

TESTING THE SHALLOW STRUCTURE HYPOTHESIS IN L2 JAPANESE

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ABSTRACT

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Language processing heuristics are one of the possible sources of divergence between first and second language systems. The Shallow Structure Hypothesis (SSH) (Clahsen and Felser, 2006) proposes that non-native language processing relies primarily on semantic, and not syntactic, information, and that second language (L2) processing is therefore necessarily less sensitive to syntactic constraints than native language (L1) processing. The SSH further predicts that regardless of whether a participant's L1 and L2 instantiate the same structure, L2 processing will always be less sensitive to structural constraints. The present dissertation tests these claims in non-native Japanese processing. L1 English and L1 Korean speakers completed a self-paced reading task that tested their ability to rely on case particles to project clause structure in relative clauses, their sensitivity to *wh*-dependencies, and their ambiguity resolution preferences. Results suggest that L1 English and L1 Korean speakers rely on case particles to project structure, but that they diverge from native Japanese speakers with respect to whether projecting a second clause facilitates the processing of the head noun of the relative clause. Results also suggest that L2 Japanese speakers are sensitive to *wh*-dependencies in canonical *wh*-biclausal sentences, but not scrambled ones. Ambiguity resolution preferences for both L2 groups converge on native-like preferences. These results are incompatible with the predictions of the SSH. The role of L2 literacy and syntactic knowledge in language processing is also discussed.

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Or: Backpacking in the Grand Canyon as an Extended Metaphor for Dissertation Writing

The best way to get a sense for the grandeur and majesty of the Grand Canyon is to hike in it: hiking brings you face-to-face with the desert, with the severe, stark beauty of the canyon and with your own physical and mental limitations. Backpacking trips in the canyon have several distinct stages: there's the descent, there's a day spent hiking along the river and exploring the northern side of the canyon, and then there's the ascent. Graduate school has phases, too, and, for me, the dissertation writing process has felt a lot like hiking out of the canyon.

The hike out of the canyon has three distinct stages: the River Trail, which runs from the campground, takes the hiker across the Colorado and along the riverbank for about a mile and a half. This stage is relatively easy: the main concern is to get started. This was the experimental design and data collection phase of this project. It requires discipline and effort, but it's easy to see progress and it's not particularly demanding.

After about a mile and a half, the River Trail reaches the Bright Angel Trail, which connects the river and the rim. The Bright Angel Trail is divided into two distinct stages: the first three and a half miles to Indian Garden, and the last four and a half miles to the rim. Before Indian Garden, the Bright Angel trail is not particularly strenuous. There is one section of switchbacks, but overall, the vertical elevation gain is 1,320 feet over about three and a half miles, so this section of the trail is not particularly steep. For me, this was the bulk of the writing process. The things that go into the initial writing process—reading and research and composing text—are work, but it's straightforward. At this point, you're also early enough in the project that

the end is not yet in sight, so it is relatively easy to keep working, because this is how you make progress.

The trail is relatively flat for about three-quarters of a mile leaving Indian Garden, but it heads straight for the canyon walls, which still tower 3,000 vertical feet above the trail. As the canyon walls get closer, the trail starts to get steeper. About 3.5 miles from the top, the trail hits the canyon wall, and becomes one long set of switchbacks. These switchbacks enable the remaining 3,060 feet of vertical elevation gain, but they are mentally and physically demanding. Every time you reach the end of one switchback, the next one takes you back across the canyon wall. Half the time, it feels like the trail is taking you in the opposite direction from where you need to be. These switchbacks are, of course, necessary, and a better solution than trying to climb the canyon walls. But they are exhausting. For me, the final months of this project have felt at times like climbing these switchbacks. What seemed at the outset to be a fairly straightforward task—analyze the data, write up the results, and interpret them—turned into a much more complicated and multi-faceted project than it seemed at the outset. Each ‘switchback’, however, proved necessary, and has resulted—I hope!—in a better project.

The other thing about both backpacking and dissertation writing is that, although they are both, in some senses, solitary activities, they are both made much, much better with good travel companions by your side. I have been particularly fortunate in this regard; I have had some great travel companions.

Bill VanPatten has been a vital source of support and encouragement to me since I was a first year M.A. student at Texas Tech and he was the director of Graduate Studies. Over the years, he has answered questions, provided professional advice, and even walked my dog. I am

deeply indebted to him for his support and encouragement over the years. It is a tremendous privilege to be able to call him both a mentor and a friend.

I am also thankful for Patti Spinner and Aline Godfroid have both been available for conceptual and methodological questions at various points along the way. I have also appreciated their willingness to talk about navigating various aspects of life in academia. Although this project is outside of her bailiwick, Charlene Polio was gracious enough to agree to serve on this committee. Her support when it came to contacts in Japan, as well as at the Japan Center for Michigan Universities was also instrumental in ensuring that this project got off the ground.

The Second Language Studies Program is, as a whole, made up of faculty and graduate students who are collegial and supportive, and it has been a privilege to be a part of this program. Three people were particularly helpful at various stages of this project, and deserve to be mentioned here. Kimi Nakatsuksa checked and revised all of my awkward Japanese. Irene Ahn translated materials into Korean. Dan Isbell showed me around R and R Studio. These three contributions have made this both a better and more manageable project, and I am thankful for their help.

Data for this project were collected at various places in Japan during the summer of 2015. In particular, the following people and organizations provided key support for recruiting participants and other logistical matters. First and foremost, I'm indebted to the Japan Center for Michigan Universities, and in particular Kate Simon at Michigan State University and Ben McCracken in Hikone, Japan. Both of them were willing to accommodate data collection to to a teaching job, and I could not have done one without the other. The following organizations were also a significant source of help in recruiting participants. Many of my Korean participants were recruited through the alumni networks at Nagano Prefectural University and Waseda University,

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The remaining travel companions are people whose friendship and support over the years have made life richer and better. Le Anne Spino-Seijas’s friendship has made graduate school fun. In addition to professional support, she even took it upon herself to improve my wardrobe. I’m afraid her efforts there have been in vain. Her friendship over the years has been delightful. Dan Trego, and Luca Giupponi are both, I’m sure, disappointed that I will not be opening a bakery any time soon. Still, I have enjoyed having willing guinea pigs for Saturday baking projects, and will miss their teasing. I will miss the friendship of my Thursday night small group when I move. Other travel companions whose friendship has been invaluable include Laura Ballard, who was crazy enough to sign up to a trip to the Grand Canyon with me, Jess Fox, and Jenn Brooke.

Much of what I know about life, perseverance, and ‘applying myself to a task’ I learned from my family, and it was in their company that I first encountered the Grand Canyon. Among other things, my father taught me to tackle problems, to persevere, and that a positive attitude makes a big difference. My mother taught me to write, and that love is not conditional on

performance. In their own ways, my siblings have taught me to not take myself too seriously, and that sometimes, card games with people are better than reading by myself.

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CHAPTER 1

FIRST AND SECOND LANGUAGE PROCESSING

A popular assumption is that second language (L2) systems are necessarily different from the first language (L1) system. The implication, even if it is not necessarily explicitly stated, is that second language systems are somehow qualitatively different from first language systems, and that proficient bilingualism is rare. The latter claim—that highly advanced or near-native L2 attainment is rare—has a good deal of empirical support, but this doesn't necessarily entail that there is something inherently different about either the process of second language acquisition, or the qualitative nature of the system being acquired. There are several possible loci for divergence between L1 and L2 systems, and the present dissertation investigates whether non-native language processing differs in fundamental ways from native language processing.

Constraints on Interlanguage Systems

Perhaps the central question in the field of second language acquisition (SLA) research is whether L1 and L2 linguistic systems are qualitatively the same type of system. This question applies equally to the process—first and second language acquisition—and the product—the L1 and L2 grammars. Given that L2 steady state grammars often appear to diverge from L1 steady state grammars in myriad ways, one answer to this question of whether L1 and L2 linguistic systems are qualitatively different is that L2 grammars are fundamentally different from L1 grammars. This theoretical position has been formulated under the Fundamental Difference Hypothesis (FDH) (Bley-Vroman, 1989, 1990, 2009), and arguments and evidence for various types of syntactic impairment have also been proffered (e.g., R. Hawkins & Chan, 1997; R. Hawkins & Liszka, 2003; Tsimpli & Roussou, 1991). At the same time, however, a collection of compelling arguments and evidence suggests that at least some of the knowledge of the target

language (TL) that L2 learners acquire is qualitatively the same type of knowledge that native speakers of that same language acquire (e.g., Schwartz & Sprouse, 1996; Schwartz, 1998; White, 2003). Evidence for this claim comes primarily from research that has investigated Poverty of the Stimulus (POS) effects in interlanguage grammars. POS effects are evident in cases in which speakers' linguistic knowledge is underdetermined by the input to which they were exposed. POS effects were first observed in native speakers, and they remain a key piece of evidence for the argument that native language acquisition is constrained by Universal Grammar (UG). A significant body of work has addressed the question of whether L2 learners continue to have access to UG by investigating whether POS effects are also present in L2 grammars. Evidence for POS effects in L2 grammars comes from work that has found evidence for Overt Pronoun Constraint (OPC) effects in the interlanguage grammars of L1 English speakers learning either Spanish (e.g., Perez-Leroux & Glass, 1999; Rothman, 2009) or Japanese (Kanno, 1997, 1998) as a L2. Similar results are found in studies that have investigated other structures, such as L2 learners' knowledge of case drop in Japanese (Kanno, 1996), and L2 learners' knowledge of constraints on verb movement in French (Ayoun, 1999). Thus, despite the arguments advanced in favor of the FDH, there is evidence that interlanguage grammars are not qualitatively different from native language grammars. In other words, the L2 grammar is not a different type of system than the L1 grammar.

This position does not entail that L2 grammars are necessarily identical to L1 grammars, and it doesn't necessarily preclude the possibility that L2 grammars will diverge from native language grammars in important ways. It does mean, however, that identifying the source of these divergences is important, and that whatever the source of perceived 'deficits' in L2 grammars is, this source is not ultimately due to qualitative differences in the type of knowledge

or system being acquired. It is indeed well established that certain aspects of L2 grammars—such as inflectional morphology—seem to be subject to protracted delays in SLA (see e.g., Slabakova, 2008 for discussion). A theory of second language knowledge and acquisition needs to account for both convergence on native-like knowledge and divergence from it. One way to do this is to posit that L1 and L2 linguistic systems are qualitatively the same type of system, but that there are still important differences between the two systems. The question then becomes what the locus or loci of these hypothetical differences is and what governs these differences. One possible source of L1 and L2 differences lies in the difference between linguistic knowledge and linguistic use.

Proficient language use draws on two things: a grammar of the target language and the ability to use said grammar in contextually and socially appropriate ways in real time. The first aspect, grammatical knowledge, is called *competence*, and the second aspect, language use, is called *performance*. The competence and performance systems are related to each other, if only because the performance systems necessarily draw on the competence systems. They do not, however, have to be the same system, and it is common to assume that these systems are in some sense distinct (e.g., Chomsky, 1959; Prévost & White, 2000; White & Genesee, 1996; White, 2003). A major implication of this position is that it is possible to have *knowledge* of some aspect of the TL and still have an incomplete or impaired ability to deploy that knowledge in communicative settings. This assumption leaves us with a couple of possibilities for the locus of apparently divergent L2 knowledge or use. One possibility is that both L2 competence and L2 performance are fundamentally different from the corresponding L1 systems. This position does not allow us to account for evidence of acquisition in L2 POS contexts. The second, albeit fairly unlikely, possibility is that the L2 competence system, but not the performance system, diverges

from the corresponding L1 system. The third possibility is that the L2 competence system is relatively unimpaired, and that the L2 performance system is the most subject to impairments. The third position—that the locus of differences in L2 grammars is found primarily in the performance system—allows us to accommodate both pieces of evidence mentioned earlier: the observation that the nature of the linguistic system that L2 learners acquire is fundamentally the same as that of native speakers, and that any apparent divergence is traceable to deficits or impairments in the performance systems. A significant body of research investigating both L2 competence (e.g., Prévost & White, 2000; Rothman & Iverson, 2007, 2013; Rothman, 2009; White, Valenzuela, Kozłowska-Macgregor, & Leung, 2004) and ultimate attainment (e.g., Serratrice, Sorace, Filiaci, & Baldo, 2011; Slabakova, Kempchinsky, & Rothman, 2012; Slabakova, 2008; Sorace, 2004, 2005, 2011; VanPatten, Keating, & Leiser, 2012) supports this claim (see, e.g., Slabakova, 2008; White, 2003 for discussion and evidence).

Researchers who take this position draw a fairly sharp distinction between representation and processing. *Representation* in this case refers to the primitives, such as constraints on language derived from UG as well as features, that underlie L2 competence. For example, Japanese marks nominative and accusative case on nouns. The L2 Japanese speaker's ability to do this depends on having acquired a representation for case marking. Acquiring a representation for case marking includes mapping the lexical items *-ga* and *-o* to their functions, namely marking nominative and accusative case, respectively. Assuming that L2 grammars are also subject to UG-based constraints (see e.g., White, 2003 for evidence and argumentation), acquiring case marking also means that the L2 Japanese learner will also be sensitive to the UG-based constraints that govern when case particles are obligatory, and they will have instantiated the features and functional projections that allow the grammar to insert a case particle. In

addition to representing case in the interlanguage grammar, learners must also be able to rely on case particles to construct a structure for the sentences they hear. This is the ability to make use of case marking during language processing. Maintaining a distinction between representation and processing allows us to posit, for example, that L2 Japanese speakers might have a representation for case marking, but that if they do, this does not necessarily mean they will be able to make use of it with as much facility as native speakers, a deficit that may be apparent either in non-target like production of forms, or in non-native-like online processing heuristics. Processing heuristics in particular may be an important source of variability in L2 grammars, and researchers are increasingly turning their attention to this question. The present dissertation investigates the L2 processing behaviors of native English and native Korean speakers who speak Japanese as an L2. The remaining sections of this chapter describe the Shallow Structure Hypothesis, which deals with the nature of L2 processing, and make the case for using non-native Japanese processing as a test case for the SSH.

The Shallow Structure Hypothesis and L2 Processing

Language processing is important for both language acquisition and competent linguistic use. Language acquisition depends on language processing because, regardless of whether the learners are children learning their first language or adults learning a second language, learners must process the input to which they are exposed in order to construct a grammar for the target language. At the same time, comprehending a language requires mapping the input string to a structural representation and meaning in real time. The ability to do this depends on having acquired a grammar for the TL. Thus, *processing* can be investigated as an aspect of the language acquisition process more generally, and this domain of research endeavors to understand how naïve learners approach the input, and how the mind/brain deals with input to

construct a system (e.g., Sharwood Smith, 2005; Truscott & Sharwood Smith, 2004; VanPatten, 2004, 2007). The second domain owes a tremendous debt to the native language psycholinguistics literature, and investigates L2 speakers' (relatively) mature processing heuristics in order to understand the nature of the L2 system, and to locate possible divergences from the mature L1 system. The present study falls within the second domain.

The major hypothesis within the second domain is the Shallow Structure Hypothesis (SSH) (Clahsen & Felser, 2006). The SSH has two major prongs. The first is that “the syntactic representations adult L2 learners compute for comprehension are shallower and less detailed than those of native speakers” (Clahsen & Felser, 2006, p. 32). The second is that there is little to no L1 transfer in the domain of language processing, thus, the prediction is that L2 learners, regardless of their L1s, will perform more similarly to each other than they will to native speakers of the TL. Each of these prongs is fleshed out below.

The first prong of the SSH is a proposal about the nature of structural representations that L2 speakers and learners compute for the TL. Evidence for this claim comes primarily from research that has investigated the processing of *wh*-dependencies, such as the example in (1) below.

- (1) The manager_{*i*} who_{*i*} the consultant claimed that the new proposal had pleased *t_i* will hire five new employees.

In the theoretical literature, Chomsky (1981) argued that these sentences include an intermediate gap at the head of the embedded CP, as illustrated in (2) below.

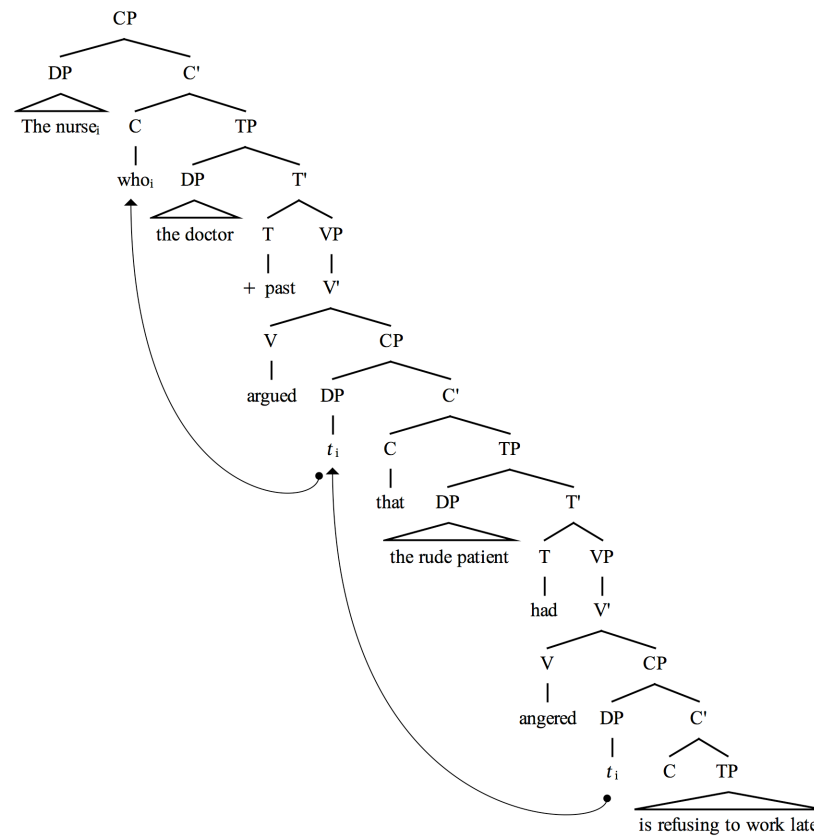
- (2) The manager_{*i*} who_{*i*} the consultant claimed *t_i* that the new proposal had pleased *t_i* will hire five new employees.

In these kinds of long distance dependencies, the *wh*- word is base generated in the specifier of the lowest IP and then moves up to the specifier of the matrix clause by successive cyclic movement. In the process, it passes through the specifier of the embedded CP. It was hypothesized that successive cyclic movement facilitates the processing of these types of long distance dependencies, and experimental evidence with native English speakers confirmed that hypothesis (e.g., Gibson & Warren, 2004; J. Hawkins, 1999). Specifically, native English speakers slow down at both gap positions, which suggests that the parser is integrating the filler with each gap position in order to construct a detailed syntactic representation of the sentence. *Wh*- dependencies can be either local or long distance, as the sentences in (3) illustrate.

- (3) a. The nurse likes the patient_{*i*} who [*e_i*] was admitted last night. (local)
- b. The nurse_{*i*} who the doctor argued [*e_i*] that the rude patient had angered [*e_i*] is refusing to work late. (long distance)

As discussed above, when the NP *nurse* is moved to the front of the sentence, it passes through an intermediate gap in the specifier of the embedded CP, as demonstrated in Figure (4).

(4)



The parser uses the intermediate position to facilitate the processing of long distance dependencies. In native language processing, this movement leaves a trace that shows up as elevated reading times on the complementizer *that* as compared to a control sentence. In contrast, experimental evidence suggests that L2 English speakers do not make use of the intermediate gap (Marinis, Roberts, Felser, & Clahsen, 2005). Crucially, however, they do indicate successful comprehension of these sentences, indicating that L2 speakers are able to construct enough of a representation to interpret them accurately.

Based on evidence that suggests that L2 speakers rely more heavily on lexical semantics and plausibility to interpret sentences than native speakers do, Clahsen and Felser (2006) propose that the L2 parser constructs predicate-argument frames, and does not construct a complete syntactic representation. Thus, when faced with sentences like those in (3), the parser does not

construct a representation with gaps. Instead, it relies on the argument structure of the verbs to construct a representation for these sentences. In (3b), for example, the parser knows that *argue* takes an agent and a sentential complement as its theme, and it assigns these roles to *the doctor* and the embedded clause. When it gets to *anger*, the parser assigns its theta roles to *patient* and *nurse*, thereby constructing a complete semantic representation and an underspecified syntactic representation for this sentence. In other words, L2 processing is primarily driven by semantic, and not syntactic information. Thus, the SSH predicts that non-native speakers will not show the same reliance on syntactic information to process sentences that native speakers show.

The second prong of the SSH deals with the issue of L1 transfer into the L2 processing system. This aspect of the SSH is admittedly less well articulated than the first prong, but it proposes that L2 learners do not transfer processing heuristics from the L1 into the L2. Evidence for this claim comes from the work on *wh*-dependencies and from research that has investigated L2 learners' ambiguity resolution preferences. Marinis et al. (2005) investigated L2 English speakers with four different L1 backgrounds—German, Greek, Chinese, and Japanese—to see whether the L2 speakers made use of intermediate gaps when processing sentences such as those in (4). German and Greek are both *wh*-movement languages, and thus these participants might have been expected to make use of the intermediate gaps. In contrast, Japanese and Chinese are *wh*-in situ languages, and do not have an L1 processing system that is tuned to *wh*-movement structures. All four of the L2 groups had longer reading times at the extraction site—indicating that they were reintegrating the filler at its base-generated position—but not at the intermediate gap site. Marinis et al. interpreted these results as evidence for the claim that L1 processing strategies do not transfer to the L2. Additional evidence for the lack of L1 transfer of processing

heuristics comes from research that has investigated ambiguity resolution strategies in globally ambiguous sentences (e.g., Dussias, 2003; Felser, Roberts, Marinis, & Gross, 2003).

Japanese as a Test Case for the SSH

To date, the research on L2 parsing has ignored some basic issues in native language processing, and these issues may shed some important light on the nature of the L2 processing system. In particular, one of the early questions that native language psycholinguistic research tried to answer was whether processing heuristics are universal or whether they are ‘tuned’ to each particular language. A separate, but related, question is what kind of information the parser makes use of to process language. If processing heuristics are universal, then it seems reasonable to assume that L2 learners have nothing to acquire. Under this assumption, any apparent divergences from native language processing are necessarily due to deficits in the L2 processing system. On the other hand, if processing heuristics are, to a certain extent, ‘tuned’ to the language in question, then depending on the L1/L2 pairings in question, L2 speakers may have new processing heuristics to acquire, and deficits in the system could be due to incomplete acquisition.

The SSH does not take an explicit position on these larger questions, and, to date, no research has investigated the non-native processing of a language that makes use of basic processing heuristics that are fundamentally different from those used in the L1. As will be discussed in more detail in the next chapter, native speakers of head-initial languages, like English, rely on different processing heuristics than native speakers of head-final languages, like Japanese. Head-initial languages place structural information, such as phrasal heads and verbs, early in phrases, clauses, and sentences, which means that the parser encounters this information early, and can use it to build structure. In contrast, in a head-final language, this information

occurs relatively late in the sentence, and it is not available to the parser. Native speakers of English rely primarily on verbs and functional heads to construct a representation for input streams (e.g., Pritchett, 1991), but native Japanese speakers rely primarily on case markers to do so (Miyamoto, 2002). These basic differences in processing heuristics have received little attention in the L2 processing literature, but they are a potentially important source of information about L2 processing. Specifically, the ability to process input streams incrementally is critically important for basic language comprehension. Native speakers of head initial and head final languages make use of different syntactic information to process sentences incrementally. If, as the SSH predicts, all L2 processing relies primarily on semantic, and not syntactic representations, then the SSH also predicts that L2 speakers should not be able to rely on the same structural information for incremental processing as native speakers of the TL do.

No research has investigated L2 acquisition of processing heuristics with learners whose L1 and L2 have typologically different word orders—and no research has specifically investigated whether basic processing heuristics are impaired¹ in an L2. These fundamental typological differences in the syntax of a language have implications for theories of L2 processing. For example, if the SSH is correct, then L2 learners might be predicted to face difficulties in learning to process even basic sentences efficiently, regardless of the L1. Native

¹ Conceptually, it is possible to distinguish between processing heuristics that are not finely tuned to the L2 input and those that are impaired. In the first case—a lack of tuning—it is theoretically possible that with more exposure to input, the parser will become more finely-tuned to the L2 input, and that observed non-native processing behaviors are temporary. In the case of impaired heuristics, however, the claim is that the parser cannot overcome non-native processing heuristics. It is difficult, however, to distinguish between these two positions empirically. Non-native processing behaviors are evidence for either a lack of tuning or for impairment. Evidence for tuning accounts over impairment accounts would come from the following sources: longitudinal within subjects data that suggest that processing heuristics become more native-like as a function of proficiency, and from evidence of native-like processing heuristics. Native-like processing heuristics suggest that any observed divergences from native-speaker norms is not necessarily evidence of a global deficit.

English speakers learning other head-initial languages are predicted to be less sensitive to information from verbs and functional heads in their L2, and the same prediction holds for learning head-final languages. On the other hand, contra the SSH, we might expect to see L1 transfer areas such as incremental processing routines such that native speakers of a head final language, like Korean, are better able to process another head-final language than native speakers of a head-initial language, like English, are. The present dissertation investigates non-native Japanese speakers' sensitivity to three processing constraints in Japanese: reliance on case particles for incremental processing, sensitivity to *wh*- dependencies, and ambiguity resolution preferences. Japanese was selected as the target language for the present dissertation because it is a head-final, *wh*- in situ language, and thus instantiates different mechanisms for both incremental processing and computing *wh*- dependencies than head-initial, *wh*- movement languages, like English and German.

The Present Dissertation

The present dissertation tests two aspects of the SSH: (a) the claim that non-native speakers do not process the L2 at the same depth as native speakers, and (b) the claim that L1 processing strategies do not transfer to L2 processing. These claims will be tested by investigating the L2 processing strategies of L1 Korean and L1 English near-native Japanese speakers. This dissertation investigates three different aspects of L2 Japanese processing: the non-native processing of case particles, which relates to the ability to process sentences incrementally; the non-native processing of *wh*- dependencies, which relates to the ability to integrate information across clauses; and non-native ambiguity resolution heuristics. The first structure, case particles, has not been investigated in the literature. *Wh*- dependencies and ambiguity resolution preferences have received a good deal of attention in the literature testing

the SSH (Dussias & Sagarra, 2007; Dussias, 2003; Felser et al., 2003; Felser & Roberts, 2007; Marinis et al., 2005; Miyao & Omaki, 2002), but they have been investigated in the context of acquiring a *wh*- movement language (in the case of *wh*- dependencies) or where the branching direction of the L1 and L2 match (in the case of ambiguity resolution strategies). These two structures here are included for the sake of comparability with previous research, and because, as will be discussed in more detail in later chapters, these structures work differently in Japanese than they do in languages that have been investigated to date. The present dissertation investigates whether non-native Japanese speakers rely on syntactic cues to process three types of sentences. The first set of sentences is used to investigate whether native and non-native speakers rely on case particles to process sentences incrementally. The second set is used to investigate native and non-native speakers' sensitivity to *wh*- dependencies, and the third set is used to investigate native and non-native speakers ambiguity resolution preferences. L1 Korean and L1 English speaking participants were tested to investigate whether L1 processing heuristics play a role in L2 processing. Korean and Japanese are both head-final, case-marking languages that lack *wh*- movement and share ambiguity resolution preferences. English diverges from Korean and Japanese in all three domains, so if L1 transfer facilitates processing, the L1 Korean speakers are predicted to have an advantage in processing Japanese. Specific research questions are presented in each chapter. The SSH predicts that both the L1 English and the L1 Korean groups will diverge from native Japanese speakers on all structures.

Overview of the Dissertation

This dissertation is structured as follows. This chapter has discussed the theoretical background of the SSH, and has motivated the need for researchers to investigate fundamental differences in processing heuristics as part of a research agenda for linguistic processing and

ultimate attainment. The next three chapters each present a self-paced reading study that investigated one of the research questions above. Each chapter describes the target structure and discusses previous research that pertains to that specific structure. Each chapter also presents results, analyses, and an interim discussion of the results. Chapter 5 provides a general discussion of the results of the three studies and a conclusion.

Definition of Terms

Wh- dependencies: The syntactic relationship created between an element that has been moved from its base-generated position (the filler) and the base generated position (the gap).

Head-driven parsing: A model for native language sentence processing that assumes that people rely primarily on heads to project clause structure and process sentences incrementally.

Head final language: A language that instantiates complement-head word order as its basic word order. Head final languages are rigidly verb final. Head final languages present problems for head-driven parsing models because these models predict head-final languages will be massively more difficult to parse than head-initial languages. Japanese and Korean are head final languages.

Head initial language: A language that instantiates head-complement word order as its basic word order. Verbs in head initial languages occur relatively early in the sentence, and complementizers precede their complement.

Incremental parsing: A universal parsing heuristic in which the parser integrates each word into the parse as it encounters it. The specific mechanisms for incremental parsing vary depending on the target language.

Interlanguage grammars: The developing grammar that L2 learners construct. Originally defined in Selinker (1972).

Linguistic competence: The mental grammar for a language that is stored in the speakers' mind/brain. Competence is abstract, unconscious, and subject to universal constraints.

Linguistic performance: Linguistic competence put to use in production or comprehension.

Linguistic performance draws on competence, but it is potentially subject to various external factors that make it an inexact reflection of linguistic competence.

Parser: The mechanisms that allow people to construct an interpretation for sentences as they read or hear them in real time. The native language parser draws on information from syntactic, semantic, and pragmatic information to make structural decisions in real time.

Poverty of the Stimulus: Evidence that both native and non-native speakers come to know more about the target language than they could have learnt based on the input to which they were exposed. Sensitivity to the Overt Pronoun Constraint (OPC) is one source of evidence for Poverty of the Stimulus effects.

Theta roles: Roles such as *agent*, *patient*, and *theme* that are part of the properties of verbs. Verbs assign theta roles to their arguments, and sensitivity to the possible theta roles and the frequency with which they are assigned facilitates incremental parsing in head-initial languages.

CHAPTER 2

EXPLOITING CASE MARKERS FOR INCREMENTAL PROCESSING

Models of language processing attempt to account for the observation that mature language processing draws on information from syntactic, semantic, and pragmatic sources to interpret sentences quickly and efficiently. To do so, these processing models have to balance the theoretical desideratum that, because it is part of the human endowment for language, the parser must be universal, with experimental evidence that native speakers of different languages rely on different syntactic information to process their native language. This is typically done by assuming that all language processing is incremental, but that the parser becomes attuned to specific syntactic information depending on the branching direction of the language (e.g., Fodor, 1998a, 1998b; Miyamoto, 2006). This has implications for L2 acquisition: in order to efficiently process language, L2 learners need to be able to do so incrementally. Thus, L2 learners who have an L1 with a branching direction that matches that of the L2 might have an advantage in L2 processing over L2 learners whose L1 instantiates a branching direction different from that of the L2. This is because when the branching directions of language learners' L1s and L2s do not match, the parser has to become attuned to new syntactic information, thus possibly increasing the acquisition burden. When the branching directions match, however, L2 learners may transfer basic heuristics from the L1 to the L2². Because the Shallow Structure Hypothesis (SSH)

² This assumes that branching direction plays a significant role in determining incremental processing heuristics so that, for instance, head-final languages necessarily rely on case particles. The typological picture is not quite this neat. According to the World Atlas of Linguistic Structures (WALS) database, there are 313 languages that are rigidly SOV and mark case overtly. In contrast, 82 SVO languages mark case overtly. There are 87 SOV languages that do not mark case but 187 SVO languages that do not mark case. Thus, while there are exceptions to this generalization, it is clear that SOV languages are more likely to mark case than SVO languages are. In addition, both Korean and Japanese obligatorily mark case on NPs, so the processing heuristics in question in the present study are comparable.

predicts that L2 processing relies on semantic, and not syntactic, information, it predicts that all L2 parsing should be insensitive to structural constraints. Thus, it predicts that L2 learners cannot process the L2 incrementally regardless of L1 background. This chapter fleshes out mechanisms for incremental processing in Japanese and English, and discusses implications for L2 processing.

Background and Motivation

Incremental Processing

One of the earliest questions in psycholinguistic research was how people parse sentences. It was clear that native speakers are able to rapidly and efficiently integrate syntactic, lexical, and semantic information into parses; the question was what kind of information (structural and/or semantic) gets priority in sentence processing. The predominant model of mature sentence processing is an incremental model: the parser incorporates each word into the parse as it encounters it (see e.g., Fodor & Inoue, 1994; Frazier & Fodor, 1978; Frazier, 1998 for arguments and evidence). The major drawback of incremental processing is that the parser runs the risk of projecting the wrong structure, as seen in the prototypical garden path sentence in (1):

(1) The horse raced passed the barn fell.

Up until the parser encounters the last word—*fell*—it can (and does) interpret this sentence as a simple declarative sentence and not as one that includes a reduced relative clause. Upon encountering *fell*, the parser has to revise its original analysis to incorporate *fell* into the structure. At that point, the parser goes back and changes its analysis of the sentence from a simple declarative clause structure to one containing a reduced relative clause structure. Reanalysis is costly, and an alternative to incremental parsing holds that the parser keeps constituents in working memory and waits to commit to a parse until all constituents have been

encountered. While the latter theory clearly allows for a higher degree of accuracy, it also entails that parsing taxes working memory resources, particularly in longer sentences. In addition, evidence from native language processing heuristics suggests that the parser does commit to a parse as it encounters words—this is the source of garden path effects, after all—and that it relies on a range of information to do so. Currently, all models of sentence processing assume that the parser is incremental, and that it has some mechanism for repair (see e.g., Fodor, 1998a, 1998b; Kamide & Mitchell, 1999; Miyamoto, 2002, 2006 for discussion and evidence).

The parser relies on a variety of informational sources to construct a representation for the sentence, many of which are structural. Early models of sentence processing were based primarily on data from English, and assumed that the parser made use of lexical and functional heads, as well as information in the verb to project structure (Pritchett, 1991). This works for head-initial languages like English because this information is present and transparent early in the input string. For example, the sentence fragments in (2) have relatively unambiguous structures once the last element is encountered.

- (2) a. The boy...
- b. The boy sees...
- c. The boy who sees...

Either (2b) or (2c) is a possible continuation of (2a). However, once *sees* is reached in (2b), the parser can predict that the next phrase is likely to be a DP. Similarly, when the parser encounters *who* in (2c), it projects another clause, and it can do so without reanalyzing a parse. In contrast, as several researchers have pointed out (e.g., Miyamoto, 2002, 2006; Yamashita, 1997 *inter alia*), the rigidly head-final nature of Japanese, coupled with robust use of empty categories and the relatively free word order of non-verbal elements (i.e., nominals) has serious implications for head-driven models of sentence processing that are assumed to be universal. In short, these

models predict that head-final languages like Japanese should be massively more difficult to parse than head-initial languages are—either because head-driven parsing of head-final languages means that several elements would have to be held in working memory before they could be integrated into the parse or because parses would require frequent reanalysis. For example, the Japanese equivalent of (2b) is compatible with two different analyses: a sentence with a null object (as in 3b) and the modifier in a pre-nominal relative clause (as in 3c):

- (3) a. *otokonoko-ga [e] suki...*
 boy-NOM likes...
 b. *otokonoko-ga [e] suki da*³.
 boy-NOM [e] likes COP⁴.
 ‘The boy likes (the girl, the dog...).’
 c. *otokonoko-ga suki-na inu-ga...*
 boy-NOM likes-adj dog-NOM...
 ‘The dog the boy likes...’

In these examples, it is only when the parser encounters the material that follows *suki* (“like”) that it knows whether the input is a simple sentence as in (3b) or a modification structure as in (3c). In addition, in (3c), assuming that the parser has projected the NP *otokonoko* as the structural subject of TP—which it should do if it is sensitive to the nominative case marking—it also has to go back and associate the NP as the object of the relative clause. Once it has done this, it projects a new clause with *inu* (“dog”) as the matrix subject. A significant body of literature has investigated how native speakers process Japanese, and despite the fact that Japanese seems like it should be significantly more difficult to process than English, there is no

³ These sentences are also an example of how robust use of null nominals complicates the processing of Japanese. Because the verb *like* in Japanese does not take an accusative case marked object, examples (3a) and (3b) are ambiguous between two readings: one in which the boy likes someone or something, and one in which someone likes the boy. Spelling out the second argument (either the subject or the object) takes care of this ambiguity.

⁴ Abbreviations used in the glosses are as follows: ACC = accusative case, COMP = complementizer, COP = copula, DAT = dative case, GEN = genitive case, NOM = nominative case, LOC = locative case, TOP = topic marker, Q = question particle.

experimental L1 evidence that suggests that it is. Instead, the experimental evidence suggests that Japanese speakers are able to process Japanese quickly, efficiently, and incrementally (Miyamoto, 2002, 2006; Yamashita, 1997, 2000). These findings have implications both for models of language processing and for L2 acquisition.

Models of language processing have to balance a key theoretical desideratum on the one hand with typological and experimental evidence on the other hand. The theoretical desideratum is that the mechanisms that process language are part of the universal human endowment for language. There are two important reasons for assuming this. The first is that it simplifies the native language acquisition task in that it means that children are equipped with the mechanisms they need to parse the L1 input from their first encounters with their L1. The second is that it is consistent with the larger assumption that each individual language is one instantiation of the category called Language. Assuming that the parser is universal, however, presents problems when confronted with actual linguistic data. For instance, as discussed above, there is good empirical evidence that native speakers of head-initial and head-final languages rely on different syntactic information to parse input strings. This suggests that the English parser and the Japanese parser are actually tuned to different sources of syntactic information.

In order to balance the theoretical desideratum of a relatively simple, generalized universal processor on one hand with the clear evidence that the parser must rely on different pieces of information to process different languages on the other hand, contemporary models of language processing assume a general parser that becomes tuned to the specific language it is processing (see, e.g., Cuetos & Mitchell, 1988; Fodor, 1998a, 1998b; Miyamoto, 2006 for discussion). This allows us to account for data that suggests that native speakers of head-initial languages, like English, rely heavily on the verb and on functional heads to build structure (e.g.,

Snedeker & Trueswell, 2004; Trueswell & Kim, 1998), whereas native speakers of head-final languages, like Japanese, rely on case marking information as the building blocks of sentence structure (e.g., Miyamoto, 2002; Yamashita, 1997, 2000). A universal parser can be assumed if it has some mechanism that makes it possible for the child growing up in an English-speaking environment to learn to build structure based on lexical and functional heads and the verb, and for the child growing up in a Japanese-speaking environment to build structure based on case marking cues. In the case of moment-by-moment structural computation, a universal parser can be assumed as long as the specific mechanisms for computation are either left underspecified or are adjusted based on experience with the input.

Case Marking and Incremental Processing

Japanese, like many head-final languages, obligatorily marks NPs with a case particle (e.g., Fukuda, 1993; Hinds, 1982; Hosokawa, 1991; Yoo, Kayama, Mazzotta, & White, 2001). Native Japanese speakers rely heavily on these case markings to process the language (Miyamoto, 2003, 2006; Tamaoka et al., 2005; Yamashita, 1997). Specifically, there are two constraints that govern the occurrence of case particles in sentences. The first one is that no single clause can have two nouns marked with the nominative case particle, *-ga*, and the second is that no verb takes two arguments that are both marked with the accusative case particle, *-o*. These constraints have the following implications for processing. First, when native speakers encounter a second *-ga*-marked NP, the parser automatically projects a second clause. Second, even if both subjects are null, the presence of a second accusative case-marked noun indicates that the sentence is biclausal, and the parser should expect both an embedded clause and a matrix clause verb. Miyamoto (2002) tested native Japanese speakers' sensitivity to these constraints using contrasts such as those seen in (4), for nominative case markers.

- (4) a. Obasan-ga [RC t_i toshiyori-o kousaten-de mita] onanoko-ni_i koe-o kaketa.
 Woman_{NOM} [RC t_i old man_{ACC} intersection_{LOC} saw] girl-to_i called.
 “The woman called to the girl who saw the old man at the intersection”
 b. Obasan-ga [RC toshiyori-ga t_i kousaten-de mita] onanoko-ni_i koe-o kaketa.
 Woman_{NOM} [RC old man_{NOM} t_i intersection_{LOC} saw] girl-to_i called.
 “The woman called to the girl who the old man saw at the intersection.”
 (Miyamoto, 2002, ex. 18, p. 326)

In (4a), the beginning of the sentence (*Obasan-ga toshiyori-o kousaten-de mita*) is compatible with a declarative sentence, and has an interpretation in which the woman saw the old man at the intersection. The parser initially adopts this interpretation. When it reaches *onanoko*, which cannot be integrated into the existing parse, the parser is forced to reanalyze the segment as a modification structure. At this point, it has to revise the parse to posit a gap before *toshiyori-o*, and to associate the noun *onanoko* with the gap position⁵. This imposes a processing cost at *onanoko*. In contrast, when the parser encounters *toshiyori-ga* in (4b), it automatically projects a second clause that it closes when it reaches *onanoko*, and does not need to reanalyze anything. Projecting a second clause at *toshiyori-ga* increases the processing load at the beginning of the clause, but facilitates processing at the end of the relative clause. Reading times at *onanoko* in (4b) are therefore predicted to be shorter than those at *onanoko* in (4a). Similarly, reading times at *toshiyori* in (4b) are predicted to be longer than those in (4a). Miyamoto found this to be the case—the presence of the second nominative case marked NP in (4b) facilitated the processing of *onanoko* later in the sentence as measured by shorter reading times for *onanoko* in (4b) than in (4a).

Miyamoto also tested speakers’ ability to use accusative case markers to project clause boundaries as in the contrast illustrated in (5).

⁵ Unlike relative clauses in English, which are usually introduced with a complementizer, Japanese relative clauses are externally headed, but do not contain any lexical items in C⁰. This creates additional ambiguity in subject RCs.

- (5) a. Ofisu-de shokuin-ga [RC kakaricho-ni ocha-o dashita] jyosei-o shokaishita.
Office-in employee_{NOM} [RC manager_{DAT} tea_{ACC} served] woman_{ACC} introduced.
“At the office, the employee introduced the woman who served tea to the manager.”
- b. Ofisu-de shokuin-ga kakaricho-o [RC ocha-o dashita] jyosei-ni shokaishita.
Office-in employee_{NOM} manager_{ACC} [RC tea_{ACC} served] woman_{DAT} introduced.
“At the office, the employee introduced the manager to the woman who served tea.” (Miyamoto, 2002, exs. 8-9, pp. 314-315)

Until the noun *jyosei* is encountered in (5a), the sentence can be parsed as a declarative sentence that asserts that the employee served tea to the manager. Once the noun-case marker complex *jyosei-o* is encountered, the parser is forced to reanalyze the sentence so that *jyosei* heads a relative clause⁶. In contrast, in (5b), as soon as the second accusative-marked NP, *ocha-o*, is encountered, the parser projects a second clause, increasing reading times on that NP, but facilitating the processing of the relative clause overall. If the parser does indeed operate in this fashion, reading times at *jyosei* in (5b) are predicted to be shorter than those in (5a). Miyamoto found that native speakers are sensitive to these constraints in online processing, and use both accusative-case marked nouns and nominative-case marked nouns to project clause structure.

To date, no research has investigated the L2 acquisition of basic processing heuristics under the rubric of the SSH. This is partly because a good deal of the evidence for the SSH comes from the acquisition of European languages, almost all of which are head initial⁷, and participants are often also native speakers of other European languages. Assuming that learners use basic parsing heuristics from the L1 to process the L2, strategies for incremental structure building do not need to be acquired at the early stages of L2 acquisition. In contrast, people who

⁶ As in English, this sentence is ambiguous between two readings. The first is the reading in which the woman who served tea was introduced to the manager, and the second is the reading in which the woman who served tea to the manager was introduced to people left unspecified.

⁷ The verb second (V2) languages like German are the major exceptions to this generalization. The V2 languages are typically analyzed as underlyingly SOV, but that word order typically only surfaces in embedded clauses. These languages are different from rigidly head final languages, and the processing heuristics required to process them are beyond the scope of the present dissertation.

are acquiring a second language whose principal branching direction is different from that of their native language will begin acquiring the L2 with processing heuristics that do not match the target language. Native English speakers acquiring Japanese as an L2 who try to rely on verb- and functional head-driven parsing strategies to process Japanese will find Japanese much more difficult to parse than if they can acquire new parsing heuristics that better fit Japanese. If this group of learners can adjust their processing heuristics, they should show evidence of incremental processing in Japanese as measured by elevated reading times at the head noun of the relative clause in sentences like those in (4a) and (5a) as compared to sentences like those in (4b) and (5b). They should also show evidence of exploiting the case markers in sentences like (4b) and (5b) to project a second clause early in the sentence, as seen in longer reading times on the second case-marked NP in those sentences than in the corresponding sentences in (4a) and (5a). If they cannot refine their basic processing heuristics, native English speakers should not be sensitive to these constraints. The SSH predicts that native English speakers will not be able to use case particles to process Japanese incrementally because it predicts that the L2 parser does not rely on structural information⁸. Crucially, the SSH also makes this prediction for native Korean speakers with Japanese as an L2, even though these speakers rely on case markers to process Korean (Kim, 1999). Comparing L1 English and L1 Korean speakers' ability to rely on case particles to process Japanese thus provides an avenue for investigating whether hypothetical

⁸ Case particles are technically surface-level information in that they are phonologically overt in the input string. This is also true, incidentally, of other lexical items that head functional projections, such as *that* in English. What is at issue in the present study, however, is whether the parser relies on them to project structure, not whether the parser is sensitive to phonologically null information. The ability to project structure is a key part of what the parser does, and, regardless of the language, it always projects structure on the basis of lexical items in the input string. There is a larger issue lurking in the background here; namely, that the SSH is not specific on the distinction between 'deep' and 'shallow' processing. Until that is clarified, it stands to reason that any functional information used for syntactic processing—such as case particles—is open to investigation under the rubric of the SSH.

deficits in L2 parsing are due to global deficits in the L2 parser, or whether they are due to L1 influence.

The Present Study

The following research questions guided the present study:

1. Do native Japanese speakers and near-native Japanese speakers with either English or Korean as an L1 show evidence of the ability to use nominative case markers to build structure incrementally as measured by longer reading times when a second *-ga-* marked NP is introduced in object relative clause structures, and by longer reading times at the head noun of subject relative clause structures compared to object relative clause structures?
2. Do L1 English and L1 Korean speakers differ in terms of their sensitivity to these processing constraints?
3. Do native Japanese and near-native Japanese speakers with either English or Korean as an L1 show evidence of the ability to use accusative case markers to build structure incrementally as measured by longer reading times when a second *-o-*marked NP is introduced in object relative clauses, and as measured by longer reading times at the head noun of subject relative clauses than in object relative clauses?
4. Do L1 English and L1 Korean speakers differ in terms of their ability to rely on case particles to process these sentences?

The SSH predicts that neither the L1 English nor the L1 Korean speakers will show evidence of elevated reading times on subject relative clauses with two nominative or two accusative case particles.

Method and Procedure

Participants

A total of 35 non-native Japanese speakers participated in this study; 18 were L1 English speakers, and 17 were L1 Korean speakers. A group of 29 L1 Japanese speakers served as a control group. Participants were recruited through university communities and the researcher's personal contacts. On average, the L1 English speakers had lived in Japan for five years and three months. A subset ($n = 3$) of the L1 English speakers was employed at an American study abroad center in central Japan. Another subset ($n = 5$) consisted of university students studying at Japanese universities, and one was a PhD candidate in Japanese literature. The remaining L1 English speakers were employed as English teachers in Japan. Several of the L1 English speakers had studied languages other than Japanese, but all rated Japanese as their most dominant second language, and none had studied another rigidly head-final language. On average, the L1 Korean speakers had lived in Japan for four years and eight months. A subset of this group ($n = 8$) was enrolled in Japanese universities. The remaining L1 Korean participants were working in Tokyo. All of the L1 Korean participants indicated that they had studied English in addition to Japanese, and some also indicated that they had studied Chinese. All of the L1 Korean speakers indicated that Japanese was their dominant second language. The native Japanese speakers were either students at a university in central Japan ($n = 13$) or enrolled in ESL classes at a private ESL institution ($n = 16$). All of the native Japanese speakers indicated that they had studied English. All participants were living in Japan at the time of the study.

Materials

Participants completed a set of proficiency measures and a self-paced reading task. The proficiency measures consisted of the *Language Experience and Proficiency Questionnaire*

(LEAP-Q), a grammar test, and a test of *kanji*⁹ knowledge. The LEAP-Q was adapted from Marian, Blumenfeld, and Kaushanskaya (2007), and the researcher created the rest of the materials. Each one will be discussed in turn.

Proficiency measures. Participants completed two proficiency measures: the LEAP-Q and a grammar test. These were given to ensure that participants' proficiency levels were high enough to complete the self-paced reading task, and to identify any relative proficiency differences between the two L2 groups. The LEAP-Q (see Appendix A) is an instrument designed to provide researchers with a consistent, reliable measure of bilinguals' language experience and proficiency. It depends on self-reported data, and includes information about participants' age of acquisition, contexts in which participants use the target language, and self-rated proficiency assessments. The LEAP-Q can be used with adult bilinguals who have at least a high school education in one of their languages. Although the original instrument was created in English, it can be translated into other languages (Marian et al., 2007). For the purposes of the present study, it was translated into Japanese.

The grammar test was adapted from a practice book for the Japanese Language Proficiency Test (JLPT) Level 2 (see Appendix B). The JLPT is a Japanese proficiency test used in Japan as a measure of non-native Japanese knowledge. Passing the Level 2 test is a rough proxy for Advanced High proficiency. The test consisted of 28 multiple choice and cloze test items that tested participants' knowledge of various grammatical structures. The L1 Japanese

⁹ Japanese is written with a combination of three different scripts: *hiragana*, *katakana*, and *kanji*. *Hiragana* and *katakana* are phonetic syllabaries, and *kanji* are the logographic characters borrowed from Chinese in the 7th and 8th centuries, C.E. *Hiragana* are primarily used for grammatical functions, such as particles and verb endings, and to write 'content' words that lack *kanji*. *Kanji* are used for content words such as nouns, verbs and adjective roots. *Katakana* are used to write foreign words and for emphasis, much like italics are in English. All *kanji* can be transcribed into *hiragana* or *katakana*. Familiarity with and fluency in all three scripts are required for fluent reading in Japanese.

group performed at ceiling on this test ($M = 98\%$; $SD = 1.04$). In addition to the grammar test, participants also completed a *kanji* test (see Appendix C). This test consisted of a list of 73 *kanji* compounds taken from the self-paced reading task describe below. The L2 groups were asked to provide the Japanese pronunciation of the *kanji* in *hiragana*, and either an English or a Korean translation of the word. The Japanese speakers were asked to provide the *hiragana* only. The *kanji* test was included to ensure that participants knew enough *kanji* to understand the reading task.

Self-paced reading materials. The self-paced reading task (see Appendix D) consisted of two lists of 16 doublets testing the processing of nominative and accusative case-marked sentences. These sentences were adapted from Miyamoto (2002). The first list tested participants' sensitivity to nominative case marking cues, and consisted of 16 doublets.

As discussed above, there are two words in these sentences that are important for processing. The first is the second NP in the sentence, marked with the accusative particle *-o* in (6a) and the nominative case particle *-ga* in (6b). Reading times on this word are predicted to be longer in (6b) than in (6a) because the parser projects a second clause in (6b). The second critical region in these sentences is the noun that heads the relative clause. Reading times on *onanoko*, or girl, in (6a) are predicted to be longer than those on *onanoko* in (6b) because the presence of a second nominative case marked noun in (6b) facilitates the processing of the relative clause.

- (6) a. Obasan-ga [_{RC} t_i shinsetsu-na toshiyori-o kousaten-de mita] onanoko-ni_i
 Woman_{NOM} [_{RC} t_i nice-adj old man_{ACC} intersection_{LOC} saw] girl-to_i
 ogoe-de koe-o kaketa.
 loudly called.
 "The woman called loudly to the girl who saw the nice old man at the intersection"
- b. Obasan-ga [_{RC} t_i shinsetsu-na toshiyori-ga kousaten-de mita] onanoko-ni_i
 Woman_{NOM} [_{RC} t_i nice-adj old man_{NOM} intersection_{LOC} saw] girl-to_i
 ogoe-de koe-o kaketa.
 loudly called.

“The woman called loudly to the girl who the nice old man saw at the intersection.”

Experimental sentences were constructed so that an adjective intervened between the first two nouns in the sentence and between the relative clause head and the final verb to create a spillover region. The length of critical and spillover regions was controlled so that each region contained three characters¹⁰: two *kanji* followed by a particle written in *hiragana*.

The second list consisted of 16 doublets testing participants’ ability to use accusative case markers to process incrementally. There are also two regions in these sentences that are important for processing. The first region is the word *ocha*, or tea, which is marked accusative particles in both sentences. The difference is that, in (7a), it follows a noun marked with a dative case particle, and in (7b), it follows a noun marked with an accusative case particle. Reading times should be longer at *tea* in (7b) than in (7a) because the parser is projecting a second clause. The second critical region in these sentences is the head of the relative clause, in this case, the noun *woman*.

- (7) a. Ofisu-de shokuin-ga [RC kakaricho-ni ocha-o dashita] jyosei-o teinei-ni
Office-in employee_{NOM} [RC manager_{DAT} tea_{ACC} served] woman_{ACC} politely
shokaishita.
introduced.
“At the office, the employee politely introduced the woman who served tea to the manager.”
- b. Ofisu-de shokuin-ga kakaricho-o [RC ocha-o dashita] jyosei-ni teinei-ni
Office-in employee_{NOM} manager_{ACC} [RC tea_{ACC} served] woman_{DAT} politely
shokaishita.
introduced.
“At the office, the employee introduced the manager to the woman who served tea.”

¹⁰ *Characters* is used here for the Japanese 字, or *ji*, which refers to the smallest graphical unit, and can therefore refer to a single *hiragana* or *katakana* symbol, a single *kanji*, or, in *katakana*, the – used to indicate a long vowel.

Again, an adverb was inserted between the relative clause head and the matrix clause verb in order to create a spillover region. The length of the regions was controlled so that each region consisted of three characters: two *kanji* and a *hiragana* particle. The stimuli in these two lists were adapted from Miyamoto (2002), but the vocabulary was simplified and the length of the regions was controlled across the entire stimulus list. In total, participants read 32 sentences testing sensitivity to case particles. Half of these (16 sentences) tested sensitivity to nominative case particles, and the other half tested sensitivity to accusative case particles. Reading times for nominative and accusative sentences were analyzed separately.

Sentences were segmented for presentation. The most common way to segment sentences in Japanese self-paced reading studies is to divide the sentences so that each segment consists of one *bunsetsu* (e.g., Aoshima, Yoshida, & Phillips, 2009; Miyamoto, 2002; Nakamura & Miyamoto, 2013). A *bunsetsu* is the smallest phonological unit in a Japanese sentence, and it minimally consists of a lexical item and a case marker. Segmentation for the sentence in (7) is illustrated in (8):

- (8) a. Ofisu-de \ shokuin-ga \ [RC kakaricho-ni \ ocha-o \ dashita] \ jyosei-o \ teinei-ni
 1 2 3 4 5 6 7
 Office-in \ employee_{NOM} \ [RC manager_{DAT} \ tea_{ACC} \ served] \ woman_{ACC} \ politely
 shokaishita.
 8
 introduced.
 “At the office, the employee politely introduced the woman who served tea to the
 manager.”
- b. Ofisu-de \ shokuin-ga \ kakaricho-o \ [RC ocha-o \ dashita] \ jyosei-ni \ teinei-ni
 1 2 3 4 5 6 7
 Office-in \ employee_{NOM} \ manager_{ACC} \ [RC tea_{ACC} \ served] \ woman_{DAT} \ politely
 shokaishita.
 8
 introduced.
 “At the office, the employee introduced the manager to the woman who served
 tea.”

In this case, regions 4 and 6 were the critical regions and regions 5 and 7 was the spillover regions.

Each stimulus sentence was followed by a comprehension check. Because of the inclusion of sentences testing *wh*- dependencies, these comprehension checks took the form of a sentence completion task. The comprehension check that followed (8) is given in (9).

(9) Kono bunsho-ni yoru to...
This sentence_{DAT} according_{COMP}
According to this sentence,

A. Jyosei-ga ocha-o dashita.
Woman_{NOM} tea_{ACC} served
“The woman served tea”

B. Shokuin-ga ocha-o dashita.
Employee_{NOM} tea_{ACC} served
“The employee served tea”

For half of the sentences, the question asked about the relative clause, and the other half of the sentences asked about the matrix clause. For half of the items in each list, the correct answer was A and, for the other half, the correct answer was B. These sentences were intermixed with target stimuli for other studies (see Chapters 3 and 4) that served as fillers and distractors for this experiment. In order to ensure that the L2 groups understood the target sentences, they also completed a short translation task at the end of the self-paced reading task. This task consisted of 12 items taken from the target stimuli. Participants were given two possible translations and asked to pick the best translation into either English or Korean.

Procedure

Participants were tested individually, and were paid ¥2,000 (about \$20) for their participation. Participants read a consent form, and then began the experiment. Participants completed the self-paced reading experiment first. The self-paced reading experiment was divided in half so that participants read 72 sentences, took a break, and then read the remaining 72 sentences. Stimulus sentences were evenly distributed across both halves of the experiment.

The L1 English and L1 Korean speakers completed the translation task at the end of the self-paced reading task. After participants had finished the self-paced reading task, they completed the LEAP-Q, the grammar test, and the *kanji* test.

The self-paced reading task was presented using SuperLab 5. Stimulus sentences were segmented as described above, and participants pressed a button to move from segment to segment. Participants moved through the self-paced reading task at their own pace. This study used the non-cumulative moving window paradigm, so that when participants pressed a button to display one segment, the previous segment disappeared from the screen. Once participants reached the end of the stimulus sentence, they pressed a button to reveal the comprehension question. Participants selected either A or B on the response pad to answer the comprehension question. On average, the native speaker controls completed the study in 60 minutes, and the L2 speakers completed the study in 90 minutes.

Scoring and Analysis

The proficiency test was scored first. Scores on the proficiency test were submitted to a one-way ANOVA to identify any differences in proficiency levels between groups. The comprehension questions were scored next. Any participant who scored below 65% accuracy on the comprehension questions overall would have been eliminated from further analyses. No participant scored below this threshold, indicating that participants were paying attention to the test sentences. The self-paced reading data were analyzed using a generalized linear mixed effects model. These models take into account the variance due to both fixed (e.g., language background, proficiency level) and random (e.g., items, average reading times by participant) effects, and allow variables to be either continuous or categorical. As such, they are more robust

than traditional inferential statistics (e.g., Baayen, Davidson, & Bates, 2008), and they are increasingly being used in language processing research.

In both the native language and second language processing literature, reading time data have traditionally been analyzed using some sort of ANOVA (see, e.g., Jegerski, 2014; Keating & Jegerski, 2015 for discussion). This is problematic because reading time typically violate key assumptions of an ANOVA, such as independence of observations (each participant contributes reading times for multiple items) and normality, and because random variation due to individual differences in reading speed and item difficulty cannot be accounted for in one model. The latter issue has traditionally been dealt with by running two analyses: a by-items analysis and a by-participants analysis. In the by-items analysis, reading times are averaged across subjects for each item, thus holding any item-specific variation constant. The same thing is done for items in the by-participants analysis. This is an inelegant fix, and, if the two analyses yield different results, it also makes the analyses difficult to interpret. In light of this, several researchers have begun to argue for the use of mixed effects models instead. Mixed effects models can include multiple parameters, so that fixed and random effects can be accounted for in one model (see e.g., Baayen et al., 2008; Cunnings, 2012; Jaeger, 2008 for discussion).

The structure of the data for the present study is described below. In the sample as a whole, 64 participants contributed reading times for seven regions in 16 sentences. Participants belonged to three different groups: native Japanese speakers ($n = 29$), native English speakers ($n = 18$), and native Korean speakers ($n = 17$). Participants also read two types of sentences, with eight items for each type. The first set of sentences could plausibly be analyzed as a declarative sentence until the head noun of a relative clause was encountered, and one in which two nominative case marked NPs were introduced early in the sentence, telling the parser to project a

second clause, and thus facilitating the processing of the head noun of the relative clause. Group and sentence type are the independent variables, and reading times on individual regions are the dependent variable. Each participant contributed eight reading times per region for each sentence type. As the graph in Figure 2.1 shows, these data were skewed to the right and bounded at zero. Because of the distribution of the data, they were modeled using a generalized linear mixed effects model with a gamma distribution and an inverse link function. A gamma distribution can be used to model continuous data, and assumes the data contains no values that are less than or equal to zero. Together with the inverse-link function, the model also accounts for the non-linear relationship between time and changes in time. In other words, the gamma distribution and the link function account for the fact that reading time differences between, for example, one and two seconds are of a greater magnitude than differences between, for example, 10 and 11 seconds. The inverse link function changes the sign of the coefficients, so that values have to be back-transformed to be interpreted. The model included a random intercept by participant, and two independent variables, Group (Japanese, English, and Korean), and Function (Target and Control). Including a random effect for items did not add significant explanatory power to the model, so this effect was not included in the final model. In all cases, these data were analyzed using models with and without interaction terms. Interactions are reported where they were significant.

Results

Proficiency Test Results

The Japanese speakers scored the highest on the proficiency test ($M = 27.25$, $SD = 1.06$), and the Korean speakers ($M = 21.35$, $SD = 4.59$) scored better than the English speakers ($M = 18.28$, $SD = 4.03$). These results were submitted to a one-way ANOVA, which indicated that

these group differences were significant; $F(2, 23.56) = 50.62, p < .001$. Post-hoc independent samples t -tests indicated that the Japanese group differed significantly from both the English group; $t(18.5) = 9.02, p < .001, d = 3.04$) and the Korean group; $t(17.07) = 5.07, p < .001, d = 1.77$). The English and Korean groups also differed significantly from each other; $t(31.84) = -2.05, p = .05, d = .71$). On the translation task, the average accuracy score for the English speakers was 78%, and the average accuracy score for the Korean speakers was 77%. This indicates that both groups understood the target structures reasonably well, and that one group did not understand them better than the other.

Nominative Case Marking

Descriptive statistics for each region in both types of nominative case marked sentences are given in Table 2.1. The sentences with two nominative case marked NPs are the control sentences. Reading times are predicted to be longer at Region 2 in the control sentences than in the target sentences, and reading times are predicted to be longer at Region 5 in the target sentences than in the control sentences. Numerically, all three groups take longer to read Region 2 in the control sentences than in the target sentences. The Japanese and Korean groups, but not the English group, take longer to read Region 5 in the target sentences than in the control sentences. These patterns are illustrated in Figure 2.2. The reading time data for Region 2 were analyzed using a generalized linear mixed effects model using the lme4 package (Bates, Maechler, Bolker, & Walker, 2015a, 2015b) in R (R Core Team, 2015). Because of the distribution of the data, a gamma distribution with an inverse link function was specified. The model specifications are given in Table 2.2, and the results of the model are given in Table 2.3.

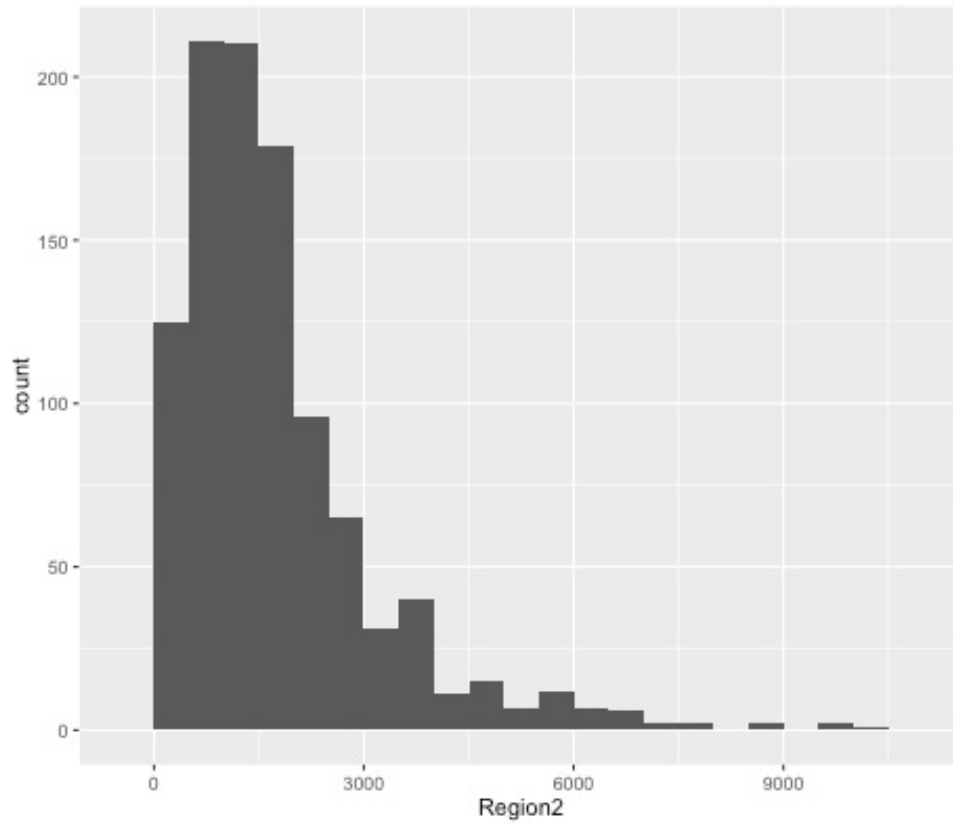


Figure 2.1
Histogram of reading time data for Region 2 of the nominative case marked sentences

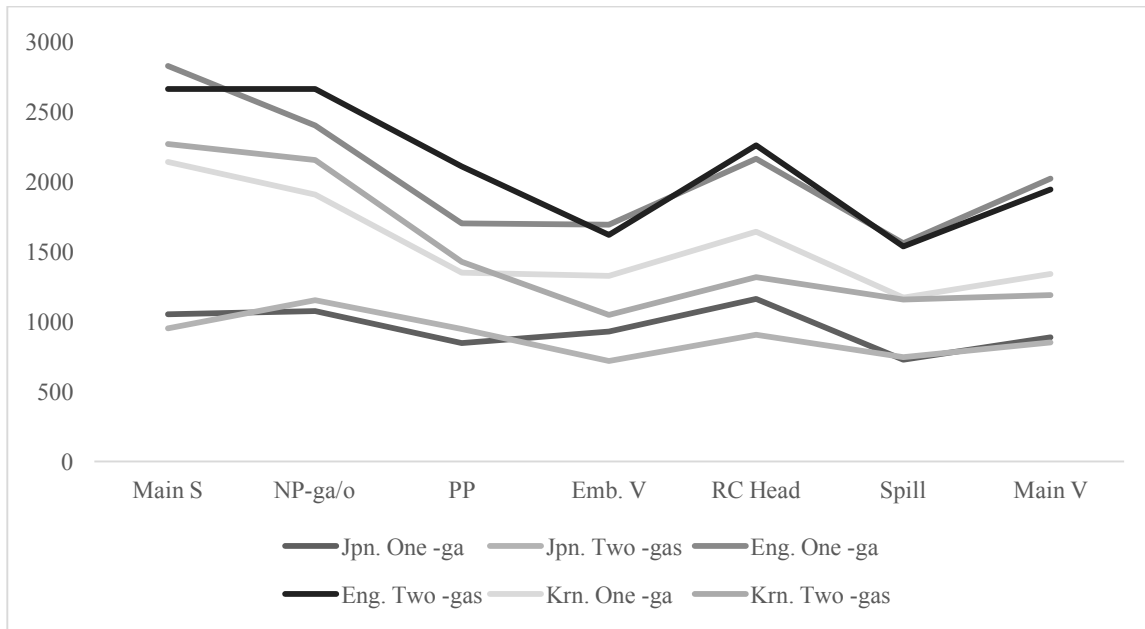


Figure 2.2
Reading times by group for nominative case marked sentences

Table 2.1

Descriptive Statistics for Each Region in Target and Control Nominative Case Marked Sentences.

	Japanese (<i>n</i> = 29)				English (<i>n</i> = 18)				Korean (<i>n</i> = 17)			
	Target		Control		Target		Control		Target		Control	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Main S	1050.38	853.78	949.66	628.35	2820.71	1839.18	2659.50	1968.32	2135.28	2396.49	2266.04	3117.49
NP-ga/o	1072.78	875.53	1151.22	810.19	2395.69	1671.25	2655.51	1639.36	1903.76	1487.15	2150.24	1270.38
PP	946.51	805.96	944.41	701.96	1700.00	955.54	2107.45	1292.78	1347.51	939.90	1427.76	1129.51
Emb. V	926.35	922.01	720.04	593.88	1690.76	1305.45	1615.33	1790.16	1327.01	1310.24	1046.21	658.20
RC head	1162.03	1113.61	904.46	841.69	2159.66	2058.22	2257.65	1665.41	1637.98	1544.72	1315.35	1275.19
Spill	725.88	673.35	747.84	728.47	1559.58	1283.22	1534.78	869.51	1171.69	1031.17	1156.64	914.71
Main V	886.02	793.39	851.70	567.79	2019.54	2558.35	1942.87	2123.18	1338.41	1274.05	1188.32	811.46

Table 2.2

Model Specifications for Nominative Case Marking Data for Regions 2, 3, and 6

Level of Analysis	Units	Description	Model
1	Time/Experimental observations	Overall effect of function on reading times	$1/\text{Time} = \beta_{0i} + e_{ij}$
2	Participants	Random effect includes overall average, group effects, function effects, and participant-specific deviations from the average	$\beta_{0i} = \gamma_{00} + \gamma_{01} * \text{Group} + \gamma_{02} * \text{Function} + u_{0i}$

Note. The model $\text{Inverse}(\text{Time}) = \beta_{0i} + e_{ij}$ was analyzed using the 16 multiple measures per participant.

Table 2.3

Model Results for Nominative Case Marking Data for Region 2

Meaning	Fixed Effects		Estimate	SE	<i>p</i> -value
Overall effect of being a native Japanese speaker reading the target sentences	Intercept (I)	γ_{00}	1.09	.06	< .001
Effect of being an English speaker (compared to Japanese speakers)	Group _{English} (on I)	$\gamma_{01\text{English}}$	-.60	.10	< .001
Effect of being a Korean speaker (compared to Japanese speakers)	Group _{Korean} (on I)	$\gamma_{01\text{Korean}}$	-.50	.10	< .001
Differences due to Japanese speakers reading control sentences compared to target sentences	Function (on I)	γ_{02}	.05	.02	.007
		Random Effects	Variance		
		Intercept	u_{01}	.05	
		Residual	e_{ij}	.36	

Note. Group is a categorical variable with three levels. Japanese was taken as the reference category. Function is a categorical variable with two levels. Control sentences (those with two nominative particles early) were taken as the reference category.

The average Japanese participant had a value of 1.09 in inverse time units, or .96 seconds¹¹. This time is significantly different from zero ($\gamma_{00} = 1.09, p < .001$). The average English speaker had a value of .44 in inverse time units for the target sentences¹², or 2.27 seconds. This difference in reading times between Japanese and English speakers is significant ($\gamma_{01\text{English}} = -.60, p < .001$). Similarly, the average Korean speaker had a value of .54 in inverse time units for the target sentences, or 1.85 seconds. This difference between Japanese and

¹¹ The model transforms the raw data using an inverse function to conduct the analyses, so the output has to be back-transformed into the original units. This is done by taking the inverse of the estimate for the reference category, or $1/1.09$, in this case. The value for the Intercept takes into account effects of both reference categories—in this case, differences in native speaker reading behavior due to reading the two types of sentences.

¹² Because Japanese was specified as the reference category for the fixed effect of Group, values for English and Korean speakers are relative to the reference category. Thus, their value in inverse units is calculated by subtracting the estimate for each of these groups from the estimate for the reference category. For example, the value for English speakers in inverse time units is .44 ($1.04 - .60 = .44$). This value is then used in the back-transformation ($1/.44 = 2.27$).

Korean speakers is also significant ($\gamma_{01\text{Korean}} = -.50, p < .001$). The difference in sentence types—whether the NP in this region is marked with a nominative case particle—is also significant for all participants ($\gamma_{02} = .05, p = .007$).

Reading time data for Region 5 were analyzed using the same models. In this instance, the interaction was significant. The model specifications for Region 5, the head noun of the relative clause, are given in Table 2.4, and the results are given in Table 2.5. When the head noun of the relative clause followed two nominative case marked NPs, the average Japanese participant had a value of 1.38 in inverse time units, or 0.72 seconds, which is significantly different from zero ($\gamma_{00} = 1.18, p < .001$). In the same condition, the average English participant had a value of .54 in inverse time units, or 1.85 seconds, which is significantly different from the average Japanese speaker ($\gamma_{01\text{English}} = -0.83, p < .001$). The average Korean participant had a value of .91 in inverse time units, or 1.09 seconds; this is also significantly different from the average Japanese speaker ($\gamma_{01\text{Korean}} = -.46, p = .01$). The overall effect of Function is significant ($\gamma_{02} = .20, p < .001$) for Japanese speakers, meaning that they read the head noun of the relative clause significantly slower when it was preceded by one nominative case marked noun than. The interaction between English speakers and Function ($\gamma_{03\text{English}} = -.21, p < .001$) is significant. Post hoc comparisons indicate that the English speakers' difference in reading times for these two sentences is not significantly different from zero (estimate = $-.02, p = .80$). The interaction between Korean speakers and function is not significant ($\gamma_{03\text{Korean}} = -.07, p = .27$), indicating that the Japanese and Korean speakers do not differ from each other in terms of how they treat the head noun of the relative clause. In other words, both groups take significantly longer to read the head noun of the relative clause when they had not read two nominative case marked nouns in a row.

Table 2.4

Model Specifications for Nominative Case Marked Data for Region 5

Level of Analysis	Units	Description	Model
1	Time/Experimental observations	Overall effect of function on reading times	$1/\text{Time} = \beta_{0i} + e_{ij}$
2	Participants	Random effect includes overall average, group effects, function effects, and participant-specific deviations from the average	$\beta_{0i} = \gamma_{00} + \gamma_{01} * \text{Group} + \gamma_{02} * \text{Function} + \gamma_{03} * (\text{Group} * \text{Function}) + u_{0i}$

Note. The model $\text{Inverse}(\text{Time}) = \beta_{0i} + e_{ij}$ was analyzed using the 16 multiple measures per participant.

Table 2.5

Model Results for Analyses of Region 5 of Nominative Case Marked Sentences

Meaning	Fixed Effects		Estimate	Std. Err.	p-value
Overall effect of being a native Japanese speaker reading the control sentences	Intercept (I)	γ_{00}	1.37	.10	< .001
Effect of being an English speaker (compared to Japanese speakers)	Group _{English} (on I)	$\gamma_{01\text{English}}$	-.83	.15	< .001
Effect of being a Korean speaker (compared to Japanese speakers)	Group _{Korean} (on I)	$\gamma_{01\text{Korean}}$	-.46	.15	.01
Differences due to Japanese speakers reading control sentences compared to target sentences	Function (on I)	γ_{02}	.20	.05	< .001
Effects of English speakers reading control sentences	Group _{English} * Function	$\gamma_{01\text{English}} * \gamma_{02} * \gamma_{03\text{English}}$	-.21	.06	< .001
Effects of Korean speakers reading control sentences	Group _{Korean} * Function	$\gamma_{01\text{Korean}} * \gamma_{02} * \gamma_{03\text{Korean}}$.07	.07	.27
		Random Effects	Variance		
		Intercept	u_{01}	.12	
		Residual	e_{ij}	.51	

Note. Group is a categorical variable with three levels. Japanese was taken as the reference category. Function is a categorical variable with two levels. Control sentences (those with two nominative particles early) were taken as the reference category.

In addition to the analyses for the two critical regions, the reading time data for Regions 3 and 6, which were the spillover regions, were also analyzed using a generalized linear mixed effects model. The model specifications for these regions were the same as the model used for

Region 2, and are provided in Table 2.2. The results of this model for the reading time data in Region 3 are provided in Table 2.6.

Table 2.6
Model Results for Nominative Case Marking Data on Region 3

Meaning	Fixed Effects		Estimate	Std. Err.	<i>p</i> -value
Overall effect of being a native Japanese speaker reading the control sentences	Intercept (I)	γ_{00}	1.13	.06	< .001
Effect of being an English speaker (compared to Japanese speakers)	Group _{English} (on I)	$\gamma_{01\text{English}}$	-.59	.09	< .001
Effect of being a Korean speaker (compared to Japanese speakers)	Group _{Korean} (on I)	$\gamma_{01\text{Korean}}$	-.38	.09	< .001
Differences due to reading control sentences compared to target sentences	Function (on I)	γ_{02}	.05	.03	.06
Random Effects			Variance		
Intercept		u_{01}	.05		
Residual		e_{ij}	.44		

Note. Group is a categorical variable with three levels. Japanese was taken as the reference category. Function is a categorical variable with two levels. Control sentences (those with two nominative particles early) were taken as the reference category.

For Region 3, the first spillover region, the average Japanese participant had a value of 1.13 in inverse time units, or .88 seconds, which is significantly different from zero ($\gamma_{00} = 1.13, p < .001$). The average English speaker had a value of .54 in inverse time units for the target sentences, or 1.85 seconds, which is significantly slower than the average Japanese participant ($\gamma_{01\text{English}} = -.59, p < .001$). Similarly, the average Korean speaker had a value of .75 in inverse time units for the target sentences, or 1.33 seconds, which is also significantly slower than the average Japanese participant ($\gamma_{01\text{Korean}} = -.38, p < .001$). The difference in sentence types—whether this region follows an NP marked with a nominative case particle—is not significant for all participants ($\gamma_{02} = .05, p = .06$).

The model results for Region 6, which followed the head noun of the relative clause, are given in Table 2.7.

Table 2.7
Model Results for Region 6 in Nominative Case Marked Sentences

Meaning	Fixed Effects		Estimate	Std. Err.	<i>p</i> -value
Overall effect of being a native Japanese speaker reading the target sentences	Intercept (I)	γ_{00}	1.60	.10	< .001
Effect of being an English speaker (compared to Japanese speakers)	Group _{English} (on I)	$\gamma_{01\text{English}}$	-.84	.15	< .001
Effect of being a Korean speaker (compared to Japanese speakers)	Group _{Korean} (on I)	$\gamma_{01\text{Korean}}$	-.62	.14	< .001
Differences due to reading control sentences compared to target sentences	Function (on I)	γ_{02}	.0007	.03	.98
Random Effects			Variance		
Intercept		u_{01}	.11		
Residual		e_{ij}	.39		

Note. Group is a categorical variable with three levels. Japanese was taken as the reference category. Function is a categorical variable with two levels. Control sentences (those with two nominative particles early) were taken as the reference category.

On the second spillover region, Region 6, the average Japanese participant had a value of 1.60 in inverse time units, or .63 seconds, which is significantly different from zero ($\gamma_{00} = 1.60$, $p < .001$). The average English speaker had a value of .76 in inverse time units for the target sentences, or 1.32 seconds, which is significantly slower than the average Japanese participant ($\gamma_{01\text{English}} = -.84$, $p < .001$). Similarly, the average Korean speaker had a value of .98 in inverse time units for the target sentences, or 1.02 seconds, which is also significantly slower than the average Japanese participant ($\gamma_{01\text{Korean}} = -.62$, $p < .001$). The difference in sentence types—whether this region follows the head noun of a RC that forced reanalysis—is not significant ($\gamma_{02} = .0007$, $p = .98$).

Overall, then, these analyses indicate the following. The native Japanese speakers perform as expected, and have significantly longer reading times at Region 2 when the noun is marked with a nominative case particle. This group also has significantly longer reading times at Region 5 when this region was not preceded by two nominative case marked NPs. L1 English speakers pattern like the native Japanese speakers on Region 2, but not on Region 5, and L1 Korean speakers pattern like native Japanese speakers on both Region 2 and Region 5. These differences are not maintained on either spillover region.

Accusative Case Marking

Descriptive statistics for each region in sentences testing participants' reliance on accusative case particles are given in Table 2.8. The regions of interest in these sentences are as follows. Region 4 is the region in which the second NP marked with *-o* was introduced. Reading times are predicted to be longer on this region in the control sentences than in the target sentences. Region 6 is the head noun of the relative clause. If participants are able to use the case particle on the NP in region 4 to project a second clause, reading times should be shorter on Region 6 in the control sentences than in the target sentences. Descriptively, this pattern holds for all three participant groups. Reading times at Region 4 are longer in the control sentences than in the target sentences, and reading times at Region 6 are shorter in the control sentences than in the target sentences. The overall pattern of reading times is provided in Figure 2.3.

Table 2.8

Descriptive Statistics for Target and Control Accusative Case Marked Sentences by Region

	Japanese (<i>n</i> = 29)				English (<i>n</i> = 18)				Korean (<i>n</i> = 17)			
	Target		Control		Target		Control		Target		Control	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PP	1008.65	1043.65	1029.04	1291.08	2055.89	1214.26	2455.92	1772.72	1604.66	1275.88	1633.50	1472.18
NP-ga	903.82	640.70	866.51	575.71	2318.80	1385.88	2458.99	1513.17	2696.26	928.69	1688.70	1400.36
NP-ga/o	1124.04	930.36	1056.48	953.15	2443.44	1980.13	2590.53	1736.82	1522.43	1081.02	1725.32	1781.69
tea-o	968.01	822.04	1234.17	1145.45	1612.54	1035.28	1909.28	1525.78	1202.75	840.22	1458.27	1054.77
Emb. V	762.45	647.44	758.04	733.21	1441.81	914.29	1517.58	992.35	939.87	605.91	1192.85	1047.29
NP-ga/-ni	1135.55	1422.99	884.82	783.00	2514.57	2058.23	2353.58	1574.50	1675.10	1443.75	1523.78	1372.77
Spill	679.28	624.34	639.17	384.15	1509.60	1231.77	1688.21	1275.46	939.41	630.09	1020.58	800.98
Main V	895.57	1006.43	982.64	942.92	1949.58	1788.28	2062.35	1547.88	1221.01	1286.81	1413.09	1630.81

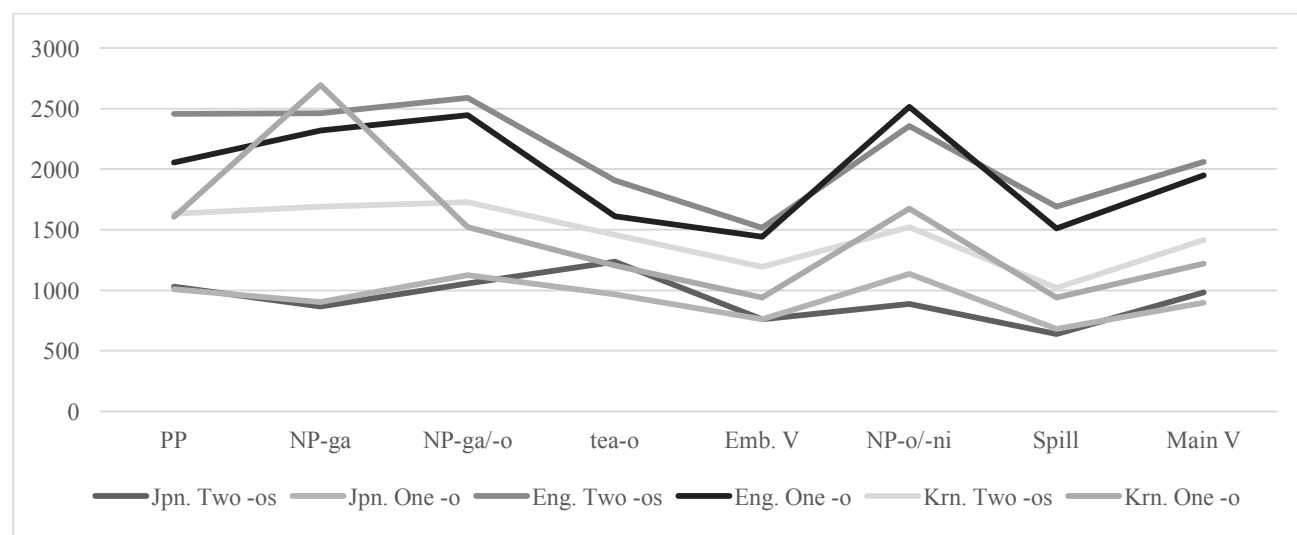


Figure 2.3

Reading times by group for accusative case marked sentences.

Reading time data for Region 4 were analyzed using a generalized linear mixed effects model. Because of the distribution of the data, a gamma distribution with an inverse link function was specified using the lme4 package (Bates et al., 2015) in R (R Core Team, 2015). The same model specifications used to analyze the nominative case marked data were used to analyze these data. These specifications are repeated in Table 2.9.

Table 2.9

Model Specifications for Region 4 of the Accusative Case Marking Data

Level of Analysis	Units	Description	Model
1	Time/Experimental observations	Overall effect of function on reading times	$1/\text{Time} = \beta_{0i} + e_{ij}$
2	Participants	Random effect includes overall average, group effects, function effects, and participant-specific deviations from the average	$\beta_{0i} = \gamma_{00} + \gamma_{01} * \text{Group} + \gamma_{02} * \text{Function} + u_{0i}$

Note. The model $\text{Inverse}(\text{Time}) = \beta_{0i} + e_{ij}$ was analyzed using 16 multiple measures per participant.

The results of the model are given in Table 2.10

Table 2.10

Model Results for Region 4 of the Accusative Case Marking Data

Meaning	Fixed Effects		Estimate	Std. Err.	p-value
Overall effect of being a native Japanese speaker reading the target sentences	Intercept (I)	γ_{00}	1.03	.07	< .001
Effect of being an English speaker (compared to Japanese speakers)	Group _{English} (on I)	$\gamma_{01\text{English}}$	-.46	.11	< .001
Effect of being a Korean speaker (compared to Japanese speakers)	Group _{Korean} (on I)	$\gamma_{01\text{Korean}}$	-.23	.11	.03
Differences due to reading control sentences compared to target sentences	Function (on I)	γ_{02}	.13	.02	< .001
			Random Effects		
			Variance		
Intercept		u_{01}	.06		
Residual		e_{ij}	.43		

Note. Group is a categorical variable with three levels. Japanese was taken as the reference category. Function is a categorical variable with two levels. Control sentences (those with two accusative particles early) were taken as the reference category.

On average, Japanese participants had a value of 1.03 in inverse units, or .97 seconds, which is significantly different from zero ($\gamma_{00} = 1.03, p < .001$). The average English speaker had a value of .57 in inverse time units for the control sentences, or 1.75 seconds. This difference in reading times between Japanese and English speakers is significant ($\gamma_{01\text{English}} = -.54, p < .001$). Similarly, on average, the Korean speakers had a value of .8 in inverse time units for the control sentences, or 1.25 seconds. The Korean and Japanese speakers are also significantly different from each other ($\gamma_{01\text{Korean}} = -.50, p < .001$). The difference in reading target sentences instead of control sentences—is also significant for all participants ($\gamma_{02} = .13, p < .001$).

Reading time data for Region 6, which was the head noun of the relative clause, were analyzed using a generalized linear mixed effects model. Again, a gamma distribution with an inverse link function was specified. In this instance, including the interaction term provided more explanatory power. This model is given in Table 2.11.

Table 2.11

Model Specifications for Accusative Case Marked Data for Region 6

Level of Analysis	Units	Description	Model
1	Time/Experimental observations	Overall effect of function on reading times	$1/\text{Time} = \beta_{0i} + e_{ij}$
2	Participants	Random effect includes overall average, group effects, function effects, and participant-specific deviations from the average	$\beta_{0i} = \gamma_{00} + \gamma_{01} * \text{Group} + \gamma_{02} * \text{Function} + \gamma_{03} * (\text{Group} * \text{Function}) + u_{0i}$

Note. The model $\text{Inverse}(\text{Time}) = \beta_{0i} + e_{ij}$ was analyzed using the 16 multiple measures per participant.

The results of this model are given in Table 2.12.

Model Results for Region 6 of the Accusative Case Marking Data

Note. Group is a categorical variable with three levels. Japanese was taken as the reference category. Function is a categorical variable with two levels. Control sentences (those with two accusative particles early) were taken as the reference category.

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groups ($\gamma_{02} = -0.18, p < .001$). In addition, the interaction between English speakers and sentence type is significant ($\gamma_{03\text{English}} = 0.16, p = .002$), as is the interaction between Korean speakers and sentence type ($\gamma_{03\text{Korean}} = .13, p = .02$). Post hoc comparisons indicate that the differences in reading between target and control sentences are not significantly different from zero for either the English speakers (estimate = $-.02, p = .60$) or the Korean speakers (estimate = $-.05, p = .35$).

Because processing is cumulative, reading times for Regions 5 and 7, both of which followed critical regions, were also analyzed. These regions were analyzed using the model provided in Table 2.9. The results of the model for the first spillover region, Region 5, are given in Table 2.13.

Table 2.13
Model Results for Region 5 of the Accusative Case Marking Data

Meaning	Fixed Effects		Estimate	Std. Err.	p-value
Overall effect of being a native Japanese speaker reading the target sentences	Intercept (I)	γ_{00}	1.60	.09	< .001
Effect of being an English speaker (compared to Japanese speakers)	Group _{English} (on I)	$\gamma_{01\text{English}}$	-.85	.14	< .001
Effect of being a Korean speaker (compared to Japanese speakers)	Group _{Korean} (on I)	$\gamma_{01\text{Korean}}$	-.53	.14	.03
Differences due to reading control sentences compared to target sentences	Function (on I)	γ_{02}	.07	.03	.01
Random Effects			Variance		
Intercept		u_{01}	.10		
Residual		e_{ij}	.33		

Note. Group is a categorical variable with three levels. Japanese was taken as the reference category. Function is a categorical variable with two levels. Control sentences (those with two accusative particles) were taken as the reference category.

For Region 5, the average Japanese participant had a value of 1.60 in inverse units, or .63 seconds. This time is significantly different from zero ($\gamma_{00} = 1.60, p < .001$). The average English speaker had a value of .75 in inverse time units for the target sentences, or 1.33 seconds. This

difference in reading times between Japanese and English speakers is significant ($\gamma_{01\text{English}} = -.85$, $p < .001$). Similarly, on average, the Korean speakers had a value of 1.07 in inverse time units for the target sentences, or .93 seconds. This difference between Korean and Japanese speakers is significant ($\gamma_{01\text{Korean}} = -.53$, $p = .03$). The difference in sentence types—whether this word follows an NP marked with an accusative case particle—is also significant for all participants ($\gamma_{02} = .07$, $p = .01$).

The model results for the spillover region that followed the head noun of the relative clause, Region 7, are given in Table 2.14.

Table 2.14
Model Results for Region 7 of the Accusative Case Marking Data

Meaning	Fixed Effects		Estimate	Std. Err.	p-value
Overall effect of being a native Japanese speaker reading the target sentences	Intercept (I)	γ_{00}	1.69	.09	< .001
Effect of being an English speaker (compared to Japanese speakers)	Group _{English} (on I)	$\gamma_{01\text{English}}$	-.99	.15	< .001
Effect of being a Korean speaker (compared to Japanese speakers)	Group _{Korean} (on I)	$\gamma_{01\text{Korean}}$	-.55	.14	< .001
Differences due to reading control sentences compared to target sentences	Function (on I)	γ_{02}	.04	.02	.09
Random Effects			Variance		
Intercept		u_{01}	.10		
Residual		e_{ij}	.33		

Note. Group is a categorical variable with three levels. Japanese was taken as the reference category. Function is a categorical variable with two levels. Control sentences (those with two accusative particles early) were taken as the reference category.

For Region 7, the average Japanese participant had a value of 1.69 in inverse time units, or 0.59 seconds. This time is significantly different from zero ($\gamma_{00} = 1.69$, $p < .001$). The average English speaker had a value of 0.70 in inverse time units for the target sentences, or 1.43 seconds. This difference in reading times between Japanese and English speakers is significant

($\gamma_{01\text{English}} = -0.99, p < .001$). The average Korean participant had a value of 1.14 in inverse time units for the target sentences, or .88 seconds, which is significantly different from the native Japanese speakers ($\gamma_{01\text{Korean}} = -0.55, p < .001$). The difference in sentence types—whether this word follows the head noun of a relative clause that had been preceded by two NPs marked with accusative case particles—is not significant for all participants ($\gamma_{02} = .04, p < .09$).

In sum, native Japanese speakers take significantly longer to read Region 4 when the NP is marked with an accusative case particle, and they take longer to read Region 6 when it had not been preceded by two NPs marked for accusative case. Both L2 groups—the English speakers and the Korean speakers—take longer to read Region 4 when it is marked with an accusative case particle, but neither group shows facilitation effects at Region 6. The differences in reading times due to the presence of a second accusative case particle are significant for all three groups on Region 5, the spillover region that followed the second accusative case marked noun. No group has significant reading time differences on Region 7.

Discussion for Experiment 1

The first two research questions asked whether L1 English and L1 Korean speakers were able to use case particles to process Japanese incrementally, as measured by sensitivity to the constraint that no single clause in Japanese takes two nominative case marked nouns, and whether there were group differences between L1 English and L1 Korean speakers. Results suggest that the answer to both question is a qualified yes. All three participant groups—native Japanese speakers, L1 English speakers, and L1 Korean speakers take significantly longer to read the NP marked with a nominative case particle that introduces a second clause. At the head noun of the relative clause, however, only the native Japanese speakers and the native Korean speakers show facilitation effects. The L1 English speakers do not. Thus, Korean speakers are

sensitive to this constraint both when the second clause is introduced and at the head noun of the relative clause, and English speakers are only sensitive when the second clause is introduced. This suggests that both L2 groups display some ability to use nominative case particles to process Japanese incrementally, and that there are group differences in terms of their ability to do so.

The third and fourth research questions asked whether L1 English and L1 Korean speakers were able to use accusative case particles to process Japanese incrementally, and whether there are differences between groups in terms of their ability to do so. Again, the answer to this question is a qualified yes. Results suggest that both L2 groups are sensitive to this constraint when the second accusative case marked NP is introduced, but that neither group shows facilitation effects at the head noun of the relative clause. Thus, there is some evidence that the L2 speakers are able to use case particles to project clause structure, and, in the case of accusative particles, the groups do not differ from each other in terms of their ability to do so.

Taken together, the results of this study do not provide clear-cut evidence in favor of the SSH. The SSH predicts that non-native Japanese speakers will not show evidence of the ability to use case particles to process sentences incrementally. If this were the case, neither L2 group should be able to use case particles to project a second clause, contrary to the results of the present study. Both L2 groups do diverge from the L1 Japanese speakers in important ways. The L1 English group does not show facilitation effects in processing the head noun of object relative clauses in either the nominative or accusative case marked sentences, and the L1 Korean group does not show facilitation effects when reading the head noun of the relative clause in the accusative case marked sentences. Proponents of the SSH might argue that these results are evidence for a global L2 processing deficit. That position is too strong, because it fails to take

into account the evidence that both the L1 Korean and the L1 English participants were able to use the second nominative or accusative case marked particle to project a second clause in the first place. It also doesn't account for the evidence of facilitation effects at the head noun of the relative clause in the nominative case marked sentences for the Korean group. Thus, although it is clear that there are differences between native and non-native speakers in these data, it is necessary to consider sources of these differences that are not due to deficits in the L2 parsing system. Two alternative possibilities are discussed below.

The first possibility has to do with the interaction of reading skills and processing measures. For self-paced reading to be an accurate measure of processing, participants need to have automatized reading skills. Because the Japanese writing system is more complex than the alphabetic writing systems used in English speaking countries and in Korea, both participant groups in the present study needed to have learned sufficient *kanji*, and to have acquired them well enough that the phoneme-grapheme correspondences between individual *kanji*, their semantic mappings, and their phonological mappings are well established. Although all participants scored well on the *kanji* test, indicating that they knew the *kanji*, there may have been cases in which participants' ability to access phonological and semantic mappings for the *kanji* were not completely automatized. If this is the case, it could slow processing down and mask any sensitivity to structural constraints. Although there is no direct evidence in the present study that *kanji* recognition skills influence processing behaviors, it is the case that the English speakers have slightly lower proficiency scores than the Korean speakers, and that they spend less time reading in Japanese than the Korean speakers do. Both of these factors may contribute to the differences between these groups in terms of their processing of the nominative case marked sentences. At the very least, research into L2 processing should take into account the

influence of orthography on processing. One way to do so would be to replicate this study with a methodology, such as self-paced listening or auditory ERPs, that allows for aural presentation of the stimuli.

The other possibility is that overall processing difficulty of the structure of the stimulus sentences washes out any facilitation effects at the head noun of the relative clause. There is independent evidence that object relative clauses are relatively more difficult for native and non-native speakers to process than subject relative clauses are (Arnon, 2010; Havik, Roberts, van Hout, Schreuder, & Haverkort, 2009; Juffs, 2007; Ueno & Garnsey, 2008) and, as Juffs and Harrington (1996) have argued, processing difficulty and structural knowledge interact, and can create significant processing burdens for L2 speakers. If this is the case, it may be that the L2 parser is less efficient than the L1 parser and therefore less able to recover from garden path sentences, which is essentially what the target sentences in the present study are¹³. Because both L2 groups read all regions significantly slower than the native Japanese speakers, there is evidence that L2 parsing is slower and, therefore, less efficient, than native Japanese parsing. This could be due to a less efficient parser, to less efficient word recognition processes, or to some combination of these factors. Less efficient processing mechanisms, however, do not necessarily entail that the parser cannot make use of structural information. Indeed, there is some evidence in this study that even though the L2 groups are less efficient, they are sensitive to the role that case markers play in projecting clauses.

¹³ The subject relative clauses seem to induce more severe garden paths than the object relative clauses, which suggests that the results of the accusative case structures are unexpected. However, there is experimental evidence from both L1 acquisition (e.g., Clancy et al., 1986) and L2 acquisition (e.g., Kanno, 2007) that Japanese learners find object relative clauses more difficult to process than subject relative clauses. Thus, it is still possible that processing difficulty is a factor in these sentences.

CHAPTER 3

PROCESSING *WH*-DEPENDENCIES

As stated previously, incremental processing is a basic processing heuristic, and one that is essential for language processing. This chapter focuses on a different function of the parser; namely, the ability to link information across different parts of the sentence by computing *wh*-dependencies. *Wh*-dependencies are most commonly found in *wh*-structures. In *wh*-movement languages, they are created when a *wh*-word is displaced from its base-generated position and moved to a different part of the sentence. The parser reintegrates the *wh*-word into the parse at the original, base-generated position, thus inflating reading times. This creates a syntactic and semantic link between the two positions. A significant amount of evidence for the Shallow Structure Hypothesis (SSH) comes from work that has investigated the L2 processing of *wh*-dependencies in *wh*-movement languages. This chapter discusses the processing of *wh*-dependencies in Japanese, which is a *wh*-in situ language, and tests whether native and non-native Japanese speakers compute *wh*-dependencies in Japanese.

Background and Motivation

***Wh*-Dependencies**

Wh-dependencies are created when an element in a sentence is moved from its original position to a different position in the sentence. In English, *wh*-dependencies are most frequently associated with *wh*-movement structures such as *wh*-questions and relative clauses, as the example in (1) illustrates.

(1) a. Who_{*i*} did John see *e_i*?

b. The girl_{*i*} that John saw *e_i* was wearing purple.

The sentence in (1a) is a standard *wh*- question, and the sentence in (1b) is a relative clause. In both cases, the filler (*who* in (1a), and *the girl* in (1b)) has been displaced from its original position, creating a gap, and has been moved to the front of the sentence. Linguistic theory postulates the presence of a trace indicating the origin of a moved element, and online processing research has validated this by showing that native speakers slow down at the word after the gap position in order to associate the filler with the gap position and integrate it into the parse (Gibson & Warren, 2004).

The processing of *wh*- dependencies has received a significant amount of attention in both the native language and the non-native language processing literature. From the early days of native language processing research, researchers have been interested in how people process gaps. These are of interest for several reasons. First, gaps are phonologically null, and although they were theoretically necessary, work that demonstrated that people slowed down when processing gap positions (Frazier & Clifton, 1989; Frazier, 1995) provided evidence that gaps or empty categories are also a psycholinguistic reality. Research has also investigated when gaps are posited. The main hypothesis that accounts for how the parser posits gaps is called the Active Filler Hypothesis, and is stated in (2). A significant body of work supports this proposal (Fodor & Inoue, 1994; Fodor, 1989, 1998a, 1998b).

- (2) When a filler has been identified, rank the option of assigning it to a gap above all other options (Frazier & Clifton, 1989).

In other words, when the parser has identified a word that serves as a filler, such as a *wh*- word, it automatically assumes that the sentence will also contain a gap, and it actively looks for this gap. The parser postulates a gap at every possible opportunity, attempting to resolve the dependency at the earliest possible place in the parse. It will do so unless other factors—such as

nonsensical semantics or structural properties—prevent it from doing so. This suggests that gap-filling is a fundamental part of what the native language parser does: it is sensitive to the elements that participate in *wh*-dependencies, and it is biased to resolve these dependencies as soon as possible. The alternative hypothesis is that the parser postulates gaps only as a last resort (e.g., Frazier & Fodor, 1978). Under this hypothesis, gaps are postulated only when there is no lexical item that can be plausibly associated with a given position in the sentence. In other words, under this hypothesis, the parser only projects a gap position when it has no other choice.

Within the second language acquisition literature, research that investigates the processing of *wh*-dependencies has primarily been done with English-language learners, and these results have been used to argue for two positions. The first group of studies has investigated the relationship between processing patterns and sensitivity to grammatical and ungrammatical *wh*-extractions, and the second group of studies has investigated the nature of the L2 parser. Each will be discussed in turn.

The first group of studies (e.g., Juffs & Harrington, 1995, 1996; Juffs, 2001, 2005; White & Juffs, 1997), which investigated whether English language learners were sensitive to the constraints on *wh*-extraction in English, focused on the relative difficulty of the filler gap-dependencies created in object and subject extractions, such as those given in (3).

- (3) a. What_{*i*} does Mary believe John teaches *e_i*? (Object extraction)
 b. Who_{*i*} does Mary believe *e_i* teaches linguistics? (Subject extraction)

In both (3a) and (3b) the question words *what* and *who* are associated with gap positions. In the case of the sentence in (3a) the gap position is the object in the embedded clause. In (3b), however, the gap position is the subject position of the embedded clause. There is some evidence that native Chinese speakers with English as an L2 were more accurate at judging the

grammaticality of object extractions than subject extractions in English (e.g., White & Juffs, 1997). Some of the earliest work on L2 processing examined whether these apparent syntactic difficulties were also present in online processing. Juffs and Harrington (1995, 1996) found that non-native speakers had lower comprehension accuracy rates on garden path sentences and sentences with subject extractions, both of which are more difficult to process than sentences with object extractions. Similarly, Juffs (2005) found that this interaction between accuracy and processing difficulty was a feature of L2 English processing regardless of whether participants' L1 was a *wh*- in situ language. Specifically, the L1 Spanish speakers in this study did not have an advantage over native Chinese or Japanese speakers in processing English subject extractions. Results of these studies suggest that non-native speakers, regardless of the L1, have difficulty processing subject extractions. Juffs (2005) suggested that this is possibly due to garden path effects related to encountering two adjacent finite verbs, and not due to a structural deficiency. Working memory was not a factor in processing difficulty in this study.

The second group of studies investigated the processing of *wh*- dependencies with and without intermediate gaps, such as those given in (4).

- (4) a. The nurse who the doctor argued ____ that the rude patient had angered ____ is refusing to work late.
- b. The nurse who the doctor's argument about the rude patient had angered ____ is refusing to work late.

The sentence in (4a) contains an intermediate gap between *argued* and *that*, as well as a gap after *angered*, from whence the DP *the nurse* was extracted. In contrast, the sentence in (4b) contains only one gap: the extraction site after *angered*. Native English speakers make use of the intermediate gap position in (4a) to facilitate the processing of these types of sentences; this is

evident in longer reading times on *that* compared to a control condition that lacks a gap at this position. There is some evidence that suggests that non-native English speakers, regardless of whether participants' native language is a *wh*- movement or a *wh*- in situ language, fail to make use of the intermediate gap position in sentences like those in (4a) (Felser & Roberts, 2007; Marinis et al., 2005; Takahashi, 2006). Taken together, results of these two groups of studies suggests that non-native English speakers, regardless of L1, find it difficult to process sentences with *wh*- dependencies, though the relative difficulty is moderated by the type of dependency. Subject extractions appear to present more difficulty than object extractions, and non-native English speakers appear to not make use of intermediate gap positions. These studies form the bulk of the evidence for the SSH, and researchers have argued that these data suggest that non-native processing is fundamentally shallower than native language processing, and relies less heavily on structural representations (Clahsen & Felser, 2006; Felser & Roberts, 2007; Marinis et al., 2005). Relatively little work, however, has investigated the non-native processing of *wh*-dependencies in languages other than English. One exception is Jackson and Dussias (2009), who investigated the processing of subject and object extractions in L2 German using self-paced reading. They found that the L2 German speakers processed these sentences in the same manner as the native German speakers, and the authors argue that L2 processing heuristics are acquirable. Similarly, some evidence suggests that access to naturalistic input influences whether learners are sensitive to long distance dependencies. Pliatsikas and Marinis (2013) investigated whether naturalistic input made a difference in terms of whether L2 English learners with Greek as an L1 were able to fill intermediate gaps when processing *wh*- dependencies in English. They found that the group that had been exposed to naturalistic English input was sensitive to the position of the intermediate gap, but the group that had not spent time in an English-speaking

country was not. Thus, there is some evidence that L2 speakers are sensitive to the relationship between a filler and an intermediate gap.

Despite the evidence that some L2 learners do process *wh*-dependencies in a native-like way, research on the L2 processing of *wh*-dependencies has provided a substantial amount of evidence in favor of the SSH. For this reason, it is important to include *wh*-dependencies in the present dissertation. However, because Japanese is a *wh*-in situ language, it lacks the same type of *wh*-dependencies instantiated in English. As will be described in more detail below, Japanese *wh*-words do enter into a relationship with clause-final particles that is analogous to a *wh*-dependency. These structures are comparable to the dependencies created by *wh*-movement because they both test the parser's ability to formulate expectations for what it will encounter later in the sentence based on encountering a *wh*-word early in the sentence.

***Wh*-Dependencies in Japanese**

Japanese is a *wh*-in situ language. The default option is for *wh*-words to remain in their base generated position, and *wh*-words are not typically associated with displaced elements, as shown in (5).

- (5) a. Taro-ga zoo-o mimashi.ta.
Taro-nom elephant-acc see.pst
"Taro saw an elephant."
b. Taro-ga nani-o mimashi.ta.ka?
Taro-nom what-acc see.pst.Q
"What did Taro see?"

The sentence in (5a) is a declarative clause, and the sentence in (5b) is the corresponding sentence with the object questioned. Unlike the English translation of (5b), in which the *wh*-word has been moved to the front of the sentence, in the Japanese sentence in (5b), the question word has simply replaced the object in its base-generated position. In addition, the question particle *-ka* has been inserted in C^0 , so that it heads CP and takes the rest of the sentence as its

complement. Together, the question particle and the question word make the sentence a question, and not a statement.

Parsing questions in Japanese depends not on associating displaced *wh*- words with their base-generated position, but on using the *wh*- word and the question particle to compute questions. Experimental evidence suggests that when the Japanese parser encounters a *wh*- word, it expects a clause-final question particle (Aoshima, Phillips, & Weinberg, 2004; Lieberman, Aoshima, & Phillips, 2006; Ueno & Kluender, 2009). Japanese has three particles that can be inserted in C^0 : the declarative complementizer *toh*¹⁴ and two question particles, *ka* and *no*. Because Japanese is head final, all *wh*- words precede clause-final particles. When the parser encounters a *wh*- word, it looks for a particle to link the *wh*- word to, and it must resolve a *wh*- word by linking it to a question particle, and not to a declarative complementizer. This creates a relationship between the *wh*- word and the question particles that is analogous to the *wh*- dependencies created by *wh*- movement in *wh*- movement languages. In order to resolve the *wh*- dependency as soon as possible, the parser first looks for a question particle in its clause (Aoshima et al., 2004; Lieberman et al., 2006; Ueno & Kluender, 2009). This expectation is easily met in single clause sentences, but it creates processing confounds in bi-clausal sentences that can be exploited in processing research.

In bi-clausal sentences, question particles can be attached either to the embedded verb or to the matrix verb. This has implications for the scope and interpretation of the *wh*- word, as illustrated in (6).

- (6) a. Sensei-wa [EC ryugakusei-ga dono kodomo-ni hon-o ageta toh]
 Teacher_{TOP} [exchange student_{NOM} which child_{DAT} book_{ACC} gave COMP]

¹⁴ This is a non-standard Romanization for the Japanese particle と, usually Romanized as ‘to’ and pronounced like ‘toe’. I use it here to help the reader keep it separate from the English word *to*.

oya-ni oshiemashita.ka

parents_{DAT} told.Q

(Declarative comp)

“Did the teacher tell the parents which child the exchange student gave a book to?”

b. Sensei-wa [_{EC} ryugakusei-ga dono kodomo-ni hon-o ageta ka]

Teacher_{TOP} [exchange student_{NOM} which child_{DAT} book_{ACC} gave Q]

oya-ni oshiemashita.

parents_{DAT} told.

(Question comp)

“The teacher told the parents which child the exchange student gave a book to.”

Both (6a) and (6b) have two clauses, and the right edge of the embedded clause is marked with a declarative complementizer (*toh*) in (6a) and with a question particle (*ka*) in (6b). The clause in which the question particle occurs is the clause in which the *wh*- word is interpreted, and, in this case, the two sentences are interpreted differently. In (6a), the question particle takes matrix clause scope, and the whole sentence is interpreted as a question. In (6b), on the other hand, the question particle takes embedded clause scope, and the sentence is interpreted as a statement. From a processing perspective, however, because the *wh*- word is in the embedded clause, native speakers look to resolve the *wh*- dependency at the embedded clause verb, *ageta*, leading to longer reading times on the embedded clause verb in (6a) compared to the verb in (6b).

In addition to being a *wh*- in situ language, Japanese also permits scrambling. Thus, it allows *wh*- words to be moved leftward out of their base-generated position. Scrambling leaves traces, but it also potentially changes the parser’s preferences for resolving *wh*- dependencies. This can be tested by crossing scrambling and the type of complementizer (declarative vs. question) sentences with both matrix and embedded clauses as indicated in (7):

(7) a. Sensei-wa [_{EC} ryugakusei-ga dono kodomo-ni hon-o ageta toh]

Teacher_{TOP} [_{EC} exchange student_{NOM} which child_{DAT} book_{ACC} gave COMP]

oya-ni oshiemashita.ka?

parents_{DAT} told.Q

(*Wh*- in situ, declarative comp)

“Did the teacher tell the parents which child the exchange student gave a book to?”

b. Dono kodomo-ni sensei-wa [_{EC} ryugakusei-ga *e_i* hon-o ageta toh]

Which child_{DAT*i*} teacher_{TOP} [_{EC} exchange student_{NOM} *e_i* book_{ACC} gave COMP]

oya-ni oshiemashita.ka?

parents_{DAT} told.Q

(*Wh*- scrambled, declarative comp)

- “Did the teacher tell the parents which child the exchange student gave a book to?”
- c. Sensei-wa [EC ryugakusei-ga dono kodomo-ni hon-o ageta ka]
 Teacher_{TOP} [EC exchange student_{NOM} which child_{DAT} book_{ACC} gave Q]
 oya-ni oshiemashita.
 parents_{DAT} told. (*Wh-* in situ, question comp)
 “The teacher told the parents which child the exchange student gave a book to.”
- d. Dono kodomo-ni_i sensei-wa [EC ryugakusei-ga *e_i* hon-o ageta ka]
 Which child_{DAT*i*} teacher_{TOP} [EC exchange student_{NOM} *e_i* book_{ACC} gave Q]
 oya-ni oshiemashita.
 parents_{DAT} told. (*Wh-* scrambled, question comp)
 “The teacher told the parents which child the exchange student gave a book to.”

Sentences (7a) and (7b) both contain the declarative complementizer *toh* affixed to the matrix clause verb. In (7a), the *wh-* word is in its normal, base-generated position, and in (7b) it has moved out of its base generated position in the embedded clause to a position in the matrix clause. If the parser wants to link the *wh-* word to the first question particle it encounters, then the declarative complementizer in these sentences should impose a processing cost compared to the corresponding sentences in (7c) and (7d) regardless of the position of the *wh-* word.

Alternatively, because the *wh-* word in the scrambled items has been moved to the matrix clause, it is possible that the parser prefers to link the *wh-* word to a matrix clause question particle instead. Empirical evidence, however, suggests that native Japanese speakers resolve *wh-* dependencies locally, or in the same clause as the base-generated position of the *wh-* word. Thus, the parser expects a question particle at the end of the clause in which the *wh-* word originated (Aoshima et al., 2004; Ueno & Kluender, 2009).

The present dissertation tests whether native English and native Korean speakers expect clause-final question particles when they encounter *wh-* words in the sentence. In other words, it tests non-native speakers’ ability to process structures analogous to *wh-* dependencies in L2 Japanese. As discussed earlier, a substantial amount of evidence for the SSH comes from the processing of *wh-* dependencies in L2 English. It is therefore important to determine whether

other types of *wh*- dependencies are equally subject to shallow processing in an L2, or whether the data from L2 English speakers are better understood as a property of processing *wh*-movement¹⁵. The Japanese *wh*- dependencies described above provide an alternative test case.

In addition, these structures provide a way of determining whether the L1 makes a difference for L2 participants' ability to process *wh*- dependencies. L1 English speakers do construct *wh*- dependencies in English, but they do so as part of processing *wh*- movement. Because there is no movement in Japanese, a parser attuned to *wh*- movement from L1 English will have to acquire a different set of dependencies in L2 Japanese. Again, native Korean speakers provide a helpful contrast to the L1 English speakers. Direct and indirect *wh*- questions in Korean are constructed in the same manner as those in Japanese (Beck & Kim, 1997). Thus, although there is no empirical evidence to date that speaks to how Korean questions are processed, it is reasonable to assume that the same relationship between *wh*- words and particles that exists in Japanese also holds for L1 Korean processing given that Korean is also a *wh*- in situ language that makes use of particles.

Because the SSH predicts that L2 parsing is necessarily shallow, and that L2 speakers do not rely on structural information to process sentences in the L2, the SSH predicts that neither the native English nor the native Korean speakers will be able to compute the dependencies associated with Japanese direct and indirect questions. Although Korean is structured similarly to

¹⁵ For the sake of comparability, it would be better to use sentences closer to those in Marinis et al. (2005). However, even though Japanese relative clauses are externally headed, they are not introduced with an overt complementizer. This means that nothing triggers the *wh*- dependency until the head noun is encountered. In addition, because Japanese is a head final language, gap positions precede heads. From a processing perspective, this means that part of the question is whether people return to the gap position in online processing to posit a gap. This type of question is better investigated using eye-tracking. Given these constraints, the relationship between *wh*- words and particles is a suitable substitute target structure for the present dissertation.

Japanese, and L1 Korean speakers might be predicted to transfer processing routines into L2 Japanese, the SSH predicts that processing heuristics do not transfer from the L1 to the L2. Because English is a *wh*- movement language and does not make use of question particles, native English processing heuristics cannot play a facilitative effect in L2 Japanese processing. Thus, native English speakers have to acquire new processing routines. The SSH predicts that they will not do so. The SSH predicts that neither the native English nor the native Korean speakers should show evidence of elevated reading times at the embedded verb when it is followed by a declarative complementizer.

Research Questions

The following research question guided the present study:

1. Do native and near native Japanese speakers with either English or Korean as an L1 show evidence of the ability to compute *wh*- dependencies, as measured by longer reading times on embedded verbs marked with declarative case markers compared to those marked with question particles?
2. Is there a difference between the two L2 groups in terms of their ability to do so?

Method and Procedure

Participants

The participants who participated in the study reported in Chapter 1 also participated in this study. There were 45 non-native Japanese speakers 18 were L1 English speakers, and 17 were L1 Korean speakers. A group of 29 L1 Japanese speakers served as a control. Participants were recruited through university communities and the researcher's personal contacts in Hikone, Shizuoka, Nagano, and Tokyo, Japan. On average, the L1 English speakers had lived in Japan for five years and three months. A subset ($n = 3$) of the L1 English speakers was employed at the

Japan Center for Michigan Universities. Another subset ($n = 5$) consisted of university students studying at Japanese universities, and one was a PhD candidate in Japanese literature. The remaining L1 English speakers were employed as English teachers in Japan. Several of the L1 English speakers had studied languages other than Japanese, but all rated Japanese as their most dominant second language, and none had studied another rigidly head-final language. On average, the L1 Korean speakers had lived in Japan for four years and eight months. A subset of this group ($n = 8$) was enrolled in Japanese universities. The remaining L1 Korean participants were working in Tokyo. All of the L1 Korean participants indicated that they had studied English in addition to Japanese, and some also indicated that they had studied Chinese. All of the L1 Korean speakers indicated that Japanese was their most dominant second language. The native Japanese speakers were either students at a university in central Japan ($n = 13$) or were enrolled in private ESL classes ($n = 11$). All of the native Japanese speakers indicated that they had studied English. All participants were living in Japan at the time of the study.

Materials

Participants completed the same set of proficiency measures and the same self-paced reading task described in Chapter 2. The proficiency measures consisted of the *Language Experience and Proficiency Questionnaire* (LEAP-Q), a grammar test, and a test of *kanji*¹⁶ knowledge. The LEAP-Q was adapted from Marian, Blumenfeld, and Kaushanskaya (2007), and the researcher created the rest of the materials. Each one will be discussed in turn.

¹⁶ Japanese is written with a combination of three different scripts: *hiragana*, *katakana*, and *kanji*. *Hiragana* and *katakana* are phonetic syllabaries, and *kanji* are the logographic characters borrowed from Chinese in the 7th and 8th centuries, C.E. *Hiragana* are primarily used for grammatical functions, such as particles and verb endings, and to write ‘content’ words that lack *kanji*. *Kanji* are used for content words such as nouns and verb and adjective roots. *Katakana* are used to write foreign words and for emphasis, much like italics are in English. All *kanji* can be transcribed into *hiragana* or *katakana*. Familiarity with and fluency in all three scripts are required for fluent reading in Japanese.

Proficiency measures. The LEAP-Q (see Appendix A) is an instrument designed to provide researchers with a consistent, reliable measure of bilinguals' language experience and proficiency. It depends on self-reported data, and includes information about participants' age of acquisition, contexts in which participants use the target language, and self-rated proficiency assessments. The LEAP-Q can be used with adult bilinguals who have at least a high school education in one of their languages. Although the original instrument was created in English, it can be translated into other languages (Marian et al., 2007). For the purposes of the present study, it was translated into Japanese.

The grammar test was adapted from a practice book for the Japanese Language Proficiency Test (JLPT) Level 2 (see Appendix B). The JLPT is a Japanese proficiency test used in Japan as the measure of non-native Japanese knowledge. Passing the Level 2 test is a rough proxy for Advanced High proficiency. The test consisted of 28 multiple choice and cloze test items that tested participants' knowledge of various grammatical structures. The L1 Japanese group performed at ceiling on this test ($M = 98\%$; $SD = 1.04$). In addition to the grammar test, participants also completed a *kanji* test (see Appendix C). This test consisted of a list of 73 *kanji* compounds taken from the self-paced reading task describe below. The L2 groups were asked to provide the Japanese pronunciation of the *kanji* in *hiragana*, and either an English or a Korean translation of the word. The Japanese speakers were asked to provide the *hiragana* only. The *kanji* test was included to ensure that participants knew enough *kanji* to understand the reading task.

Stimuli testing *wh*- dependencies. This set of stimulus sentences tested participants' sensitivity to the dependency created between a *wh*- word and a question particle. Because Japanese allows scrambling, *wh*- words can be scrambled out of their base generated position.

Crossing scrambling with complementizer type allows researchers to test readers' sensitivity to the interaction between the position of the *wh*- word and expectations about the type of complementizer participants expect. A list of 32 experimental quadruplets was created based on the stimuli used in Aoshima, Phillips, and Weinberg (2004) to test online sensitivity to the dependency between *wh*- words and particles. Each sentence consisted of two clauses. The matrix clause verb always took a clausal complement and a dative-marked argument. Scrambling and complementizer type were crossed so that each sentence had four versions, as shown in (8).

- (8) a. Sensei-wa ryugakusei-ga dono kodomo-ni hon-o ageta toh
 Teacher_{TOP} exchange student_{NOM} which child_{DAT} book_{ACC} gave COMP
 kyoshitsu-de oya-ni oshiemashita.ka?
 classroom_{LOC} parents_{DAT} told.Q (*Wh*- in situ, declarative comp)
 “Did the teacher tell the parents which child the exchange student gave a book to?”
- b. Dono kodomo-ni sensei-wa ryugakusei-ga hon-o ageta toh¹⁷
 Which child_{DAT} teacher_{TOP} exchange student_{NOM} book_{ACC} gave COMP
 kyoshitsu-de oya-ni oshiemashita.ka?
 classroom_{LOC} parents_{DAT} told.Q (*Wh*- scrambled, declarative comp)
 “Did the teacher tell the parents which child the exchange student gave a book to?”
- c. Sensei-wa ryugakusei-ga dono kodomo-ni hon-o ageta ka
 Teacher_{TOP} exchange student_{NOM} which child_{DAT} book_{ACC} gave Q
 kyoshitsu-de oya-ni oshiemashita.
 classroom_{LOC} parents_{DAT} told. (*Wh*- in situ, question comp)
 “The teacher told the parents which child the exchange student gave a book to.”
- d. Dono kodomo-ni sensei-wa ryugakusei-ga hon-o ageta ka
 Which child_{DAT} teacher_{TOP} exchange student_{NOM} book_{ACC} gave Q
 kyoshitsu-de oya-ni oshiemashita.
 classroom_{LOC} parents_{DAT} told. (*Wh*- scrambled, question comp)
 “The teacher told the parents which child the exchange student gave a book to.”

In these sentences, the critical region is the embedded clause verb, *ageta*, because that is where the parser will first try to resolve the dependency created by the *wh*- word. The dative marked argument always followed the embedded clause verb, and served as the spillover region.

Reading times on embedded clause verbs with declarative complementizers—(8a) and (8b) in

¹⁷ Both clause-final particles used in these stimuli are written with one *kana* in Japanese, so there are no differences in length.

this case—are predicted to be longer than their counterparts with question particles because the parser cannot resolve the *wh*- dependency in the clause where it was created. The length of the critical and spillover regions was controlled so that each one consisted of three characters: a *kanji* compound and a *hiragana* particle. As is typically done in Japanese self-paced reading studies, these sentences were segmented into *bunsetsu* for presentation. *Bunsetsu* are the smallest phonological unit in Japanese, consisting minimally of a word and a particle. Segmentation is illustrated in (9).

- (9) a. Sensei-wa \ ryugakusei-ga \ dono kodomo-ni \ hon-o \ ageta toh\
 1 2 3 4 5
 Teacher_{TOP} \ exchange student_{NOM} \ which child_{DAT} \ book_{ACC} \ gave_{COMP} \
 1 2 3 4 5
 kyoshitsu-de \ oya-ni \ oshiemashita.ka?
 6 7 8
 classroom_{LOC} \ parents_{DAT} \ told.Q (Wh- in situ, declarative comp)
 “Did the teacher tell the parents which child the exchange student gave a book to?”
- b. Sensei-wa \ ryugakusei-ga \ dono kodomo-ni \ hon-o \ ageta ka \
 1 2 3 4 5
 Teacher_{TOP} \ exchange student_{NOM} \ which child_{DAT} \ book_{ACC} \ gave Q \
 1 2 3 4 5
 kyoshitsu-de \ oya-ni \ oshiemashita.
 6 7 8
 classroom_{LOC} \ parents_{DAT} \ told. (Wh- in situ, question comp)
 “The teacher told the parents which child the exchange student gave a book to.”

In this case, the critical region was region 5, and the spillover region was region 6.

These sentences were also followed by a comprehension check. The comprehension question for (8) is given below in (10).

- (10) Kono bunsho-ni yoru to, ryugakusei-ga...
 This sentence_{DAT} according_{COMP}, exchange student_{NOM}
 “According to this sentence, the exchange student....
- A. ...kodomo-ni hon-o ageta.
 child_{DAT} book_{ACC} gave
 ...gave a book to the child
- B. ...sensei-ni hon-o ageta.
 teacher_{DAT} book_{ACC} gave
 ...gave a book to the teacher

These questions always asked about the content of the embedded clause.

These sentences were distributed across four lists so that each list contained one version of the sentence. Each list also included items testing participants' ability to use case marking to process sentences incrementally (see Chapter 2) and items testing participants' ambiguity resolution strategies (see Chapter 4). Each set of target sentences served as distractors for the other sentence types. Each master list of target sentences was intermixed with a list of sentences that contained short and long distance scrambling that served as filler items. Each list consisted of 144 sentences. To ensure that the native English and native Korean speakers understood the sentences they read, each list was followed by a translation task with 12 items. Participants read 12 Japanese sentences from the self-paced reading task and chose the best translation into either English or Korean for each sentence. The average accuracy score for the English speakers was 78%, and the average accuracy score for the Korean speakers was 77%. This indicates that both groups understood the target structures reasonably well, and that one group did not understand them better than the other.

Procedure

Participants were tested individually, and were paid ¥2,000 (about \$20) for their participation. Participants read a consent form, and then began the experiment. Participants completed the self-paced reading experiment first. The self-paced reading experiment was divided in half so that participants read 72 sentences, had a break, and then read the remaining 72 sentences. Stimulus sentences were evenly distributed across both halves of the experiment. The L1 English and L1 Korean speakers completed the translation task at the end of the self-paced reading task. After participants had finished the self-paced reading task, they completed the LEAP-Q, the grammar test, and the *kanji* test.

The self-paced reading task was presented using SuperLab 5. Stimulus sentences were segmented as described above, and participants pressed a button to move from sentence to sentence. Participants moved through the self-paced reading task at their own pace. This study used the non-cumulative moving window paradigm, so that when participants pressed a button to display one segment, the previous segment disappeared from the screen. Once participants reached the end of the stimulus sentence, they pressed a button to reveal the comprehension question. Participants selected either A or B on the response pad to answer the comprehension question. On average, the native speaker controls completed the study in 60 minutes, and the L2 speakers completed the study in 90 minutes.

Scoring and Analysis

The proficiency test was scored first. Scores on the proficiency test were submitted to a one-way ANOVA to identify any differences in proficiency levels between groups. The comprehension questions were scored next. Any participant who scored below 65% accuracy on the comprehension questions overall would have been eliminated from further analyses. No participant scored below this threshold, indicating that participants were paying attention to the test sentences. The self-paced reading data were analyzed using a generalized linear mixed effects model, the structure of which is described below. In the sample as a whole, 64 participants contributed reading times for eight regions in 16 sentences. Participants belonged to three different groups: native Japanese speakers ($n = 29$), native English speakers ($n = 18$), and native Korean speakers ($n = 17$). Participants read two types of bi-clausal sentences, one with a question particle on the embedded clause verb, and one with a declarative particle on the embedded clause verb. Each participant read eight items for each sentence type. Group and sentence type are the independent variables, and reading times on individual regions are the

dependent variable. Each participant contributed eight reading times per region for each sentence type. The reading time data for the *wh*- sentences did not meet the assumption of normality, so they were also modeled using a generalized linear mixed effects model. Again, a gamma distribution and an inverse link function were specified. The model included a random intercept by participant, and two independent variables, Group (Japanese, English, and Korean), and Function (Control and Target). In all cases, these data were analyzed using models with and without interaction terms. Interactions are reported where they were significant.

Results

Proficiency Test Results

The Japanese speakers scored the highest on the proficiency test ($M = 27.25$, $SD = 1.06$), and the Korean speakers ($M = 21.35$, $SD = 4.59$) scored slightly better than the English speakers ($M = 18.28$, $SD = 4.03$). These results were submitted to a one-way ANOVA, which indicated that these group differences were significant; $F(2, 23.56) = 50.62$, $p < .001$. Post-hoc paired samples *t*-tests indicated that the Japanese group differed significantly from both the English group; $t(18.5) = 9.02$, $p < .001$, $d = 3.04$) and the Korean group; $t(17.07) = 5.07$, $p < .001$, $d = 1.77$). The English and Korean groups also differed significantly from each other; $t(31.84) = -2.05$, $p = .05$, $d = .71$).

Results for *Wh*- Canonical Sentences

Descriptive statistics for all regions in the canonical sentences with *wh*- dependencies are given in Table 3.1. These sentences contained no movement (i.e., the *wh*- word was in its base generated position) and a question particle following either the embedded verb or on the matrix verb. Sentences with a question particle following the matrix verb had a declarative clause complementizer on the embedded verb. If participants are sensitive to the relationship between

the *wh*- word and the question particle, this should be apparent in longer reading times on the embedded verb—Region 5—when it is marked with a declarative particle than when it is marked with a question particle. Numerically, only the Korean group has longer reading times for embedded verbs marked with declarative complementizers in this region. Both the Japanese and the English group have longer reading times on embedded verbs marked with question particles. These two groups have slightly longer reading times on the spillover region, Region 6, for sentences with declarative complementizers on the embedded verb. The overall pattern of reading times is displayed in Figure 3.1.

Reading time data for the embedded verb, which was in Region 5, were analyzed using a generalized linear mixed effects model using the *lme4* (Bates et al., 2015a, 2015b) package in R (R Core Team, 2015). Again, a gamma distribution with an inverse link function was specified. The interaction between function and group was significant, and the model used is given in Table 3.2. Model results are given in Table 3.3.

Table 3.1

Descriptive Statistics for Wh- Canonical Sentences by Region

	Japanese (n = 29)				English (n = 18)				Korean (n = 17)			
	V-toh		V-ka		V-toh		V-ka		V-toh		V-ka	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Main S	758.60	595.60	740.77	612.99	3179.25	2346.02	2834.00	1534.84	1982.41	1436.45	1787.38	1127.90
Emb. S	943.59	873.06	1090.58	1265.38	2877.60	2319.48	2517.31	1687.28	1933.74	1605.18	1647.89	1088.03
Wh-	1110.56	1087.11	1137.76	1161.70	3252.60	2134.54	2854.22	2015.34	1843.72	1335.94	1886.53	1472.62
Emb. O	870.55	914.76	984.69	1722.67	1983.49	1725.11	1861.05	1299.71	1426.32	1084.91	1270.97	954.73
V-part	695.18	675.60	822.07	1101.84	1791.76	1632.29	1962.17	1597.43	1381.54	1400.08	1168.85	1119.24
Spill.	643.81	492.39	579.27	317.90	1879.16	2028.08	1778.30	1233.15	1211.55	845.15	1075.05	1370.04
Main O	619.90	428.35	567.72	327.58	1909.47	1209.31	1694.83	1156.66	1078.25	623.63	898.75	590.60
Main V	749.88	566.76	690.52	541.58	2129.66	4044.10	1575.76	1272.03	1378.97	1749.96	951.73	733.93

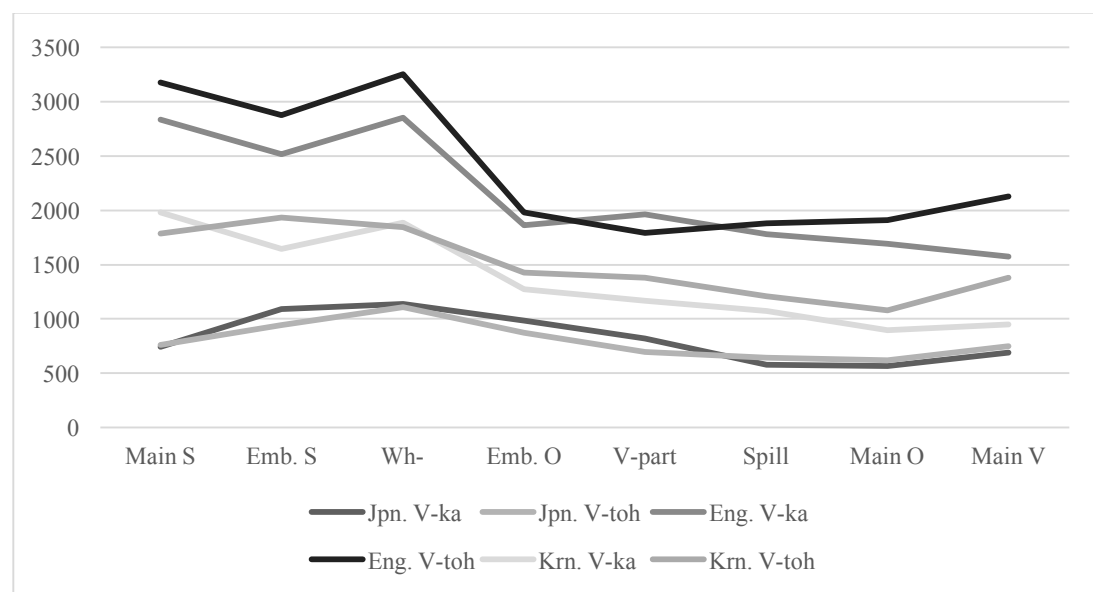


Figure 3.1

Reading times by group for the wh- canonical sentences

Table 3.2

Model Specifications for Region 5 of Wh- Canonical Sentences

Level of Analysis	Units	Description	Model
1	Time/Experimental observations	Overall effect of function on reading times	$1/\text{Time} = \beta_{0i} + e_{ij}$
2	Participants	Random effect includes overall average, group effects, function effects, and participant-specific deviations from the average	$\beta_{0i} = \gamma_{00} + \gamma_{01} * \text{Group} + \gamma_{02} * \text{Function} + \gamma_{03} * (\text{Group} * \text{Function}) + u_{0i}$

Note. The model $\text{Inverse}(\text{Time}) = \beta_{0i} + e_{ij}$ was analyzed using the 16 multiple measures per participant.

Table 3.3

Model Results for Region 5 of Wh- Canonical Sentences

Meaning	Fixed Effects		Estimate	SE	<i>p</i> -value
Overall effect of being a native Japanese speaker reading the target sentences	Intercept (I)	γ_{00}	1.71	.11	< .001
Effect of being an English speaker (compared to Japanese speakers)	Group _{English} (on I)	$\gamma_{01\text{English}}$	-1.04	.17	< .001
Effect of being a Korean speaker (compared to Japanese speakers)	Group _{Korean} (on I)	$\gamma_{01\text{Korean}}$	-.76	.17	< .001
Differences due to reading control sentences compared to target sentences	Function (on I)	γ_{02}	-.19	.06	.003
Effects of English speakers reading control sentences	Group _{English} * Function	$\gamma_{01\text{English}} * \gamma_{02} * \gamma_{03\text{English}}$.14	.07	.04
Effects of Korean speakers reading control sentences	Group _{Korean} * Function	$\gamma_{01\text{Korean}} * \gamma_{02} * \gamma_{03\text{Korean}}$.30	.08	< .001
Random Effects			Variance		
Intercept		u_{01}	.17		
Residual		e_{ij}	.52		

Note. Group is a categorical variable with three levels. Japanese was taken as the reference category. Function is a categorical variable with two levels. Control sentences (those with the embedded verb marked with a question particle) were taken as the reference category.

The average Japanese participant had a value of 1.71 in inverse time units, or .58 seconds, which is significantly different from zero ($\gamma_{00} = 1.71, p < .001$). The average English-speaking participant had a value of .67 in inverse time units, or 1.49 seconds. This differs

significantly from the average Japanese participant ($\gamma_{01\text{English}} = -1.04, p < .001$). The average Korean participant had a value of .95 in inverse time units, or 1.05 seconds, which is significantly different from the average Japanese speaker ($\gamma_{01\text{Korean}} = -.76, p < .001$). The overall effect of function is significant for all groups ($\gamma_{02} = -.19, p = .003$). The interaction between English speakers and Function is significant ($\gamma_{03\text{English}} = .14, p = .03$), as is the interaction between Korean speakers and Function ($\gamma_{03\text{Korean}} = .30, p < .001$). Post hoc comparisons indicate that the reading time differences for English speakers between the target and control sentences are not significantly different from zero (estimate = $-.04, p = .34$). These differences are significantly different from zero for the Korean speakers (estimate = $.11, p = .04$). Overall, then, the native Japanese speakers take significantly longer to read the embedded verb when it is marked with a question particle than when it is marked with a declarative clause particle, the native English speakers do not treat these regions significantly different from each other, and the native Korean speakers take significantly longer to read the embedded verb when it is marked with a declarative clause particle than when it is marked with a question particle.

Reading times for Region 6, the spillover region, were also analyzed using a generalized linear mixed effects model with a gamma distribution and an inverse link function. In this case, there were no significant interactions between groups. The model summary is given in Table 3.4, and the results are given in Table 3.5.

Table 3.4

Model Summary for Region 6 in the Wh- Canonical Sentences

Level of Analysis	Units	Description	Model
1	Time/Experimental observations	Overall effect of function on reading times	$1/\text{Time} = \beta_{0i} + e_{ij}$
2	Participants	Random effect includes overall average, group effects, function effects, and participant-specific deviations from the average	$\beta_{0i} = \gamma_{00} + \gamma_{01} * \text{Group} + \gamma_{02} * \text{Function} + u_{0i}$

Note. The model $\text{Inverse}(\text{Time}) = \beta_{0i} + e_{ij}$ was analyzed using 16 multiple measures per participant.

Table 3.5

Model Results for Region 6 of the Wh- Canonical Sentences

Meaning	Fixed Effects		Estimate	SE	p-value
Overall effect of being a native Japanese speaker reading the control sentences	Intercept (I)	γ_{00}	1.82	.09	< .001
Effect of being an English speaker (compared to Japanese speakers)	Group _{English} (on I)	$\gamma_{01\text{English}}$	-1.17	.16	< .001
Effect of being a Korean speaker (compared to Japanese speakers)	Group _{Korean} (on I)	$\gamma_{01\text{Korean}}$	-.80	.16	< .001
Differences due to reading control sentences compared to target sentences	Function (on I)	γ_{02}	.06	.02	.01
			Random Effects		
			Variance		
			Intercept	u_{01}	.10
			Residual	e_{ij}	.33

Note. Group is a categorical variable with three levels. Japanese was taken as the reference category. Function is a categorical variable with two levels. Control sentences (those with the embedded clause verb marked with a question particle) were taken as the reference category.

The average Japanese participant had a value of 1.82 in inverse time units, or .55 seconds. This is significantly different from zero ($\gamma_{00} = 1.82, p < .001$). The average English participant had a value of .65 in inverse time units, or 1.54 seconds, which is significantly different from the average Japanese participant ($\gamma_{01\text{English}} = -1.65, p < .001$). The average Korean participant had a value of 1.02 in inverse time units, or .98 seconds. This is also significantly different from the average Japanese participant ($\gamma_{01\text{Korean}} = -.80, p = .001$). In addition, the effect

of Function is significant for all participants ($\gamma_{02} = .06, p = .01$). Thus, all three groups take significantly longer to read the spillover region following an embedded clause verb marked with a declarative particle than one marked with a question particle.

Results for the *Wh*- Scrambled Sentences

Descriptive statistics for all regions in scrambled sentences with embedded clause question particles and embedded clause declarative particles are given in Table 3.6. In these sentences, the question is whether scrambling the *wh*- word changes the scope of the interpretation of the question for L2 Japanese speakers. If non-native speakers process like native speakers, reading times are still predicted to be longer on the embedded verb marked with a declarative particle than on the embedded verb marked with a question particle. Numerically, the English and Japanese speakers have slightly longer reading times on the embedded verb when it is marked with a declarative clause particle. The Korean speakers have slightly longer reading times on the embedded verb marked with a question particle. The overall pattern of reading times is illustrated in Figure 3.2. Reading times for Regions 5 and 6, the critical and spillover regions, respectively were modeled using a generalized linear mixed effects model in using the lme4 package in R. Again, because the data were not normally distributed, a gamma distribution with an inverse link function was specified. The interaction term was significant for both the critical and spillover region. The model that was used to analyze the critical regions in the canonical sentences was also used to analyze both regions in the scrambled sentences. This model is repeated here as Table 3.7, and the results are given in Table 3.8.

Table 3.6

Descriptive Statistics for Wh- Scrambled Sentences by Region

	Japanese (<i>n</i> = 29)				English (<i>n</i> = 18)				Korean (<i>n</i> = 17)			
	V-toh		V-ka		V-toh		V-ka		V-toh		V-ka	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<i>Wh-</i>	970.81	908.24	928.90	683.19	3419.11	3077.44	3010.35	2152.74	2060.78	1764.70	2075.28	1726.36
Main S	1029.37	975.25	901.07	781.06	2595.46	2062.52	2803.33	2302.38	1911.94	1764.14	1894.56	1651.65
Emb. S	1081.20	1298.45	1087.88	1208.32	2643.41	2063.58	3250.92	2162.69	1875.23	1393.32	1789.03	1280.05
Emb. O	892.01	928.86	1064.27	1338.27	1970.67	1270.25	1846.85	1467.72	1241.35	943.45	1427.92	1352.86
V-part	839.02	1268.16	718.81	755.05	1875.51	1444.17	1752.78	1598.11	1114.83	926.20	1317.90	1040.30
Spill.	820.92	870.78	736.46	627.22	1856.35	2211.28	1784.85	1994.31	919.78	590.25	1167.82	824.80
Main O	567.73	319.35	718.75	681.08	1620.31	921.18	1760.25	1090.84	932.61	714.06	1124.21	729.45
Main V	1386.90	1600.16	1482.00	1846.46	1978.94	3747.23	1970.65	4004.37	1274.79	1798.64	1596.24	2063.80

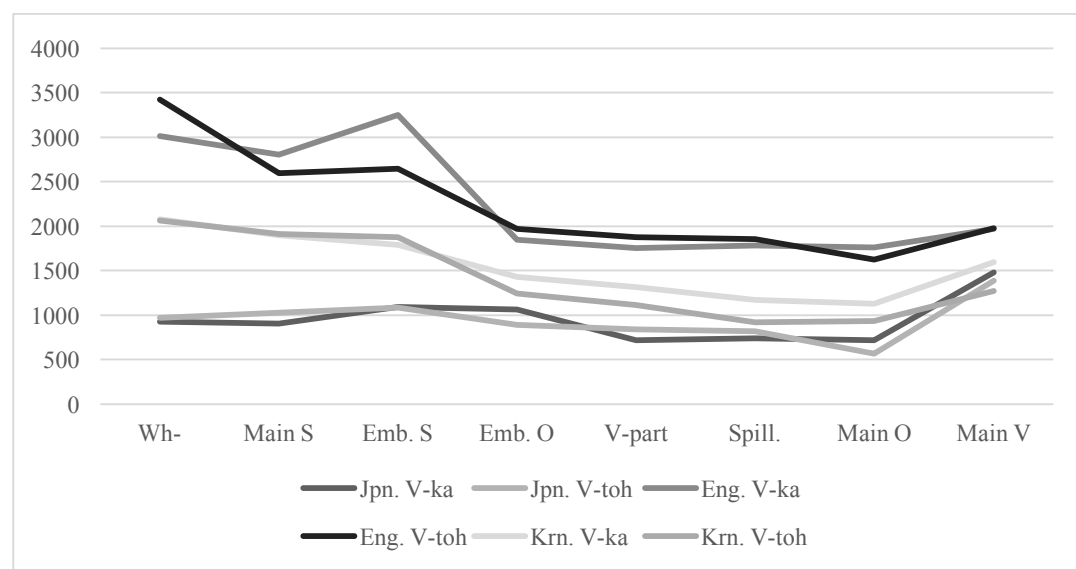


Figure 3.2

Reading times by group for the wh- scrambled sentences

Table 3.7

Model Summary for Regions 5 and 6 in the Wh- Scrambled Sentences

Level of Analysis	Units	Description	Model
1	Time/Experimental observations	Overall effect of function on reading times	$1/\text{Time} = \beta_{0i} + e_{ij}$
2	Participants	Random effect includes overall average, group effects, function effects, and participant-specific deviations from the average	$\beta_{0i} = \gamma_{00} + \gamma_{01} * \text{Group} + \gamma_{02} * \text{Function} + \gamma_{03} * (\text{Group} * \text{Function}) + u_{0i}$

Note. The model $\text{Inverse}(\text{Time}) = \beta_{0i} + e_{ij}$ was analyzed using the 16 multiple measures per participant.

Table 3.8

Model Results for Region 5 of Wh- Scrambled Sentences

Meaning	Fixed Effects		Estimate	Std. Err.	<i>p</i> -value
Overall effect of being a native Japanese speaker reading the control sentences	Intercept (I)	γ_{00}	1.70	.12	< .001
Effect of being an English speaker (compared to Japanese speakers)	Group _{English} (on I)	$\gamma_{01\text{English}}$	-1.06	.19	< .001
Effect of being a Korean speaker (compared to Japanese speakers)	Group _{Korean} (on I)	$\gamma_{01\text{Korean}}$	-.61	.19	.002
Differences due to reading control sentences compared to target sentences	Function (on I)	γ_{02}	.15	.05	.007
Effects of English speakers reading target sentences	Group _{English} * Function	$\gamma_{01\text{English}} * \gamma_{02} * \gamma_{03\text{English}}$	-.11	.07	.06
Effects of Korean speakers reading target sentences	Group _{Korean} * Function	$\gamma_{01\text{Korean}} * \gamma_{02} * \gamma_{03\text{Korean}}$	-.27	.07	< .001
Random Effects			Variance		
Intercept		u_{01}	.19		
Residual		e_{ij}	.43		

Note. Group is a categorical variable with three levels. Japanese was taken as the reference category. Function is a categorical variable with two levels. Control sentences (those with the embedded verb marked with a question particle) were taken as the reference category.

The average Japanese participant had a value of 1.70 in inverse time units, or .58 seconds for the sentences in which the embedded verb was marked with a question particle. This is significantly different from zero ($\gamma_{00} = 1.70, p < .001$). For the same condition, the average

English participant had a value of .64 in inverse time units, or 1.56 seconds, which is significantly slower than the average Japanese speaker ($\gamma_{01\text{English}} = -.61, p = .002$). The average Korean speaker had a value of 1.09 in inverse time units, or .92 seconds on the embedded verb marked with a question particle. This is also significantly slower than the average Japanese speaker ($\gamma_{01\text{Korean}} = -1.06, p < .001$). The effect of Function was significant for Japanese speakers ($\gamma_{02} = .15, p = .007$), meaning that they take longer to read the embedded verb marked with a declarative clause particle than when it is marked with a question particle. The interaction between English speakers and Function was not significant ($\gamma_{03\text{English}} = -.11, p = .06$); meaning that there is no statistical difference between how English and Japanese speakers treat the two verbs. The interaction between Korean speakers and Function was significant ($\gamma_{03\text{Korean}} = -.27, p < .001$), indicating that Japanese and Korean speakers treat this verb statistically differently from each other depending on the question particle. Specifically, the Korean speakers take significantly longer to read the embedded verb marked with a question particle than the Japanese speakers. For the Korean speakers, post hoc comparisons indicate that the difference in reading times between target and control regions is significantly different from zero (estimate = $-.12, p = .03$).

Reading time data from Region 6, the spillover region were analyzed using the same model. These results are given in Table 3.9. The average Japanese participant had a value of 1.74 in inverse time units, or .57 seconds for the control sentences, which is significantly different from zero ($\gamma_{00} = 1.74, p < .001$). For the same sentences, the average English speaker had a value of .67 in inverse time units, or 1.49 seconds, which is significantly different from the average Japanese speaker ($\gamma_{01\text{English}} = -1.07, p < .001$). The average Korean speaker had a value of 1.22 in inverse time units, or .90 seconds for the sentences in which the embedded verb was marked with

a question particle. This is also significantly different from the average Japanese speaker ($\gamma_{01\text{Korean}} = -.52, p = .009$). The effect of Function was significant for the Japanese speakers ($\gamma_{02} = .10, p = .05$). The interaction between English speakers and Function was not significant ($\gamma_{03\text{English}} = -.08, p < .15$), indicating that the Japanese speakers and the English speakers do not differ from each other statistically in terms of how they treat these regions. The interaction between Korean speakers and Function was significant ($\gamma_{03\text{Korean}} = -.31, p < .001$), indicating that the Korean speakers and the Japanese speakers differ from each other statistically in terms of how they treat the target and control sentences. These differences are significantly different from zero for the Korean speakers (estimate = $-.21, p < .001$). Results of the analyses for the critical and spillover regions in scrambled sentences suggest that both the native Japanese speakers and the native English speakers read the embedded clause verb significantly slower when it is marked with a declarative clause particle. The Korean speakers, however, differ from both the Japanese and English speakers with respect to their reading times on the critical and spillover regions in scrambled sentences. Specifically, the Koreans take longer to read the embedded verb marked with a question particle than when it is marked with a declarative clause particle. This differs from their reading times on the *wh*- canonical sentences, and is contrary to the expected processing patterns.

Table 3.9

Model Results for Region 6 of Wh- Scrambled Sentences

Meaning	Fixed Effects		Estimate	Std. Err.	<i>p</i> -value
Overall effect of being a native Japanese speaker reading the control sentences	Intercept (I)	γ_{00}	1.74	.12	< .001
Effect of being an English speaker (compared to Japanese speakers)	Group _{English} (on I)	$\gamma_{01\text{English}}$	-1.07	.20	< .001
Effect of being a Korean speaker (compared to Japanese speakers)	Group _{Korean} (on I)	$\gamma_{01\text{Korean}}$	-.52	.19	.009
Differences due to reading control sentences compared to target sentences	Function (on I)	γ_{02}	.10	.05	.05
Effects of English speakers reading control sentences	Group _{English} *Function	$\gamma_{01\text{English}} * \gamma_{02} * \gamma_{03\text{English}}$	-.08	.06	.15
Effects of Korean speakers reading control sentences	Group _{Korean} *Function	$\gamma_{01\text{Korean}} * \gamma_{02} * \gamma_{03\text{Korean}}$	-.31	.08	< .001
Random Effects			Variance		
Intercept			u_{01}		
Residual			e_{ij}		

Note. Group is a categorical variable with three levels. Japanese was taken as the reference category. Function is a categorical variable with two levels. Control sentences (those with the embedded verb marked with a question particle) were taken as the reference category.

Discussion of Experiment 2

The first research question asked whether native Japanese speakers, L1 English speakers with Japanese as an L2, and L1 Korean speakers with Japanese as an L2 compute *wh*-dependencies between question words and question particles in Japanese. For the sentences with canonical word order, the L1 Korean group had significantly longer reading times at the verb marked with a declarative clause particle than a question particle, and these were maintained at the spillover region. The native Japanese speakers and the L1 English speakers did not show evidence of elevated reading times at the critical region—the verb—but they did at the spillover region following the verb. In scrambled sentences, both the native Japanese speakers and the L1 English speakers showed evidence of computing these dependencies. The L1 Korean speakers take significantly longer to read control sentences than target sentences. Thus, the answer to the first research question is a qualified yes: all three groups compute *wh*-dependencies between question words and question particles in canonical Japanese sentences, suggesting that both the L1 English and the L1 Korean participants expected that the *wh*-dependency would be resolved in the embedded clause. The three groups diverged, however, in their processing of *wh*-dependencies in scrambled sentences. The native Japanese and native English speaker continue to resolve the *wh*-dependency locally, and have shorter reading times on embedded verbs marked with a question particle. The L1 Korean groups had longer reading times on embedded clause verbs marked with a question particle than on those marked with a declarative clause particle. The second research question asked whether there are differences between the L1 Korean and L1 English groups in terms of their ability to compute these filler gap dependencies. There do seem to be qualitative differences between the two groups in canonical sentences—the Koreans are sensitive at the verb and the spillover region, but the English speakers are only

sensitive on the spillover region—but both groups do compute the dependency. In the scrambled sentences, the L1 English speakers, but not the L1 Korean speakers compute the *wh*- dependency locally. Thus, the English group, but not the Korean group processes the scrambled sentences in the same way as the native Japanese speakers.

Again, these results do not provide unequivocal support for the SSH, which predicts that neither L2 group should be able to compute these kinds of *wh*- dependencies. Instead, they provide evidence that, at least in canonical sentences, non-native speakers do compute filler gap dependencies in Japanese. Thus, these results are compatible with previous research that suggests that L1 English speakers are sensitive to the relationship between question words and question particles in L2 Japanese (Lieberman et al., 2006), and with the research that suggests that, at least in some cases, non-native English speakers activate intermediate gaps to facilitate processing (Pliatsikas & Marinis, 2013).

That said, it is also the case that the L1 Korean group in the present study does not show evidence of computing *wh*- dependencies in scrambled sentences. This could be interpreted as partial evidence for the SSH, but because the SSH predicts both that non-native speakers will not compute these dependencies in canonical sentences either, and that there should be no differences in the L2 groups in terms of how they process these sentences. This prediction is not borne out in the data: the L1 English group does show native-like processing heuristics in both the canonical and scrambled sentences. Thus, the Koreans' processing patterns in the scrambled sentences are probably better understood as a constrained deficit. It is possible that this deficit is related to the nature of scrambling in Japanese. When nouns are scrambled out of their base-generated positions, they have to be reintegrated into the parse in their original position (Miyamoto & Takahashi, 2004; Nakano, Felser, & Clahsen, 2002; Sekerina, 1998; Yamashita,

1997). Thus, scrambling creates a second dependency between the scrambled word and its base generated position. There is evidence that L2 Japanese speakers do compute *wh*- dependencies when they process scrambling, but this evidence comes from work that tested learners' processing of long and short distance scrambling, and these sentences have only one *wh*- dependency (e.g., Hara, 2010; Mitsugi & MacWhinney, 2010). In contrast, the scrambled sentences in the present study required the parser to compute two dependencies: the dependency between the *wh*- word and the complementizer, and the dependency between the scrambled noun and its base generated position. This may have increased the parsing burden for the non-native speakers, rendering them insensitive to the *wh*- dependency between the question word and the clause particle. This is a little unlikely, though, because the Korean speakers scored higher on the proficiency test than the English speakers and because Korean, like Japanese, scrambles.

An alternative explanation is that the Korean speakers are not reintegrating the scrambled phrase into the embedded clause, and are interpreting it in the matrix clause instead. If this is the case, this suggests that the Korean speakers do compute the *wh*- dependency locally, but that locally is in the matrix, and not the embedded clause. This processing heuristic does differ from that of native Japanese speakers, but it does not indicate that the Korean speakers do not compute *wh*- dependencies at all. Neither of these explanations provide strong evidence for the SSH, however, because both L2 groups are sensitive to *wh*- dependencies in canonical sentences, and the L1 English group is sensitive in scrambled sentences as well. The SSH predicts evidence of non-reliance on structure across the board, but non-native speakers in both groups compute these dependencies in canonical sentences. Thus, the lack of sensitivity in scrambled sentences is better understood as a more constrained deficit.

CHAPTER 4

AMBIGUITY RESOLUTION

Ambiguity is part of natural language, and thus models of language processing have to account for how the parser deals with ambiguous sentences. Ambiguity resolution strategies have thus received a good deal of attention in both the native language and non-native language processing literature. These strategies are of interest in the study of native language processing for two reasons. First, ambiguity provides insight into how the parser works, and, at least in the case of structural ambiguity, provides information about the how the parser makes syntactic decisions (such as where to attach a constituent). Secondly, ambiguity resolution heuristics provide an interesting cross-linguistic test case. Unlike other sentence types, such as the double case-marked sentences discussed in Chapter 2, or the *wh*- dependencies discussed in Chapter 3, in which the type of syntactic structure individual languages instantiate influences the type of processing heuristics speakers of those languages rely on, certain types of ambiguity are common cross-linguistically. Thus, cross-linguistic differences in ambiguity resolution provide evidence that helps determine whether purportedly universal parsing heuristics actually are universal. Within the domain of second language acquisition research, first (L1) and second (L2) language differences in ambiguity resolution preferences provide an avenue in which to investigate whether L1 strategies transfer to the second language. Because ambiguity resolution strategies are not something usually taught in language classes, researchers can be relatively sure that they are testing parsing heuristics that are not influenced by metalinguistic knowledge. This chapter presents the results of a study that investigated L1 English and Korean speakers' ambiguity resolution preferences in their L2, Japanese. The rest of this chapter discusses the following: the evidence that ambiguity resolution strategies differ cross-linguistically, the L2 processing of

ambiguous sentences and what these data suggest about the Shallow Structure Hypothesis, and the processing of ambiguous sentences in Japanese.

Background and Motivation

Ambiguity Resolution in Native Language Grammars

The processing of ambiguous sentences like those in (1) was first investigated in monolingual English speakers.

(1) Somebody saw the servant of the actress who was on the balcony.

Although sentences like these are, in principle, ambiguous—both the servant and the actress could plausibly have been on the balcony—native English speakers resolve this ambiguity in favor of an interpretation in which the actress was on the balcony (Matthews & Chodorow, 1988). This attachment preference is called ‘low attachment’ because, structurally, the relative clause is attached to the lower NP in the original sentence. This preference is compatible with a hypothesized general principle of natural language sentence processing called Late Closure. Late Closure states that, to the extent possible, new information should be attached to the constituent currently being parsed. That constituent in (1) is the lower of the two NPs, so, assuming Late Closure, the relative clause is attached low. This general idea is also compatible with other apparently universal parsing heuristics such as recency (Fodor, 1998a, 1998b; Frazier & Fodor, 1978).

If the Late Closure strategy were universal and were the determining factor in explaining how people resolve the ambiguity in sentences like (1), we would predict that, regardless of the language in question, ambiguous sentences like these would always be resolved based on a low attachment preference. In other words, the prediction is that there should be no cross-linguistic differences in ambiguity resolution preferences. This prediction is not borne out; several

languages, such as Spanish (Cuetos & Mitchell, 1988), French (Frenck-Mestre & Pynte, 1997), German (Felser et al., 2003), Greek (Papadopoulou & Clahsen, 2003), Japanese (Kamide & Mitchell, 1997), and Korean (Miyao & Omaki, 2002) show a preference for high attachment. To account for these observed cross-linguistic differences, Cuetos and Mitchell (1988) proposed the Tuning Hypothesis, which states that native speakers of a language tune their parsing heuristics based on the input data they receive. Thus, differences in how native English and native Spanish speakers resolve the ambiguity in sentences like those in (1) stem from these speakers' experience processing their respective languages over time. Given the cross-linguistic differences in native language ambiguity resolution preferences, it seems clear that the English preference for attaching low cannot be due to reliance on Late Closure—or, if it is, it is only because the parser hasn't adopted an alternative heuristic. Thus, the present study adopts the assumption that native language differences in processing heuristics for these types of ambiguous sentences are derived from the L1 input, and that, as such, they emerge relatively late in the course of L1 acquisition.

The Non-Native Processing of Ambiguity Resolution

The processing of ambiguous sentences like those in (1) has received a significant amount of attention in the bilingual and non-native processing literature, and, consequently, forms a significant portion of the empirical basis for the Shallow Structure Hypothesis. This is likely due to the fact that these NP-of-NP attachment ambiguity structures provide an avenue for testing various aspects of non-native processing. First, ambiguity is often structural, so the way in which people resolve ambiguous sentences is thought to provide some insight into the way the parser organizes information. Assuming for a moment that the SSH is an accurate account of L2 parsing heuristics, then ambiguity resolution preferences are a domain in which we might predict

that would be evidence of clear L1/L2 differences. Second, because ambiguity resolution preferences in NP-of-NP structures vary as a function of language, these structures provide fertile ground for testing both whether non-native preferences are acquirable and whether L1 heuristics transfer.

A number of studies have investigated bilingual ambiguity resolution preferences for these NP-of-NP structures. There is some evidence that non-native speakers do, indeed, diverge from native speakers in terms of their ambiguity resolution preferences (e.g., Dussias, 2003; Felser et al., 2003; Papadopoulou & Clahsen, 2003). Papadopoulou and Clahsen (2003) investigated ambiguity resolution preferences in L2 Greek speakers from three different L1 backgrounds, Russian, German, and Spanish. All four of these languages prefer high attachment, and resolve ambiguity in favor of the first NP. Because ambiguity resolution preferences can vary based on whether a preposition or a complementizer introduces the adjunct clause, participants were tested on two types of ambiguous structures: NP-PP structures, and NP-NP_{GEN} structures, which are analogous to the NP-of-NP structures that are the focus of the present chapter). The first languages of the participants—Spanish, Russian, and German—all share a preference for high attachment in NP-NP_{GEN} structures. As Papadopoulou and Clahsen point out, the Tuning Hypothesis predicts that because these languages share an ambiguity resolution preference, non-native Greek speakers with these L1 backgrounds should have no need to change their ambiguity resolution preferences, and we might expect to see no group differences in terms of ambiguity resolution preferences. The authors found, however, that the non-native speakers showed no clear preference for resolving this kind of ambiguity. Clahsen and Felser (Clahsen & Felser, 2006) suggest that these results, as well as the results of Felser, Roberts, Marinis, and Gross (2003), which also failed to find clear ambiguity resolution preferences in favor of NP2

with a group non-native English speakers, provide evidence that non-native ambiguity resolution relies on mechanisms that are not purely structural to resolve these types of ambiguity. They further point out that these results are somewhat unexpected, given that both studies also found that non-native speakers pattern with native speakers in their ambiguity resolution preferences for the ambiguity in sentences like those in (2).

(2) The doctor recognized the pupil with the nurse who was feeling very tired.

In the case of (2), the two NPs are joined with the preposition *with*, and the overwhelming preference cross-linguistically is to attach low (Felser et al., 2003). Clahsen and Felser (2006) argue that the thematic preposition *with* is lexical and not structural, and that it therefore provides a cue for disambiguation that the *of* in the genitive structure in (1) does not provide.

There is, however, a competing body of evidence that suggests that non-native speakers do resolve these ambiguous structures in their L2 in the same manner as native speakers of that language (e.g., Frenck-Mestre & Pynte, 1997; Miyao & Omaki, 2002; Omaki & Arij, 2005). For instance, Miyao and Omaki (2002) investigated whether L1 Korean speakers who spoke Japanese as an L2 were sensitive to the preferred high attachment preference in Japanese. As will be discussed in more detail below, both Japanese and Korean attach high, and thus, the Korean participants might be predicted to transfer their L1 processing heuristics to Japanese. The native Korean speakers in this study patterned like the native Japanese speakers in both an offline ambiguity resolution task and an online self-paced reading task designed to test ambiguity resolution preferences. Similarly, Omaki and Arij (2005) found that L2 English speakers rely on the same lexical and structural information to process ambiguous relative clauses as native English speakers do. Thus, there is at least some evidence that, depending on the native and non-

native language pairings and the precise structures under investigation, non-native speakers do rely on the same structural information to process their L2 as native speakers of that language do.

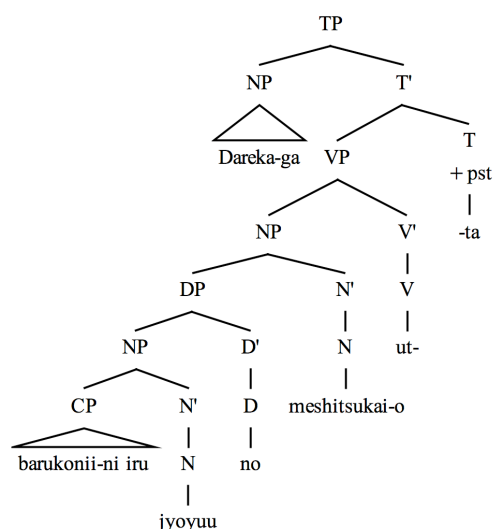
Ambiguity Resolution in Japanese

Japanese is a head-final language, so, in the NP-of-NP structures discussed above, the relative clause always precedes the NP-of-NP complex, as shown in (3).

- (3) Dareka-ga [RC barukonii-ni iru] jyoyu-no meshitsukai-o ut.ta.
 Someone_{NOM} [RC balcony_{ON} be] actress_{GEN} servant_{ACC} shot.
 “Someone shot the servant of the actress who was on the balcony.”

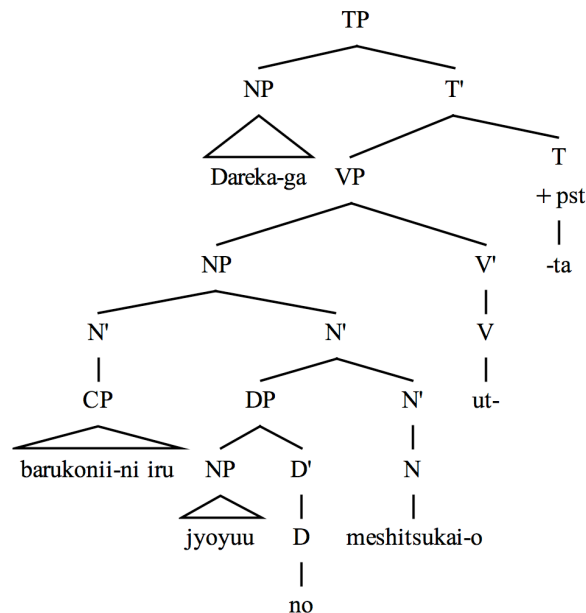
Because Japanese is a head-final language, the relative clause (*barukonii-ni iru*) intervenes between the matrix clause and the genitive construction. This has two implications; the first is structural, and the second is processing related. The structural implication is that, in the case of Japanese, a *low* attachment preference is a preference for the noun the parser encounters first (i.e., the actress), and a *high* attachment preference is a preference for the noun the parser encounters second (i.e., the servant). These structural differences are illustrated in (4), for low attachment, and (5), for high attachment. Some structure has been simplified for the sake of clarity.

(4)



In the structure in (4), the relative clause is adjoined to the lower NP, yielding an interpretation in which the actress is on the balcony.

(5)



In this example, the relative clause is adjoined at the higher N' level, thus yielding an interpretation in which the servant is on the balcony. Thus, in Japanese, a preference for NP2 is a preference for *high* attachment, and a preference for NP1 is a preference for *low* attachment. Although the high and low attachment interpretations are the same, in that in both English and Japanese, a *high* attachment preference yields an interpretation in which the servant is on the balcony, the mapping between the linear order of the nouns and their interpretation in Japanese is the opposite of what it is in English and other head-initial languages.

The processing implication is that processing heuristics based on either Late Closure heuristic or recency would predict that speakers will resolve this ambiguity in favor of low attachment, or what is linearly, NP1. Native Japanese speakers, however, have a preference to attach high, and will thus interpret sentences like the one in (3) to mean that the servant, not the actress, was on the balcony (Kamide & Mitchell, 1997; Miyao & Omaki, 2002). There is, in fact,

some experimental evidence that suggests that native Japanese speakers initially opt for a recency-based processing strategy, and, rather than leave the relative clause unadjoined, attach it to the lower NP, and revise this upon encountering the higher NP (Miyamoto, Gibson, Pearlmutter, Aikawa, & Miyagawa, 1999).

Little work has investigated non-native ambiguity resolution preferences in Japanese. One study, Miyao and Omaki (2002) investigated the ambiguity resolution preferences of L1 Korean speakers with Japanese as an L2. Like Japanese, Korean has a preference for high attachment. Participants completed an offline interpretation task and an online self-paced reading task. The sentences in the offline task were globally ambiguous like the one in (3), above. The sentences in the self-paced reading task were biased towards either a high-attachment resolution, as in (6a), or a low-attachment resolution, as in (6b).

- (6) a. Okashi-o yoku taberu depato-no tenin-ga nikoniko-to warateiru.
 Snacks_{ACC} often eat department store_{GEN} manager_{NOM} widely smiling
 “The department store manager who often eats snacks is laughing”.
 b. Eki-no tonari-ni aru depato-no tenin-ga nikoniko-to warateiru.
 Station_{GEN} next to_{LOC} be department store_{GEN} manager_{NOM} widely smiling
 “The manager of the department store that is next to the station is laughing.”

In (6a), the verb in the relative clause can only take an animate subject, so the relative clause cannot plausibly be attached to the inanimate noun, *depato*, even though it linearly precedes the head of the genitive NP. In (6b), however, it is plausible that a station and a department store would be next to each other, so the parser can plausibly attach the relative clause to the first noun it encounters. The prediction is that if speakers are sensitive to the preference for high attachment in Japanese, they should read the NP-of-NP phrase slower in the low attachment condition than in the high attachment condition. This is because, even though the sentence is plausible, the attachment goes against the parser’s preferred strategy. Miyao and Omaki found that their Korean participants patterned like the native speakers on both tasks, and they argued that these

results suggest that it is possible for non-native speakers to have native-like ambiguity resolution preferences.

The Present Study

The present study tests the Shallow Structure Hypothesis by investigating native English and native Korean speakers' ambiguity resolution preferences in L2 Japanese. The SSH predicts that neither group will perform like native Japanese speakers with respect to their ambiguity resolution preferences for these sentences, and it also predicts that even though Korean and Japanese both have a preference for high attachment (Miyao & Omaki, 2002), the Korean speakers will not transfer this preference to Japanese. The following research questions guided this study:

1. Are L1 English and L1 Korean speakers with Japanese as an L2 more likely to resolve Japanese NP-of-NP ambiguous sentences in favor of NP2, as native Japanese speakers are?
2. Is there a difference between the L1 Korean and L1 English speakers in terms of their interpretation of these sentences?
3. Do L1 English and L1 Korean near-native Japanese speakers demonstrate a bias for high attachment of relative clauses in NP-of-NP ambiguous sentences in online processing?
4. Is there a difference between the Korean and English groups in terms of their processing of these sentences?

Method and Procedure

Participants

The same group of 45 non-native Japanese speakers who participated in the studies reported in Chapters 2 and 3 also participated in this study. Of these, 18 were L1 English speakers, and 17 were L1 Korean speakers. The same group of 29 L1 Japanese speakers served as a control. Participants were recruited through university communities and the researcher's personal contacts in Hikone, Shizuoka, Nagano, and Tokyo, Japan. On average, the L1 English speakers had lived in Japan for five years and three months. A subset ($n = 3$) of the L1 English speakers was employed at the Japan Center for Michigan Universities. Another subset ($n = 5$) consisted of university students studying at Japanese universities, and one was a PhD candidate in Japanese literature. The remaining L1 English speakers were employed as English teachers in Japan. Several of the L1 English speakers had studied languages other than Japanese, but all rated Japanese as their most dominant second language, and none had studied another rigidly head-final language. On average, the L1 Korean speakers had lived in Japan for four years and eight months. A subset of this group ($n = 8$) was enrolled in Japanese universities. The remaining L1 Korean participants were working in Tokyo. All of the L1 Korean participants indicated that they had studied English in addition to Japanese, and some also indicated that they had studied Chinese. All of the L1 Korean speakers indicated that Japanese was their most dominant second language. The native Japanese speakers were either students at a university in central Japan ($n = 13$) or were enrolled in private ESL classes ($n = 11$). All of the native Japanese speakers indicated that they had studied English. All participants were living in Japan at the time of the study.

Materials

Participants completed the same set of proficiency measures and the self-paced reading task described in Chapters 2 and 3. The proficiency measures consisted of the *Language Experience and Proficiency Questionnaire* (LEAP-Q), a grammar test, and a test of *kanji*¹⁸ knowledge. The LEAP-Q was adapted from Marian, Blumenfeld, and Kaushanskaya (2007), and the researcher created the rest of the materials. Each one will be discussed in turn.

Proficiency measures. The LEAP-Q (see Appendix A) is an instrument designed to provide researchers with a consistent, reliable measure of bilinguals' language experience and proficiency. It depends on self-reported data, and includes information about participants' age of acquisition, contexts in which participants use the target language, and self-rated proficiency assessments. The LEAP-Q can be used with adult bilinguals who have at least a high school education in one of their languages. Although the original instrument was created in English, it can be translated into other languages (Marian et al., 2007). For the purposes of the present study, it was translated into Japanese.

The grammar test was adapted from a practice book for the Japanese Language Proficiency Test (JLPT) Level 2 (see Appendix B). The JLPT is a Japanese proficiency test used in Japan as the measure of non-native Japanese knowledge. Passing the Level 2 test is a rough proxy for Advanced High proficiency. The test consisted of 28 multiple choice and cloze test items that tested participants' knowledge of various grammatical structures. The L1 Japanese

¹⁸ Japanese is written with a combination of three different scripts: *hiragana*, *katakana*, and *kanji*. *Hiragana* and *katakana* are phonetic syllabaries, and *kanji* are the logographic characters borrowed from Chinese in the 7th and 8th centuries, C.E. *Hiragana* are primarily used for grammatical functions, such as particles and verb endings, and to write 'content' words that lack *kanji*. *Kanji* are used for content words such as nouns and verb and adjective roots. *Katakana* are used to write foreign words and for emphasis, much like italics are in English. All *kanji* can be transcribed into *hiragana* or *katakana*. Familiarity with and fluency in all three scripts are required for fluent reading in Japanese.

group performed at ceiling on this test ($M = 98\%$; $SD = 1.04$). In addition to the grammar test, participants also completed a *kanji* test (see Appendix C). This test consisted of a list of 73 *kanji* compounds taken from the self-paced reading task describe below. The L2 groups were asked to provide the Japanese pronunciation of the *kanji* in *hiragana*, and either an English or a Korean translation of the word. The Japanese speakers were asked to provide the *hiragana* only. The *kanji* test was included to ensure that participants knew enough *kanji* to understand the reading task.

Stimuli testing NP-of-NP ambiguity resolution. Two sets of stimuli were created to test participants' ambiguity resolution preferences. The first set of stimuli consisted of 16 globally ambiguous sentences. These sentences were created to investigate offline ambiguity resolution preferences. The example in (7) shows a globally ambiguous sentence.

- (7) Dareka-ga barukoni-ni iru jyoyu-no meshitsukai-o mita.
 Someone-NOM balcony-LOC be actress-GEN servant-ACC saw.
 "Someone saw the servant of the actress who was on the balcony."

These sentences were followed by a comprehension question that forced participants to resolve the ambiguity. The comprehension question for (7) is given in (8).

- (8) Kono bunsho-ni yoru to...
 This sentence_{DAT} according COMP
 "According to this sentence..."
 A. Meshitsukai-ga barukoni-ni ita. B. Jyou-ga barukoni-ni ita.
 Servant_{NOM} balcony_{LOC} was Actress_{NOM} balcony_{LOC} was
 "The servant was on the balcony" "The actress was on the balcony"

In half of the items, eight sentences, the choice in A was the first NP (low attachment) and in the other eight items, the choice in A was the second NP (high attachment).

The second set of stimuli tested participants' online ambiguity resolution preferences. These stimuli also consisted of 16 sentences pairs. These sentences were based on those used in Miyao and Omaki (2002), but were slightly revised to control the length of the target region.

One version was pragmatically biased to force high attachment (HA), and the other was biased to force low attachment (LA), as shown in (9).

- (9) a. Tsukue-no ue-ni noseteita sensei-no pen-ga yuka-ni otoshita.
 Desk_{GEN} top_{LOC} placed teacher_{GEN} pen_{NOM} floor_{LOC} fell.
 “The pen of the teacher that was placed on the desk fell to the floor.”
 b. Seito-to hanashiteita sensei-no pen-ga yuka-ni otoshita.
 Student_{WITH} talked teacher_{GEN} pen_{NOM} floor_{LOC} fell.
 “The pen of the teacher that was talking to a student fell to the floor.”

In (9a), the higher noun, which is NP2 in Japanese, is *pen*, or pen, and pens, but not students are more like to be placed on desks. If participants have a preference for HA, reading times at this noun and possibly the following region, should be shorter than the reading times on corresponding sentences biased for LA, such as those in (9b). These sentences were segmented for presentation, as shown in (10). Following previous work (Miyao & Omaki, 2002), both NPs were presented as one region.

- (10) Tsukue-no ue-ni \ noseteita \ sensei-no pen-ga \ yuka-ni \ otoshita.
- | | | | | |
|--|----------|---|------------------------|------|
| 1 | 2 | 3 | 4 | 5 |
| Desk _{GEN} top _{LOC} \ | placed \ | teacher _{GEN} pen _{NOM} \ | floor _{LOC} \ | fell |
| 1 | 2 | 3 | 4 | 5 |
- “The pen of the teacher that was placed on the desk fell to the floor”.

These sentences were also followed by a comprehension check. The comprehension check that corresponded to (10a) is given in (11).

- (11) Kono bunsho-ni yoru to...
 This sentence_{DAT} according_{COMP}
 “According to this sentence...”
- | | |
|---|---|
| A. Pen-ga otoshita
Pen _{NOM} fell
“The pen fell” | B. Enpitsu-ga otoshita
Pencil _{NOM} fell
“The pencil fell” |
|---|---|

Answers were distributed so that for half of the items, the correct answer A, and for the other half, the correct answer was B.

These items were intermixed with 32 items testing participants' incremental processing heuristics (see Chapter 2) and their ability to compute *wh*-dependencies (see Chapter 3). These test items served as distractors for each other, and were intermixed with an additional 32 filler sentences. The filler sentences tested dative and accusative scrambling across short and long distances. Items were pseudorandomized in a Latin Square design to create four lists, with one version of each sentence per list. No participant read multiple versions of the same sentence. In total, participants read 144 sentences. The complete set of experimental stimuli is given in Appendix C.

Procedure

Participants were tested individually, and were paid ¥2,000 (about \$20) for their participation. The experiment consisted of the self-paced reading task, the proficiency test, and the LEAP-Q. Participants read a consent form and then proceeded to the self-paced reading experiment. The self-paced reading experiment was divided in half so that participants read 72 sentences and then had a break in the middle. The different types of stimulus sentences were evenly divided across the two halves of the self-paced reading experiment. The proficiency test and the LEAP-Q were given at the break, and then participants completed the self-paced reading experiment.

The self-paced reading task was presented using SuperLab 5. Stimulus sentences were segmented into *bunsetsu*, and participants pressed a button to move from region to region in each sentence. Participants moved through the stimulus sentences at their own pace. The non-cumulative moving window paradigm was used for this study so that when participants pressed a button to display one segment, the previous segment disappeared from the screen. Once all the segments had been read, participants pressed a button to reveal the comprehension question.

Participants selected either A or B on the response pad to answer the comprehension question. In total, the experiment took the native speakers about 60 minutes and the non-native speakers about 90 minutes.

Scoring and Analysis

The proficiency test was scored first. Scores on the proficiency test were submitted to a one-way ANOVA to identify any differences in proficiency levels between groups. The comprehension questions were scored next. Any participant who scored below 65% accuracy on the comprehension questions overall would have been eliminated from further analyses. No participant scored below this threshold, indicating that participants were paying attention to the test sentences.

Sentence interpretation task. The structure of these data is as follows. Native Japanese speakers ($n = 29$), native English speakers ($n = 18$) and native Korean speakers ($n = 17$) read 16 globally ambiguous sentences. Participants were asked to resolve the ambiguity by selecting one of two nouns, and the overall frequency with which participants selected each noun was calculated. If participants are sensitive to these ambiguity resolution preferences, they should be more likely to select NP2 than NP1. Since the dependent variable is categorical, the data was analyzed using a generalized linear model with a binomial distribution and a logit link function.

Self-paced reading data. The self-paced reading data were analyzed using a generalized linear mixed effects model. As described in Chapter 2, these models take into account the variance due to both fixed (e.g., language background, proficiency level) and random (e.g., items, average reading times by participant) effects, and allow variables to be either continuous or categorical. Again, because the data were not normally distributed, a gamma distribution with an inverse link function was specified.

The structure of the data for the ambiguous sentences is described below. In the sample as a whole, 64 participants contributed reading times for five regions in 16 sentences, eight of which were biased towards a high attachment interpretation, and eight of which were biased towards a low attachment interpretation. Participants belonged to three different groups: native Japanese speakers ($n = 29$), native English speakers ($n = 18$), and native Korean speakers ($n = 17$). Group and sentence type are the independent variables, and reading times on individual regions are the dependent variable. Each participant contributed eight reading times per region for each sentence type. The reading time data for the NP-of-NP sentences did not meet the assumption of normality, so they were also modeled using a generalized linear mixed effects model. Again, a gamma distribution and an inverse link function were specified. The model included a random intercept by participant, and two independent variables, Group (Japanese, English, and Korean), and Function (High and Low). In all cases, these data were analyzed using models with and without interaction terms. Interactions are reported where they were significant.

Results

Interpretation Data

Frequency counts by Group for the interpretation data are given in Table 4.1. In Japanese, a preference for NP2 indicates a preference to attach the relative clause high.

Table 4.1
Frequency counts for the ambiguity resolution task by group

Group	NP1	NP2	Percent NP1	Percent NP2
Japanese	162	302	34.9	65.1
English	119	169	41.3	58.7
Korean	77	195	28.3	71.7

Note. Frequency counts are based on responses to 16 globally ambiguous sentences, so each participant contributes 16 responses to the overall count.

All three groups have a preference for NP2 attachment, or high attachment. These data were modeled using a generalized linear mixed effects model with a binomial distribution, and a logit link function. Model results are given in Table 4.2.

Table 4.2
Model Results for Ambiguity Resolution Data

Meaning	Estimate	Std. Err.	p Value
Effect of being a Japanese speaker and resolving ambiguity	.62	.097	< .001
Effect of being an English speaker (compared to Japanese)	-.27	.154	.08
Effect of being a Korean speaker (compared to Japanese)	.31	.166	.07

The log odds for the average Japanese participant was .62. This indicates that the probability that the average Japanese participant will resolve ambiguity in favor of NP2 is .65¹⁹. This is significantly greater than chance (estimate = .62, $p < .001$). The log odds for the average English participant was .35 (.62 – .27). This indicates that the native English speakers' probability of choosing NP2 is .59²⁰. This is not significantly different from the average Japanese participant (estimate = -.27, $p = .08$). The log odds for the average Korean participant was .93. This indicates a probability of selecting NP2 of 0.72²¹, which does not differ significantly from that of the average Japanese participant (estimate = .30, $p = .07$). These results suggest that, regardless of L1 background, all participants are more likely to resolve ambiguous sentences in favor of NP2.

¹⁹ The model uses a logistic link function, so it returns a value that indicates the log of the odds ratio. This needs to be back transformed to get the probability: $e^{0.62}/(1 + e^{0.62}) = 0.65$

²⁰ $e^{0.35}/1 + e^{0.35} = 0.59$

²¹ $e^{0.93}/1 + e^{0.93} = 0.72$

Self-Paced Reading Data

Descriptive statistics by region for the ambiguity resolution data are given in Table 4.5. Reading times are predicted to be longer on Region 3, which is the critical region and contains the two nouns, and possibly Region 4, which is the spillover region, in sentences biased for LA than in those biased for HA. The overall pattern of reading times is given in Figure 4.1 All three groups show the predicted pattern of reading times: sentences biased for high attachment are read faster than those biased for low attachment.

Reading time data for Region 3 was analyzed using a generalized linear mixed effects model with a gamma distribution and an inverse link function. Model specifications for Region 3 are given in Table 4.6, and model results are given in Table 4.7. The average Japanese participant had a value of 1.10 in inverse time units, or .91 seconds. This is significantly different from zero ($\gamma_{00} = 1.10, p < .001$). The average English speaker had a value of .34 in inverse time units, or 2.94 seconds. This differs significantly from the average Japanese speaker ($\gamma_{01\text{English}} = -.76, p < .001$). The average Korean speaker had a value of .54 in inverse time units, or 1.85 seconds, which also differs significantly from the average Japanese speaker ($\gamma_{01\text{Korean}} = -.56, p < .001$). The effect of Function is also significant for all participants ($\gamma_{02} = .03, p = .05$). This suggests that all three groups take significantly longer to read the region with two nouns when the sentences are biased for low attachment than when they are biased for high attachment.

Reading times at the spillover region, Region 4, were also analyzed using a generalized linear mixed effects model. Again, a gamma distribution with an inverse link function was specified. In this case, the model with the interaction term was significant. Model specifications are given in Table 4.8, and results are given in Table 4.9.

The average Japanese participant had a value of 1.87 in inverse time units, or .53 seconds. This is significantly different from zero ($\gamma_{00} = 1.87, p < .001$). The average English speaker had a value of 1.00 in inverse time units, or 1 second, which is significantly different from the average Japanese participant ($\gamma_{01\text{English}} = -.87, p < .001$). The average Korean participant had a value of 1.2 in inverse time units, or .83 seconds. This differs significantly from the average Japanese participant ($\gamma_{01\text{Korean}} = -.62, p < .001$). The effect of Function was significant for all participants ($\gamma_{02} = 0.16, p = .008$). The interaction between English speakers and Function was not significant ($\gamma_{03\text{English}} = -.10, p = .18$), but the interaction between Korean speakers and Function was significant ($\gamma_{03\text{Korean}} = -.16, p = .04$). Post hoc comparisons indicated that these differences in reading times were not significantly different from zero for either the English group (estimate = -0.06, $p = .22$) or the Korean group (estimate = .004, $p = .99$). These results suggest that the difference in reading times for sentences biased for low attachment as opposed to those biased for high attachment is maintained for the Japanese speakers on the spillover region, but not for either of the other two groups.

Table 4.3

Descriptive Statistics for Ambiguous Sentences by Region

	Japanese (<i>n</i> = 29)				English (<i>n</i> = 18)				Korean (<i>n</i> = 17)			
	HA		LA		HA		LA		HA		LA	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
RC NP	1070.50	2470.16	835.29	659.12	1932.08	1215.33	1983.51	1530.93	1709.24	1826.25	1387.15	1162.22
RC	735.16	533.12	705.32	484.15	1619.08	1137.76	1612.65	1065.68	1354.56	1156.79	1164.96	881.36
Verb												
NP-of-NP	1178.07	894.30	1237.11	1021.25	3123.72	1780.63	3381.40	2433.96	2343.66	1790.83	2467.07	2095.14
PP	572.95	303.35	637.38	409.65	1060.38	731.40	1145.30	702.97	882.68	583.57	871.68	469.19
Matrix	1497.48	3157.26	923.54	861.40	1579.67	1343.67	1368.50	1995.62	1172.03	1030.17	1040.18	845.98
Verb												

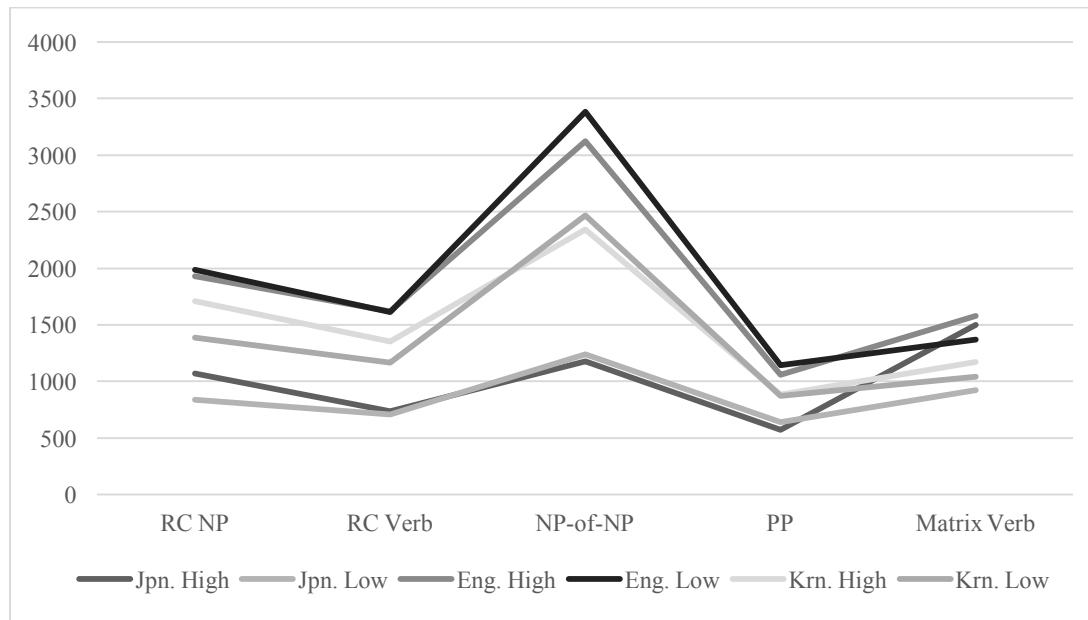


Figure 4.1

Reading times by group in the NP-of-NP ambiguous sentences

Table 4.4

Model Specifications for Region 3 of the Ambiguous Sentences

Level of Analysis	Units	Description	Model
1	Time/Experimental observations	Overall effect of function on reading times	$1/\text{Time} = \beta_{0i} + e_{ij}$
2	Participants	Random effect includes overall average, group effects, function effects, and participant-specific deviations from the average	$\beta_{0i} = \gamma_{00} + \gamma_{01} * \text{Group} + \gamma_{02} * \text{Function} + u_{0i}$

Note. The model $\text{Inverse}(\text{Time}) = \beta_{0i} + e_{ij}$ was analyzed using 16 multiple measures per participant.

Table 4.5

Model Results for Region 3 of the Ambiguous Sentences

Meaning	Fixed Effects		Estimate	Std. Err.	<i>p</i> -value
Overall effect of being a native Japanese speaker reading the target sentences	Intercept (I)	γ_{00}	1.10	.08	< .001
Effect of being an English speaker (compared to Japanese speakers)	Group _{English} (on I)	$\gamma_{01\text{English}}$	-.76	.13	< .001
Effect of being a Korean speaker (compared to Japanese speakers)	Group _{Korean} (on I)	$\gamma_{01\text{Korean}}$	-.56	.13	< .001
Differences due to reading control sentences compared to target sentences	Function (on I)	γ_{02}	.03	.02	.05
Random Effects			Variance		
Intercept		u_{01}	.07		
Residual		e_{ij}	.38		

Note. Group is a categorical variable with three levels. Japanese was taken as the reference category. Function is a categorical variable with two levels. Control sentences (those biased for high attachment) were taken as the reference category.

Table 4.6

Model Specifications for Region 4 of the Ambiguous Sentences

Level of Analysis	Units	Description	Model
1	Time/Experimental observations	Overall effect of function on reading times	$1/\text{Time} = \beta_{0i} + e_{ij}$
2	Interaction between Group and Function	Effect of function by individual groups	$\beta_{0i} = \gamma_{00} + \gamma_{01} * \text{Group} + \gamma_{02} * \text{Function} + \gamma_{03} + u_{0i}$
3	Participants	Random effect includes overall average, group effects, function effects, and participant-specific deviations from the average	$\beta_{0i} = \gamma_{00} + \gamma_{01} * \text{Group} + \gamma_{02} * \text{Function} + \gamma_{03} + u_{0i}$

Note. The model $\text{Inverse}(\text{Time}) = \beta_{0i} + e_{ij}$ was analyzed using the 16 multiple measures per participant.

Table 4.7

Model Results for Region 4 of the Ambiguous Sentences

Meaning	Fixed Effects		Estimate	Std. Err.	<i>p</i> -value
Overall effect of being a native Japanese speaker reading the target sentences	Intercept (I)	γ_{00}	1.87	.08	< .001
Effect of being an English speaker (compared to Japanese speakers)	Group _{English} (on I)	$\gamma_{01\text{English}}$	-.87	.13	< .001
Effect of being a Korean speaker (compared to Japanese speakers)	Group _{Korean} (on I)	$\gamma_{01\text{Korean}}$	-.62	.13	< .001
Differences due to reading control sentences compared to target sentences	Function (on I)	γ_{02}	.16	.06	.008
Effects of English speakers reading control sentences	Group _{English} * Function	$\gamma_{01\text{English}} * \gamma_{02} * \gamma_{03\text{English}}$	-.10	.07	.18
Effects of Korean speakers reading control sentences	Group _{Korean} * Function	$\gamma_{01\text{Korean}} * \gamma_{02} * \gamma_{03\text{Korean}}$	-.16	.08	.04
		Random Effects	Variance		
		Intercept	u_{01}	.07	
		Residual	e_{ij}	.25	

Note. Group is a categorical variable with three levels. Japanese was taken as the reference category. Function is a categorical variable with two levels. Control sentences (those biased for high attachment) were taken as the reference category.

Discussion for Experiment 3

The first two research questions asked whether non-native Japanese speakers with either English or Korean as an L1 were more likely to resolve ambiguous NP-of-NP sentences in favor of the second noun, thus indicating a bias for high attachment that mimics that of native Japanese speakers, and whether the L1 English and L1 Korean groups differed in terms of their ambiguity resolution preferences. The answer to the first question is yes. Results suggest that all participant groups are significantly more likely to select NP2 in resolving this kind of attachment ambiguity. The answer to the second question is no: there are no differences between groups in terms of their ambiguity resolution preferences.

The third and fourth research questions asked whether non-native Japanese speakers asked whether these participants were sensitive to ambiguity resolution biases in online processing. The results of the self-paced reading task suggest that all three groups are sensitive to the Japanese bias to attach the relative clause high. This difference is maintained on the spillover region for the L1 Japanese group, but not for either L2 group. Thus, the answer to the third research question is yes: non-native Japanese speakers are sensitive to the Japanese bias for high attachment. The answer to the fourth research question is no; there are no group differences in ambiguity resolution preferences.

These results are incompatible with the predictions of the SSH, which predicts that both L2 groups should not have strong ambiguity resolution preferences in an L2. This means that they should perform at chance on the interpretation task, and biases for high attachment should not show up in online processing. The participants in the present study, however, show clear evidence of a bias for high attachment in both the interpretation and the processing task. These results are compatible with previous research that indicates that L2 speakers are sensitive to the

ambiguity resolution preferences of the L2 (e.g., Dussias & Sagarra, 2007; Frenck-Mestre & Pynte, 1997; Jackson & Dussias, 2009). Thus, the results of this study suggest that L2 Japanese speakers do demonstrate native-like biases in resolving NP-of-NP attachment ambiguity, and that the participants' L1 does not influence their ambiguity resolution preferences.

CHAPTER 5

GENERAL DISCUSSION AND CONCLUSIONS

The present study tested whether the Shallow Structure Hypothesis (SSH) accounted for non-native Japanese speakers' use of syntactic cues to process Japanese sentences. The first study investigated whether non-native Japanese speakers were able to use case particles to project clause structure in Japanese. The second study investigated whether non-native Japanese speakers compute *wh*- dependencies between *wh*- words and clause particles. The third study investigated whether non-native Japanese speakers were sensitive to the high attachment bias for relative clause attachment ambiguity resolution. Participants with either English or Korean as an L1 were recruited. L1 Korean participants were included because Japanese and Korean share the same processing heuristics for the structures under investigation. Thus, if L1 processing heuristics facilitate L2 processing, L1 Korean speakers might be predicted to have an advantage in L2 processing. English, however, either lacks the structures under investigation (e.g., case particles and *wh*- dependencies), or has a different bias (e.g., ambiguity resolution). Thus, transferring L1 processing heuristics into Japanese does not help L1 English speakers process Japanese efficiently. Instead, in order to process Japanese efficiently, L1 English speakers need to acquire new processing heuristics. The remainder of this chapter summarizes the results of each of these studies and discusses the significance of the study with a particular focus on the theoretical implications of the findings. Limitations and directions for future research are also discussed.

Summary of the Findings

The results of the present study are summarized in Table 5.1.

Table 5.1

Summary of the Experimental Findings Reported in Chapters 2 – 4.

Structure	Outcome	Significance	Supports SSH?
Nominative case particles	<ul style="list-style-type: none"> • L1 English and L1 Korean groups rely on the second nominative case marked NP to project a second clause • Facilitation effects at the head noun of the relative clause for Korean participants • No facilitation effects for L1 English participants 	<ul style="list-style-type: none"> • Tests structural cues for incremental processing • Suggests that L2 groups are able to process base on structural cues • English/Korean differences in facilitation effects 	No
Accusative case particles	<ul style="list-style-type: none"> • L1 English and L1 Korean groups rely on the second accusative case marked NP to project a second clause • No facilitation effects at the head noun of the relative clause for either L2 Group 	<ul style="list-style-type: none"> • Tests structural cues for incremental processing • Suggests that L2 groups are able to process base on structural cues • No L2 facilitation effects 	Partial
<i>Wh</i> - dependencies	<ul style="list-style-type: none"> • L1 English and L1 Korean groups sensitive to <i>wh</i>- dependencies in canonical sentences • L1 English speakers sensitive in scrambled sentences • L1 Korean speakers show a reversal of preferences in scrambled sentences 	<ul style="list-style-type: none"> • L2 speakers compute <i>wh</i>-dependencies in a <i>wh</i>- in situ language • The status of <i>wh</i>-movement in the L1 does not influence L2 <i>wh</i>-processing • L1 English sensitivity to the dependency maintained in scrambled sentences 	No
Ambiguity resolution	<ul style="list-style-type: none"> • L1 English and L1 Korean groups sensitive to high attachment in Japanese in interpretation and processing 	<ul style="list-style-type: none"> • L1 Korean speakers resolve ambiguity like L1 Japanese speakers, but Korean and Japanese have the same preferences • L1 English speakers have acquired the Japanese high attachment preference • Attachment ambiguity is acquirable in an L2 	No

As this table suggests, the results of the present study do not provide unequivocal support for the SSH. For all structures tested, both L2 groups show evidence of at least partial convergence on native-like processing behaviors. In the sentences that tested incremental processing, both L2 groups are able to use nominative and accusative case particles to project a second clause. The divergence from native-speaker norms comes at the head noun of the relative clause. The native English speakers do not show facilitation effects at the head noun of the relative clause in sentences with either nominative or accusative particles. The native Korean speakers do show evidence of facilitation effects at the head noun of the relative clause in nominative case marked sentences, but not in accusative sentences. Thus, non-native speakers are sensitive to some of the structural constraints that govern the processing of case particles in Japanese. Both L2 groups are able to compute *wh*- dependencies in canonical biclausal sentences. Again, both L2 groups diverge from native speaker norms when the *wh*- word is scrambled out of its base-generated position. Lastly, both L2 groups show evidence of native-like biases in resolving NP-of-NP attachment ambiguity, both online and offline.

Implications of the Findings

Overall, the findings of the present study present somewhat of a contradictory picture. On the one hand, there is clear evidence that L1 English and L1 Korean speakers are sensitive to some of the structural constraints required for processing Japanese. On the other hand, both of the L2 participant groups diverge from native speakers in key places; namely, in the lack of facilitation effects at the head noun of the relative clause in case marked sentences, and in the L1 Korean speakers' lack of sensitivity to *wh*- dependencies in *wh*- scrambled sentences. These results have theoretical and methodological implications for theories of L2 parsing. Each of these is discussed in more detail below.

With the caveats discussed above, these results do not provide unequivocal support for the SSH. Instead, these results provide some support for the claim that the L2 parser can make use of structural constraints to process the L2, as well as some evidence that L2 processing diverges from L1 processing in certain respects. One possible source of this divergence has to do with the relationship between the grammar and the parser. One of the operating assumptions in this study, as well as in L2 parsing research more generally, is that participants have fully-fledged syntactic representations for the structures in question. Only if this assumption is made, can researchers make claims about L2 parsing as distinct from grammatical knowledge²². This may not be an entirely warranted assumption. If the relevant syntactic knowledge is not represented, then the parser cannot make use of it to parse sentences. This is not indicative of a parsing failure, however. Rather, it is indicative of a grammatical deficit.

For example, one possible explanation for L2 speakers' apparent lack of facilitation effects at the head noun of the relative clause reported in Chapter 2, is that the L2 participants do not have syntactic representations for case particles in their interlanguage grammars. If this were the case, then the prediction is that they should not be able to use them in online processing. Although very little work has directly investigated the acquisition of case particles in L2 Japanese, the work that has been done suggests that case particles are acquired relatively early (e.g., Kanno, 1996; Smith, *in press*; Yoo et al., 2001), so it's unlikely that the lack of facilitation effects is due to a syntactic deficit. That said, this assumption should be independently verified.

²² This is somewhat of an oversimplification. In addition to work that investigates L2 processing heuristics (e. g., Felser et al., 2003; Felser, Sato, & Bertenshaw, 2009; Jegerski, 2012; Marinis et al., 2005; Pliatsikas & Marinis, 2013), there is also a burgeoning body of work that uses processing methodologies to draw conclusions about the nature of the L2 grammar (e.g., Hopp, 2010; Keating, 2009; VanPatten et al., 2012; VanPatten & Smith, 2015 *inter alia*). This is an unfortunate confound, due, at least in part, to the fact that it is impossible to tap grammatical competence without also engaging the processing system in some way.

Similarly, the lack of facilitation effects could also be due in part to participants' incomplete acquisition of relative clause structures in L2 Japanese. Without an independent measure of syntactic knowledge, it is impossible to argue convincingly that this is the case in the present study. These possibilities point to a larger issue: to the extent possible, it may be necessary to independently verify that the relevant syntactic knowledge is represented in L2 grammars before concluding that L2 parsing is unable to rely on syntactic information. Independently verifying this would have two results: the first is that it would enable researchers to make a strong distinction between the grammar and the parser. The second is that, because the distinction between the grammar and the parser is clear, claims about the nature of interlanguage grammars, the L2 parser, and the relationship between the two can be strengthened.

A related issue is the question of whether L2 learners also need to acquire new L2 processing heuristics. This study is one of the few that has investigated whether participants can rely on different structural information to parse the L2 incrementally. The results suggest that they can, but they do not shed much light on whether this is something that emerges relatively early, along with, for example, the representation of case particles in Japanese interlanguage grammars, or whether it is something that develops over time. A good model of L2 parsing should consider what it means to acquire and parse languages that are typologically different from each other.

Another theoretical issue that has received relatively little attention in the work investigating L2 parsing is the relationship between input, language acquisition, and language processing. This has received some discussion in the L2 literature more generally (Sharwood Smith, 2005; e.g., Truscott & Sharwood Smith, 2004; VanPatten, 2004, 2007), but researchers who work on L2 processing have done relatively little work investigating the relationship

between the input available to L2 learners, whether new parsing heuristics need to be acquired to parse this input, and whether access to input plays a role in apparent non-native-like L2 parsing. A couple of notable exceptions to this generalization (e.g., Keating, VanPatten, & Jegerski, 2011; Pliatsikas & Marinis, 2013) have found that exposure to naturalistic input influences whether bilinguals process the structures under investigation in a native-like fashion. Access to input is important when the target structures are, as is often the case in processing work, relatively complex modification structures, such as relative clauses. Complex modification structures are a feature of written and not spoken language. Thus, written input is the main source of input available to learners for these structures, and, without sufficient input, learners may not have developed the parsing heuristics necessary to process these sentences efficiently. This is a possible intervening variable in the present study—sensitivity to case marking and *wh*-dependencies were both tested using structures that are relatively rare in spoken language. If learners' primary exposure to the target language is aural, then they may not have had access to sufficient input to process complex modification structures. Indeed, Pavesi (1986) argued that access to written input provides learners with access to more complex syntactic structures, and that this explained the difference in tutored and naturalistic L1 Italian speakers' performance on a variety of English relative clause structures. Given the nature of the target structures in the present study and the role of input in second language acquisition, results that indicate that L2 parsing does not rely on syntactic information to parse sentences do not necessarily mean that the L2 parser *cannot* do so. Indeed, Pliatsikas and Marinis (2013) found that L2 English learners with Greek as an L1 who had had naturalist exposure to English—i.e., more and better input—were able to make use of intermediate gaps. In the case of the present study, the Korean participants had more exposure to written Japanese input than the English speaking participants,

thus making it more likely that they had received input for relative clause constructions and *wh*-dependencies. Again, the relationship between access to input, syntactic knowledge, and language processing needs to be more carefully investigated.

The last implication of the present study is that the role that participants' L2 literacy skills play in L2 processing needs to be more carefully considered. This implication is both theoretical and methodological. The theoretical implications have to do with issues already discussed—namely, access to input and ensuring complete acquisition of target structures. Specifically, processing work that investigates *wh*-dependencies typically relies on long-distance dependencies. These are usually found in written language, not spoken language, and thus, the primary input for these structures will be written. Thus, overall literacy and reading comprehension may interact with participants' ability to process these sentences.

The methodological implication is particularly important for L2 processing work that investigates L2 processing in cases where participants' L1 and L2 do not share a writing system. Literate adults take literacy skills for granted, but, when participants' L1 and L2 do not share an orthography, part of the L2 acquisition task includes acquiring novel phoneme/grapheme correspondences for the L2, and having enough practice and exposure to written texts in the L2 to develop fully automatized orthographic processing skills. To the extent that these are not automatized, online parsing methodologies that rely on written texts may be inadvertently measuring non-automatized orthographic processing, which may mask sensitivity to L2 structure. The present study cannot really speak to the literacy issue—but it is a factor lurking in the background.

Limitations

All empirical research is limited by its sample size and random variations in the populations. The present study is no exception. This study is also limited in what it can say about some of the implications discussed in the previous section, namely the relationship between the grammar and the parser and the relationship between literacy and processing.

As discussed above, under the assumption that the grammar and the parser are distinct from each other, it is necessary to ensure that claims about L2 parsing are claims about L2 parsing, and are not confounded by participants' lack of the relevant syntactic knowledge. The present study has no independent measure of participants' relevant syntactic knowledge, so all claims about L2 parsing heuristics are made under the assumption that the structures under investigation were indeed represented in participants' grammars.

Similarly, the present study assumes that the L2 participants' Japanese reading skills—and particularly their *kanji* processing skills—were automatized enough that the processing data are a reliable measure of L2 parsing, and don't also include noise attributable to incomplete literacy skills. This is particularly an issue in work that investigates L2 Japanese processing because of the nature of the Japanese writing system. Japanese is written with a mix of scripts; two of which are comprised of one-to-one phoneme/grapheme correspondences, and one of which, *kanji*, is logographic. *Kanji* have both a phonological and a semantic representation, and native Japanese speakers activate both of these while reading in Japanese (e.g., Morita & Tamaoka, 2002). Non-native speakers, however, may know one of these mappings, but not both, and it is not clear how incomplete *kanji* knowledge interacts with L2 Japanese reading skills. It is highly likely, however, that incomplete *kanji* knowledge slows down processing of written tasks. Thus, it is possible that the L2 participants' performance in the present study is, in some cases,

confounded by incomplete or less than automatized *kanji* processing. To ensure that these results are reliable, this study should be replicated with tasks that rely on auditory stimuli to measure processing.

Future Research

This section lays out two directions for future research. Both are related to the issue of literacy skills and processing, but the first is structural and the second is orthographic.

The first direction for future research is to investigate the relationship between overall literacy skills and second language processing. This direction for would investigate the relationship between overall literacy skills, L2 grammatical knowledge, and L2 parsing. Specifically, it might be the case that L2 speakers who read fluently in the L2 (i.e., at an advanced or near-native) level have more robust representations for structures like wh-dependencies and relative clauses in the L2 than L2 speakers who do not read fluently. This may provide a way to investigate syntactic knowledge independently of processing. If learners demonstrate target-like knowledge of syntactic structures offline, then it makes sense to see if they are able to rely on structural knowledge to parse sentences online.

The second direction for future research is to investigate the relationship between orthographic knowledge and L2 processing, particularly in languages like Japanese and Chinese, where the writing systems are not transparent. There is some evidence from the native language processing literature that the nature of the Japanese writing system interacts with orthographic processing in native Japanese speakers. There is, for example, some evidence that the syllabaries are processed slower than *kanji* (e.g., Morita & Tamaoka, 2002; Shafiullah & Monsell, 1999), suggesting that fluent Japanese reading relies heavily on the semantic mappings encoded in the *kanji*. There is also some evidence that because each *kanji* has multiple possible readings, *kanji*

do not participate in morphological priming for native Japanese speakers (e.g., Verdonchot, La Heij, & Schiller, 2010). In theory, to develop fluent L2 Japanese reading skills, non-native speakers will need to be able to rely on some of this same information. Investigating how L2 Japanese speakers—who necessarily have less input and interaction with written Japanese—process written Japanese may shed light both on L2 processing and L2 literacy.

APPENDICES

APPENDIX A

Language Experience and Proficiency Questionnaire (LEAP-Q)

Name: _____

Today's date: _____

Age: _____

Date of Birth: _____

ID Number _____

1. Please list all the languages you know in order of dominance:

1	2	3	4	5

2. Please list all the languages you know in order of acquisition (your native language first):

1	2	3	4	5

3. Please list the percentage of the time you are *currently* and *on average* exposed to each language. (*Your percentages should add up to 100%*):

Language					
Percentage					

4. When choosing to read a text available in all your languages, in what percentage of cases would you choose to read it in each of your languages? Assume that the original was written in another language, which is unknown to you. (*Your percentages should add up to 100%*):

Language					
Percentage					

5. When choosing a language to speak with a person who is equally fluent in all your languages, what percentage of time would you choose to speak each language? Please report percent of total time.
(*Your percentages should add up to 100%*):

Language					
Percentage					

6. Please name the cultures with which you identify. On a scale of zero to ten, please rate the extent to which you identify with each culture. (Examples include US-American, Japanese, Korean, etc.):

7. How many years of formal education do you have? _____
What is your highest education level (degree earned)? _____
8. Date of moving to Japan, if applicable: _____
If you have ever moved to a country other than Japan, please provide the name of the country and the date here: _____.
9. Have you ever had a vision problem, hearing impairment, language disability, or learning disability? If yes, please explain:

Language: Japanese

This is my (first, second, etc.) _____ **language.**

All questions below refer to your knowledge of Japanese.

1. Age when you...:
2. Please list the number of years and months you spent in each language environment:
3. On a scale from zero to ten, zero being the lowest and ten being the highest, please indicate your *level of proficiency* in speaking, understanding, and reading Japanese.
4. On a scale from zero to ten, zero being the lowest and ten being the highest, please indicate how much the following factors contributed to you learning Japanese.
5. Please rate the extent to which you are currently exposed to Japanese in the following contexts:
6. In your perception, how much of a foreign accent do you have in Japanese?
7. How frequently do others identify you as a non-native speaker based on your accent in Japanese?

APPENDIX B

Proficiency Test

Part I: Grammar (From Ueki, Ueda, and Noguchi (2005), pp. 148-149)

1. 次の文の（ ）に最も適当なものを a ~ d の中から選びなさい。

1) 教師が「これで終わります」と言う（ ）早いか、その学生は教室を飛び出して行った。

- a. と b. が c. は d. を

2) 彼の奉仕活動は、実は有名になることが目的なので、称賛する（ ）は当たらないと言っている人達もいる。

- a. と b. の c. に d. で

3) 4年間通ったこの大学でも、明日（ ）限りにお別れた。

- a. を b. で c. の d. に

4) 今回の留学に関しては、私は私なり（ ）十分考えてのことです。

- a. と b. で c. に d. の

5) その学生は日頃から真面目な努力家なので、学校としても推薦する（ ）足る人物と判断した。

- a. を b. と c. に d. が

2. 次の文の（ ）に最も適当なものを a ~ e の中から選び書きなさい。

- a. つつ b. かたから c. がてら d. かたがた e. ついでに

1) 駅まで行く（ ）郵便局で切手を買ってきてくれないか。

2) 彼女は日本語教師の仕事の（ ）、ボランティアで手話通訳をしている。

30. 会う		
31. 探す		
32. 医者		
33. 交番		
34. 秘書		
35. 社長		
36. 電話		
37. 主人		
38. 図書館		
39. 夕飯		
40. 怒る		
41. 駅		
42. 迎えに		
43. 教室		
44. 呼ぶ		
45. 記者		
46. お客さん		
47. 断る		
48. 教師		
49. 飲む		
50. 新聞		
51. 奥さん		
52. 喜ぶ		
53. 手伝う		
54. 連れる		
55. 職員		
56. 係長		
57. 丁寧		
58. お茶		
59. 研究者		
60. 問題		
61. 説明		
62. 買う		
63. 喫茶店		
64. 先輩		
65. 偶然		
66. 食堂		
67. 同級生		
68. 定食		
69. 注文		

70. 田舎		
71. 自宅		
72. 写真家		
73. 貸した		
74. 仲間		
75. 渋々		
76. 追い出す		
77. 下町		
78. 借金		
79. 払う		
80. 長男		
81. 主人		
82. 洋服		
83. 酒屋		
84. 運動会		
85. 役員		
86. お菓子		
87. 焼く		
88. 政治家		
89. 届く		
90. 城		
91. 天皇様		
92. 侍		
93. 大名		
94. 厳しい		
95. 音楽家		
96. お土産		
97. 頼む		
98. 親切		
99. 女優		
100. 世話		
101. 子犬		
102. 見張る		
103. 机		
104. 落ちる		
105. 時計		
106. 働く		
107. 帽子		
108. 遊ぶ		
109. 汚れる		

110. 椅子		
111. 眼鏡		
112. 割れる		
113. 靴		
114. 玄関		
115. 諸説		
116. 見当たる		
117. 急いで		
118. 置く		
119. 隣		
120. 近い		
121. 挨拶		
122. 旅館		
123. 笑う		
124. 送る		
125. 手紙		
126. 空		
127. 動物園		
128. 蛇		
129. 運転手		
130. 金魚		
131. 開ける		
132. 止まる		
133. 太る		
134. 東京		
135. 広島		
136. 長崎		
137. 泳ぐ		
138. 小池		
139. 建てる		

APPENDIX C

Stimuli for the Self-Paced Reading Task

I. Stimuli for incremental processing

A. Sensitivity to the Local Assignment of Clause Boundaries condition (i.e., two nominative-case-marked NPs cannot be in the same clause) Subject reanalysis: Subject relative clause modifying an indirect object

Control for subject reanalysis: object relative clause modifying an indirect object (i.e., has an overt subject)

NB: Critical and spillover regions are underlined and sentences are glossed for the sake of the reader. They will not be underlined or glossed in the experiment.

1. a. おばさんが、おじいさんを、交差点で、見た、女子に、大声で、声をかけた。

Obasan-ga\ ojiisan-o\ kousaten-de\ mita\ jyoshi-ni\ ogoede\ koe-o kaketa.

Woman-nom\ old man-acc\ intersection-loc\ saw\ girl-to\ loudly\ called.

The woman called loudly to the girl who saw the old man at the intersection.

- b. おばさんが、おじいさんが、交差点で、見た、女子に、大声で、声をかけた。

Obasan-ga\ ojiisan-ga\ kousaten-de\ mita\ jyoshi-ni\ ogoede\ koe-o kaketa.

Woman-nom\ old man-nom\ intersection-loc\ saw\ girl-to\ loudly\ called.

The woman called loudly to the girl who the old man saw at the intersection.

- Q: この文章によると…

According to this sentence…

A. おじいさんは交差点にいました。

B. おばさんは交差点にいました。

A. The old man was at the intersection

B. The woman was at the intersection

2. a. 看護婦さんが男の子に話しかけた、医者をも病院に案内しました。

Kangofusan-ga\ otokonoko-ni\ hanashikaketa\ isha-o\ byoin-ni\ annai shimashita.

Nurse-nom\ boy-to\ talked\ doctor-acc\ hospital-to\ showed around.

The nurse showed the doctor who talked to the boy around the hospital.

- b. 看護婦さんが男の子が話しかけた、医者をも病院に案内しました。

Kangofusan-ga\ otokonoko-ga\ hanashikaketa\ isha-o\ byoin-ni\ annai shimashita.

Nurse-nom\ boy-nom\ talked\ doctor-acc\ hospital-to\ showed around.

The nurse showed the doctor who the boy talked to around the hospital.

- Q: この文章によると…

According to this sentence…

A. 看護婦は案内させた

B. 医者は案内させた

A. The nurse was shown around

B. The doctor was shown around

3. a. 校長先生が先生を、紹介した、生徒を、学校の前に叱りました。

Kochosensei-ga\ sensei-o\ shokaishita\ seito-o\ gakko-no\ mae-ni\ shikarimashita.

Principal-nom\ teacher-acc\ introduced\ student-acc\ school-gen\ front-at\ scolded.

The principal scolded the student who introduced the teacher in front of the school.

- b. 校長先生が、先生が、紹介した、生徒を、学校の前に叱りました。

Kochosensei-ga\ sensei-ga\ shokaishita\ seito-o\ gakko-no\ mae-ni\ shikarimashita.

Principal-nom\ teacher-nom\ introduced\ student-acc\ school-gen\ front-at\ scolded.

The principal scolded the student who the teacher introduced in front of the school.

Q: この文章によると…

According to this sentence...

A. 生徒は叱れた

B. 先生は叱れた

A. The student was scolded

B. The teacher was scolded

4. a. 女の子が\お姉さんを\公園で\見た\友達を\食事に\誘いました。

Onanoko-ga\ onesan-o\ kouen-de\ mita\ tomodachi-o\ shokuji-ni\ sasotta.

Girl-nom\ sister-acc\ park-loc\ saw\ friend-acc\ meal-to\ invited.

The girl invited the friend who saw her sister in the park to a party.

- b. 女の子が\お姉さんが\公園で\見た\友達を\食事に\誘いました。

Onanoko-ga\ onesan-ga\ kouen-de\ mita\ tomodachi-o\ shokuji-ni\ sasotta.

Girl-nom\ sister-nom\ park-loc\ saw\ friend-acc\ meal-to\ invited.

The girl invited the friend who her sister saw in the park to a party.

Q: この文章によると…

According to this sentence...

A. 姉が誘そわれた

B. 友達が誘われた

A. The sister was invited

B. The friend was invited

5. a. 弁護士さんが娘さんを\バスに\乗せた\女性を\突然に\会いました。

Bengoshisan-ga\ imotosan-o\ basu-ni\ noseta\ josei-o\ totsuzen-ni\ aimashita.

Lawyer-nom\ sister-acc\ bus-on\ put\ woman-acc\ suddenly\ met.

The lawyer saw the woman who put her daughter on the bus from far away.

- b. 弁護士さんが娘さんが\バスに\乗せた\女性を\突然に\会いました。

Bengoshisan-ga\ imotosan-ga\ basu-ni\ noseta\ josei-o\ totsuzen-ni\ aimashita.

Lawyer-nom\ sister-nom\ bus-on\ put\ woman-acc\ far-from\ saw.

The lawyer saw the woman who her daughter put on the bus from far away.

Q: この文章によると…

According to this sentence...

A. 娘がバスにいました

B. 女性はバスにいました

A. The daughter was on the bus

B. The woman was on the bus

6. a. 大学生が\看護婦さんを\探した\医者を\交番で\見ました。

Daigakusei-ga\ kangofusan-o\ sagashita\ isha-o\ kouban-de\ mimashita.

College student-nom\ nurse-acc\ looked for\ doctor-acc\ police box-at\ saw.

The college student saw the doctor who looked for the nurse at the police station.

- b. 大学生が\看護婦さんが\探した\医者を\交番で\見ました。

Daigakusei-ga\ kangofusan-ga\ sagashita\ isha-o\ kouban-de\ mimashita.

College student-nom\ nurse-nom\ looked for\ doctor-acc\ police box-at\ saw.

The college student saw the doctor who the nurse looked for at the police station.

Q: この文章によると…

According to this sentence...

A. 看護婦さんを見ました

B. 医者を見ました

A. The nurse was seen

B. The doctor was seen

7. a. 秘書が\社長さんに\電話をかけた\男性を\主人に\紹介しました。

Hisho-ga\ shachosan-ni\ denwa-o kaketa\ dansei-o\ shujin-ni\ shokaishimashita.

Secretary-nom\ company president-to\ called\ man-acc\ husband-to\ introduced.

The secretary introduced the man who called the company president to her husband.

- b. 秘書が\社長さんが\電話をかけた\男性を\主人に\紹介しました。
 Hisho-ga\ shachosan-ga\ denwa-o kaketa\ dansei-o\ shujin-ni\ shokaishimashita.
 Secretary-nom\ company president-nom\ called\ man-acc\ husband-to\ introduced.
 The secretary introduced the man who the company president called to her husband.

Q: この文章によると…

According to this sentence

- A. 男性が紹介された B. 社長が紹介された
 A. The man was introduced B. The company president was introduced

8. a. 弁護士さんが\男の子を\図書館で\見た\女性を\夕飯に\誘いました。
 Bengoshisan-ga\ otokonoko-o\ toshokan-de\ josei-o\ yuuhan-ni\ sasoimashita.
 Lawyer-nom\ boy-acc\ library-in\ woman-acc\ dinner-to\ invited.
 The lawyer invited the woman who saw the boy in the library to dinner.
 b. 弁護士さんが\男の子が\図書館で\見た\女性を\夕飯に\誘いました。
 Bengoshisan-ga\ otokonoko-ga\ toshokan-de\ josei-o\ yuuhan-ni\ sasoimashita.
 Lawyer-nom\ boy-nom\ library-in\ woman-acc\ dinner-to\ invited.
 The lawyer invited the woman who the boy saw in the library to dinner.

Q: この文章によると…

According to this sentence...

- A. 女性が誘われた B. 男の子が誘われた
 A. The woman B. The boy

9. a. 先生が\女の子を\公園で\いじめた\男子を\怒って\叱りました。
 Sensei-ga\ onnanoko-o\ kouen-de\ ijimeta\ otokonoko-o\ okotte\ shikarimashita.
 Teacher-nom\ girl-acc\ park-in\ teased\ boy-acc\ angrily\ scolded.
 The teacher angrily scolded the boy who teased the girl in the park.
 b. 先生が\女の子が\公園で\いじめた\男子を\怒って\叱りました。
 Sensei-ga\ onnanoko-ga\ kouen-de\ ijimeta\ otokonoko-o\ okotte\ shikarimashita.
 Teacher-nom\ girl-nom\ park-in\ teased\ boy-acc\ angrily\ scolded.
 The teacher angrily scolded the boy who the girl teased in the park.

Q: この文章によると…

According to this sentence...

- A. 男の子がいじめられた B. 女の子がいじめられた
 A. The boy B. The girl

10. a. 医者が\お姉さんを\駅で\迎えに行った\女性を\公園で\見ました。
 Isha-ga\ onesan-o\ eki-de\ mukaeni itta\ josei-o\ kouen-de\ mita.
 Doctor-nom\ sister-acc\ station-at\ picked up\ woman-acc\ park\ saw.
 The doctor saw the woman who picked her sister up at the station in the park.
 b. 医者が\お姉さんが\駅で\迎えに行った\女性を\公園で\見ました。
 Isha-ga\ onesan-ga\ eki-de\ mukaeni itta\ josei-o\ kouen-de\ mita.
 Doctor-nom\ sister-nom\ station-at\ picked up\ woman-acc\ hall\ saw.
 The doctor saw the woman who her sister picked up at the station in the park.

Q: この文章によると…

According to this sentence...

- A. 医者が駅にいました。 B. 女性が駅にいました
 A. The doctor was at the station B. The woman was at the station

11. a. おばさんが校長先生を教室で探した先生を静かに呼びました。
 Obasan-ga\ kochosensei-o\ kyoshitsu-de\ sagashita\ sensei-o\ shizuka-ni\ yobimashita.
 Obasan-nom\ principal-acc\ classroom-in\ looked for\ teacher-acc\ quietly\ called.
 The woman called softly to the teacher who looked for the principal in the classroom.
- b. おばさんが校長先生が教室で探した先生を静かに呼びました。
 Obasan-ga\ kochosensei-ga\ kyoshitsu-de\ sagashita\ sensei-o\ shizuka-ni\ yobimashita.
 Obasan-nom\ principal-nom\ classroom-in\ looked for\ teacher-acc\ quietly\ called.
 The woman called softly to the teacher who the principal looked for in the classroom.
- Q: この文章によると…
 According to this sentence…
- A. 先生が呼ばれました B. 校長先生が呼ばれました
 A. The woman was called B. The principal was called
12. a. お客さんが店員さんを店内で断った記者を突然に電話をかけました。
 Okyakusan-ga\ teninsan-o\ tennai-de\ kotowatta\ kisha-o\ totsuzen-ni\ denwa-o kaketa.
 Customer-nom\ employee-acc\ shop-in\ refused\ journalist-acc\ suddenly\ called.
 The customer suddenly called the journalist who refused the employee in the shop.
- b. お客さんが店員さんが店内で断った記者を突然に電話をかけました。
 Okaykusan-ga\ teninsan-ga\ tennai-de\ kotowatta\ kisha-o\ totsuzen-ni\ denwa-o kaketa.
 Customer-nom\ employee-ga\ shop-in\ refused\ journalist-acc\ suddenly\ called.
 The customer suddenly called the journalist who the employee refused in the shop.
- Q: この文章によると…
 According to this sentence…
- A. お客さんが電話かけられた B. 記者が電話かけられた
 A. The customer was called B. The journalist was called
13. a. サラリーマンが弟をタクシーに乗せた教師を飲みに誘いました。
 Sarariman-ga\ ototo-o\ takushii-ni\ noseta\ kyoshi-o\ nomi-ni\ sasoimashita.
 Salaryman-nom\ brother-acc\ taxi-in\ put\ teacher-acc\ drinking\ invited.
 The salary man invited the teacher who put his brother in a taxi out drinking.
- b. サラリーマンが弟がタクシーに乗せた教師を飲みに誘いました。
 Sarariman-ga\ ototo-ga\ takushii-ni\ noseta\ kyoshi-o\ nomi-ni\ sasoimashita.
 Salaryman-nom\ brother-nom\ taxi-in\ put\ teacher-acc\ drinking\ invited.
 The salary man invited the teacher whose brother put her in a taxi out drinking.
- Q: この文章によると…
 According to this sentence…
- A. 教師が誘われた B. 弟が誘われた
 A. The teacher was invited B. The brother was invited
14. a. 本屋さんがおじさんを駅で見た作者に新聞をあげました。
 Honyasan-ga\ ojisan-o\ eki-de\ mita\ sakusha-ni\ hon-o\ agemashita.
 Bookstore owner-nom\ writer-acc\ station-at\ saw\ man-to\ book-acc\ gave.
 The bookstore owner gave the writer who saw the man in the station a newspaper.
- b. 本屋さんがおじさんが駅で見た作者に新聞をあげました。
 Honyasan-ga\ ojisan-ga\ eki-de\ mita\ sakusha-ni\ hon-o\ agemashita.
 Bookstore owner-nom\ writer-nom\ station-at\ saw\ man-to\ book-acc\ gave.
 The bookstore owner gave the writer who the man saw in the station a book.

Q: この文章によると…

According to this sentence...

A. 作者が本をあげた

B. 本屋さんが本をあげた

A. The writer gave a book

B. The bookstore owner gave a book

15. a. 医者が奥さんをスーパーで探した主人を喜んで手伝えました。

Isha-ga\ okusan-o\ suupaa-de\ sagashita\ shyujin-o\ yorokonde-ni\ tetsudaemashita.

Doctor-nom\ wife-acc\ supermarket-at\ looked for\ husband-acc\ gladly\ helped.

The doctor gladly helped the husband who was looking for his wife in the grocery store.

- b. 医者が奥さんがスーパーで探した主人を喜んで手伝えました。

Isha-ga\ okusan-ga\ suupaa-de\ sagashita\ shyujin-o\ yorokonde\ tetsudaemashita.

Doctor-nom\ wife-nom\ supermarket-at\ looked for\ husband-acc\ gladly\ helped.

The doctor gladly helped the husband who his wife was looking for in the grocery store.

Q: この文章によると…

According to this sentence...

A. 医者が手伝えた

B. 奥さんが手伝えた

A. The doctor helped

B. The wife helped

16. a. 店員さんがお姉さんを仕事に連れていた男性を電車で見ました。

Teninsan-ga\ onesan-o\ shigoto-ni\ tsureteita\ dansei-o\ denshya-de\ mimashita.

Employee-nom\ sister-acc\ work-to\ took\ man-acc\ train-in\ saw.

The employee saw the man who took his sister to work in the train.

- b. 店員さんがお姉さんが仕事に連れていた男性を電車で見ました。

Teninsan-ga\ onesan-ga\ shigoto-ni\ tsureteita\ dansei-o\ denshya-de\ mimashita.

Employee-nom\ sister-nom\ work-to\ took\ man-acc\ train-in\ saw.

The employee saw the man who his sister took to work in the train.

Q: この文章によると…

According to this sentence...

A. お姉さんが電車にいた

B. 男性が電車にいた

A. The employee

B. The sister

Accusative case marking sentences

The first version of the sentence is an ambiguous relative clause, and the second version is a double accusative sentence. Adapted from Miyamoto (2002), Experiment 1.

1. a. オフィスで職員が係長に、お茶を出した女性を丁寧に紹介した。

Ofisu-de\ shokuin-ga\ kakaricho-ni\ ochya-o\ dashita\ jyosei-o\ teinei-ni\ shokaishita.

Office_{LOC}\ employee_{NOM}\ manager_{DAT}\ tea_{ACC}\ served\ woman_{ACC}\ politely\ introduced.

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

- b. オフィスで職員が係長を、お茶を出した女性に丁寧に紹介した。

Ofisu-de\ shokuin-ga\ kakaricho-o\ ochya-o\ dashita\ jyosei-ni\ teinei-ni\ shokaishita.

Office_{LOC}\ employee_{NOM}\ manager_{ACC}\ tea_{ACC}\ served\ woman_{DAT}\ politely\ introduced.

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

Q: この文章によると…

According to this sentence...

- A. 女性がお茶を出した B. 職員がお茶を出した
 A. The woman served tea B. The employee served tea
2. a. 教室で\研究者が\大学生に\問題を\説明した\先生を\簡単に\
 Kyoshitsu-de\ kenkyusha-ga\ daigakusei-ni\ mondai-o\ setsumeishita\ sensei-o\ kantan-ni
 Classroom_{LOC}\ researcher_{NOM}\ college student_{DAT}\ official_{ACC}\ explained\ teacher_{ACC}\ simply\
 紹介した。
 shokaishita.
 introduced.
 “In the classroom, the researcher introduced the teacher who explained the problem to the student.”
- b. 教室で\研究者が\大学生を\問題を\説明した\先生に\簡単に\
 Kyoshitsu-de\ kenkyusha-ga\ daigakusei-o\ koushiki-o\ setsumeishita\ sensei-ni\ kantan-ni
 Classroom_{LOC}\ researcher_{NOM}\ college student_{ACC}\ official_{ACC}\ explained\ teacher_{DAT}\ simply\
 紹介した。
 shokaishita.
 introduced.
 “In the classroom, the researcher introduced the student to the teacher who explained the problem.”
- Q: この文章によると…
 According to this sentence…
 A. 研究者が説明した B. 先生が説明した
 A. The researcher explained B. The teacher explained
3. a. 喫茶店で\少年が\友達に\コーヒーを\買った\先輩を\偶然に\会った。
 Kissaten-de\ shonen-ga\ tomodachi-ni\ koohii-o\ katta\ senpai-o\ guuzen-ni\ atta.
 Coffee shop_{LOC}\ youth_{NOM}\ friend_{DAT}\ coffee_{ACC}\ bought\ senior_{ACC}\ suddenly\ met.
 “In the coffee shop, the youth suddenly met the senior who bought coffee for a friend.”
- b. 喫茶店で\少年が\友達を\コーヒーを\買った\先輩に\偶然に\会った。
 Kissaten-de\ shonen-ga\ tomodachi-o\ koohii-o\ katta\ senpai-ni\ guuzen-ni\ atta.
 Coffee shop_{LOC}\ youth_{NOM}\ friend_{ACC}\ coffee_{ACC}\ bought\ senior_{DAT}\ suddenly\ met.
 In the coffee shop, the youth suddenly met the friend who the senior bought coffee for.
- Q: この文章によると…
 According to this sentence…
 A. 先輩がコーヒーを買った B. 少年がコーヒーを買った
 A. The employee B. The sister
4. a. 食堂で\教師が\同級生に\定食を\注文した\学生を\喜んで\手伝った。
 Shokudo-de\ kyoshi-ga\ doukyusei-ni\ teishoku-o\ chumonshita\ gakusei-o\ yorokonde\
 Cafeteria_{LOC}\ teacher_{NOM}\ classmate_{DAT}\ meal_{ACC}\ ordered\ student_{ACC}\ gladly
 tetsudatta.
 helped.
 “In the cafeteria, the teacher gladly helped the student who ordered a meal for her classmate.”
- b. 食堂で\教師が\同級生を\定食を\注文した\学生に\喜んで\手伝った。
 Shokudo-de\ kyoshi-ga\ doukyusei-o\ teishoku-o\ chumonshita\ gakusei-ni\ yorokonde\
 Cafeteria_{LOC}\ teacher_{NOM}\ classmate_{ACC}\ meal_{ACC}\ ordered\ student_{DAT}\ gladly
 tetsudatta.
 helped.
 “In the cafeteria, the teacher gladly helped the classmate who the student ordered a meal for.”

Q: この文章によると…

According to this sentence...

A. 先生が食事を注文した B. 学生が食事を注文した

A. The teacher ordered B. The student ordered

5. a. 田舎で、写真家が、男の子に、カメラを、あげた、作家を、大声で、話しかけた。

Inaka-de\ shashinka-ga\ otokonoko-ni\ kamera-o\ ageta\ sakka-o\ ogoe-de\ hanashikaketa.

Country_{LOC}\ photographer_{NOM}\ boy_{DAT}\ camera_{ACC}\ gave\ writer_{ACC}\ loudly\ spoke to.

“In the country, the photographer loudly spoke to the writer who gave the boy a camera.”

- b. 田舎で、写真家が、男の子を、カメラを、あげた、作家に、大声で、話しかけた。

Inaka-de\ shashinka-ga\ otokonoko-o\ kamera-o\ ageta\ sakka-ni\ ogoe-de\ hanashikaketa.

Country_{LOC}\ photographer_{NOM}\ boy_{ACC}\ camera_{ACC}\ gave\ writer_{DAT}\ loudly\ spoke to.

“In the country, the photographer loudly spoke to the boy who the writer gave a camera to.”

Q: この文章によると…

According to this sentence...

A. 写真家は話しかけた B. 男の子が話しかけた

The photographer spoke The boy spoke

6. a. 自宅で、お兄さんが、父親に、ビデオを、貸した、友達を、渋々に、

Jitaku-de\ oniisan-ga\ chichioya-ni\ bideo-o\ kashita\ nakama-o\ shibushibu-ni\

At the house\ older brother_{NOM}\ father_{DAT}\ video_{ACC}\ borrowed\ friend_{ACC}\ reluctantly\

紹介した。

shokaishita.

introduced.

“At the house, the older brother reluctantly introduced the friend who borrowed a video to the father.”

- b. 自宅で、お兄さんが、父親を、ビデオを、貸した、友達に、渋々に、

Jitaku-de\ oniisan-ga\ chichioya-o\ bideo-o\ kashita\ nakama-ni\ shibushibu-ni\

At the house\ older brother_{NOM}\ father_{ACC}\ video_{ACC}\ borrowed\ friend_{DAT}\ reluctantly\

紹介した。

shokaishita.

introduced.

“At the house, the older brother reluctantly introduced his father to the friend who borrowed a video.”

Q: この文章によると…

According to this sentence...

A. 父親が息子を紹介した B. お兄さんが友達を紹介した

A. The father introduced the son B. The brother introduced the friend

7. a. 下町で、おばあさんが、米屋に、借金を、払った、酒屋を、簡単に、追い出させた。

Shitamachi-de\ obaasan-ga\ komeya-ni\ shakkin-o\ haratta\ sakeya-o\ kantan-ni\ oidasasetta.

Shitamachi_{LOC}\ the old woman_{NOM}\ rice seller_{DAT}\ debt_{ACC}\ paid\ brewer_{ACC}\ easily\ kicked out.

“In Shitamachi, the old woman kicked the brewer who paid his debt to the rice seller out.”

- b. 下町で、おばあさんが、米屋を、借金を、払った、酒屋に、簡単に、追い出させた。

Shitamachi-de\ obaasan-ga\ komeya-o\ shakkin-o\ haratta\ sakeya-ni\ kantan-ni\ oidasasetta.

Shitamachi_{LOC}\ the old woman_{NOM}\ rice seller_{ACC}\ debt_{ACC}\ paid\ brewer_{DAT}\ easily\ kicked out.

“In Shitamachi, the old woman kicked the rice seller who paid his debt to the brewer out.”

Q: この文章によると…

According to this sentence...

- A. 酒屋が借金を払った B. 米屋が借金を払った
 A. The brewer paid the debt B. The rice seller paid the debt
8. a. 駅で\婦人が\長男に\カバンを\あずけた\友達を\静かに\紹介した。
 Eki-de\ shujin-ga\ chonan-ni\ kaban-o\ azuketa\ tomodachi-o\ shizuka-ni\ shokaishita.
 Station_{LOC}\ housewife_{NOM}\ oldest son_{DAT}\ collected\ friend_{ACC}\ quietly\ introduced.
 “At the station, the housewife introduced the friend who kept the bag for her son.”
- b. 駅で\主婦が\長男を\カバンを\あずけた\友達に\静かに\紹介した。
 Eki-de\ shufu-ga\ chonan-o\ kaban-o\ azuketa\ tomodachi-ni\ shizuka-ni\ shokaishita.
 Station_{LOC}\ housewife_{NOM}\ oldest son_{ACC}\ collected\ friend_{DAT}\ quietly\ introduced.
 “At the station, the housewife introduced her older son who kept the bag for her friend.”
- Q: この文章によると…
 According to this sentence…
 A. 長男がカバンをあずけた B. 友達がカバンをあずけた
 A. The son kept the bag B. The friend kept the bag
9. a. デパートで\店員が\女の子に\洋服を\見せていた\友達を\長い間\
 Depato-de\ tenin-ga\ onnanoko-ni\ youfuku-o\ miseteita\ tomodachi-o\ nagai aida\
 Department store_{LOC}\ employee_{NOM}\ clothing_{ACC}\ showed\ friend_{ACC}\ long time\
 見はらせた。
 miharaseta.
 spied on.
 “At the department store, the employee spied on the friend who was showing clothes to the girl.”
- b. デパートで\店員が\女の子を\洋服を\見せていた\友達に\長い間\
 Depato-de\ tenin-ga\ onnanoko-ni\ youfuku-o\ miseteita\ tomodachi-o\ nagai aida\
 Department store_{LOC}\ employee_{NOM}\ clothing_{ACC}\ showed\ friend_{ACC}\ long time\
 見はらせた。
 miharaseta.
 spied on.
 “At the department store, the employee spied on the girl who was showing clothes to her friend.”
- Q: この文章によると…
 According to this sentence…
 A. 店員が見張らせた B. 友達が見張らせた
 A. The employee was spying B. The friend was spying
10. a. 運動会で\役員が\お母さん達に\お菓子を\焼いた\先生を\大声で\呼ばせた。
 Undokai-de\ yakuin-ga\ okaasantachi-ni\ okashi-o\ yaita\ sensei-o\ ogoe-de\ yobaseta.
 Athletic meet_{LOC}\ staff_{NOM}\ mothers_{DAT}\ snacks_{ACC}\ grilled\ teacher_{ACC}\ loudly\ called.
 “At the athletic meet, the official called loudly to the teacher who was grilling snacks for the mothers”.
- b. 運動会で\役員が\お母さん達を\お菓子を\焼いた\先生に\大声で\呼ばせた。
 Undokai-de\ yakuin-ga\ okaasantachi-o\ okashi-o\ yaita\ sensei-ni\ ogoe-de\ yobaseta.
 Athletic meet_{LOC}\ staff_{NOM}\ mothers_{ACC}\ snacks_{ACC}\ grilled\ teacher_{DAT}\ loudly\ called.
 “At the athletic meet, the official was loudly called to by the teacher who the mothers were grilling snacks for”.
- Q: この文章によると…
 According to this sentence…
 A. 役員がお菓子を焼いた B. お母さん達がお菓子を焼いた
 A. The staff were grilling snacks B. The mothers were grilling snacks

11. a. 広島で\政治家が\校長に\ピアノを\届けた\市長を\静かに\叱った。
 Hiroshima-de\ seijika-ga\ kochou-ni\ piano-o\ todoketa\ shicho-o\ shizukani\ shikatta.
 Hiroshima_{LOC}\ politician_{NOM}\ principal_{DAT}\ piano_{ACC}\ brought\ mayor_{ACC}\ quietly\ scolded.
 “In Hiroshima, the politician quietly scolded the mayor who brought a piano to the principal.”
- b. 広島で\政治家が\校長を\ピアノを\届けた\市長に\静かに\叱った。
 Hiroshima-de\ seijika-ga\ kochou-o\ piano-o\ todoketa\ shicho-ni\ shizukani\ shikatta.
 Hiroshima_{LOC}\ politician_{NOM}\ principal_{ACC}\ piano_{ACC}\ brought\ mayor_{DAT}\ quietly\ scolded.
 “In Hiroshima, the politician quietly scolded the principal who brought a piano to the mayor.”

Q: この文章によると…

According to this sentence...

A. 市長が叱られた

B. 校長が叱られた

A. The mayor was scolded

B. The principal was scolded

12. a. 城で\天皇様が\侍に\お米を\届けた\大名を\厳しく\追い出させた。
 Shiro-de\ Tennosama-ga\ samurai-ni\ okome-o\ todoketa\ daimyo-o\ kibishiku\ oidasaseta.
 Castle_{LOC}\ emperor_{NOM}\ samurai_{DAT}\ rice_{ACC}\ brought\ daimyo_{ACC}\ strictly\ threw out.
 “At the castle, the emperor strictly threw the daimyo who brought rice to the samurai out.”
- b. 城で\天皇様が\侍を\お米を\届けた\大名に\厳しく\追い出させた。
 Shiro-de\ Tennosama-ga\ samurai-o\ okome-o\ todoketa\ daimyo-ni\ kibishiku\ oidasaseta.
 Castle_{LOC}\ emperor_{NOM}\ samurai_{ACC}\ rice_{ACC}\ brought\ daimyo_{DAT}\ strictly\ threw out.
 “At the castle, the emperor strictly threw the samurai who brought rice to the daimyo out.”

Q: この文章によると…

According to this sentence...

A. 大名がお米を届けた

B. 侍がお米を届けた

A. The daimyo brought rice

B. The samurai brought rice

13. a. バーで\音楽家が\政治家に\ビールを\買った\市長を\渋々に\紹介した。
 Baa-de\ ongakka-ga\ seijika-ni\ biiru-o\ katta\ shicho-o\ shibushibu-ni\ shokaishita.
 Bar_{LOC}\ musician_{NOM}\ politician_{DAT}\ beer_{ACC}\ bought\ mayor_{ACC}\ reluctantly\ introduced.
 “At the bar, the musician reluctantly introduced the mayor who bought a beer to the politician.”
- b. バーで\音楽家が\政治家を\ビールを\買った\市長に\渋々に\紹介した。
 Baa-de\ ongakka-ga\ seijika-o\ biiru-o\ katta\ shicho-ni\ shibushibu-ni\ shokaishita.
 Bar_{LOC}\ musician_{NOM}\ politician_{ACC}\ beer_{ACC}\ bought\ mayor_{DAT}\ reluctantly\ introduced.
 “At the bar, the musician reluctantly introduced the politician to the mayor who bought a beer.”

Q: この文章によると…

According to this sentence...

A. 市長がビールを買った

B. 音楽家がビールを買った

A. The mayor bought beer

B. The musician bought beer

14. a. 長崎で\少女が\お姉さんに\お土産を\頼んだ\友達を\偶然に\出会った。
 Nagasaki-de\ shojo-ga\ onesan-ni\ omiyage-o\ tanonda\ tomodachi-o\ guuzen-ni\ deatta.
 Nagasaki_{LOC}\ girl_{NOM}\ older sister_{DAT}\ souvenir_{ACC}\ asked\ friend_{ACC}\ suddenly\ met.
 “In Nagasaki, the girl suddenly met the friend who had asked her older sister for a souvenir.”
- b. 長崎で\少女が\お姉さんを\お土産を\頼んだ\友達に\偶然に\出会った。
 Nagasaki-de\ shojo-ga\ onesan-o\ omiyage-o\ tanonda\ tomodachi-ni\ guuzen-ni\ deatta.
 Nagasaki_{LOC}\ girl_{NOM}\ older sister_{ACC}\ souvenir_{ACC}\ asked\ friend_{DAT}\ suddenly\ met.
 “In Nagasaki, the girl suddenly met the older sister who had asked her friend for a souvenir.”

Q: この文章によると…

According to this sentence...

- A. 少女がお土産を頼んだ B. 友達がお土産を頼んだ
 A. The girl asked for a souvenir B. The friend asked for a souvenir

15. a. 横浜で、女優が、母親に、車を、買った、男性を、親切に、世話させた。
 Yokohama-de\ jyoyu-ga\ hahaoya-ni\ kuruma-o\ katta\ dansei-o\ shinsetsu-ni\ seiwasaseta.
 Yokohama_{LOC}\ actress_{NOM}\ mother_{DAT}\ car_{ACC}\ bought\ man_{ACC}\ nicely\ helped.
 In Yokohama, the actress nicely helped the man who bought a car for his mother.
- b. 横浜で、女優が、母親を、車を、買った、男性に、親切に、世話させた。
 Yokohama-de\ jyoyu-ga\ hahaoya-o\ kuruma-o\ katta\ dansei-ni\ shinsetsu-ni\ seiwasaseta.
 Yokohama_{LOC}\ actress_{NOM}\ mother_{ACC}\ car_{ACC}\ bought\ man_{DAT}\ nicely\ helped.
 “In Yokohama, the actress nicely helped the mother who the man bought a car for.”
- Q: この文章によると…
 According to this sentence...
- A. 男性が車を買った B. 女優が車を買った
 A. The man bought a car B. The actress bought a car
16. a. 公園で、先生が、子犬に、えさを、あげた、少女を、長い間、見張らせた。
 Kouen-de\ sensei-ga\ koinu-ni\ esa-o\ ageta\ shojo-o\ nagai aida\ miharaseta.
 Park_{LOC}\ teacher_{NOM}\ puppy_{DAT}\ food_{ACC}\ gave\ girl_{ACC}\ long time\ watched.
 “At the park, the teacher watched the girl who gave food to the puppy for a long time.”
- b. 公園で、先生が、子犬を、えさを、あげた、少女に、長い間、見張らせた。
 Kouen-de\ sensei-ga\ koinu-o\ esa-o\ ageta\ shojo-ni\ nagai aida\ miharaseta.
 Park_{LOC}\ teacher_{NOM}\ puppy_{ACC}\ food_{ACC}\ gave\ girl_{DAT}\ long time\ watched.
 “At the park, the teacher watched the puppy who the girl who gave food to for a long time.”
- Q: この文章によると…
 According to this sentence...
- A. 少女が先生を見た B. 先生が少女を見た
 A. The girl saw the teacher B. The teacher saw the girl

II. Indirect Questions, Scope, and Wh- Dependencies

Sentences are adapted from Aoshima et al. (2004). The first version is canonical, question particle, the second version is scrambled, embedded question particle, the third version is canonical, declarative complementizer, and the fourth version is scrambled, declarative complementizer.

1. a. 先生は、校長が、どの生徒に、英語の本を、読んだか、
 Sensei-wa\ koucho-ga\ dono seito-ni\ eigo-no hon-o\ yondaka\
 Teacher_{TOP}\ principal_{NOM}\ which student_{DAT}\ English_{GEN} book_{ACC}\ read Q\
 教室で、母親に、言いました。
 kyoushitsu-de\ hahaoya-ni\ iimashita.
 classroom_{LOC}\ mother_{DAT}\ said.
- b. どの生徒に、先生は、校長が、英語の本を、読んだか、
 Dono seito-ni\ Sensei-wa\ koucho-ga\ eigo-no hon-o\ yondaka\
 Which student_{DAT}\ teacher_{TOP}\ principal_{NOM}\ English_{GEN} book_{ACC}\ read Q\
 教室で、母親に、言いました。
 kyoushitsu-de\ hahaoya-ni\ iimashita.
 classroom_{LOC}\ mother_{DAT}\ said.

“The teacher told the mother which student the principal read the English book to in the classroom”

- c. 先生は¥校長が¥どの生徒に¥英語の本を¥読んだと¥
Sensei-wa\ koucho-ga\ dono seito-ni\ eigo-no hon-o\ yonda-to\
Teacher_{TOP}\ principal_{NOM}\ which student_{DAT}\ English_{GEN} book_{ACC}\ read COMP\
教室で¥母親に¥言いましたか。
kyoushitsu-de\ hahaoya-ni\ iimashita-ka.
classroom_{LOC}\ mother_{DAT}\ said-Q.
- d. どの生徒に¥先生は¥ 校長が¥英語の本を¥読んだと¥
Dono seito-ni\ Sensei-wa\ koucho-ga\ eigo-no hon-o\ yonda-to\
Which student_{DAT}\ teacher_{TOP}\ principal_{NOM}\ English_{GEN} book_{ACC}\ read COMP\
教室で¥母親に¥言いましたか。
kyoushitsu-de\ hahaoya-ni\ iimashita-ka.
classroom_{LOC}\ mother_{DAT}\ said-Q.

“Did the teacher tell the mother which student the principal read the English book to in the classroom?”

Q: この文章によると…

According to this sentence...

- A. 校長が本を読んだ B. 生徒が本を読んだ
A. The principal read the book B. The student read the book
2. a. おばは¥母親が¥ どの子供に¥ケーキを¥焼いたか¥台所で¥
Oba-wa\ hahaoya-ga\ dono kodomo-ni\ keiki-o\ yaita-ka\ daidokoro-de
Aunt_{TOP}\ mother_{NOM}\ which child_{DAT}\ cake_{ACC}\ baked-Q\ kitchen_{LOC}
お手伝いさんに¥知らせました。
otetsudaisan-ni\ shirasemashita.
helper_{DAT}\ told.
- b. どの子供に¥おばは¥母親が¥ケーキを¥焼いたか¥台所で¥
Dono-kodomo-ni\ oba-wa\ hahaoya-ga\ keiki-o\ yaita-ka\ daidokoro-de
Which child_{DAT}\ aunt_{TOP}\ mother_{NOM}\ cake_{ACC}\ baked-Q\ kitchen_{LOC}
お手伝いさんに¥知らせました。
otetsudaisan-ni\ shirasemashita.
helper_{DAT}\ told.
- “The aunt told the helper which child the mother baked a cake for.”
- c. おばは¥母親が¥どの子供に¥ケーキを¥焼いたと¥台所で¥
Oba-wa\ hahaoya-ga\ dono kodomo-ni\ keiki-o\ yaita-to\ daidokoro-de
Aunt_{TOP}\ mother_{NOM}\ which child_{DAT}\ cake_{ACC}\ baked-COMP\ kitchen_{LOC}
お手伝いさんに¥知らせましたか。
otetsudaisan-ni\ shirasemashita-ka.
helper_{DAT}\ told-Q.
- d. どの子供に¥おばは¥母親が¥ケーキを¥焼いたと¥台所で¥
Dono-kodomo-ni\ oba-wa\ hahaoya-ga\ keiki-o\ yaita-to\ daidokoro-de
Which child_{DAT}\ aunt_{TOP}\ mother_{NOM}\ cake_{ACC}\ baked-COMP\ kitchen_{LOC}
お手伝いさんに¥知らせましたか。
otetsudaisan-ni\ shirasemashita-ka.

helper_{DAT}\ told-Q.

“Did the aunt tell the helper which child the mother baked a cake for?”

Q: この文章によると…

According to this sentence…

A. 母親にケーキが焼いた

B. 子供にケーキが焼いた

A. The cake was baked for the mother B. The cake was baked for the child

3. a. 牧師は¥ボランティアが¥どの信者に¥ご飯を¥炊いたか¥教会で¥
Bokushi-wa\ borantia-ga\ dono jyosei-ni\ gohan-o\ taita-ka\ kyoukai-de\
Pastor_{TOP}\ volunteer_{NOM}\ which woman_{DAT}\ rice_{ACC}\ made-Q\ church_{LOC}
女性に¥伝えました。
jyosei-ni\ tsutaemashita.
woman_{DAT}\ told.
- b. どの信者に¥牧師は¥ボランティアが¥ご飯を¥炊いたか¥教会で¥
Dono jyosei-ni\ Bokushi-wa\ borantia-ga\ gohan-o\ taita-ka\ kyoukai-de\
Which woman_{DAT}\ Pastor_{TOP}\ volunteer_{NOM}\ rice_{ACC}\ made-Q\ church_{LOC}
女性に¥伝えました。
jyosei-ni\ tsutaemashita.
woman_{DAT}\ told.
- “The pastor told the woman which congregants the volunteer made the rice for.”
- c. 牧師は¥ボランティアが¥どの信者に¥ご飯を¥炊いたと¥教会で¥
Bokushi-wa\ borantia-ga\ dono jyosei-ni\ gohan-o\ taita-to\ kyoukai-de\
Pastor_{TOP}\ volunteer_{NOM}\ which woman_{DAT}\ rice_{ACC}\ made-COMP\ church_{LOC}
女性に¥伝えましたか。
jyosei-ni\ tsutaemashita-ka.
woman_{DAT}\ told-Q.
- d. どの信者に¥牧師は¥ボランティアが¥ご飯を¥炊いたと¥教会で¥
Dono jyosei-ni\ Bokushi-wa\ borantia-ga\ gohan-o\ taita-to\ kyoukai-de\
Which woman_{DAT}\ Pastor_{TOP}\ volunteer_{NOM}\ rice_{ACC}\ made-COMP\ church_{LOC}
女性に¥伝えましたか。
jyosei-ni\ tsutaemashita-ka.
woman_{DAT}\ told-Q.
- “Did the pastor tell the woman which congregants the pastor made the rice for?”
- Q: この文章によると…
- According to this sentence…
- A. ボランティアがご飯を炊いた
- B. 牧師がご飯を炊いた
- A. The volunteer made rice
- B. The pastor made rice
4. a. 部長は¥医者が¥ どの女性に¥ 新車を¥ 買ったか¥食堂で¥
Bucho-wa\ isha-ga\ dono jyosei-ni\ shinsha-o\ katta-ka\ shokudou-de\
Manager_{TOP}\ doctor_{NOM}\ which woman_{DAT}\ new car_{ACC}\ bought-Q\ cafeteria-de\
社長に¥伝えました。
shacho-ni\ oshiemashita.
boss_{DAT}\ informed.
- b. どの女性に¥部長は¥ 医者が¥ 新車を¥買ったか¥食堂で¥
Dono jyosei-ni\ bucho-wa\ isha-ga\ shinsha-o\ katta-ka\ shokudou-de\
Which woman_{DAT}\ manager_{TOP}\ doctor_{NOM}\ new car_{ACC}\ bought-Q\ cafeteria-de\

社長に¥教えました。
 shacho-ni\ oshiemashita.
 boss_{DAT}\ informed.

“The manager told the boss in the cafeteria which woman the doctor bought a new car for.”

c. 部長は¥ 医者が¥ どの女性に¥ 新車を¥ 買ったと¥ 食堂で¥
 Bucho-wa\ isha-ga\ donojyosei-ni\ shinsha-o\ katta-to\ shokudou-de\
 Manager_{TOP}\ doctor_{NOM}\ which woman_{DAT}\ new car_{ACC}\ bought-COMP\ cafeteria-de
 社長に¥教えましたか。
 shacho-ni\ oshiemashita-ka.
 boss_{DAT}\ informed-Q.

d. どの女性に¥部長は¥ 医者が¥ 新車を¥ 買ったと¥ 食堂で¥
 Donojyosei-ni\ bucho-wa\ isha-ga\ shinsha-o\ katta-to\ shokudou-de\
 Which woman_{DAT}\ manager_{TOP}\ doctor_{NOM}\ new car_{ACC}\ bought-COMP\ cafeteria-de
 社長に¥教えましたか。
 shacho-ni\ oshiemashita-ka.
 boss_{DAT}\ informed-Q.

“Did the manager tell the boss which woman the doctor bought a car for in the cafeteria?”

Q: この文章によると…

According to this sentence...

A. 女性が車を買った

B. 医者が車を買った

A. The woman bought a car

B. The doctor bought a car

5. a. 夫は¥ 妻が¥ どの家族に¥ 弁当を¥ 作ったか¥ 公園で¥ 友人に¥
 Otto-wa\ tsuma-ga\ dono kazoku-ni\ bento-o\ tsukatta-ka\ kouen-de\ yuujin-ni\
 Husband_{TOP}\ wife_{NOM}\ which family_{DAT}\ bento_{ACC}\ made-Q\ park_{LOC}\ friend_{DAT}\
 伝えました。
 tsutaemashita.
 told.

b. どの家族に¥ 夫は¥ 妻が¥ 弁当を¥ 作ったか¥ 公園で¥ 友人に¥
 Dono kazoku-ni\ otto-wa\ tsuma-ga\ bento-o\ tsukatta-ka\ kouen-de\ yuujin-ni\
 Which family_{DAT}\ husband_{TOP}\ wife_{NOM}\ bento_{ACC}\ made-Q\ park_{LOC}\ friend_{DAT}\
 伝えました。
 tsutaemashita.
 told.

“The husband told a friend in the park which family his wife made a lunch for.”

c. 夫は¥ 妻が¥ どの家族に¥ 弁当を¥ 作ったと¥ 公園で¥ 友人に¥
 Otto-wa\ tsuma-ga\ dono kazoku-ni\ bento-o\ tsukatta-to\ kouen-de\ yuujin-ni\
 Husband_{TOP}\ wife_{NOM}\ which family_{DAT}\ bento_{ACC}\ made-COMP\ park_{LOC}\ friend_{DAT}\
 伝えましたか。
 tsutaemashita-ka.
 told-Q.

d. どの家族に¥ 夫は¥ 妻が¥ 弁当を¥ 作ったと¥ 公園で¥ 友人に¥
 Dono kazoku-ni\ otto-wa\ tsuma-ga\ bento-o\ tsukatta-to\ kouen-de\ yuujin-ni\
 Which family_{DAT}\ husband_{TOP}\ wife_{NOM}\ bento_{ACC}\ made-COMP\ park_{LOC}\ friend_{DAT}\

伝えましたか。
tsutaemashita-ka.
told-Q.

“Did the husband tell a friend which family the wife made a lunch for in the park?”

Q: この文章によると…

According to this sentence…

A. 奥さんがお弁当を作った

B. 友達がお弁当を作った

A. The wife made a bento

B. The friend made a bento

6. a. 教授は¥父親が¥ どの学生に¥ 就職を¥ 探したか¥ 食堂で¥

Kyoju-wa\ chichioya-ga\ dono gakusei-ni\ shushoku-o\ sagashita-ka\ shokudou-de

Professor_{TOP}\ father_{NOM}\ which student_{DAT}\ job_{ACC}\ looked for-Q\ cafeteria_{LOC}

学部長に¥説明した。

gakubucho-ni\ setsumeishita.

administrator_{DAT}\ explained.

- b. どの学生に¥ 教授は¥ 父親が¥ 就職を¥ 探したか¥ 食堂で¥

Dono gakusei-ni\ kyoju-wa\ chichioya-ga\ shushoku-o\ sagashita-ka\ shokudou-de

Which student_{DAT}\ professor_{TOP}\ father_{NOM}\ job_{ACC}\ looked for-Q\ cafeteria_{LOC}

学部長に¥説明した。

gakubucho-ni\ setsumeishita.

administrator_{DAT}\ explained.

“The professor explained to the administrator in the cafeteria which student the father found a job for.”

- c. 教授は¥ 父親が¥ どの学生に¥ 就職を¥ 探したと¥ 食堂で¥

Kyoju-wa\ chichioya-ga\ dono gakusei-ni\ shushoku-o\ sagashita-to\ shokudou-de

Professor_{TOP}\ father_{NOM}\ which student_{DAT}\ job_{ACC}\ looked for-COMP\ cafeteria_{LOC}

学部長に¥説明したか。

gakubucho-ni\ setsumeishita-ka.

administrator_{DAT}\ explained-Q.

- d. どの学生に¥ 教授は¥ 父親が¥ 就職を¥ 探したと¥ 食堂で¥

Dono gakusei-ni\ kyoju-wa\ chichioya-ga\ shushoku-o\ sagashita-to\ shokudou-de

Which student_{DAT}\ professor_{TOP}\ father_{NOM}\ job_{ACC}\ looked for-COMP\ cafeteria_{LOC}

学部長に¥説明したか。

gakubucho-ni\ setsumeishita-ka.

administrator_{DAT}\ explained-Q.

“Did the professor explain to the administrator in the cafeteria which student the father found a job for?”

Q: この文章によると…

According to this sentence…

A. 学生が就職を探した

B. 父親が就職を探した

A. The student looked for a job

B. The father looked for a job

7. a. 祖父は¥おじさんが¥ どの少年に¥ 大きな魚を¥ 釣ったか¥ 公園で¥

Sofu-wa\ ojisan-ga\ dono shonen-ni\ ookina sakana-o\ tsutta-ka\ kouen-de\

Grandfather_{TOP}\ uncle_{NOM}\ which boy_{DAT}\ big fish_{ACC}\

caught-Q\ park_{LOC}\

祖母に¥知らせました。

sobo-ni\ shrasemashita.

- grandmother_{DAT}\ told.
- b. どの少年に¥祖父は¥おじさんが¥大きな魚を¥釣ったか¥公園で¥
 Dono shonen-ni\ sofū-wa\ ojisan-ga\ ookina sakana-o\ tsutta-ka\ kouen-de\
 Which boy_{DAT}\ grandfather_{TOP}\ uncle_{NOM}\ big fish_{ACC}\ caught-Q\ park_{LOC}\
 祖母に¥知らせました。
 sobo-ni\ shrasemashita.
 grandmother_{DAT}\ told.
 “The grandfather told the grandmother which boy the uncle caught a big fish in the park for.”
- c. 祖父は¥おじさんが¥どの少年に¥大きな魚を¥釣ったと¥公園で¥
 Sofu-wa\ ojisan-ga\ dono shonen-ni\ ookina sakana-o\ tsutta-to\ kouen-de\
 Grandfather_{TOP}\ uncle_{NOM}\ which boy_{DAT}\ big fish_{ACC}\ caught-COMP\ park_{LOC}\
 祖母に¥知らせましたか。
 sobo-ni\ shrasemashita-ka.
 grandmother_{DAT}\ told-Q
- d. どの少年に¥祖父は¥おじさんが¥大きな魚を¥釣ったと¥公園で¥
 Dono shonen-ni\ sofū-wa\ ojisan-ga\ ookina sakana-o\ tsutta-to\ kouen-de\
 Which boy_{DAT}\ grandfather_{TOP}\ uncle_{NOM}\ big fish_{ACC}\ caught-COMP\ park_{LOC}\
 祖母に¥知らせましたか。
 sobo-ni\ shrasemashita-ka.
 grandmother_{DAT}\ told-Q
 “Did the grandfather tell the grandmother which boy the uncle caught a big fish for in the park?”

Q: この文章によると…

According to this sentence...

- A. おじさんが魚を釣った B. 祖父は魚を釣った
 A. The uncle caught a fish B. The grandfather caught a fish
8. a. 社長は¥政治家が¥どの女性に¥タクシーを¥呼んだか¥電話で¥ 市長に¥
 Shacho-wa\ seijika-ga\ dono jyosei-ni\ takushii-o\ yonda-ka\ denwa-de\ shicho-ni\
 Boss_{TOP}\ politician_{NOM}\ which woman_{DAT}\ taxi_{ACC}\ called-Q\ phone-by\ mayor_{DAT}\
 報告しました。
 hokokushimashita.
 alerted.
- b. どの女性に¥社長は¥政治家が¥タクシーを¥呼んだか¥電話で¥市長に¥
 Dono jyosei-ni\ shacho-wa\ seijika-ga\ takushii-o\ yonda-ka\ denwa-de\ shicho-ni\
 Which woman_{DAT}\ boss_{TOP}\ politician_{NOM}\ taxi_{ACC}\ called-Q\ phone-by\ mayor_{DAT}\
 報告しました。
 hokokushimashita.
 alerted.
 “The boss alerted the mayor by phone which woman the politician called a taxi for.”
- c. 社長は¥政治家が¥どの女性に¥タクシーを¥呼んだと¥電話で¥市長に¥
 Shacho-wa\ seijika-ga\ dono jyosei-ni\ takushii-o\ yonda-to\ denwa-de\ shicho-ni\
 Boss_{TOP}\ politician_{NOM}\ which woman_{DAT}\ taxi_{ACC}\ called-COMP\ phone-by\ mayor_{DAT}\
 報告しましたか。
 hokokushimashita-ka.

alerted-Q.

- d. どの女性に¥社長は¥政治家が¥タクシーを¥呼んだと¥電話で¥市長に¥
Dono jyosei-ni\ shacho-wa\ seijika-ga\ takushii-o\ yonda-to\ denwa-de\ shicho-ni
Which woman_{DAT}\ boss_{TOP}\ politician_{NOM}\ taxi_{ACC}\ called-COMP\ phone-by\ mayor_{DAT}
報告しましたか。

hokokushimashita-ka.

alerted-Q.

“Did the boss alert the mayor by phone which woman the politician called a taxi for?”

Q: この文章によると…

According to this sentence…

A. 市長がタクシーを呼んだ

B. 政治家がタクシーを呼んだ

A. The mayor called a taxi

B. The politician called a taxi

9. a. 先生は¥ 留学生が¥ どの園児に¥ 折り紙を¥折ったか¥
Sensei-wa\ ryugakusei-ga\ dono enji-ni\ origami-o\ otta-ka\
Teacher_{TOP}\ exchange student_{NOM}\ which child_{DAT}\ origami_{ACC}\ folded-Q\
教室で¥母親に¥教えました。

kyoushitsu-de\ hahaoya-ni\ oshiemashita.

classroom_{LOC}\ mother_{DAT}\ told.

- b. どの園児に¥先生は¥ 留学生が¥ 折り紙を¥折ったか¥
Dono enji-ni\ sensei-wa\ ryugakusei-ga\ origami-o\ otta-ka\
Which child_{DAT}\ teacher_{TOP}\ exchange student_{NOM}\ origami_{ACC}\ folded-Q\
教室で¥母親に¥教えました。

kyoushitsu-de\ hahaoya-ni\ oshiemashita.

classroom_{LOC}\ mother_{DAT}\ told.

“The teacher told the mother which child the exchange student folded origami for in the classroom.”

- c. 先生は¥留学生が¥ どの園児に¥ 折り紙を¥折ったと¥
Sensei-wa\ ryugakusei-ga\ dono enji-ni\ origami-o\ otta-to\
Teacher_{TOP}\ exchange student_{NOM}\ which child_{DAT}\ origami_{ACC}\ folded-COMP\
教室で¥母親に¥教えましたか。

kyoushitsu-de\ hahaoya-ni\ oshiemashita-ka.

classroom_{LOC}\ mother_{DAT}\ told-Q.

- d. どの園児に¥先生は¥ 留学生が¥ 折り紙を¥折ったと¥
Dono enji-ni\ sensei-wa\ ryugakusei-ga\ origami-o\ otta-to\
Which child_{DAT}\ teacher_{TOP}\ exchange student_{NOM}\ origami_{ACC}\ folded-COMP\
教室で¥母親に¥教えましたか。

kyoushitsu-de\ hahaoya-ni\ oshiemashita-ka.

classroom_{LOC}\ mother_{DAT}\ told-Q.

“Did the teacher tell the mother which child the exchange student folded origami for in the classroom?”

Q: この文章によると…

According to this sentence…

A. 留学生が折り紙を折った

B. 先生が折り紙を折った

A. The exchange student folded origami

B. The teacher folded origami

10. a. マネージャーは¥歌手が¥どの女優に¥ 花を¥あげたか¥電話で¥
 Maneijaa-wa\ kashu-ga\ dono jyoyu-ni\ hana-o\ ageta-ka\ denwa-de\
 Manager_{TOP}\ singer_{NOM}\ which actress_{DAT}\ flower_{ACC}\ gave-Q\ phone-by
 記者に¥伝えました。
 kisha-ni\ tsutaemashita.
 journalist_{DAT}\ told
- b. どの女優に¥マネージャーは¥歌手が¥花を¥あげたか¥電話で¥
 Dono jyoyu-ni\ maneijaa-wa\ kashu-ga\ hana-o\ ageta-ka\ denwa-de\
 Which actress_{DAT}\ manager_{TOP}\ singer_{NOM}\ flower_{ACC}\ gave-Q\ phone-by
 記者に¥伝えました。
 kisha-ni\ tsutaemashita.
 journalist_{DAT}\ told
- “The manager told the journalist by phone which actress the singer gave flowers to.”
- c. マネージャーは¥歌手が¥どの女優に¥花を¥あげたと¥電話で¥
 Maneijaa-wa\ kashu-ga\ dono jyoyu-ni\ hana-o\ ageta-to\ denwa-de\
 Manager_{TOP}\ singer_{NOM}\ which actress_{DAT}\ flower_{ACC}\ gave-COMP\ phone-by
 記者に¥伝えましたか。
 kisha-ni\ tsutaemashita-ka.
 journalist_{DAT}\ told-Q
- d. どの女優に¥マネージャーは¥歌手が¥花を¥あげたと¥電話で¥
 Dono jyoyu-ni\ maneijaa-wa\ kashu-ga\ hana-o\ ageta-to\ denwa-de\
 Which actress_{DAT}\ manager_{TOP}\ singer_{NOM}\ flower_{ACC}\ gave-COMP\ phone-by
 記者に¥伝えましたか。
 kisha-ni\ tsutaemashita-ka.
 journalist_{DAT}\ told-Q.
- “Did the manager tell the journalist by phone which actress the singer gave flowers to?”
- Q: この文章によると…
 According to this sentence…
- | | |
|--------------------------------|----------------------------|
| A. 記者は花をあげた | B. 歌手が花をあげた |
| A. The journalist gave flowers | B. The singer gave flowers |
11. a. 記者は¥ 学生が¥どの政治家に¥ 手紙を¥書いたか¥教室で¥
 Kisha-wa\ gakusei-ga\ dono seijika-ni\ tegami-o\ kaita-ka\ kyoshitsu-de\
 Journalist_{TOP}\ student_{NOM}\ which politician_{DAT}\ letter_{ACC}\ wrote-Q\ clasrrom_{LOC}
 教授に¥言いました。
 kyoju-ni\ iimashita.
 professor_{DAT}\ said.
- b. どの政治家に¥記者は¥ 学生が¥手紙を¥書いたか¥教室で¥
 Dono seijika-ni\ kisha-wa\ gakusei-ga\ tegami-o\ kaita-ka\ kyoshitsu-de\
 Which politician_{DAT}\ journalist_{TOP}\ student_{NOM}\ letter_{ACC}\ wrote-Q\ clasrrom_{LOC}
 教授に¥言いました。
 kyoju-ni\ iimashita.
 professor_{DAT}\ said.
- “The journalist told the professor in the classroom which politician the student wrote a letter to.”
- c. 記者は¥学生が¥ どの政治がに¥ 手紙を¥書いたと¥教室で¥

Kisha-wa\ gakusei-ga\ dono seijika-ni\ tegami-o\ kaita-to\ kyoshitsu-de\
 Journalist_{TOP}\ student_{NOM}\ which politician_{DAT}\ letter_{ACC}\ wrote-COMP\ classroom_{LOC}
 教授に¥言いましたか。

kyoju-ni\ iimashita-ka.

professor_{DAT}\ said-Q.

- d. どの政治家に¥記者は¥ 学生が¥手紙を¥書いたと¥教室で¥

Dono seijika-ni\ kisha-wa\ gakusei-ga\ tegami-o\ kaita-to\ kyoshitsu-de\
 Which politician_{DAT}\ journalist_{TOP}\ student_{NOM}\ letter_{ACC}\ wrote-COMP\ classroom_{LOC}
 教授に¥言いましたか。

kyoju-ni\ iimashita-ka.

professor_{DAT}\ said-Q.

“Did the journalist tell the professor in the classroom which politician the student wrote a letter to?”

Q: この文章によると…

According to this sentence…

A. 学生が手紙を書いた

B. 政治が手紙を書いた

A. The student wrote a letter

B. The politician wrote a letter

12. a. 店長は¥コックが¥どの客に¥野菜を¥ 炒めたか¥台所で¥

Tencho-wa\ kokku-ga\ dono kyaku-ni\ yasai-o\ itameta-ka\ daidokoro-de\
 Owner_{TOP}\ cook_{NOM}\ which guest_{DAT}\ vegetables_{ACC}\ stir fried-Q\ kitchen_{LOC}
 ウエイトレスに¥知らせました。

ueitoresu-ni\ shirasemashita.

waitress_{DAT}\ told.

- b. どの客に¥ 店長は¥ コックが¥野菜を¥ 炒めたか¥台所で¥

Dono kyaku-ni\ tencho-wa\ kokku-ga\ yasai-o\ itameta-ka\ daidokoro-de\
 Which guest_{DAT}\ owner_{TOP}\ cook_{NOM}\ vegetables_{ACC}\ stir fried-Q\ kitchen_{LOC}
 ウエイトレスに¥知らせました。

ueitoresu-ni\ shirasemashita.

waitress_{DAT}\ told.

“The owner told the waitress which guest the cook stir fried vegetables for in the kitchen”

- c. 店長は¥ コックが¥どの客に¥ 野菜を¥ 炒めたと¥ 台所で¥

Tencho-wa\ kokku-ga\ dono kyaku-ni\ yasai-o\ itameta-to\ daidokoro-de\
 Owner_{TOP}\ cook_{NOM}\ which guest_{DAT}\ vegetables_{ACC}\ stir fried-COMP\ kitchen_{LOC}
 ウエイトレスに¥知らせましたか。

ueitoresu-ni\ shirasemashita-ka.

waitress_{DAT}\ told-Q.

- d. どの客に¥ 店長は¥ コックが¥野菜を¥ 炒めたと¥ 台所で¥

Dono kyaku-ni\ tencho-wa\ kokku-ga\ yasai-o\ itameta-to\ daidokoro-de\
 Which guest_{DAT}\ owner_{TOP}\ cook_{NOM}\ vegetables_{ACC}\ stir fried-COMP\ kitchen_{LOC}
 ウエイトレスに¥知らせましたか。

ueitoresu-ni\ shirasemashita-ka.

waitress_{DAT}\ told-Q.

“Did the owner tell the waitress which guest the cook stir fried vegetables for in the kitchen?”

Q: この文章によると…

According to this sentence...

A. 店長が野菜を炒めた

B. コックが野菜を炒めた

A. The owner stir fried vegetables

B. The cook stir fried vegetables

13. a. 母親は¥ 父親が¥ どの子に¥おもちゃを¥買ったか¥お店で¥友達に¥
Hahaoya-wa\ chichoya-ga\ dono ko-ni\ omocha-o\ katta-ka\ omise-de\ tomodachi-ni\
Mother_{TOP}\ father_{NOM}\ which child_{DAT}\ toy_{ACC}\ bought-Q\ store_{LOC}\ friend_{DAT}\
伝えました。

tsutaemashita.

told.

- b. どの子に¥母親は¥ 父親が¥おもちゃを¥買ったか¥お店で¥友達に¥
Dono ko-ni\ hahaoya-wa\ chichoya-ga\ omocha-o\ katta-ka\ omise-de\ tomodachi-ni\
Which child_{DAT}\ mother_{TOP}\ father_{NOM}\ toy_{ACC}\ bought-Q\ store_{LOC}\ friend_{DAT}\
伝えました。

tsutaemashita.

told.

“The mother told the friend which child the father bought a toy for in the store.”

- c. 母親は¥ 父親が¥どの子に¥おもちゃを¥買ったと¥お店で¥友達に¥
Hahaoya-wa\ chichoya-ga\ dono ko-ni\ omocha-o\ katta-to\ omise-de\ tomodachi-ni\
Mother_{TOP}\ father_{NOM}\ which child_{DAT}\ toy_{ACC}\ bought-COMP\ store_{LOC}\ friend_{DAT}\
伝えましたか。

tsutaemashita-ka.

told-Q.

- d. どの子に¥母親は¥ 父親が¥おもちゃを¥買ったと¥お店で¥友達に¥
Dono ko-ni\ hahaoya-wa\ chichoya-ga\ omocha-o\ katta-to\ omise-de\ tomodachi-ni\
Which child_{DAT}\ mother_{TOP}\ father_{NOM}\ toy_{ACC}\ bought-COMP\ store_{LOC}\ friend_{DAT}\
伝えましたか。

tsutaemashita-ka.

told-Q.

“Did the mother tell a friend which child the father bought a toy for in the store?”

Q: この文章によると…

According to this sentence...

A. 父親がおもちゃを買った

B. 母親がおもちゃを買った

A. The father bought a toy

B. The mother bought a toy

14. a. 校長は¥ 生徒が¥ どの少女に¥ 絵本を¥読んだか¥ 教室で¥
Kocho-wa\ seito-ga\ dono sensei-ni\ shosetsu-o\ yonda-ka\ kyoshitsu-de\
Principal_{TOP}\ student_{NOM}\ which teacher_{DAT}\ novel_{ACC}\ read-Q\ classroom_{LOC}\
母親に¥教えました。

hahaoya-ni\ hokoku shimashita.

mother_{DAT}\ alerted.

- b. どの少女に¥ 校長は¥ 生徒が¥ 絵本を¥読んだか¥教室で¥
Dono sensei-ni\ kocho-wa\ seito-ga\ shosetsu-o\ yonda-ka\ kyoshitsu-de\
Which teacher_{DAT}\ principal_{TOP}\ student_{NOM}\ novel_{ACC}\ read-Q\ classroom_{LOC}\
母親に¥教えました。

hahaoya-ni\ hokoku shimashita.

mother_{DAT}\ alerted.

“The principal told the mother in the classroom which teacher the student read a novel to.”

- c. 校長は¥生徒が¥ どの少女に¥ 絵本を¥読んだと¥教室で¥
Kocho-wa\ seito-ga\ dono sensei-ni\ shosetsu-o\ yonda-to\ kyoshitsu-de\
Principal_{TOP}\ student_{NOM}\ which teacher_{DAT}\ novel_{ACC}\ read-COMP\ classroom_{LOC}\
母親に¥教えましたか。

hahaoya-ni\ hokoku shimashita-ka.

mother_{DAT}\ alerted-Q.

- d. どの少女に¥校長は¥ 生徒が¥絵本を¥ 読んだと¥教室で¥
Dono sensei-ni\ kocho-wa\ seito-ga\ shosetsu-o\ yonda-to\ kyoshitsu-de\
Which teacher_{DAT}\ principal_{TOP}\ student_{NOM}\ novel_{ACC}\ read-COMP\ classroom_{LOC}\
母親に¥教えましたか。

hahaoya-ni\ hokoku shimashita-ka.

mother_{DAT}\ alerted-Q.

“Did the principal tell the mother in the classroom which teacher the student read a novel to?”

Q: この文章によると…

According to this sentence…

A. 母親が本を読んだ

B. 学生が本を読んだ

A. The mother read a book

B. The student read a book

15. a. ディレクターは¥タレントが¥どの女の子に¥ギターを¥弾いたか¥楽屋で¥
Direkutaa-wa\ tarento-ga\ dono onanoko-ni\ gitaa-o\ hiita-ka\ gakuya-de
Director_{TOP}\ talent-nom\ which girl_{DAT}\ guitar_{ACC}\ played-Q\ studio_{LOC}\
記者に¥説明した。

kisha-ni\ setsumeishita.

journalist_{DAT}\ explained

- b. どの女の子に¥ディレクターは¥タレントが¥ギターを¥弾いたか¥楽屋で¥
Dono onanoko-ni\ direkutaa-wa\ tarento-ga\ gitaa-o\ hiita-ka\ gakuya-de
Which girl_{DAT}\ director_{TOP}\ talent-nom\ guitar_{ACC}\ played-Q\ studio_{LOC}\
記者に¥説明した。

kisha-ni\ setsumeishita.

journalist_{DAT}\ explained

“The director explained to the journalist which girl the talent played the guitar for in the studio.”

- c. ディレクターは¥タレントが¥どの女の子に¥ギターを¥弾いたと¥楽屋で¥
Direkutaa-wa\ tarento-ga\ dono onanoko-ni\ gitaa-o\ hiita-to\ gakuya-de
Director_{TOP}\ talent-nom\ which girl_{DAT}\ guitar_{ACC}\ played-COMP\ studio_{LOC}\
記者に¥説明したか。

kisha-ni\ setsumeishita-ka.

journalist_{DAT}\ explained-Q.

- d. どの女の子に¥ディレクターは¥タレントが¥ギターを¥弾いたと¥楽屋で¥
Dono onanoko-ni\ direkutaa-wa\ tarento-ga\ gitaa-o\ hiita-to\ gakuya-de
Which girl_{DAT}\ director_{TOP}\ talent-nom\ guitar_{ACC}\ played-COMP\ studio_{LOC}\

記者に説明したか。

kisha-ni\ setsumeishita-ka.

journalist_{DAT}\ explained-Q.

“Did the director explain to the journalist which girl the talent played the guitar for in the studio?”

Q: この文章によると…

According to this sentence…

A. タレントがギターを弾いた

B. 女の子がギターを弾いた

A. The talent played a guitar

B. The girl played the guitar

16. a. 校長は 父親が どの男の子に お菓子を買ったか公園で

Koucho-wa\ chichioya-ga\ dono otokonoko-ni\ okashi-o\ katta-ka\ kouen-de\

Principal_{TOP}\ father_{NOM}\ which boy_{DAT}\ snack_{ACC}\ bought-Q\ park_{LOC}\

先生に知らせました。

sensei-ni\ shirasemashita.

teacher_{DAT}\ told.

- b. どの男の子に校長は父親がお菓子を買ったか公園で

Dono otokonoko-ni\ koucho-wa\ chichioya-ga\ okashi-o\ katta-ka\ kouen-de\

Which boy_{DAT}\ principal_{TOP}\ father_{NOM}\ snack_{ACC}\ bought-Q\ park_{LOC}\

先生に知らせました。

sensei-ni\ shirasemashita.

teacher_{DAT}\ told.

“The principal told the teacher which boy the father bought a snack for at the park.”

- c. 校長は 父親が どの男の子に お菓子を買ったと公園で

Koucho-wa\ chichioya-ga\ dono otokonoko-ni\ okashi-o\ katta-to\ kouen-de\

Principal_{TOP}\ father_{NOM}\ which boy_{DAT}\ snack_{ACC}\ bought-COMP\ park_{LOC}\

先生に知らせましたか。

sensei-ni\ shirasemashita-ka.

teacher_{DAT}\ told-Q.

- d. どの男の子に校長は父親がお菓子を買ったと公園で

Dono otokonoko-ni\ koucho-wa\ chichioya-ga\ okashi-o\ katta-to\ kouen-de\

Which boy_{DAT}\ principal_{TOP}\ father_{NOM}\ snack_{ACC}\ bought-COMP\ park_{LOC}\

先生に知らせましたか。

sensei-ni\ shirasemashita-ka.

teacher_{DAT}\ told-Q.

“Did the principal tell the teacher which boy the father bought a sack for at the park?”

Q: この文章によると…

According to this sentence…

A. 先生がお菓子を買った

B. 父親がお菓子を買った

A. The teacher bought a snack

B. The father bought a snack

17. a. 校長先生はミュージシャンがどの女の子に歌を歌ったか食堂で母親に説明しました。

- b. どの女の子に校長先生はミュージシャンが歌を歌ったか食堂で母親に説明しました。

“The principal explained to the mother in the cafeteria which girl the musician sang a

song to.”

c. 校長先生はミュージシャンがどの女の子に歌を歌ったと食堂で母親に説明しましたか。

d. どの女の子に校長先生はミュージシャンが歌を歌ったと食堂で母親に説明しましたか。

“Did the principal explain to the mother in the cafeteria which girl the musician sang a song to?”

Q: この文章によると…

According to this sentence…

A. ミュージシャンが歌を歌った

B. 女の子が歌を歌った

A. The musician sang a song

B. The girl sang a song

18. a. 研究者は教授がどの教え子に研究テーマを選んだか教室で学長に説明した。

b. どの教え子に研究者は教授が研究テーマを選んだか教室で学長に説明した。

“The researcher explained to the dean in the classroom which advisee the professor picked a topic for.”

c. 研究者は教授がどの教え子に研究テーマを選んだと教室で学長に説明したか。

d. どの教え子に研究者は教授が研究テーマを選んだと教室で学長に説明したか。

“Did the researcher explain to the dean in the classroom which advisee the professor picked a topic for?”

Q: この文章によると…

According to this sentence…

A. 教え子が研究テーマを選んだ

B. 教授が研究テーマを選んだ

A. The advisee picked a topic

B. The teacher picked a topic

19. a. 監督は選手がどのファンにボールをあげたか体育館でマネージャーに言いました。

b. どのファンに監督は選手がボールをあげたか体育館でマネージャーに言いました。

“The coach told the manager in the gym which fan the player gave a ball to.”

c. 監督は選手がどのファンにボールをあげたと体育館でマネージャーに言いましたか。

d. 監督は選手がどのファンにボールをあげたと体育館でマネージャーに言いましたか。

“Did the coach tell the manager in the gym which fan the player gave a ball to?”

Q: この文章によると…

According to this sentence…

A. 選手がボールをあげた

B. 監督がボールをあげた

A. The player gave a ball

B. The coach gave a ball

20. a. 看護婦は\おじさんが\どの老人に\タバコを\あげたか\病室で\医者に\報告した。
b. どの老人に\看護婦は\おじさんが\タバコを\あげたか\病室で\医者に\報告した。
“The nurse alerted the doctor which old man the uncle gave tobacco to.”
c. 看護婦は\おじさんが\どの老人に\タバコを\あげたと\病室で\医者に\報告したか。
d. どの老人に\看護婦は\おじさんが\タバコを\あげたと\病室で\医者に\報告したか。
“Did the nurse alert the doctor wich old man the uncle gave tobacco to?”

Q: この文章によると…

According to this sentence...

A. 看護婦はタバコをあげた

B. おじさんはタバコをあげた

A. The nurse gave tobacco

B. The uncle gave tobacco

21. a. 祖母は\祖父が\どの孫に\おもちゃを\買ったか\居間で\父親に\教えました。
b. どの孫に\祖母は\祖父が\おもちゃを\買ったか\居間で\父親に\教えました。
“The grandmother told the father which grandchild the grandfather bought a toy for.”
c. 祖母は\祖父が\どの孫に\おもちゃを\買ったと\居間で\父親に\教えましたか。
d. どの孫に\祖母は\祖父が\おもちゃを\買ったと\居間で\父親に\教えましたか。
“Did the grandmother tell the father which grandchild the grandfather bought a toy for?”

Q: この文章によると…

According to this sentence...

A. 祖父がおもちゃを買った

B. 父親がおもちゃを買った

A. The grandfather bought a toy

B. The father bought a toy

22. a. タレントは\音楽家が\どのピアニストに\花を\買ったか\廊下で\歌手に\言いました。
b. どのピアニストに\タレントは\音楽家が\花を\買ったか\廊下で\歌手に\言いました。
“The talent told the singer which pianist the musician bought flowers for”
c. タレントは\音楽家が\どのピアニストに\花を\買ったと\廊下で\歌手に\言いましたか。
d. どのピアニストに\タレントは\音楽家が\花を\買ったと\廊下で\歌手に\言いましたか。
“Did the talent tell the singer which pianist the musician bought flowers for?”

Q: この文章によると…

According to this sentence...

A. タレントが花を買った

B. 音楽家が花を買った

A. The talent bought flowers

B. The musician bought flowers

23. a. スチュワーデスは\おじさんが\どの乗客に\ドアを\開けたか\通路で\機長に\報告した。
b. どの乗客に\スチュワーデスは\おじさんが\ドアを\開けたか\通路で\機長に\報告した。

“The stewardess alerted the captain in the aisle which passenger the old man opened the door for.”

c. スチュワーデスは\おじさんが\どの乗客に\ドアを\開けたと\通路で\機長に\報告したか。

d. どの乗客に\スチュワーデスは\おじさんが\ドアを\開けたと\通路で\機長に\報告したか。

“Did the stewardess alert the captain in the aisle which passenger the old man opened the door for?”

Q: この文章によると…

According to this sentence...

A. おじさんがドアを開けた

B. 機長がドアを開けた

A. The old man opened the door

B. The captain opened the door

24. a. 担当者は\編集長が\どの作家に\アシスタントを\雇ったか\会議で\出版社に\教えました。

b. どの作家に\担当者は\編集長が\アシスタントを\雇ったか\会議で\出版社に\教えました。

“The case manager told the publisher at the meeting which writer the publisher hired an assistant for.”

c. 担当者は\編集長が\どの作家に\アシスタントを\雇ったと\会議で\出版社に\教えましたか。

d. どの作家に\担当者は\編集長が\アシスタントを\雇ったと\会議で\出版社に\教えましたか。

“Did the case manager tell the publisher at the meeting which writer the publisher hired an assistant for?”

Q: この文章によると…

According to this sentence...

A. 作家がアシスタントを雇った

B. 編集長がアシスタントを雇った

A. The writer hired the assistant

B. The publisher hired the assistant

25. a. 担任は\司書が\どの新入生に\漫画本を\勧めたか\廊下で\校長先生に\言いました。

b. どの新入生に\担任は\司書が\漫画本を\勧めたか\廊下で\校長先生に\言いました。

“The homeroom teacher told the principal in the hallway which new student the librarian recommended the manga to.”

c. 担任は\司書が\どの新入生に\漫画本を\勧めたと\廊下で\校長先生に\言いましたか。

d. どの新入生に\担任は\司書が\漫画本を\勧めたと\廊下で\校長先生に\言いましたか。

“Did the homeroom teacher tell the principal in the hallway which new student the librarian recommended the manga to?”

Q: この文章によると…

According to this sentence...

A. 司書が漫画を勧めた

B. 担任が漫画を勧めた

A. The librarian recommended the manga

B. The teacher recommended the

26. a. 母親は\お手伝いさんが\どの子供に\お弁当を\渡したか\台所で\父親に\言いました。

b. どの子供に\母親は\お手伝いさんが\お弁当を\渡したか\台所で\父親に\言いました。

“The mother told the father in the kitchen which child the maid gave a bento to.”

c. 母親は\お手伝いさんが\どの子供に\お弁当を\渡したと\台所で\父親に\言いましたか。

d. どの子供に\母親は\お手伝いさんが\お弁当を\渡したと\台所で\父親に\言いましたか。

“Did the mother tell the father in the kitchen which child the maid gave a bento to?”

Q: この文章によると…

According to this sentence...

A. 父親が弁当を渡した

B. お手伝いさんが弁当を渡した

A. The father gave the bento

B. The maid gave the bento

27. a. 学部長は\助手が\どの教授に\実験を\見せたか\教室で\大学院生に\説明しました。

b. どの教授に\学部長は\助手が\実験を\見せたか\教室で\大学院生に\説明しました。

“The chair explained to the grad student which professor the assistant showed the experiment to.”

c. 学部長は\助手が\どの教授に\実験を\見せたと\教室で\大学院生に\説明しましたか。

d. どの教授に\学部長は\助手が\実験を\見せたと\教室で\大学院生に\説明しましたか。

“Did the chair explain to the grad student which professor the assistant showed the experiment to?”

Q: この文章によると…

According to this sentence...

A. 助手は実験を見せた

B. 大学院生が実験を見せた

A. The assistant showed the experiment

B. The grad student showed the

28. a. 祖母は\孫が\どの友達に\絵本を\もらったか\母親に\玄関で\教えました。

b. どの友達に\祖母は\孫が\絵本を\もらったか\母親に\玄関で\教えました。

“The grandmother explained to the mother in the entry way which friend the grandchild got a book from.”

- c. 祖母は\孫が\どの友達に\絵本を\もらったと\母親に\玄関で\教えましたか。
d. どの友達に\祖母は\孫が\絵本を\もらったと\母親に\玄関で\教えましたか。
“Did the grandmother explain to the mother in the entry way which friend the grandchild got a book from?”

Q: この文章によると…

According to this sentence...

A. 友達が本をもらった

B. 孫が本をもらった

A. The friend received a book

B. The grandchild received a book

29. a. 先生は\留学生が\どの園児に\着物を\着せたか\教室で\園長に\知らせました。
b. どの園児に\先生は\留学生が\着物を\着せたか\教室で\園長に\知らせました。
“The teacher told the principal in the classroom which kindergartener the exchange student dressed in kimono.”
c. 先生は\留学生が\どの園児に\着物を\着せたと\教室で\園長に\知らせましたか。
d. どの園児に\先生は\留学生が\着物を\着せたと\教室で\園長に\知らせましたか。
“Did the teacher tell the principal in the classroom which kindergartener the exchange student dressed in kimono?”

Q: この文章によると…

According to this sentence...

A. 園児が着物を着た

B. 留学生が着物を着た

A. The kindergartener wore kimono

B. The exchange student wore

kimono

30. a. 妻は\夫が\どの友人に\子犬を\預けたか\電話で\祖母に\言いました。
b. どの友人に\妻は\夫が\子犬を\預けたか\電話で\祖母に\言いました。
“The wife told the grandmother on the phone which friend the husband left the puppy with.”
c. 妻は\夫が\どの友人に\子犬を\預けたと\電話で\祖母に\言いましたか。
d. どの友人に\妻は\夫が\子犬を\預けたと\電話で\祖母に\言いましたか。
“Did the wife tell the grandmother on the phone which friend the husband left the puppy with?”

Q: この文章によると…

According to this sentence...

A. 祖母が子犬を預けた

B. 夫が子犬を預けた

A. The assistant showed the experiment

B. The grad student showed the

experiment

31. a. 店長は\店員が\どの子供に\ゲームを\見せたか\店内で\母親に\知らせました。
b. どの子供に\店長は\店員が\ゲームを\見せたか\店内で\母親に\知らせました。
“The store manager explained to the mother in the store which child the employee showed the game to.”
c. 店長は\店員が\どの子供に\ゲームを\見せたと\店内で\母親に\知らせましたか。
d. どの子供に\店長は\店員が\ゲームを\見せたと\店内で\母親に\知らせましたか。

“Did the store manager explain to the mother in the store which child the employee showed the game to?”

Q: この文章によると…

According to this sentence...

A. 店員がゲームを見せた

B. 子供がゲームを見せた

A. The employee showed the game

B. The child showed the game

32. a. 運転手は\警官が\どの犯人に\警察官バッジを\見せたか\車内で\刑事に\伝えました。

b. どの犯人に\運転手は\警官が\警察官バッジを\見せたか\車内で\刑事に\伝えました。

“The driver told the detective which criminal the police officer showed his badge to in the car.”

c. 運転手は\警官が\どの犯人に\警察官バッジを\見せたか\車内で\刑事に\伝えましたか。

d. どの犯人に\運転手は\警官が\警察官バッジを\見せたか\車内で\刑事に\伝えましたか。

“Did the driver tell the detective which criminal the police officer showed his badge to in the car?”

Q: この文章によると…

According to this sentence...

A. 運転手がバッジを見せた

B. 警官がバッジを見せた

A. The driver showed his badge

B. The policeman showed his badge.

III. Relative Clause Attachment

A. Disambiguated sentences.

Sentences are adapted from Miyao and Omaki (2005). The first version forces high attachment, and the second version forces low attachment.

1. a. 机の上に¥乗せていた¥先生のペンが¥ゆかに¥落とした。

Tsukue-no ue-ni\ noseteita\ sensei-no pen-ga\ yuka-ni\ otoshita.

Desk_{GEN} top_{LOC}\ placed\ teacher_{GEN} pen_{NOM}\ floor_{LOC}\ fell.

“The pen of the teacher that was placed on the desk fell to the floor.”

b. 生徒と¥話していた¥先生のペンが¥ゆかに¥落とした。

Seito-to\ hanashiteita\ sensei-no pen-ga\ yuka-ni\ otoshita.

Student_{WITH}\ talked\ teacher_{GEN} pen_{NOM}\ floor_{LOC}\ fell.

“The pen of the teacher that was talking to a student fell to the floor.”

Q: この文章によると…

According to this sentence...

A. ペンが落とした

B. 鉛筆が落とした

A. The pen fell

B. The pencil fell

2. a. かべに¥かかっていた¥父親の時計は¥とても¥古かった。
 Kabe-ni\ kakatteita\ chichioya-no tokei-wa\ totemo\ furukatta.
 Wall_{LOC}\ hung\ father_{GEN} watch_{TOP}\ very old
 “The watch of the father that was hung on the wall was very old.”
 b. 医者として¥働いている¥父親の時計は¥とても¥古かった。
 Isha toshite\ hataraiteru\ chichioya-no tokei-wa\ totemo\ furukatta.
 Doctor as\ worked\ father_{GEN} watch_{TOP}\ very old
 “The watch of the father that worked as a doctor was very old.”
 Q: この文章によると…
 According to this sentence…
 A. 絵が古かった B. 時計が古かった
 A. The picture was old B. The watch was old
3. a. 道に¥落ちていた¥子供の帽子が¥とても¥汚れていた。
 Michi-ni\ ochiteita\ kodomo-no boushi-ga\ totemo\ yogoreteita.
 Street_{LOC}\ fell\ child_{GEN} hat_{NOM}\ very\ dirty.
 “The hat of the child that fell in the street was very dirty.”
 b. 道で¥遊んでいた¥子供の帽子が¥とても¥汚れていた。
 Michi-de\ asondeita\ kodomo-no boushi-ga\ totemo\ yogoreteita.
 Street_{LOC}\ played\ child_{GEN} hat_{NOM}\ very\ dirty.
 “The hat of the child that played in the street was very dirty.”
 Q: この文章によると…
 According to this sentence…
 A. 帽子が汚れた B. 子供が汚れた
 A. The hat was dirty B. The child was dirty
4. a. 椅子に¥乗せていた¥作者の眼鏡が¥さっき¥割れた。
 Isu-ni\ noseteita\ sakusha-no megane-ga\ sakki\ wareta.
 Chair_{LOC}\ placed\ writer_{GEN} glasses_{NOM}\ before\ broken.
 “The glasses of the writer that were placed on the chair were previously broken.”
 b. 長い諸説を¥書いた¥作者の眼鏡が¥さっき¥割れた。
 Nagai shosetsu-o\ kaita\ sakusha-no megane-ga\ sakki\ wareta.
 Long novel_{ACC}\ wrote\ writer_{GEN} glasses_{NOM}\ before\ broken.
 “The glasses of the writer that wrote a long novel were previously broken.”
 Q: この文章によると…
 According to this sentence…
 A. カップが割れた B. メガネが割れた
 A. The cup broke B. The glasses broke
5. a. 玄関に¥置いてあった¥男の子の靴が¥なぜか¥見当たらなかった。
 Genkan-ni\ oiteatta\ otokonoko-no kutsu-ga\ nazeka\ miataranakatta.
 Entryway_{LOC}\ placed\ boy_{GEN} shoes_{NOM}\ somehow\ disappeared
 “The shoes of the boy that were placed in the entryway somehow disappeared.”
 b. 公園で¥遊んでいた¥男の子の靴が¥なぜか¥見当たらなかった。
 Kouen-de\ asondeita\ otokonoko-no kutsu-ga\ nazeka\ miataranakatta.
 Park_{LOC}\ played\ boy_{GEN} shoes_{NOM}\ somehow\ disappeared
 “The shoes of the boy that played in the park somehow disappeared.”

Q: この文章によると…

According to this sentence...

A. 靴が見当たらなかった

B. 傘が見当たらなかった

A. The shoes disappeared

B. The umbrella disappeared

6. a. カバンに¥入っていた¥友達のかぎが¥さっき¥なくなった。

Kaban-ni\ haitteita\ tomodachi-no kagi-ga\ sakki\ nakunatta.

Bag_{LOC}\ placed\ friend_{GEN} key_{NOM}\ previously\ lost.

“The keys of the friend that were placed in the bag were previously lost.”

- b. 急いで¥走っていた¥友達のかぎが¥さっき¥なくなった。

Isoide\ hashiteita\ tomodachi-no kagi-ga\ sakki\ nakunatta.

Quickly\ running\ friend_{GEN} key_{NOM}\ previously\ lost.

“The keys of the friend that was running quickly were previously lost.”

Q: この文章によると…

According to this sentence...

A. メガネがなくなった

B. かぎがなくなった

A. The glasses were lost

B. The keys were lost

7. a. 机の上に¥置いてあった¥弟の教科書が¥ゆかに¥落ちた。

Tsukue-no ue-ni\ oiteatta\ ototo-no kyoukasho-ga\ yuka-ni\ ochita.

Desk_{GEN} top_{LOC}\ placed\ brother_{GEN} textbook_{NOM}\ floor_{LOC}\ fell.

“The textbook of the brother that was placed on the desk fell to the floor.”

- b. ベッドで¥寝ていた¥弟の教科書が¥ゆかに¥落ちた。

Beddo-de\ neteita\ ototo-no kyoukasho-ga\ yuka-ni\ ochita.

Bed_{LOC}\ sleeping\ brother_{GEN} textbook_{NOM}\ floor_{LOC}\ fell.

“The textbook of the brother that was sleeping on the bed fell to the floor.”

Q: この文章によると…

According to this sentence...

A. 教科書が落ちた

B. 小説が落ちた

A. The textbook fell

B. The novel fell

8. a. 学校の¥隣にある¥弁護士の家は¥すごく¥大きかった。

Gakko-no\ tonari-ni aru\ bengoshi-no ie-wa\ sugoku\ ookikatta.

School_{GEN}\ next to\ lawyer_{GEN} house_{TOP}\ extremely\ large.

“The house of the lawyer that was next to the school was extremely large.”

- b. とても¥忙しかった¥弁護士の家は¥すごく¥広かった。

Totemo\ isogashikatta\ bengoshi-no ie-wa\ sugoku\ ookikatta.

Very\ busy.past\ lawyer_{GEN} house_{TOP}\ extremely\ large.

“The house of the lawyer that was very busy was extremely large.”

Q: この文章によると…

According to this sentence...

A. 家が狭かった

B. 家が広かった

A. The house was small

B. The house was big

9. a. バスに¥乗っていた¥学校の先生が¥子供に¥挨拶した。

Basu-ni\ notteita\ gakkou-no sensei-ga\ kodomo-ni\ aisatsushita.

Bus-on\ boarded\ school_{GEN} teacher_{NOM}\ child-to greeted.

“The teacher of the school that was on the bus greeted the child.”

- b. 公園の¥近くにある¥学校の先生が¥子供に¥挨拶した。
 Kouen-no\ chikaku-ni aru\ gakkou-no sensei-ga\ kodomo-ni\ aisatsushita.
 Park_{GEN}\ close to\ school_{GEN} teacher_{NOM}\ child-to greeted.
 “The teacher of the school that was close to the park greeted the child.”

Q: この文章によると…

According to this sentence…

- A. 先生が子供に挨拶した B. 先生が母親に挨拶した
 A. The teacher greeted the child B. The teacher greeted the parent

10. a. お菓子が¥大好き¥本屋の店員が¥突然に¥笑っていた。
 Okashi-ga\ daisuki\ honya-no tenin-ga\ totsuzen-ni\ waratteita.
 Snacks_{NOM}\ liked\ bookstore_{GEN} employee_{NOM}\ suddenly\ laughed.
 “The employee of the bookstore that liked snacks laughed suddenly.”
 b. 駅の隣に¥ある¥本屋の店員が¥突然に¥笑っていた。
 Eki-no\ tonari-ni aru\ honya-no tenin-ga\ totsuzen-ni\ waratteita.
 Station_{GEN}\ next to\ bookstore_{GEN} employee_{NOM}\ suddenly\ laughed.
 “The employee of the bookstore that was next to the station laughed suddenly.”

Q: この文章によると…

According to this sentence…

- A. 店員が泣き出した B. 店員が笑った
 A. The employee cried B. The employee laughed

11. a. アメリカに¥いる¥旅館の社長が¥手紙を¥送った。
 Amerika-ni\ iru²³\ ryokan-no shacho-ga\ tegami-o\ okutta.
 America_{LOC}\ is\ inn_{GEN} owner_{NOM}\ letter_{ACC}\ sent.
 “The owner of the ryokan who is in America sent a letter.”
 b. ワイキキに¥ある¥旅館の社長が¥手紙を¥送った。
 Waikiki-ni\ be\ ryokan-no shacho-ga\ tegami-o\ okutta.
 Waikiki_{LOC}\ is\ inn_{GEN} owner_{NOM}\ letter_{ACC}\ sent.
 “The owner of the ryokan who is in America sent a letter.”

Q: この文章によると…

According to this sentence…

- A. 手紙を送った B. メールをを買った
 A. A letter was sent B. An email was sent

12. a. 空を¥見ていた¥学校の先生が¥とても¥静かだった。
 Sora-o\ miteita\ gakkou-no sensei-ga\ totemo\ shizuka datta.
 Sky_{ACC}\ looking\ school_{GEN} teacher_{NOM}\ very\ quiet.
 “The teacher of the school that was looking at the sky was very quiet.”
 b. 山の¥近くにあった¥学校の先生が¥とても¥静かだった。
 Yama-no\ chikaku-ni atta\ gakkou-no sensei-ga\ totemo\ shizuka datta.
 Mountain_{GEN}\ close to\ school_{GEN} teacher_{NOM}\ very\ quiet.
 “The teacher of the school that was next to the mountain was very quiet.”

²³ This sentence is ambiguous in English, but not in Japanese. Japanese has two verbs, *iru* and *aru*, that both translate as ‘be’ in English. In Japanese, however, *iru* is only used with animate subjects, and *aru* is only used for inanimate subjects. Using *iru* in this sentence means that the relative clause has to attach to the animate NP, *shacho*.

Q: この文章によると…

According to this sentence...

- A. 先生が話していた B. 先生が静かだった
A. The teacher was talking B. The teacher was quiet

13. a. 静かに¥泳いでいた¥小池の金魚が¥大きく¥口を¥開けた。
Shizuka-ni\ oyoideita\ koike-no kingyo-ga\ ookiku\ kuchi-o\ aketa.
Quietly\ swimming\ small pond_{GEN} goldfish_{NOM}\ big\ mouth_{ACC}\ opened.
“The goldfish of the small pond that was quietly swimming opened his mouth wide.”
b. 家の¥近くにある¥小池の金魚が¥大きく¥口を¥開けた。
Ie-no\ chikaku-ni aru\ koike-no kingyo-ga\ ookiku\ kuchi-o\ aketa.
House_{GEN} \ near\ small pond_{GEN} goldfish_{NOM}\ big\ mouth_{ACC}\ opened.
“The goldfish of the small pond that was next to the house opened his mouth wide.”

Q: この文章によると…

According to this sentence...

- A. 金魚は口を開けた B. 金魚がえさを食べた
A. The goldfish opened his mouth B. The goldfish ate food

14. a. えさを¥食べていた¥動物園の蛇が¥大きな¥ネズミを¥食べた。
Esa-o\ tabeteita\ doubutsuen-no hebi-ga\ ookina\ nezumi-o\ tabeta.
Food_{ACC}\ was eating\ zoo_{GEN} snake_{NOM}\ big\ rats_{ACC}\ ate.
“The snake of the zoo that was eating food ate a big rat.”
b. 東京に¥建てていた¥動物園の蛇が¥大きな¥ネズミを¥食べた。
Tokyo-ni\ tateteita\ doubutsuen-no hebi-ga\ ookina\ nezumi-o\ tabeta.
Tokyo_{LOC}\ constructed\ zoo_{GEN} snake_{NOM}\ big\ rats_{ACC}\ ate.
“The snake of the zoo that was built in Tokyo ate a big rat.”

Q: この文章によると…

According to this sentence...

- A. 蛇が庭にいた B. 蛇がネズミを食べた
A. The snake was in the garden B. The snake ate a rat

15. a. とても¥太っていた¥車の運転手が¥ご飯を¥食べていた。
Totemo\ futotteita\ kuruma-no untenshu-ga\ gohan-o\ tabeteita.
Very\ fat\ car_{GEN} driver_{NOM}\ food_{ACC}\ was eating.
“The driver of the car that was very fat was eating a meal.”
b. 道に¥止まっていた¥車の運転手が¥ご飯を¥食べていた。
Michi-ni\ tomatteita\ kuruma-no untenshu-ga\ gohan-o\ tabeteita.
Street_{LOC}\ stopped\ car_{GEN} driver_{NOM}\ food_{ACC}\ was eating.
“The driver of the car that was stopped in the street was eating a meal.”

Q: この文章によると…

According to this sentence...

- A. 運転手がご飯を食べた B. 運転手がコーヒーを飲んだ
A. The driver ate a meal B. The driver drank coffee

16. a. お腹が¥ついた¥公園の子犬が¥急いで¥逃げ出した。
Onaka-ga\ tsuita\ kouen-no koinu-ga\ isoide\ nigedashita.
Stomach_{NOM}\ empty\ park_{GEN} puppy_{NOM}\ quickly\ ran away.
“The puppy of the park that was hungry quickly ran away.”

- b. 毎日開いていた公園の子犬が急いで逃げ出した。
 Mainichi\ aiteita\ kouen-no koinu-ga\ isoide\ nighedashita.
 Every day\ was open\ park_{GEN} puppy_{NOM}\ quickly\ ran away.
 “The puppy of the park that was open every day quickly ran away.”

Q: この文章によると…

According to this sentence…

- | | |
|---------------------------|-----------------------|
| A. 子犬が寝ていた | B. 子犬が逃げ出した |
| A. The puppy was sleeping | B. The puppy ran away |

B. Fully ambiguous sentences (adapted from Cuetos and Mitchell, 1999)

- 誰かがバルコニーにいる女優の召使いを見た。
 Someone saw the servant of the actress who was on the balcony.
 この文章によると…
 According to this sentence…

A. 女優がバルコニーにいた	B. 召使いがバルコニーにいた
A. The actress was on the balcony	B. The servant was on the balcony
- 太郎はドイツにいた先生の友達と出会った。
 Taro met the friend of the teacher who was in Germany.
 この文章によると…
 According to this sentence…

A. 先生はドイツにいた	B. 友達はドイツにいた
A. The teacher was in Germany	B. The friend was in Germany
- 警察署が手紙を送り出した男性の息子を見た。
 The police officer was watching the son of the man who was mailing a letter.
 この文章によると…
 According to this sentence…

A. 男性が手紙を送り出した	B. 息子が手紙を送り出した
A. The boy sent a letter	B. The son sent a letter
- 学生がフランスにいた先生の友達に手紙を書いた。
 The student wrote a letter to the friend of the teacher who was in France.
 この文章によると…
 According to this sentence…

A. 友達はフランスにいた	B. 先生はフランスにいた
A. The friend was in France	B. The teacher was in France
- 花子が隣に住んでいた歌手の友達にCDをあげた。
 Hanako gave a CD to the friend of the singer who was living next door.
 この文章によると…
 According to this sentence…

A. 歌手は隣に住んでいた	B. 友達が隣に住んでいた
A. The singer lived next door	B. The friend lived next door
- おばあちゃんがベッドにいた赤ちゃんのお姉さんを見た。
 The grandmother was looking at the older sister of the baby that was on the bed.

この文章によると...

According to this sentence...

A. お姉さんはベッドにいた

B. 赤ちゃんはベッドにいた

A. The older sister was on the bed

B. The baby was on the bed

7. 記者は殺された大統領の奥さんにについて記事を書いた。

The journalist wrote about the wife of the president who was killed.

この文章によると...

According to this sentence...

A. 大統領は殺された

B. 奥さんは殺された

A. The president was killed

B. The wife was killed

8. 女の子がギターを弾ける友達のお兄さんが好きだ。

The girl likes the brother of the friend who plays guitar.

この文章によると...

According to this sentence...

A. お兄さんはギターを弾ける

B. 友達はギターを弾けた

A. The older brother played the guitar

B. The friend played the guitar

9. 男の子が電車を待っていた友達のお母さんを見た。

The boy saw the mother of the friend who was waiting for a train.

この文章によると...

According to this sentence...

A. 友達は電車を待っていた

B. お母さんは電車を待っていた

A. The friend was waiting for a train

B. The mother was waiting for the train

10. おばさんはコーヒーを飲んでいた店員の弟に挨拶した。

The old woman greeted the brother of the shopkeeper who was drinking coffee.

この文章によると...

According to this sentence...

A. 弟はコーヒーを飲んでいて

B. 店員はコーヒーを飲んでいて

A. The brother was drinking coffee

B. The shopkeeper was drinking coffee

11. 写真家が庭に遊んでいた女の子の妹の写真を撮った。

The photographer took a picture of the sister of the girl who was playing in the garden.

この文章によると...

According to this sentence...

A. 妹は庭に遊んでいた

B. 女の子は庭に遊んでいた

A. The sister was playing in the garden

B. The girl was playing in the park

12. 男の子たちが公園にいた女の子の子犬をいじめた。

The boys teased the puppy of the girl who was in the park.

この文章によると...

According to this sentence...

A. 子犬はいじめられた

B. 女の子はいじめられた

A. The puppy was being teased

B. The girl was being teased

13. おばあさんが公園に散歩していた医者の子を見た。

The old woman saw the son of the doctor who was walking in the park.

この文章によると...

According to this sentence...

- A. 医者は公園に散歩した B. 息子は公園に散歩した
 A. The doctor was walking in the park B. The son was walking in the park
14. 看護婦が入院した記者の妹に薬をあげた。
 The nurse gave the medicine to the sister of the journalist who was in the hospital.
 この文章によると...
- According to this sentence...
- A. 妹は入院した B. 記者は入院した
 A. The sister was in the hospital B. The journalist was in the hospital
15. 記者がお金を盗んだ市長の運転手にについて記事を書いた。
 The journalist wrote about the driver of the mayor who was in an accident.
 この文章によると...
- According to this sentence...
- A. 市長はお金を盗んだ B. 運転手はお金を盗んだ
 A. The mayor stole the money B. The driver stole the money
16. 医者が家にいた奥さんの友達を見た。
 The doctor saw the friend of the wife who was at home.
 この文章によると...
- According to this sentence...
- A. 友達は家にいた B. 奥さんは家にいた
 A. The friend was at home B. The wife was at home
17. 男の子が公園にいた友達の妹と遊んでいた。
 The boy was playing with the sister of the friend who was at the park.
 この文章によると...
- According to this sentence...
- A. 友達は公園にいた B. 妹は公園にいた
 A. The friend was in the park B. The sister was in the park
18. おばあちゃんがパリに旅行した市長の奥さんを見た。
 The grandmother saw the wife of the mayor who travelled to Paris.
 この文章によると...
- According to this sentence...
- A. 奥さんはパリに旅行した B. 市長はパリに旅行した
 A. The wife went to Paris B. The mayor went to Paris

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