final Phone call winning tennis match The phone call of winning the tennis championship The phone call alerting the victory that they had in tennis A phone call regarding winning the tennis finals

'advertisement' *kookoku*	Communication	Stimulus: [saying (someone) is selling the second hand piano] advertisement Responses: Advertisement that say that they are selling old pianos The advertisement that says there are second hand pianos for sale **An advertisement which sells second hand piano** **Advertisement that sell second hand pianos** The advertisement for selling second hand pianos The advertisement for selling a used piano The advertisement about selling the piano Advertisement regarding second hand piano for sale Advertisement with regard to the sale of used piano
'question' *shitumon*	Communication	Stimulus: [saying there are Christmas presents] question Responses: Questions about there are going to be Christmas presents or not Questions about what if there are Christmas presents Questions about whether there are Christmas presents The question which asks if there are Christmas presents Questions asking if the Christmas presents are there Question of whether or not there were Christmas presents The question of asking whether there are Christmas presents A question as to whether there are Christmas presents
'opinion' *iken*	Communication	Stimulus: [saying if (you are)women, (you)should stay home] opinion Responses: The opinion that if you are woman you should be in the house The opinion that if you are woman you need to stay in the nouse The opinion that women has to stay in the house Opinion that if you are women you should stay in the home The opinion which says that if you are a woman you should be in the house An opinion expressing that woman must be in the house The opinion of if being a woman one should stay home
'wish' *yokubou*	Thought and feeling	Stimulus: [saying (I) want to see inside the room no matter what] desire Responses: The desire to see inside the room My desire to see the inside of the room no matter what My wish to see inside the room at any cost The urge to see inside the room ("used twice") The desire to absolutely see the inside of the room no matter what The desire of one way of another seeing the inside the room The wish of no matter ho much you want to see the room
'endurance' *gaman*	Thought and feeling	Stimulus: [(you) keep reading the same work even reluctantly] endurance Responses: Endurance to keep on reading the same thing Endurance to keep reading the same work of literature The patience to keep reading the same piece The patience reading the same thing To endure reading of the same work The patience for reading bad writing

'memory *omoide*	Other content taking noun	Stimulus: [(I) played naked on the snow]memory Responses: Memories of playing naked on the snow My memory of playing naked on the snow Memories of playing in the snow The memory of playing on top of the snow naked The memory of playing naked in the snow The memories of playing on top of the snow naked The memories of playing in the snow naked The memories of playing naked on the snow **The memory that I have about playing naked in the snow**
'plea' *uttae*	Other content taking noun	Stimulus: [saying (we) should increase the number of children's playgrounds]plea Responses: The petition to increase the playground that kids are playing Petition to increase the number of playground for children The petition to increase the number of children's playground A petition worrying to increase the number of the playgrounds for kids The petition requesting the increase in the playgrounds for children The petition calling for increasing children's playground
'logic' *rikutsu*	Other content taking noun	Stimulus: [saying the more you hurry the more you are late] logic Responses: Logic that says to be late or hurry Reasoning which says that the more you hurry the more you are late Logic that says the more you hurry the more later you become The logic that the more you hurry the later you get The logic you only hurry as much as you need to hurry The logic of being late no matter how much you hurry The logic of the more you rush you will become late
'decision' *kettei*	Other content taking noun	Stimulius: [saying (we) are doing the rebuilding of the library] decision Responses: The decision to rebuild the library ("used nine times") The decision of rebuilding the library

Note. The pair of square brackets indicates the location of the modifying clause. The head noun is underlined. The pair of parentheses indicates the element that was not overtly expressed in the stimuli. Obvious non linguistic elemenst such as 'uh' and 'um' and repetition and rephrasing in the responses were eliminated. The complete written transcript of the stimuli including incorrect reponses is in Appendix 7. *The classification of the head noun is based on Matsumoto (1997). **'saying' refers to *to-yuu* (quotative marker- say) in Japanese.

Analyses for the COMP responses involving change in the original predicate-argument structures. The first two (**An advertisement which sells second hand piano, Advertisement that sell second hand pianos**) were associated with the material with 'advertisement' as the head noun. The original structure was 'sell ((someone), second hand piano),' where 'someone' was not explicit and 'advertisement' was not included in the proposition with 'sell' as a predicate. In the two output, this predicate structure was changed to 'sell (advertisement, second hand piano).' The original head noun 'an advertisement' was used also as a head noun of the relative clause, and the head noun was the subject of the verb 'sell' which took 'second hand piano' as a direct object,

yielding 'an advertisement which sells second hand piano, advertisement that sell second hand pianos.'

The third case (**The memory that I have about playing naked in the snow**) was associated with the stimuli with 'memory' as the head noun. The original predicate-argument structure was 'play ((I), snow),' where 'I' was missing and the head noun 'memory' was not included. In the output, this structure was changed to 'have (I, memory)' as in 'the memory that I have about playing naked in the snow.' The head noun 'memory' was used as a direct object of the new verb 'have.'

9C. Responses for Translation of CN Stimuli and Analyses for the Responses Involving Change in the Original Predicate-Argument Structures (in bald face)

Head Noun	Semantics of Head Noun*	Stimuli and Responses
'result' *kekka*	Relational head noun	Stimulus: [(I) overate yesterday at the restaurant] result Responses: The result of eating too much at the restaurant yesterday The result of overeating at the restaurant yesterday The results of eating too much yesterday in a restaurant The result of overeating yesterday in a restaurant The results of eating too much at the restaurant yesterday ("used twice") As a result of the fact that I ate too much at the restaurant yesterday Due to the fact I overate at yesterday's restaurant The result of yesterday's restaurant overeating
'reason' *riyuu*	Relational head noun	Stimulus: [(I) did not go to the piano lessons] reason Responses: The reason why I didn't go to the piano lessons ("used twice") The reason why I didn't go to my piano lesson ("used twice") The reason why I don't go to the piano lesson The reason why I didn't go to the piano lesson The reason for not going to piano lessons The reason for not going to the piano lesson The reason for not going to the piano lesson The reason of not going to the piano lesson The reason I didn't come to the piano lessons
'the moment before' *chokuzen*	Relational head noun	Stimulus: [the airplane bound to Asia left] the moment before Responses: Before the plane to Asia took off Before I left for Asia Right before the airplane departed for Asia Right before the plane going to Asia took off Just the moment before the plane left for Asia Just a moment before the plane to Asia took off The moment prior to the plane departing for Asia More prior to the plane's departure for Asia Just before the departure of the plane in Asia The moment prior to the plane's departure for Asia
'the space between' *aida*	Relational head noun	Stimulus: [two white cars were running] the space between Responses: Between the two white cars that are running The space between the two white cars racing In between the two cars that were running

'the space next to' *yoko*	Relational head noun	Stimulus: [the old man was reading the magazine] the space next to Responses: Beside the elderly man who was reading a magazine Beside old guy reading a magazine By a side of old men who are reading magazines To the side of the old guy who is reading the magazine The side grandfather reading the newspaper The side of old men who are reading magazines The side where the grandfather was reading the magazine
'the space around' *atari*	Relational head noun	Stimulus: [the elementary students were noisily gathering] the space around Responses: Around the place where a bunch of elementary students are gathering Around the place where the elementary school students are having fun Somewhere around the noisy elementary school kids are gathering Somewhere around where elementary students noisily gathered The area where elementary students were gathered noisily The area where noisy elementary school children are gathered Somewhere around with the elementary students are gathered Somewhere the elementary students gathered noisily
'the space behind' *urabawa*	Relational head noun	Stimulus: [the big building was built] the space behind Responses: Behind where the big building was built Behind the big building that was just built On the backside of the big building built The backside of the building that was built Backside of the big built building
'sound' *oto*	Perception head noun	Stimulus: [the big bus were passing the main road] sound Responses: The sound of the bus going through the main street The sound of buses passing on the main audry The sound of the bus passing the main street The noise of the bus passing through main street The noise of the bus passing through the main street The noise that the bus passing down the main street The sound from the buses that are on the main street The sound when the buses pass the main street
'study' *benkyoo*	Perception head noun	Stimulus: [(you) become a useful member of the society] study Responses: (The) study or hard work to become a useful member of society Study to become a useful member of society Studying to become a useful member of society Study for becoming a useful member of the society The study of becoming a useful member of the society **A study which will allow one to become a member and is useful in society**
'morning' *asa*	Quasi-relational head noun	Stimulus: [after a long while (I) stayed in Kyoto] morning Responses: The morning of having stayed in Kyoto after a long time The morning of having stayed in Tokyo overnight after a long time

Note. The pair of square brackets indicates the location of the modifying clause. The head noun is underlined. The pair of parentheses indicates the element that was not overtly expressed in the stimuli.

Obvious non linguistic elemenst such as 'uh' and 'um' and repetition and rephrasing in the responses were eliminated. The complete written transcript of the stimuli including incorrect reponses is in Appendix 7. *The classification of the head noun is based on Matsumoto (1997).

Analyses for the CN responses involving change in the original predicate-argument structures. There was only one case that went through the reorganization (**A study which will allow one to become a member and is useful in society**). The original argument structure was 'become ((you), useful member of the society),' where 'you' was not explicit, and the head noun 'study' was not included. This structure was changed to 'allow (study, (become (one, useful member of the society)).' In the actual output (A study which will allow one to become a member and is useful in society), 'study,' the original head noun of CN, was used as a head noun of the relative clause. The head noun was the subject of the new verb 'allow' which took 'one to become a useful member of the society' as the complement.

9D. Responses for Translation of GR Stimuli and Analyses for the Responses Involving Change in the Original Predicate-Argument Structures (in bald face)

Head Noun	Relation between [Modifier]and Head*	Stimuli and Responses
'education' *gakumon*	[consequence] condition	Stimulus: [without noticing yourself (you) become unhappy] education Responses: **Education that does not make you happy** **Education that causes you not to notice suffering** **The study that makes me unhappy even half my nose in**
'exercise' *undoo*	[consequence] condition	Stimulus: [every day meals become tasty] exercise Responses: **Exercises that make your everyday meal taste good** **Exercise which makes everyday meals more tasty** **Exercise that makes meal more delicious every day** **Exercise of making everyday meal tasty**
'prize money' *shookin*	[condition] consequence	Stimulus: [(I) came the first at the violin contest] prize money Responses: The prize money for having been number one The prize for being first place at the violin contest The prize for coming first in the piano contest The prize money for getting the first in the violin contest The prize for taking the first place in the violin contest The prize of becoming the champion
'fatigue' *tsukare*	[condition] consequence	Stimulus: [(I) couldn't sleep at all since yesterday] fatigue Responses: The fatigue from not sleeping at all last night Tiredness from not being able to sleep at all since yesterday Tiredness from not sleeping at all from yesterday Being exhausted from not being able to sleep the night before The exhaustion from not sleeping at all yesterday The fatigue of not getting enough sleep at all yesterday

'practice' *renshuu*	[purpose] requisite	Stimulus: [(I) win chess games withoug fail] practice Responses: **Practice that would let you win every chess game** **A practice which will allow winning a chess game without fail** **The practice you need to do to win in chess** Practice for definitely winning a game of chess The practice of winning chess without failure Practicing to definitely win in the chess game The practice in order to definitely win the chess game
'walk' *sanpo*	[purpose] requisite	Stimulus: [(I) can sleep from night to morning] walk Responses: **A leasurely walk that will let you sleep from night to morning** **The walk which allow sleeping from night to morning**
'breakfast' *choosboku*	[requisite] purpose	Stimulus: [(I) don't have to do preparation after waking up]breakfast Responses: **Breakfast that I don't really have to prepare right after I get up** **The breakfast which I don't have to prepare after getting up** **Breakfast that you don't have to prepare right after you wake up** **The breakfast that doesn't have to be prepared after waking up** **Breakfast that does not need preparation once you wake up**
'separation' *wakare*	[requisite] purpose	Stimulus: [preparation has been done from long time ago]separation Responses: **The separation for which I have been planning since a long time ago** **The parting which I have been preparing for sometime** **The separation that have I prepared from way before** **The breakup that I have been preparing for a long time** **Departing which was prepared all along from before since while ago**
'movie' *eiga*	[part] whole	Stimulus: [the plot becomes understandable/ (you) understand the plot in the first five minutes] movie[i] Responses: The movie where you can understand the plot within the first five minutes Movies where you can get the plots within the first five minutes A movie where the plot can be understood in the first five minutes The movie where I could understand the plot in five minutes Movie where you figure out the plot in the first five minutes The film where by the plot is understood in the first five minutes A movie we understand the plot within the first five minutes The movie that I don't understand the plot for the first five minutes
'laundry' *sentaku*	[event] usual cause of opposite event	Stimulus: [a pure white shirt becomes black] laundry Responses: **Laundry that makes a perfectly white shirt go black** **Washing that makes pure white T-shirt become black** **Laundry process that turns pure white shirts black** The laundry where my white shirt had become black A laundry of a pure white shirt that became black Washing a completely white shirt that has turn black

Note. The pair of square brackets indicates the location of the modifying clause. The head noun is underlined. The pair of parentheses indicates the element that was not overtly expressed in the stimuli. Obvious non linguistic elemenst such as 'uh' and 'um' and repetition and rephrasing in the responses were eliminated. The complete written transcript of the stimuli including incorrect reponses is in Appendix 8. *The classification of the relation between the modifying clause and the head noun is based on Matsumoto (1997).

Analyses for the GR responses involving change in the original predicate-argument structures. The first two stimuli with the head nouns 'education' and 'exercise' are examples where the modifying clause and the head noun are related on the basis of consequence and condition. The head noun denotes a condition, and its consequence is denoted by the modifying clause.

In both stimuli, the verb used was *naru* (become) in intransitive use.[ii] In the responses in bold face for both stimuli, the transitive verbs 'make' or 'cause,' which take the head noun as subjects or maker/ causer, were used. Particularly, in the responses to the first stimulus with 'education' (**Education that does not make you happy, Education that causes you not to notice suffering, The study that makes me unhappy even half my nose in**), the thematic relation between the head noun and the clausal predicate was established by changing the original predicate structure. Originally it was 'become ((you), unhappy),' and the new structure is 'make (education, become ((you) unhappy)),' where a new verb 'make' governs the noun 'education' so that the head noun 'education' has a thematic relation with the verb in the relative clause. In the responses to the second stimulus with 'exercise' (**Exercises that make your everyday meal taste good, Exercise which makes everyday meals more tasty, Exercise that makes meal more delicious every day**), a similar change was made. 'Become (everyday meal, tasty)' originally canged to 'make (exercise, become (everyday meal, tasty)),' where the new verb 'make' takes the head noun 'exercise' as an argument.

The second stimulus, with 'exercise' as the head noun, had one non-relative clause response (**Exercise of making everyday meal tasty**) where the modifying clause was expressed by the gerundive phrase 'making everyday meal tasty,' with a new verb 'make.' The relation between the head noun 'exercise' and the complement was expressed by the preposition 'of.' In this case, the consequence of the exercise seems to be interpreted as the attribute belonging to the exercise with the sense of belonging expressed by the preposition 'of.' In any case, all the responses for 'study' and 'exercise' stimuli included changes in the original predicate- argument structures.

The next two stimuli, with 'prize money' and 'fatigue' as the heads, are examples of the GR type where the modifying clause denotes a condition leading to the consequence denoted by the head noun.[iii] The modifying clause and the head noun form the relation of [condition] consequence, opposite of the first two examples, which together form the relation of [consequence] condition. The original proposition was maintained in all responses for 'prize money' and 'fatigue' stimuli; that is, introducing new verbs in order to have the head noun as a part of the arguments did not take place. This raises the question of how the head noun that is the argument of the unexpressed predicate was expressed. Therefore, individual responses were analyzed.

The relation of the two constituents, the head noun and the complement (gerundive phrase) was made via prepositions such as 'from,' 'for,' and 'of' in all the responses. The content of the condition (i.e., the meaning of the modifying clause) was

expressed by the gerundive phrases and the prepositions linked the head noun and the gerandive phrases in all cases.

In the case of the NMC with 'prize money' as the head noun, the original predicate structure expressed in the stimulus was 'win ((you), first place),' in which the head noun 'prize money' is not an argument with the predicate 'win.' In the responses (**The prize money for having been number one, The prize for being first place at the violin contest, The prize for coming first in the piano contest, The prize money for getting the first in the violin contest, The prize for taking the first place in the violin contest, The prize of becoming the champion**), 'the prize money' was used as the head noun, and the complement with the preposition denotes the proposition of the original predicate structure.

In case of the NMC with 'fatigue' as the head noun, the original predicate structure in the stimuli was 'NOT (sleep ((you))),' where the head noun 'fatigue' is not an argument. In the actual responses, with the prepositions, the head noun 'fatigue' was associated with the gerundive complement that denotes the proposition expressed by the same predicate structure'NOT (sleep ((you))).'

The motivation for the use of 'from' which was used dominantly with 'fatigue' stimuli is transparent; the gerundive phrase denotes the condition, and the sense of source associated with 'from' was utilized to indicate that the complement denotes condition. The motivation for the use of 'for' frequently with 'prize money' is that the prize money was received 'for' the reason of winning the contest, i.e., a sense of 'for' of reason. The use of 'of' which was found in both cases of 'prize money' and 'fatigue' responses can be accounted for by the sense of belonging associated with 'of.' The participants received the modifying clauses as an attributes of the head nouns 'prize money' and 'fatigue,' and the sense of attribute was expressed by 'of.'

The next two responses came from the stimuli with the head nouns 'practice' and 'walk,' and the stimuli form [purpose] requisite relation between the modifying clause and the head noun in this order.[iv] With 'practice' responses, both relative and non-relative clauses were used. In 'walk' responses, there were only responses with relative clauses. In the responses with relative clauses, the original predicate- argument structures were changed, while in the reponses with non-relative clauses, the original proposition was maintained.

The strategy of forming a relative clause is the same as in the previously reviewed responses with the head nouns 'education' and exercise' where the constituents form a relation of [consequence] condition.[v] That is, a new verb was introduced and reorganization was done in order to include the head noun as a part of the arguments.

In the case with 'practice' the original predicate structure was 'win ((you), chess game)' where the head noun 'practice' was not an argument. This predicate structure was changed in the three responses with relative clauses (**Practice that would let you win every chess game, A practice which will allow winning a chess game without fail, The practice you need to do to win in chess**). In two cases (**Practice that would let you win every chess game, A practice which will allow winning a chess game without fail**), it was changed to 'let/ allow (practice, win (you, chess game))' where 'practice' fills in the position of an argument in relation with the predicate 'let/allow'. In another case (**The practice you need to do to win in chess**), it was changed to 'need to do (you, practice)' so that 'practice' is an argument, and the verb 'win' of the clausal

predicate was used in infinitive form 'to win in chess' to indicate that the action of winning was the purpose.

In the responses with 'walk' too, a change of predicate structure was observed. The original structure was 'sleep ((you), from night to morning)' where 'walk' is not a member of the arguments. In the responses, all of which contained relative clauses (**A leasurely walk that will let you sleep from night to morning, The walk which allow sleeping from night to morning**), the new structure was 'allow/ let (walk, sleep ((you), from night to morning))' where a new verb 'allow' or 'let' is the predicate and 'walk' fills an position of the argument of the predicate.

As for responses without changes in the original predicate structures, there were four responses for 'practice' stimuli (**Practice for definitely winning a game of chess, The practice of winning chess without failure, Practicing to definitely win in the chess game, The practice in order to definitely win the chess game**) and none for 'walk' stimuli. For the first two responses (**Practice for definitely winning a game of chess, The practice of winning chess without failure**), again the gerundive phrases were used as complement to the head nouns, and the prepositions 'for' and 'of' were used to indicate the relation. 'For' is a logical choice because the modifying clause denotes purpose of the head noun 'walk,' and 'for' has a sense of purpose. 'Of' was again used here, and its sense of belonging was at work so that 'practice' has an attribute of 'winning chess.' The last two responses (**Practicing to definitely win in the chess game, The practice in order to definitely win the chess game**) used the infinitival form of 'win' to express the meaning that winning the game was the purpose in relation with the requisite that the head noun 'practice' expresses.

The translation of the stimuli with 'breakfast' and 'separation' as the head nouns exclusively utilized the relative clause, and all involved reorganization of the original predicate structures. In these two stimuli, the modifying clause and the head noun form [requisite] purpose.[vi] This relation is opposite from the one between the constituents in the stimuli with 'practice' and 'walk' as the head nouns.

Literally, in the stimuli with the head noun 'breakfast,' the modifying clause says [(I) do not have to do preparation], where the head noun 'breakfast' is not an argument in relation with the verb 'do.' Grammatically the object of the verb 'do' is 'preparation,' not 'breakfast.' This grammatical relation was changed during the process of converting Japanese to English. In the responses, 'do preparation' was changed to the verb 'prepare,' which takes the head noun 'breakfast' as its grammatical object. In this way, the relation between the modifying clause and the head noun of the relative clause was established for the four responses (**Breakfast that I don't really have to prepare right after I get up, The breakfast which I don't have to prepare after getting up, Breakfast that you don't have to prepare right after you wake up, The breakfast that doesn't have to be prepared after waking up**). The fifth response (**Breakfast that does not need preparation once you wake up**) preserved the noun status of 'preparation' but used a new verb 'need' so that the head noun 'breakfast' is the subject of the verb, and 'preparation' is the object of the verb. By this grammatical relation embodied in the form of relative clause, the relation of the head noun and the modifying clause in the relative clause was established.

A similar process was observed in the reponses for the stimulus with 'separation.' Literally, the modifying clause of the stimulus says 'the preparation has been done from

long time ago,' where the object of the verb 'do' is 'the preparation,' not the head noun 'separation.' The new verb 'prepare/ plan' was introduced in translation, and the head noun 'separation' was related as the object of the new verb. This accounts for all the responses (**The separation for which I have been planning since a long time ago, The parting which I have been preparing for sometime, The separation that have I prepared from way before, The breakup that I have been preparing for a long time, Departing which was prepared all along from before since while ago**).

The stimulus with 'movie' as a head noun is an example of the GR where the modifying clause and the head noun form the relation of [part] whole.[vii] In all the responses, the original predicate structure is maintained.

It is noticeable that the relative adverb 'where' was used for the first six responses with 'movie' (**The movie where you can understand the plot within the first five minutes, Movies where you can get the plots within the first five minutes, A movie where the plot can be understood in the first five minutes, The movie where I could understand the plot in five minutes, Movie where you figure out the plot in the first five minutes, The film where by the plot is understood in the first five minutes**). In the responses, 'where' implies that the head noun 'movie' was captured as a location in which the plot is understood in the first five minutes. In other words, the relation that the movie is whole and the modifying clause is the movie's part was expressed by 'where,' a word that, among other things, marks the location of events.

The last two responses (**A movie we understand the plot within the first five minutes, The movie that I don't understand the plot for the first five minute**) are not, strictly speaking, grammatical English because the relation between the head noun and the clause is not marked. These are examples where pragmatic knowledge plays a role for interpretaion, in colloqual English, are believed to be acceptable.

The last stimulus with 'laundry' as the head noun is an example where the modifying clause and the head noun form the relation of [event] usual cause of opposite event.[viii] Literally, the modifying clause of the stimulus says 'a pure white shirt becomes black,' an event which is not usually caused by the referent of the the head noun 'laundry.' Half the responses involved reorganization of the original predicate sturctures.

The reorganization of the predicate structure was managed with the form of relative clause. The relative clauses were used where a new verb 'make /turn' was introduced, so that the head noun 'laundry/ washing/ laundry process' has a thematic relation with the verb in the relative clause (**Laundry that makes a perfectly white shirt go black, Washing that makes pure white T-shirt become black, Laundry process that turns pure white shirts black**).

Strategies that did not involve a change of predicate structure include the use of an adverbial clause introduced by 'where,' the use of the preposition 'of,' and the use of the relative clause. An adverbial clause with 'where' was used so that the head noun 'laundry' is a whole process during which the action of white shirt becoming black took place (**The laundry where my white shirt had become black**). With the head noun 'a laundry' the preposition 'of' was used taking as its object 'a pure white shirt' which was a subject in the original modifying clause. This noun phrase became a subject of the relative clause, which describes the event of pure white shirt becomes black (**A laundry of a pure white shirt that became black**). The last method was to change the head noun 'laundry' to a gerund 'washing' and to relate the noun 'a completely white shirt' as the

direct object of the verb. The event of a white shirt becoming black was again described in the relative clause which takes 'a completely white shirt' as the head noun (Washing a completely white shirt that has turned black).

Notes for Appendix 9

[i] For this stimulus, two propositional structures were stipulated, 'become (plot, understandable)' and 'understand ((you), plot),' which correspond in this order the two translations below.

[hajimeno	go-hun-de	suji-ga	wakaru]	eiga
first	5-minutes-with	plot-NOM	understand	movie

The movie (whose) plot becomes understandable in the first five minutes
The movie that (you) understand the plot of in the first five minutes

For the purpose of evaluating the change of the original predicate- argument structure, both propositional structures were accepted as the original propositional structure for the following reason. With an intellectual cognitive verb such as *wakaru* (understand) in Japanese, the object of understanding takes nominative marker *ga* leading the learners to believe the noun, the object of understanding, is a grammatical subject, which tends to lead the learners to believe *wakaru* (understand) is an adjective understandable. This should yield the translation of 'the plot becomes understandable.' On the other hand, when *suji* (plot) with nominative marker *ga* was interpreted as an object of the verb *wakaru* (understand), the English translation is 'you understand the plot.' Both propositional structures were accepted as the original ones.

[ii] *Naru* (become) is not the only verb used for this type. Other examples for [consequence] condition type of GR, according to Matsumoto (1997), who quotes written book titles and written advertisements, include the following:

[hykuman en	tamaru]	tyokin-bako
million yen	accumulate	savings-box

a savings box (by using which) a million yen accumulates

[yaseru]	onsen
become.slim	hot.spring

the hot spring (by soaking in which) (you) become slim

[moteru]	sake
be.popular.with.the.opposite.sex	liquor

the (way of drinking) liquor (by which) (you) will be popular with the opposite sex

[iii] Other examples of [condition] consequence type of GR , according to Matsumoto (1997) includes the following:

[honyaku-shita]	kane
translated	money

the money (which resulted after) (you) translated (something)

[beekingu-paudaato		abura o	mazekonda]	koromo
baking-powder	and	oil ACC	mixed.in	batter

the batter (which is produced by) mixing baking powder and oil

[amai mono	o	tabe-sugita]	mushiba
sweets	ACC	ate.excessively	cavity

the cavity (which resulted from) eating too much sweets

[iv] Other examples of GR with [purpose] requisite relation, according to Matsumoto (1997) include the followings:

[shotai	o	motsu]	heya
household	ACC	have	room

a room (which I need in order to be able to) have a household

[amerika	ni	iku]	biza
America	Loc	go	visa

The visa (which is necessary for (you) to go to America

[kore	o	nakus-anai]	fairu kabaa
this	ACC	lose-not	file cover

a file cover (which (you) need so as) not to lose this

[v] The relation of [purpose] requisite resembles the relation of [consequence] condition in that both events described by requisite and condition take place before the events described by purpose and consequence. Matsumoto (1997) points out that the difference is that the consequence is a state which naturally came from the condition while the purpose is a state that somebody intentionally is trying to achieve.

[vi] Other examples of GR with [requisite] purpose relation, according to Matsumoto (1997) include the followings:

[biza	o	totta]	amerika-iki
vias	ACC	obtained	America-going

a trip to America (for which) () obtained a visa

[yoshuu	0	shita]	jyugyoo
preparation	ACC	did	class

the class (for which) () prepared

[vii] Other examples of GR with [part] whole relation, according to Matsumoto (1997) include the followings:

[se	ga	takai]	hito
stature	NOM	high	person

a person (whose) stature is high

[otooto	ga	byooki	no]	Itoo-san
younter.brother	NOM	sick	GEN	Ms. Ito

Ms. Ito, (whose) younger brother is sick

[viii] Other examples according to Matsumoto (1997) of GR with [evemt] usual cause for opposite event include the following.

[hutor-anai]	okashi
gain.weight-not	sweet

sweets (even though (you) eat which) (you) don't gain weight

[yoru	nemureru]	koohii
night	sleep.can	coffee

the coffee (even though (you) drink which) (you) can sleep at night

Appendix 10. Stimuli Set

10A. Version [a] and [b] Sentences

Trial#	Version	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6	Segment 7	Probe
RR1	a	傷ついた	人の心を	なぐさめる	音楽は	昔から	大切に	されている	音楽
		[injured	person's mind-ACC	comfort]	music -TOP	from old time	treasure	do+PASS+PROG	music
		The music [that comforts people's scared mind] has been treasured for ages.							
	b	さっきから	聞こえるが	有名な	合唱を	流している	ラジオは	FMだろう	合唱
		while ago-from	hear-but	[famous	choir -ACC	casting]	radio-TOP	FM+be+probably	choir
		Hearing (it) since a while ago, (I) suspect that the radio [that has been broadcasting the famous choral] is FM.							
RR2	a	きれいな	ガラスの箱に	入っている	人形は	カナダから	船便で	来たらしい	人形
		[pretty	glass box-in	enter-be]	doll-TOP	Canada-from	sea mail-by	come+seem	doll
		The doll [that is in the pretty glass box] seems to have come from Canada by sea.							
	b	この地域の	駅の改札は	今夜の	花火を	見に行く	列だけで	一杯になる	花火
		this community's	ticket check-TOP	[tonight's	fireworks-ACC	see+go]	line+only-with	full+become	fireword
		The ticket check of the station in this community becomes full only with the lines (of people) who go to see the fireworks tonight.							
RR3	a	いくらか	お金を	寄ふした	講堂から	お礼の	カードが	とどいた	講堂
		[somewhat	money-ACC	donated]	practice hall-from	gratitude-'s	card-NOM	arrived	practice hall
		A thank you card arrived from the practice hall [to which (I) donated some money].							
	b	体の調子が	悪いとき	いつでも	自宅から	連絡できる	会社が	働きやすい	自宅
		body condition-NOM	bad+when	[any time	home-from	make contact+can]	company-NOM	easy to work	home
		When health condition is bad, the company [that (you) can make contact from home any time] is easy to work for.							
RR4	a	化粧を	あつく	ぬった	顔は	遠くから	見るほうが	きれいだ	顔
		[cosmetics-ACC	thickly	pasted]	face-TOP	distance-from	watch+more-NOM	pretty-COP	face
		The face where cosmetics is thickly pasted] looks prettier from the distance.							
	b	ほこりが	多い日は	時々	目から	流れてくれる	涙が	役に立つ	目
		dust-NOM	plenty day-TOP	[sometimes	eye-from	flow]	tear-NOM	helpful	eye
		On dusty days, the tear that flow from eyes sometimes is helpful.							
RR5	a	五年間から	一人で	続けてきた	研究が	やっと	終わろうと	している	研究
		[five years ago	alone	continued]	research-NOM	finally	trying to end	doing	research
		The research [that (I) have continued by myself for five years] is finally trying to end.							
	b	どの分野でも	そうだが	単純な	実験だけで	みつかる	答えは	あまりない	実験
		any fields-at-even	so+COP+but	[simple	experiment+only-with	find+can]	answer-TOP	plenty+not	experiment
		(This is) true in any field, but there are not many answers [that (one) can find by a simple experiment only].							
RR6	a	学生のころ	安いので	よく使った	電車が	古くなって	どんどん	消えていく	電車
		[student-'s+time	cheap+because	often+used]	[train-NOM	old+because	steadily	disappear	train
		The trains [that (I) used often because of the low price] because old seat are disappearing steadily.							
	b	きのう	お店で	友達と	映画で	取った	写真を	受け取った	映画
		yesterday	store-at	[friend-with	railway-at	took]	picture-ACC	received	railway
		Yesterday at the store, (I) picked up the pictures [that (I) took with my friends at the railway].							
RR7	a	金持ちも	貧乏人も	成功する	都市なんて	どこも	さがしても	ないと思う	都市
		[rich-also	poor-also	succeed]	city-TOP	anywhere	search-even if	non existent-think	city
		(I) think the city [where both rich and poor succeed] is nowhere.							
	b	モールの	中心に	歌って	ふるさとが	思い出せる	バーが	できた	ふるさと
		mall-'s	center-at	[sing-while	hometown-ACC	remember]	bar-NOM	came out	hometown
		At the center of the mall, a bar [where (one) remembers (his) hometown while drinking] appeared.							
RR8	a	花よめと	花むこが	出てきた	教会は	あたり一面	白い花が	かざってある	教会
		[bride-with	bridegroom-NOM	exited]	church-TOP	everywhere	white flower-NOM	decorated-be	church
		The church [(from which) the bride and the groom exited] is decorated with white flowers everywhere.							
	b	祖母は	その晩から	まごの	高校	よく見える	部屋に	泊まった	高校
		grandmother-TOP	that evening-from	[grandchild-'s	highschool-NOM	well+see+can]	room-at	stayed	highschool
		The grandmother stayed in the room [((from which) (she) can see the grandchild's highschool well] since that night.							
RR9	a	記者と	パトカーが	向かった	病院は	すでに	けが人で	あふれていた	病院
		[reporter-and	patrol car-NOM	went forward]	hospital-TOP	already	injured-with	overflew-be	hospital
		The hospital that the reporter and the patrol car went to] was overflown with the injured already.							
	b	大火事の	広島で	市民が	公園から	逃げてきた	橋なら	あそこにある	公園
		big fire-'s	Hiroshima-at	[citizen-NOM	park-from	escaped-came]	bridge-TOP	over there-exist	park
		The bridge that the citizen escaped from the park toward in Hiroshima on the big fire is over there.							
RR10	a	小さいころ	毎日のように	通った	広場が	とりこわされ	パーキングに	なった	広場
		[young+time	everyday+like	passed]	square-NOM	demolished+and	parking lot-to	became	square
		The square [that (I) passed almost every day when (I) was young] was demolished and became a parking lot.							
	b	いくつかの	お祝いの中で	春の始めに	水田で	おこなった	まつりが	なつかしい	水田
		several	celebration-among	[early spring-at	*rice field* -at	performed]	festival-NOM	miss	rice field
		Among some celebrations, (I) miss the festival [that (we) did in the rice field at the beginning of spring].							

CR1	a	自分でも	気がつかず	不幸になる	学問は	すぐにでも	やめて	働くべきだ	学問
		(self-by-even	without noticing	unhappy+become]	learning -TOP	soon+even	quit+and	work+must	learning
		(You) should even right away quit that learning [by doing which you become unhappy without noticing by yourself] and work.							
	b	とかいの	書店では	だれにも	経済が	わかる	本などが	売れる	経済
		city-'s	bookstore-at-TOP	[everyone-to	economics -NOM	understand]	book-etcetra-NOM	sell+well	economics
		In the urban bookstores, the books [by reading which economics becomes understandable for everyone] etc. are selling well.							
CR2	a	毎日の	食事が	おいしくなる	運動に	このごろ	関心が	集まっている	運動
		(everyday-'s	meal-NOM	tasty+become]	exercise -to	recently	interest-NOM	collect+be	exercise
		Recently the interests collects to the exercise [by doing which everyday meal becomes tasty].							
	b	今日になって	やっと	一週間前	野球が	できなかった	けがが	直った	野球
		today-becoming	[finally	[a week ago-'s	baseball -NOM	could not do]	injury-NOM	recovered	baseball
		Finally today, the injury [because of which (we) could not play the baseball game a week ago] became recovered.							
CR3	a	バイオリンの	コンテストで	一番になった	賞金は	そのころは	5 ドルが	普通だった	賞金
		(violin-'s	contest-at	champion+became]	prize -TOP	those days	$5.00 -NOM	ordinary-was	prize
		The prize [that (you got when) you won the championship in violin contest] is in those days mostly five dollars.							
	b	年とった	今では	両親の	財産を	使いはたした	酒が	にくらしい	財産
		old age	now-even	[parents-'s	asset -ACC	spent all]	sake-NOM	hateful	asset
		At this old age now, (I) hate sake because of which (I) spent all the asset of my parents.							
CR4	a	昨日から	ぜんぜん	眠れなかった	つかれで	両目が	ズキズキ	している	つかれ
		(yesterday-from	entirely	slept+POSS-not]	fatigue -with	both eyes-NOM	ache	do+be	fatigue
		With the fatigue [that (I) suffer from not at all having been able to sleep since the night before], (my) both eyes are aching.							
	b	いやでも	やっぱり	他人の	いたみを	むしした	罰だから	受ける	いたみ
		unwillingly-even	after all	[others-'s	pain -ACC	ignored]	punishment+COP+S	receive	pain
		Even unwillingly, after all (I) will receive the punishment [which (I consequently receive from) ignoring other's pain.							
CR5	a	チェスの	ゲームに	必ず勝つ	練習とは	何度も	ゲームを	することだ	練習
		[chess-'s	game-at	definitely+win]	practice -TOP	many times	game-ACC	do+NMRZ+COP	practice
		The practice [(by doing which) you can definitely win the games of chess] is to play the games many times.							
	b	普通に	がんばれば	大学で	教育を	受ける	免許が	もらえる	教育
		in an ordinary way	do the best-if	[university-at	education -ACC	receive]	license+NOM	receive+can	education
		If (you) make you effort in an ordinary way, (you) can receive the license [by which (you) may receive university education.							
CR6	a	夜から	朝まで	睡眠がとれる	散歩は	一時間では	とうてい	短かすぎる	散歩
		[night-from	morning-till	sleep-NOM take]	walk -TOP	one hour-with-TOP	too far	too short	walk
		The walk [(by doing which you) can take a sleep from night till morning] is far too short if (it is) only one hour long.							
	b	地図さえ	持っていれば	山の中の	旅行を	楽しむ	道具は他	特別いらない	旅行
		map-only	have at hand-if	[in mountain-'s	trip -ACC	enjoy]	tool-TOP	not necessary	trip
		If (you) have only map at hand, (there) is no tool in particular [with which (you) enjoy the mountain trip].							
CR7	a	起きてから	用意を	しなくていい	朝食なら	必要なので	いろいろと	知っている	朝食
		[get up- and	preparation-ACC	do-not-nasy]	breakfast -TOP	since necessary	this and that	know	breakfast
		(I) know out of necessity several breakfast [that I do not have to do preparation for as I get up]							
	b	小学校	行ってたころ	急いで	弁当を	食べ終わる	遊びは	すもうだった	弁当
		elementary school-at	commuted-time	[in a hurry	lunch box -ACC	eat+finish]	play-TOP	sumo-COP+PAST	lunch box
		When (I) was in school, the play [for which (we) would finish eating lunch in a hurry] was sumo.							
CR8	a	ずっと前から	準備が	できていた	別れが	思ったほど	うまく	いかなかった	別れ
		[long ago-from	preparation-NOM	ready+was]	separation -NOM	as (I) expected	well	could not do	separation
		The separation [(for) which the preparation had been ready for a long time] did not go as well as (I) expected.							
	b	つらい思も	あったが	空港まで	見送りに	行った	友情は	続いている	見送り
		hardship-also	existed-but	[airport-till	see off -for	went]	friendship-TOP	last+being	see off
		Although (there has been) hardship, (our) friendship [for which (I) went even to the airport to see (my friend) off] is lasting.							
CR9	a	始めの	五分間で	すじがわかる	映画は	まったく	見る気に	ならない	映画
		[first	five minutes-with	plot-NOM clear]	movie -TOP	at all	watch+feelings	become+NOT	movie
		(I) don't feel like watching the movie at all [that within the first five minutes, (I) understand the plot (of)].							
	b	スポンサーに	なるなら	家族むけの	番組が	おもしろい	テレビ局を	応援したい	番組
		sponsor-to	become-if	[family-for	program -ACC	interesting]	TV station-ACC	support+want	program
		If (I) become an sponsor, (I) want to support the TV station whose programs for family are interesting.							
CR10	a	まっ白の	ワイシャツが	黒くなる	洗たくを	するなら	だれかに	たのむといい	洗たく
		[pure white	dress shirt-NOM	black+become]	laundry -ACC	do+if	somebody-to	ask+if+good	laundry
		If (you) do the laundry [by which white dress shirt becomes black], (it would be) better if (you) ask somebody else.							
	b	デパートの	売り場では	台所の	そうじが	楽にならない	道具ばかり	売っている	そうじ
		department store-at	counter-at	[kitchen-'s	cleaning -NOM	easy+become+NOT	tools-only	sell+be	cleaning
		At the counters of the department store, only the tools [by which cleaning the kitchen does not become easy] are being sold.							

CN1	a	きのう	レストランで	食べすぎた	結果	授業に	行けなく	なった	結果
		[yesterday	restaurant-at	overate]	result	school-to	go+cannot	came	result
		As a result from having overeaten at the restaurant yesterday. (I'm) not able to go to school.							
	b	薬局で	働くのは	あまりにも	条件が	悪すぎる	ため	あきらめた	条件
		pharmacy-at	work+NMZR+TOP	[too much	condition -NOM	too bad]	reason	gave up	condition
		(I) gave up (the idea of) working in the pharmacy (for the) reason (that) the condition is too bad.							
CN2	a	ピアノの	レッスンに	行かない	理由を	わざわざ	説明しても	しかたがない	理由
		[piano-'s	lesson-to	go not]	reason -ACC	especially	explain-even	cannot be helped	reason
		There is no point of explaining the reason why (you) do not go to the piano lesson.							
	b	ギャンブルを	するのは	特別な	目的もなく	生きていく	方法として	一番よい	目的
		gamble-ACC	do+NMZR-TOP	[special	purpose -without	live]	method-as	best	purpose
		Gambling is best as a method to live without special purpose							
CN3	a	アジアに	飛行機が	出発する	直前に	兄との	約束を	果たした	直前
		[Asia-for	airplane-NOM	depart]	just before -at	brother-with-'s	promise-ACC	fulfilled	just before
		(I) was able to keep the promise with my younger brother just before the time the airplane departed for Asia.							
	b	なぜか	うさぎは	かめが	途中で	休まなかった	わけに	興味がない	途中
		for some reason	hare-NOM	[tortoise-NOM	half way -at	rest-not-PAST]	reason-with	interest-NOM-not	half way
		For some reasons, the hare is not interested in the reason why the tortoise did not rest half way.							
CN4	a	二台の	白い車が	走っている	あいだを	黒い犬が	ほえながら	かけぬけた	あいだ
		[two-'s	white car-NOM	run-PROG]	space between -ACC	black dog-NOM	barking	ran through	space between
		A black dog ran barking through the space between the two white car running.							
	b	台所で	何気なく	誰かが	うしろから	近寄る	足音のほうを	向いた	うしろ
		kitchen-at	unconsciously	[somebody-NOM	back -from	approach]	footstep-'s-toward	faced	back
		In the kitchen, (I) unconsciously faced toward the foot sound of somebody coming from behind.							
CN5	a	おじいさんが	雑誌を	読んでいる	横でも	大学生は	ビデオで	遊んでいた	横
		[grandfather-NOM	magazine-ACC	read-PROG]	side -at-even	university students-T	video-with	play+PROG+PAST	side
		Even beside the place where a grandfather was reading a magazine, university students were playing with the video.							
	b	かわいそうな	ねずみは	ねこが	外から	とびこむ	足もとから	にげた	外
		pitiful	mouse-TOP	[cat-NOM	outside -from	jump in]	foot-from	escaped	outside
		The pitiful mouse escaped through the foot of the cat that jumped in from outside.							
CN6	a	わいわいと	小学生が	集まっている	あたりを	さがせば	ぼうしは	見つかる	あたり
		[loudly	elementary children-	gather-PROG]	surroundings -ACC	search-COND	hat-TOP	find-POSS	surroundings
		If (we) search for the hat around the area where the elementary students are gathering loudly, it will be found.							
	b	ゆかに	すわると	へびが	まわりを	動いた	あとが	見えてくる	まわり
		floor-at	sit-and	[snake-NOM	place around -ACC	moved]	trace-NOM	appear+come	place around
		When (you) sit, the trace that the snake moved around comes to appear.							
CN7	a	大きな	ビルが	建った	最後に	うつくしい	さくらが	咲いている	最後
		[big	building	be+built+PAST]	backside -at	beautiful	cherry blossoms-NC	bloom-PROG	backside
		The beautiful cherry blossoms are blooming behind the place where the big building was built.							
	b	病院の	かべは	銀行が	正面に	移ってきた	前の年に	ぬりかえた	正面
		hospital-'s	wall-TOP	[bank-NOM	front -at	moved]	year before-at	repainted	front
		As for the hospital wall, it was repainted in the year before when the bank moved to (its) front.							
CN8	a	バスが	大通りを	通る	音は	近所には	たいへん	めいわくだ	音
		[bus-NOM	main street-ACC	pass]	sound -TOP	neighbor-for-TOP	very	nuisance-COP	sound
		The sound of the bus passing the main street is such a nuisance for the neighbor.							
	b	幸せに	なれると	慣しすぎて	声も	でない	つらさが	わからない	声
		happiness-to	get used to -then	[(to) too]	voice -even	come out-not]	hardship-NOM	incomprehensible	voice
		Once (you) get used to being happy, the harshness of being so sad that even voice does not come out is incomprehensible to understand.							
CN9	a	世の中で	役にたつ	一員になる	勉強を	若いうちに	しっかりと	することだ	勉強
		[world-'s	helpful	member-become]	study -ACC	young-within	steadily	do+NMZR+COP	study
		Do the study while young to become a helpful member of the world.							
	b	二週間の	ホリデーは	十分に	責任を	果たした	あとに	とりたい	責任
		two weeks-'s	holiday-TOP	[enough	responsibility -ACC	finished]	time following-at	take-want	responsibility
		As for the holidays, (I) want to take it after I paid enough responsibilities.							
CN10	a	ひさしぶりに	京都に	泊まった	朝	小川が	流れるのが	聞こえてきた	朝
		[after the interval	Kyoto-at	stayed]	morning	streams-NOM	flow+NMZR-NOM	hear-came	morning
		In the morning after I stayed in Kyoto after a long interval, the sound of streams came to be heard.							
	b	宿題を	しないのは	アパートが	夜	うるさい	せいだと	言っている	夜
		homework-OM	do+not+NMZR-TOP	apartment-NOM	night	noisy	cause COP-QT	saying	night
		(They are) saying that not doing homework is due to (the fact) that the apartment building is noisy at night.							

COMP1	a	テニスの	決勝戦で	勝ったという	電話が	先ほど	母の所に	かかってきた	電話
		[volleyball-'s	final-at	won-QT]	*phone call* -NOM	while ago	mother's place-to	call-came	phone call
		The phone call that ( ) won the volleyball final was sent to my mother's place while ago.							
	b	一ヵ月	雨が降り	恋人に	手紙さえも	書きたくない	気持ちが	続いている	手紙
		one month-even	rain-NOM ran	[lover-to	*letter* -even	write-want-not]	feeling-NOM	continue+PROG	letter
		It rained even for one month, and the feeling that (I) do not want to write even to my lover has been continuing.							
COMP2	a	中古の	ピアノを	売るという	広告が	たくさん	家まで	とどいている	広告
		[second handed-'s	piano-ACC	sell-QT]	*advertisement* -etc	plenty	house-to	reached	advertisement
		Plenty of things including advertisement that (someone) sells a second hand piano came to the house.							
	b	子どもたちは	知らないが	ポケモンの	放送を	やめるという	うわさが	流れた	放送
		children-TOP	know+not-but	[Pokemon-'s	*broadcasting-TOP*	quit-QT]	rumour-NOM	flew	broadcasting
		Although children do not know this, the rumour that (they) will quit the broadcasting of Pokemon was heard.							
COMP3	a	クリスマスの	プレゼントは	あるかという	質問ばかり	するから	子供は	いやだ	質問
		[Christmas-NOM	present-TOP	exist-whether-QT]	question -only	do-because	children-TOP	tiresome	question
		Children are tiresome because (they) ask only questions whether there are Christmas gifts.							
	b	このごろ	e-メールは	簡単に	返事が	出せる	うれしさで	くせになった	返事
		recently	e-mail-TOP	[easily	*response* -NOM	return-POSS]	joy-with	habit-to-become	response
		Recently e-mail became habit due to the joy of being able to return the response easily.							
COMP4	a	女だったら	家にいる	べきだという	意見を	会話の	始めに	聞いた	意見
		[woman-be-if	house-at stay	should-COP-QT]	opinion -ACC	conversation-'s	beginning-at	heard	opinion
		(I) heard the opinion that if you are women, you should stay home at the beginning of the conversation.							
	b	この国の	文学には	気楽に	感想を	いだく	自由が	ないようだ	感想
		This country-'s	literature-at-TOP	[at leisure	*after thought* -ACC	bear]	freedom-NOM	none-seem	after thought
		It seems like in the literature of this country, there is no freedom of having after thought at leisure.							
COMP5	a	どうしても	部屋の中を	見たいという	欲望を	おさえて	主人を	待った	欲望
		[at any cost	room's inside-ACC	watch-want-QT]	desire-NOM	resisting	lord-ACC	wait-PAST	desire
		(I) waited for the lord while resisting this desire that (I) want to see inside the room at any cost.							
	b	年をとると	さるは	小さい動物に	恐れを	もつという	話しは	本当らしい	恐れ
		become aged-then+monkey-TOP	[small animal-to	fear-ACC	hold-QT]	story-TOP	true-seems	fear	
		The story that monkeys, once aged, have fear for small animals seems true.							
COMP6	a	いやでも	同じ作品を	読み続ける	がまんが	できれば	作家に	なれるだろう	がまん
		[like it or not	same book-ACC	read-continue]	endurance -NOM	can do-if	writer-to	become-maybe	endurance
		If (you can) stand the endurance of reading the same book like or not, you can probably become a writer.							
	b	追試験に	落ちてから	絶対に	努力を	する	決心を	したようだ	努力
		make up exam-with	failed-since	[absolutely	*effort* -ACC	make]	decision-did	seemed	effort
		Since (he) failed in the make up exam, (he) seems to have made a decision of making an effort without fail.							
COMP7	a	雪の上で	はだかで	遊んだ	思い出を	いつか	書きたいと	思っている	思い出
		[snow's surface-at	naked	played]	memory-ACC	someday	write-want-QT	think	memory
		(I am) thinking of someday writing out the memory of playing on the snow naked.							
	b	人の前で	話すときは	すべて	体験から	話している	気分で	やるといい	体験
		in public	speak-when	[everything	experience-from+speaking]	feeling-in	do-then-good	experience	
		It is a good idea to speak in the feelings that (you) are talking about everything from the experience when you speak in public.							
COMP8	a	子供たちの	遊び場を	増やせという	訴えが	やっと	議会まで	とどいた	訴え
		[children-'s	playground-ACC	increase-QT]	*plea* -NOM	finally	council-to	reached	plea
		The petition that the children's playground should be increased finally reached the council.							
	b	市役所の	窓口では	老人からの	頼みを	必ず聞く	規則が	守られる	頼み
		city hall-'s	window-at-TOP	[elderly-from-'s	request -ACC	listen definitely]	rule-NOM	observed	request
		At the window of the city hall, the rule that the request from the elderly must be listened is observed.							
COMP9	a	急げば	急ぐほど	遅れるという	理屈が	3年も	後になって	認められた	理屈
		[hurry-if	hurry-even	delay-QT]	*logic* -NOM	three years-even	later-become	probed	logic
		The logic that the harder you hurry, the more behind you get was probed three years later.							
	b	おとといの	事故について	運転に	無理が	あったという	説明が	あった	無理
		the day before yester	accident-regarding	[driving-with	*unmoderation* -NOM	existed-QT]	explanation-NOM	existed	unmoderation
		Regarding the day before yesterday's accident, there was an explanation that there was an unmoderate driving involved.							
COMP10	a	病院の	建てかえを	するという	決定しか	今のところ	知らされて	いない	決定
		[library-'s	rebuilding-ACC	do-QT]	*decision* -only	so far	known	not	decision
		Only the decision that the rebuilding of the hospital will be done has been known so far.							
	b	だれも	来ないので	明日までに	結論を	出すという	計画が	くるった	結論
		anyone	came-not-for	[tomorrow-by	*conclusion* -ACC	propose-QT]	plan-NOM	came+unordered	conclusion
		Since nobody came, the plan to draw the conclusion by tomorrow is not in order							

10B. Version [c] Sentences

Trial#	Version	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6	Segment 7	Probe
C1	c	とにかく	何かの	楽器で	曲を	発表しないと	教師には	なれない	秋
		anyhow	whatever	instrument-with	a piece of music-AC	perform-not-if	teacher-to-TOP	become+can+not	autumn
		Anyhow if (one) cannot present a piece of music with some kind of musical instrument, (one) cannot become a teacher.							
C2	c	お菓子やで	買い物を	するなら	風船と	あめ玉が	昔からの	好物だ	あさって
		sweet shop-at	shopping-ACC	do-if	balloon-and	candy-NOM	old time-from-'s	favorite-COP	the day after tomorrow
		When I shop at a sweet shop, a balloon and a candy have been (my) favorite from old times.							
C3	c	予約が	遅れたので	小さい	教室しか	ないと	管理人が	言った	手相
		reservation-NOM	late-was-because	small	classroom+only	not existent-QT	caretaker-NOM	said	palm lines
		Since the reservation was late, the care taker said that only small classroom is available.							
C4	c	だいたい	かぜを	ひくと	鼻より	あたまの	ほうが	いたくなる	ばんごはん
		most of the time	cold-NOM	catch-when	nose-than	head-more		painful-becomes	dinner
		Most of the time when I catch cold, the head becomes more painful than the nose.							
C5	c	夏休みは	子どもたちの	野鳥の	観察で	川のまわりは	たいへん	うるさい	ビフテキ
		summer holiday-TO	children-'s	wild birds-'s	observation-with	river-'s-vicinity-TOP	very much	noisy	beef steak
		During summer holidays, the vicinity around the river becomes noisy with children observing wild birds.							
C6	c	乗り物に	よく乗るので	わかるが	特急と	急行では	速さが	ずいぶん違う	中国
		vehicle-at	often+ride+since	understand+but	super express-and	express -COP-TOP	speed-NOM	differ much	China
		(I) know (this) since (I) often take transportation, the speed of super express and express is very different.							
C7	c	若者の	人口が	最近では	農村に	しだいに	もどって	行っている	政治
		young 's	population-NOM	recently	agricultural area to	gradually	return	going	politics
		Recently the young population is gradually returning to the agricultural area.							
C8	c	その時代は	日本の	ほとんどの	神社が	大地震に	耐えて	生き残った	ドイツ
		that era-TOP	Japan-'s	most	shrine-NOM	great earthquake-wit	endure+and	survived	Germany
		In that era, most of the shrines in Japan endured big earthquakes and survived.							
C9	c	乗り物を	降りたら	すぐに	旅館を	見つけて	安心したいと	思います	絵本
		transportation-ACC	descend-then	immediately	hotel-ACC	find-and	relieved-want-QT	think	picture book
		(I) think I (would like to be) relieved by finding the hotel immediately after getting off from the transportation.							
C10	c	すもうの後	興奮している	ファンが	道路まで	出てきて	今でも	さわいでいる	鉛筆
		sumo-'s-after	excited	fan-NOM	road-till	came out+and	now-even	make noise	pencil
		After the sumo tournament, excited fan came out to the road and noising till even now.							
C11	c	立派な	先生も	必要だが	教科が	少ないと	学生は	来ないだろう	フォーク
		excellent	teacher-also	necessary+but	subject-NOM	little-when	students-TOP	come+not+maybe	fork
		The excellent lecturers are necessary, but when the number of subjects is low, probably students will not come.							
C12	c	水の中を	歩くだけでも	体によく	水泳は	年をとっても	誰でも	楽しめる	船
		water's inside-ACC	walk-only-even	good for body	swimming-TOP	even when aged	everybody	enjoy+can	boat
		Even by walking in the water, swimming is good for health, everybody can enjoy it even when aged.							
C13	c	小さな	町や村に	住むと	税金が	高くなる	ことが	よくある	フランス
		small	town-or-village-at	live-if	tax-NOM	heighten	NMZR-NOM	often exist	France
		When you live in a small town or village, it is often the case that you tax becomes higher.							
C14	c	よく言われる	ことだが	いつまでも	うらみを	もつのは	体には	良くない	冬
		often said	thing+COP+but	forever	resentment-ACC	hold+NMRZ-TOP	health-for	good+NOT	winter
		(It is) often said, but (it is) not good for (your) health to keep the feeling of resentment forever.							
C15	c	一日中	働くと	疲れて	夜学で	起きて	いるのが	たいへんだ	元気
		day time-during	work+if	tired+and	night school-at	awake+and	be+NMRZ-NOM	difficult+COP	good heath
		If (you) work all through the daytime, (you) get tired, and (it is) difficult to stay awake at night school.							
C16	c	富士山は	日本で	一番高いから	登山は	一生に	一度くらい	しておこう	ご主人
		Mt.Fuji-TOP	Japan-in	highest-because	mountaineering-TOP	lifetime-at	once-about	do-leave-let's	your husband
		Since Mt. Fuji is the highest mountain in Japan, let's climb (it) about once in your lifetime.							
C17	c	中間テストが	近づいて	一人分の	食事を	作るのが	めんどうに	なってきた	牛乳
		mid-term-NOM	come near	one person-'s	meal-ACC	make+NMNZ-NOM	cumbersome	became+have	milk
		As the mid-term exam is coming near, it has been becoming cumbersome to make a meal for one person.							
C18	c	十一月に	なったし	コンサートの	案内が	そろそろ	来ても	いいころだ	春
		November-to	became-also	concert-'s	guidance-NOM	soon	come-if	good time+COP	spring
		November came, so it is a good time if the invitation to the concert may soon arrive.							
C19	c	きれいな	服ばかり	持っていて	芸術への	ずいたくな	関心が	表われている	イギリス
		pretty	clothes-only	have+and	arts-toward	luminous	interest-NOM	appearing	U.K.
		(She) has only pretty clothes, and her luminous interest in arts is appearing.							
C20	c	受けたことが	ない人に	とっては	あみ物の	試験は	むずかしいと	言われる	石
		take+NMRZ+NOM	not person-to	for-TOP	knitting	exam-TOP	difficult+QT	said	rock
		It is said that for someone who has never taken (it), knitting test is difficult.							

C21	c	やはり	先日の	事故の	原因は	スピード違反	らしいと	うわさされた	事務所
		after all	the other day-'s	accident-GEN	cause-TOP	over-speeding	seem-QT	rumour-PASS	office
		After all the cause of the other day's accident was said to be over-speeding by rumour.							
C22	c	その事件に	関しては	何の	関係も	ないと	医者は	言うだろう	買い物
		that incident-with	regarding	whatsoever	relation-even	not existent-QT	doctor-TOP	say-perhaps	shopping
		As for that incident, perhaps the doctor will say(he) has nothing to do with it at all.							
C23	c	やっと	古本屋で	買えたので	翌日から	テープを	使って	予習した	カメラ
		finally	second hand bookstr	purchased-so	the following day-fr	tape-ACC	use-and	previewed	camera
		Being able to finally purchase (it), from the following day (I) used the tape and previewed.							
C24	c	ステージで	子供たちは	さっそうと	まえへ	進んで	あいさつを	すませた	お湯
		stage-at	children-TOP	gallantly	front-to	proceed-and	greeting-ACC	finished	warm water
		At the stage, the children gallantly proceded to the front and finished greeting.							
C25	c	運動場の	空気は	冷たいが	中より	ずっと	体には	よろしい	今週
		track field-in	air-TOP	cold-though	inside-than	even	body-for	good	this week
		The air in the track field, although it is cold, is better for health than the air inside.							
C26	c	大切な	持ち物は	いつも	そばに	置けば	心配は	いらない	くだもの
		important	belongings-TOP	always	beside-at	place-COND	worry-TOP	unnecessary	fruits
		As for the important belongings, (if you) always place it beside, worry is unnecessary.							
C27	c	食べた	ガムの	包み紙は	両はじを	むすんで	ゴミ箱に	すてる	塾
		eaten	chewing gum-'s	wrapper-TOP	both ends-ACC	tie-and	trash can-to	discard	cram school
		As for the finished chewing gum wrappers, tie both ends of it and discard it in the trash can.							
C28	c	ミントの	ガムを	かみながら	息を	吸うと	のどが	痛くなる	車
		mint	chewing gum-ACC	chew-while	breath-ACC	inhale-then	throat-NOM	painful-become	car
		When you inhale your breath while chewing mint flavored chewing gum, the throat starts to ache.							
C29	c	年よりが	よく言うが	若いうちは	苦労は	買ってでも	したほうが	いいそうだ	お土産
		aged-NOM	often say but	young age-TOP	suffering-TOP	buying-by-even	do-better-NOM	good-seem	souvenior
		Old people say this, but while young it is better to even buy suffering.							
C30	c	このごろ	待ち遠しい	時間は	晩	からすが	山に帰って	休むときだ	選手
		nowadays	look forward to	time-TOP	evening	crows-NOM	mountain-to return	rest-time-COP	athelete
		The time (I'm) looking forward to nowadays is the time when the crows return to the mountains and rest in the evening.							
C31	c	去年	マニラにいる	ペンパルと	文通を	始めてから	切手代が	気になる	夏
		last year-from	Manila-at-live	penpal-with	correspondence-ACC	started-from	stamp fee-NOM	mind	summer
		Since (I) started correspondence with my penpal in Manila last year, (I) mind the stamp fee.							
C32	c	テレビは	ほとんど	つけないが	情報は	大切なので	新聞だけは	必ず見る	庭
		TV-TOP	seldom	turn on-not-but	information-TOP	important-COP-for	newspaper only-TOI	no fail watch	yard
		(We) seldom turn on TV, but since information is important, (we) look through only newspaper without fail.							
C33	c	教科書の	後ろの方に	この問題の	答えが	入って	いるので	見てください	パン屋
		textbook-'s	back-'s-toward-at	this question-'s	answer-NOM	entered	be-for	watch-give	bakery
		Please take a look at (the answer), since the answer for this question is entered toward the back of this textbook.							
C34	c	クエスチョン	マークは	英語の	疑問を	あらわす文	にだけ	使われる	ポスト
		question	mark-TOP	English-'s	question-ACC	indicate-sentence	for-only	use-PASS	post
		Question marks are used only for English sentences that indicate question.							
C35	c	ふだん	ストレスが	低いと	怒りも	簡単に	おさえる	ことができる	レコード屋
		every day	stress-NOM	low-when	anger-even	easely	hold	able	record shop
		If everyday stress level is low, even anger can be held easily.							
C36	c	やおやの	おばさんは	おとなしいが	意地が	悪いので	有名に	なったらしい	食堂
		vegetable store-'s	aunt-TOP	quiet-but	malice-NOM	bad-COP-so	famous-to	become-seems	dining room
		The lady at the vegetable store seems to have become famous because she is quiet but evil.							
C37	c	小さい	うちから	へんな	習慣を	覚えると	なかなか	直らない	文句
		young	from	weird	habit-ACC	learn-if	easily	corrected-NOT	complaint
		When (you) learn bad habbit while young, it will not be easily corrected.							
C38	c	平和な	２１世紀こそ	人々の	願いに	違いないと	誰もが	信じている	週末
		peaceful	21st century-TOP	people-'s	wish	no different-QT	everybody-NOM	believe	weekend
		Everybody believes that only the peaceful 21st century is people's wish.							
C39	c	あの人は	どこにいても	おもしろい	うそを	つくので	みんなに	好かれる	タクシー
		that person-TOP	no matter where	funny	lies-ACC	tell-because	everyone-with	favored	taxi cab
		That person, because he tells funny lies no matter where he is, is liked by everyone.							
C40	c	電気が	なくなって	正確な	判断など	はっきりと	だせないので	こまった	てんぷら
		electricity-NOM	disappear-and	accurate	judgement-TOP	clearly	write-POSS-not	troubled	tempura
		The electricity is shut down, so (we are) in trouble for we cannot provide accurate judgement.							

10C. Version [d] Sentences

Trial#	Version	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6	Segment 7	Probe
D1	d	ピッザや	ドーナッツを	毎日	食べた				地球
		pizza-also	doughnuts-ACC	everyday	ate				earth
		(I) ate pizza and doughnuts, etc. everyday.							
D2	d	すいぶん	りっぱな	建物が	できた				島
		extremely	magnificent	building-NOM	was built				island
		An extremely magnificent building was built.							
D3	d	昼ごはんは	いつも	うちで	食べる				海
		lunch-TOP	always	home-at	eat				ocean
		(I) always eat lunch at home.							
D4	d	近くで	安い店が	あると	助かる				ヨーロッパ
		nearby	cheap shop-NOM	exist-if	helpful				Europe
		(It would be) helpful if there is a cheap shop nearby.							
D5	d	きたない	ろうかは	だれも	歩かない				中国語
		dirty	hallway-TOP	anybody	walk-NOT				Chinese language
		As for a dirty hallway, nobody walks.							
D6	d	すし屋は	遠いので	かわりに	きっ茶店へ				ダンス
		sushi shop-TOP	far-COP-so	instead	tea shop-to				dance
		Because sushi shop is far, instead ..to a tea shop.. [incomplete sentence]							
D7	d	勉強の	食堂で	友人を	待とうと				奨学金
		Shinjuku-POSS	dining room- at	friend-ACC	wait for-to				scholarship
		in order to wait for a friend at the dining room in Shinjuku. [incomplete sentence]							
D8	d	ハワイ大学の	日本語の	授業は	とても				才能
		U of Hawai'i's	Japanese	lectures-TOP	very				talent
		The Japanese lectures at U of Hawai is very.. [incomplete sentence]							
D9	d	そうそう	わたしたちは	しつれい	しないと				ドア
		soon or later	we-TOP	excuse ourselves	do not-if				door
		If (we) do not excuse ourselves soon.. [incomplete sentence]							
D10	d	コーヒーも	ケーキも	まずい	らしく				動物
		coffee-also	cake-also	untasty	seem				animal
		(It) seems both coffee and cake are untasty.. [incomplete sentence]							
D11	d	さっぽろの	六月も	今ごろは	たぶん	暑いだろう			土曜日
		Sapporo's	June-also	by now	perhaps	hot-maybe			Saturday
		By now June even in Sapporo may be perhaps hot.							
D12	d	あした	くにへ	妹と一緒に	電車で	帰ります			ふろ
		tomorrow	home-to	sister-with	train-by	return			bath
		(I) will return to my home tomorrow with my sister by train.							
D13	d	日光見物	したいが	ひまが	ないので	ざんねんだ			カタログ
		Sightseen in Nikko	do-want-but	leisure time	not student-because	regretful			catalogue
		(It is) regretful that (I) do not have leisure time even though (I) want to visit Nikko.							
D14	d	切符は	とても	高かったが	思いきって	買った			ハンカチ
		ticket-TOP	very	expensive-although	ruthlessly	bought			handkerchief
		As for the ticket, although it was very expensive, (I) ruthlessly bought it.							
D15	d	アルバムに	家族の	写真を	たくさん	しまった			辞書
		photo album-in	family-'s	photo-ACC	plenty	stored			dictionary
		(I) stored plenty of family pictures in the photo album.							
D16	d	ともだちが	はじめて	品川駅で	新幹線に	乗って			住所録
		friends-NOM	first time	Shinagawa station-at	shinkansen-to	get on			address
		For the first time, my friend got on shinkansen at Shinagawa station, and.. [incomplete sentence]							
D17	d	駅員が	お客の	背中を	押して	すごかった			自転車
		Station crew-NOM	passengers-'s	back-ACC	pushed-and	amazing-COP-PAST			bicycle
		The stations crew pushed the passengers' back, and (it) was amazing.							
D18	d	早くても	遅くても	同じくらい	こんで	いるので			かばん
		early-also	late-also	equally	crowded	be-so			bag
		It is crowded early or late, so.. [incomplete sentence]							
D19	d	地下鉄で	行きも	帰りも	パチンコ屋に	行くから			かぜ
		subway-by	way to-also	way back-also	pachinco parlour-to	go-because			key
		Because (I) will go to the pachinco parlour by subway both the way to and the way back.. [incomplete sentence]							
D20	d	すいている	時間は	みんなが	お昼を	食べている			かんぱい
		vacant	hour-TOP	everybody-NOM	lunch-ACC	eating			cheers
		As for the vacant hour, everybody is eating lunch.							

D21	d	２０分前に	大きな	紙のふくろを	バス停の	ベンチに	忘れた		風
		twenty minutes earli- big		paperbag-ACC	bus stop-'s	bench-at	forgot		wind
		(I) forgot the paper bag on the bench at the bus stop twenty minutes ago.							
D22	d	このプールは	一年中	泳ぐことが	できるので	メンバーが	多いらしい		着物
		this pool-TOP	all year around	swimming-NOM	possible-because	members-NOM	plenty		kimono
		Because you can swim all year in this swimming pool, there seem plenty of members.							
D23	d	にぎやかな	町のなかを	食べたり	歩いたり	すれば	気がはれる		コップ
		busy	town's inside-ACC	eating-etc.	walking-etc.	do-if	feels happier		cup
		(You would) feel happier if you walk and eat around the busy town.							
D24	d	たのんだ	仕事を	今日中に	終わると	来週は	暇になる		めがね
		requested	job-ACC	today-within	finish-if	next week-TOP	free time-become		glasses
		If requested job is finished within today, the next week will be free.							
D25	d	おくりものは	心をこめて	あげないと	あまり	楽しく	ないでしょう		ねだん
		gift-TOP	heartfully	give-not-if	very	fun	not-maybe		price
		(It) may not be fun if you do not give the gift with your heart.							
D26	d	ニオの	女の子が	エリートの	幼稚園に	合格する	ために		荷物
		two years old	girl-NOM	elite	kindergarten-to	pass	in order to		luggage
		In order to pass the elite kindergarten, the two year old girl.. [incomplete sentence]							
D27	d	今日中に	申しこみを	しないと	面接が	できないと	聞いて		おくさん
		today-within	application-ACC	do-not-if	interview-NOM	cannot-QT	heard-and		wife
		(I) heard that if you do not apply within today, you cannot have interview, so.. [incomplete sentence]							
D28	d	つごうが	悪いので	明日の	会議に	出られない	かもしれ		温泉
		convenience	bad-because	tomorrow	meeting	participate-not	maybe		hot spring
		Because it is not convenience, it maybe that (I) cannot attend the meeting.. [incomplete sentence]							
D29	d	いそがしくて	パーティーに	来られないと	伝言が	ありました	から		社長
		busy-since	party-to	come-not-QT	message-NOM	existed	because		president
		Because there was a message saying since busy (someone) cannot come to the party... [incomplete sentence]							
D30	d	飛行機が	予定より	早くつく	ことだって	たまには	あるのが		水道
		airplane-NOM	scheduled than	early arrive	NOM-COP	occasionally	exist-NOM		water
		Occasionally airplanes could arrive earlier than scheduled, but.. [incomplete sentence]							
D31	d	ビールでも	飲みながら	相談が	終わるまで	ここで	ゆっくり	していたい	選手
		beer-TOP	drink while	consultation-Nom	finish-until	here	relax	do-want	athlete
		(I) want to relax here while drinking beer until the consultation finishes.							
D32	d	天気が	いいと	ロッキーに	登る人が	下から	はっきり	見える	タバコ
		weather-NOM	good-if	Rocks-to	climb person-NOM	below from	clearly	can see	cigar
		If the weather is good, (you) could see from below people who are climbing the Rockies.							
D33	d	その時代	浮世絵の	美しさを	認めたのは	ヨーロッパで	日本では	なかった	タオル
		that era	ukiyoe-'s	beauty-ACC	recognized-TOP	Europe-COP	Japan-COP-TOP	not-PAST	towel
		In that era, it was Europe not Japan that recognized the beauty of Ukiyoe.							
D34	d	さかなは	新しければ	新しいほど	いいと	買いに	来る人は	思っている	時計
		fish-TOP	fresher-if	fresher-more	good-QT	buying-to	come person-TOP	thinking	watch
		The people who come to buy fish think fish is better if it is fresher							
D35	d	ボタンを	おすと	このドアが	開いて	ジュースが	ガタンと	出てくる	机
		button-ACC	push-if	this door-NOM	open-and	juice-NOM	crash	exit	desk
		If (you) push the button, this door opens and the can of juice comes out.							
D36	d	正月には	どこも	休みなので	いつもは	よごれている	東京の	空さえ	英和辞典
		new years day-TOP	everywhere	break-COP-because	usually	dirty	Tokyo's	sky-even	E-J dictionary
		Because everywhere is having break during new year's day, even the dirty sky of Tokyo.. [incomplete sentence]							
D37	d	外国人の	名前を	おぼえるのが	得意だから	そこの	いすに	すわって	用事
		foreigners-'s	name-ACC	remember-NOM	good at-because	that	chair-at	sit	errands
		Because (you) are good at remembering foreigners' names, sit at the chair there and.. [incomplete sentence]							
D38	d	ふべんな所に	あるけど	広いし	静かだし	自分で	好きな本を	えらべる	あいさつ
		inconvenient place-e exist-but		spacious	quiet	self-by	favourite book-ACC	select-can	greeting
		The location is not good, but it is spacious and quiets, and also you can select your favorite book.. [incomplete sentence]							
D39	d	九州	四国	本州	北海道では	ずいぶん	気温の	差が	失礼
		Kyushu	Shikoku	Honshu	Hokkaido-at	very	temperature-'s	gap	excuse
		The gap in temperature among Kyushu, Shikoku, Honshu, and Hokkaido is very.. [incomplete sentence]							
D40	d	見てから	かりるか	どうか	決めたいと	思いますから	もう少し	待っては	郵便局
		see-after	rent-if	whether	decide-want-QT	think-because	more little	wait	post office
		Wait.. Because (I) think (I) want to decide whether I rent it or not after (I) see it. [incomplete sentence]							

10D. Statements (Presented for 40 Stimuli after the Probe Recognition)

Trial#	Version	Statement	Expected Answer(key)
RR1	a	Some music has been treasured.	yes(p)
RR5	a	It has been three years since the research started.	no(q)
RR9	a	There were a lot of injured in the hospital.	yes(p)
GR3	a	The average prize for the violin contest was 10 dollars.	no(q)
GR7	a	Breakfast is eaten after waking up.	yes(p)
CN1	a	Over-eating can cause problems.	yes(p)
CN5	a	An old man happened to be near the college students.	yes(p)
CN9	a	It is no use studying while young.	no(q)
COMP3	a	Children can annoy adults when Christmas is coming.	yes(p)
RR2	b	There are no fireworks in this area tonight.	no(q)
RR6	b	The photos were picked up yesterday.	yes(p)
RR10	b	Nobody yearns for the hometown festivals.	no(q)
GR4	b	There is a penalty for ignoring another's pain.	yes(p)
GR8	b	The friendship did not last.	no(q)
CN2	b	The best way to have a meaningless life is to read.	no(q)
CN6	b	Snakes moved on the ceiling.	no(q)
CN10	b	It is noisy in the apartment building at night.	yes(p)
COMP4	b	The literature of this country is full of freedom.	no(q)
COMP8	b	The city hall has certain rules for senior citizens.	yes(p)
C3	c	There are only small classrooms left.	yes(p)
C7	c	The young generation likes to be in the city nowadays.	no(q)
C11	c	Students like many courses to be offered.	yes(p)
C15	c	Night school is easy after working all day.	no(q)
GR9	c	Having pretty clothes may reflect one's interest in arts.	yes(p)
C23	c	The tapes were used on the day of the purchase.	no(q)
C27	c	Tie both ends of the wrappers before trashing.	yes(p)
C31	c	The price of the stamps was not considered.	no(q)
C35	c	Anger can be suppressed.	yes(p)
C37	c	Habits can be corrected with ease.	no(q)
C39	c	That person tells a terrible lie.	no(q)
D1	d	Pizza was eaten every day.	yes(p)
D5	d	People like a dirty floor.	no(q)
D11	d	Sapporo in June can be hot.	yes(p)
D14	d	The tickets were cheap.	no(q)
D17	d	Somebody pushes passengers into the train.	yes(p)
D21	d	The bag was left at the airport.	no(q)
D25	d	Giving thoughtful gifts is a pleasure.	yes(p)
D31	d	To hurry and leave is preferred.	no(q)
D33	d	The Japanese did not appreciate ukiyo-e in those days.	yes(p)
D35	d	If you pull the lever, a can of juice will drop.	no(q)

Appendix 11. The Nouns Used in the Fourth Segment

11A. Regular Relative (RR)

Construction Type				REGULAR RELATIVE (RR)					
Argument/ Adjunct PP				ARGUMENT NP RELATIVE					
Trial Number				RR1	RR2	RR3	RR4	RR5	RR6
Case marker of Head Noun in relation with the predicate in Clause in [a]				GA agent	GA theme of existenc	NI recipient	NI benefactive	O object of activity	O patient
T R I O	Probe Location	Head Noun	a	音楽 music	人形 doll	運場 exercise hall	顔 face	研究 research	電車 train
		NP in Clause	b	合唱 choir	花火 fire work	自宅 home	目 eye	実験 experiment	鉄道 railway
	Distractor		c	曲 piece of music	風船 balloon	教室 classroom	鼻 nose	観察 observation	特急 super express
	Semantic Field			music	toy	practice room	face	research	railway

Construction Type				REGULAR RELATIVE (RR)			
Argument/ Adjunct PP				ADJUNCT PP RELATIVE			
Trial Number				RR7	RR8	RR9	RR10
Case marker of Head Noun in relation with the predicate in Clause in [a]				DE location of action	KARA source	E direction	O path
T R I O	Probe Location	Head Noun	a	都市 city	教会 church	病院 hospital	広場 square
		NP in Clause	b	ふるさと hometown	高校 highschool	公園 park	水田 rice field
	Distractor		c	農村 agricultural area	神社 shrine	旅館 hotel	道路 road
	Semantic Field			city, community	shine, etc.	hospital, etc.	use of land

11B. Gapless Relative (GR)

Construction Type				GAPLESS RELATIVE (GR)					
[Clause] and Head Relation				[consequence]condition		[condition]consequence		[purpose]requisite	
Trial Number				GR1	GR2	GR3	GR4	GR5	GR6
T R I O	Probe Location	Head Noun	a	学問 learning	運動 exercise	賞金 prize	つかれ fatigue	練習 practice	散歩 walk
		NP in Clause	b	経済 economics	野球 baseball	財産 asset	いたみ ache	教育 education	旅行 trip
	Distractor		c	教科 subject	水泳 swimming	税金 tax	うらみ resentment	夜学 night school	登山 mountain hiking
	Semantic Field			scholastic act	sports	money	feelings	practice	leisure

Construction Type				GAPLESS RELATIVE (GR)			
[Clause] and Head Relation				[requisite]purpose		[part]whole	[event]usual cause of opposite event
Trial Number				GR7	GR8	GR9	GR10
T R I O	Probe Location	Head Noun	a	朝食 breakfast	別れ separation	映画 movie	洗たく laundry
		NP in Clause	b	弁当 lunchbox	見送り seeing off	番組 program	そうじ cleaning
	Distractor		c	食事 meal	案内 guidance	芸術 fine arts	あみ物 knitting
	Semantic Field			meal	visit	entertainment	housekeeping

1.C. Clause and Noun Host Type (CN)

Construction Type				CLAUSE AND NOUN HOST TYPE (CN)				
Semantics of Head Noun				Relational Head Noun				
Trial Number				CN1	CN2	CN3	CN4	CN5
T R I O	Probe Location	Head Noun	a	結果 result	理由 reason	直前 just before	あいだ between	横 next to
		NP in Clause	b	条件 condition	目的 purpose	途中 on the way	うしろ behind	外 outside
	Distractor		c	原因 cause	関係 relation	翌日 following day	まえ front	中 inside
	Semantic Field			cause	reason	before/after	front/back	in/out

Construction Type				CLAUSE AND NOUN HOST TYPE (CN)				
Clause and Head Relation				Relational Head Noun		Perception Head Noun		Quasi-relational Head Noun
Trial Number				CN6	CN7	CN8	CN9	CN10
T R I O	Probe Location	Head Noun	a	あたり around	裏側 back side	音 sound	勉強 study	朝 morning
		NP in Clause	b	まわり surrounding	正面 front side	声 voice	責任 responsibility	夜 night
	Distractor		c	そば side	両はし both ends	息 breath	努力 effort	晩 evening
	Semantic Field			around	face/side	sound	patience	morning/night

1.D. Complement (COMP)

Construction Type				COMPLEMENT (COMP)					
Semantics of Head Noun				Communication				Thought and Feeling	
Trial Number				COMP1	COMP2	COMP3	COMP4	COMP5	COMP6
T R I O	Probe Location	Head Noun	a	電話 telephone	広告 advertisement	質問 question	意見 opinion	欲望 desire	がまん endurance
		NP in Clause	b	手紙 letter	放送 broadcasting	返事 response	感想 after thought	恐れ fear	努力 effort
	Distractor		c	文通 correspondence	情報 information	解答 answer	疑問 question	怒り anger	意地 nature
	Semantic Field			communication	information	question	opinion	desire	feeling

Construction Type				COMPLEMENT (COMP)			
Semantics of Head Noun				Other Content-Taking Nouns			
Trial Number				COMP7	COMP8	COMP9	COMP10
T R I O	Probe Location	Head Noun	a	思い出 memory	訴え petition	理論 logic	決定 decision
		NP in Clause	b	体験 experience	頼み favor	無理 immoderation	結論 conclusion
	Distractor		c	習慣 habbit	願い wish	うそ lie	判断 judgement
	Semantic Field			experience	wish	logic	decision

Appendix 12. The Instructions for Self-Paced Reading and Probe Recognition Task

Screen 1

Instructions for the experiment

Thank you for volunteering to participate in this experiment. You will remain totally anonymous. Your data will be analyzed and pooled with others for publication. You are of course free to withdraw from the experiment at any time.

Hit the space bar to continue.

Screen 2

This is a linguistic experiment to find out how native Japanese speakers and speakers of Japanese as a second language comprehend Japanese sentences.

The experiment consists of two parts. In the first part of the experiment, you will be asked to hit the keys according to the instructions on the computer screen. In the second part of the experiment, you will be given paper and pencil and asked to answer simple questions about Japanese sentences.

Hit the space bar to continue.

Screen 4

For statistical purposes, your responses require a label. At the beginning of the experiment you picked (or the experimenter picked for you) a unique name, which will be used consistently through the experiments. Your real name will never be used.

Screen 5

You will see a part of a Japanese sentence on the screen. For example, you may see a segment such as:

明日

To continue reading the next part of the sentence, hit the space bar. The sentences may or may not be grammatical Japanese sentences and may vary in length. For example, after hitting the space bar, you see a sentence in parts such as:

明日/来年の/カレンダーを/買いに/書店へ/行かなければ/ならない

In the next screen, you may see a word surrounded by * * such as:

* *書店* *

If you remember seeing this word in the immediately preceding sentence, hit the "p"(=yes) key marked by a green sticker with your right index finger. If you do not remember seeing the word in the sentence, hit the "q" (=no) key marked by a red sticker with your left index finger. (In this case, this word was in the immediately preceding sentence, so if you remembered it, you would

hit "p".) It is important to respond to the word in the ** as quickly as possible. So please place your right index finger on the "p" key and left index finger on the "q" key now.
人さし指を'p'と'q'のキーに置いてください。Let's practice. Hit the space bar with your thumb.親指で、スペースバーを押してください。

Hit the space bar to continue.

Participants do one trial of self-timed reading and probe recognition task as follows.

明日 *(participants hit the space bar)*
来年の *(participants hit the space bar)*
カレンダーを*(participants hit the space bar)*
買いに *(participants hit the space bar)*
書店に *(participants hit the space bar)*
行かなければ *(participants hit the space bar)*
ならない *(participants hit the space bar)*
＊＊書店＊＊*(participants hit either 'p' or 'q')*

Screen 6

Did you try hitting the keys as quickly as possible?

Occasionally after you hit the 'yes' ("p") or the 'no' ("q") key, you will see a statement like:

The calendar for the next year needs to be purchased tomorrow.

If the statement is true according to the sentence you just read, hit 'yes' ("p"). If the statement is not true, hit 'no' ("q").

Hit the space bar to continue.

Screen 7

When you see :

Hit 'g' to go on.

Please press the 'g' key. 左手の人さし指で'g'を押してください。

Let's practice a bit before the main experiment.

Hit the space bar for more
practice. 親指で、スペースバーを押してください。もう少し練習をします。

Participants do three practice trials as follows.
アメリカには *(participants hit the space bar)*
首相は *(participants hit the space bar)*
いない *(participants hit the space bar)*
かもしれない *(participants hit the space bar)*
＊＊ロシア＊＊ *(participants hit either 'p' or 'q')*
"Hit 'g' to go on." *(participants hit 'g')*
CDプレーヤが *(participants hit the space bar)*
ほしいので *(participants hit the space bar)*
お金を *(participants hit the space bar)*
ためている *(participants hit the space bar)*
＊＊ステレオ＊＊ *(participants hit either 'p' or 'q')*
"This person is saving money." *(participants hit either 'p' or 'q')*
困った時は *(participants hit the space bar)*
警察に *(participants hit the space bar)*
かけこむ *(participants hit the space bar)*
より *(participants hit the space bar)*
＊＊警察＊＊ *(participants hit either 'p' or 'q')*
"Hit 'g' to go on." *(participants hit 'g')*

Screen 8

Are you ready for the main experiment? If you have questions, ask Satomi now.

If you would like to go back and practice more, hit 'b' key.

If you can start the experiment, place your index fingers at the right positions and hit the space bar now.

'p'がyes/true, 'q'がno/falseです。
Remember "p" for yes/true and "q" for no/false.

HIT THE SPACE BAR TO DO THE MAIN EXPERIMENT NOW.

IF YOU NEED MORE PRACTICE HIT 'b' TO GO BACK.

実験を始めてもいいですか。よければ、人さし指を'p'と'q'のキーに置いて、親指でスペースバーを押してください。

If ready, participants hit the space bar to do 160 trials. If not ready, participants hit 'b' to do the last three practice trials and came back to Screen 8.

(After all the trials)Screen 9

This is the end of the experiment with the computer.

In five seconds, the screen automatically changed to Screen10

Screen 10

Now I will give you the next part of the experiment.

Then participants told the experimenter, who was outside the room, that the computer session was over.