CROSSLINGUISTIC INFLUENCE OF LOANWORDS ON JAPANESE PARTICLE PROCESSING: EVIDENCE FROM JAPANESE LANGUAGE LEARNERS

by

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Studies have proposed that the spreading activation (SA) theory (Colins, & Loftus, 1975) can explain the nature of L1 and L2 predictive sentence processing (e.g., Kaan, 2014). Research on processing in L2 English has found that word information triggers learners’ semantically-driven predictive sentence processing (e.g., Hopp, 2015); however, to the best of my knowledge, few studies have been conducted in L2 Japanese. Additionally, what triggers L2 predictive sentence processing is yet to be fully discovered. Research has demonstrated that L1 English learners of Japanese as a foreign language (JFL) show cognate-like effects when English-based loanwords are used as primes in a cross-linguistic priming experiment if these loanwords retain their original English phonology and semantics (e.g., Allen, & Conklin, 2013), which suggests the existence of inter-lingual SA effects when learners process these loanwords. The purpose of the present study is to investigate whether SA effects induced by a loanword in a sentence can also facilitate learners’ predictive sentence processing.

The present study investigated whether a loanword embedded in a sentence facilitates JFL learners’ syntactic prediction. Twenty-six L1 English learners of JFL and eight native Japanese speakers participated in the study. In the experiment, they were presented with 20 fillers and 32 Japanese right-dislocated sentences ending with a noun followed by a postpositional particle. Among these 32 sentences, half of them had a loanword preceding a particle, whereas the other half had a non-loanword preceding a particle. At the end of each
sentence, the subjects were asked to make an acceptability judgment, and reaction time (RT) was recorded for statistical analysis.

The results indicated that loanwords had a statistically significant facilitative influence on predicting their adjacent postpositional particle in sentences. This was especially true for the locative particle *ni* and the comitative particle *to*. Although the loanword-induced cross-linguistic SA effects on particle processing were inhomogeneous, the study sufficiently supported the hypothesis that loanwords can facilitate learners’ predictive processing of subsequent particles, simultaneously providing evidence for the existence of SA effects in L2-Japanese sentence processing.
CHAPTER 1 INTRODUCTION

Introduction

Since the theory of spreading activation (SA) was proposed by Collins and Loftus (1975), researchers in various fields have tested its validity and generalizability. Especially researchers in psycholinguistics were eager to examine the generalizability of the theory in diverse linguistic domains of word production (e.g., Dell, 1986; Roelofs, 1992) and word recognition (e.g., Seidenberg, 1985; Tanenhaus, Flanigan, & Seidenberg, 1980) in the first language (L1). Furthermore, studies have proposed that the theory can explain more peripheral domains of a language processing, such as the nature of L1 predictive sentence processing (e.g., Altmann, & Mirkovic, 2009; Kimball, 1975): an ability to anticipate upcoming words in a sentence based on semantic and syntactic information of words being processed. Regarding this topic in a Japanese study, Kamide, Almann and Haywood (2003) found that native Japanese speakers can use case markers to anticipate their following linguistic items.

Recently, psycholinguists and applied linguists have become interested in SA in the framework of second language (L2) processing. They have proposed that the SA effects are also present in L2 processing, and many language processing models were developed based on the SA theory (e.g., RH M, BIA and BIA+). This was also true in the sentence prediction skill in L2 (Kaan, 2014). Research on processing in L2 English has found that word information triggers the learners’ syntactic and semantic predictive sentence processing (e.g., Dussias, Kroff, Tamargo, & Gerfen, 2013). However, Mitsugi and Macwhinney (2016) found that learners of JFL failed to use case markers to predict following lexical items in a sentence, which was inconsistent with previous findings of an L1 study (Kamide, Almann, & Haywood 2003). Although the study
found that learners may not be able to use case information to predictively process a sentence, they may be able to use other types of lexical cues to process a sentence predictively. However, the nature of L2 predictive sentence processing is less discussed in research, yet exploring it is important to understand the nature of L2 sentence processing in general. Further studies examining what triggers predictive sentence processing is important to understand the nature of L2 predictive sentence processing, and test the generalizability of the SA theory.

It is known that native English learners show cognate-like effects when English-based loanwords are used as primes in a cross-linguistic priming experiment (e.g., Allen, & Conklin, 2013), which suggests an existence of inter-lingual SA effects. A question proposed here is whether the SA effects triggered by a loanword in a sentence can also facilitate learners’ syntactic sentence prediction.

The present study hypothesized that English learners of JFL would benefit from a sentence-embedded loanword in terms of syntactic sentence prediction; especially the syntactic prediction of a grammatical particle preceded by the loanword in a Japanese sentence. The rationale is based on the following theory and model: the theory of spreading activation (Collins, & Loftus, 1975), and the non-selective language activation model (e.g., Dijkstra, & Van Heuven, 2002). The former theory proposes that when a person is presented with a word, other lexical items related to the word are co-activated together in his or her lexical network. Hence, it generally results in faster retrieval of words relevant to a stimulus word in priming and word association experiments. The latter model proposes that the nature of learners’ and bilingual language processing is language non-selective: L2 is activated to some extent when using L1, and the opposite is also possible. The present study aimed to test the hypothesis with a grammatical acceptability judgment task.
Purpose of the Study and Research Questions

The present study aimed to investigate whether SA effects triggered by a loanword in a sentence can also facilitate learners’ predictive sentence processing. More specifically, learners were tested whether they could process a sentence-imbedded grammatical particle faster when it was preceded by a loanword than when it was preceded by a non-loanword. Through the experiment, the present study investigated the following research questions.

Research Questions

(1) Do English-based loanwords influence learners’ particle processing?

(2) Is the loanword effect universal across four particles (locative, comitative, nominative and accusative)?

(3) Is the effect unique to learners, or shared with native Japanese speakers?

Thesis Overview

This chapter provided an overview of studies related to predictive sentence processing, and the research questions were proposed. In the following chapter, research on Japanese particles, theories and models of L1/L2 language processing, and studies on loanwords will be addressed. Subsequently, Chapter Three presents the methodology and statistic procedure performed in the present study. In Chapter Four, results of the statistical analysis of behavioral data obtained in the experiment will be explained. In addition, interpretation of the results will be discussed in this chapter. Lastly, limitations of the present study, and suggestions for future research will be discussed in Chapter Five.
CHAPTER 2 RESEARCH BACKGROUND

Japanese Grammatical Particles

Since the present study focuses on Japanese grammatical particles, we will introduce some basic functions of these particles we use in the study.

In contrast to the basic word order in English, also known as subject–verb–object (SVO), Japanese canonical word order is subject–object–verb (SOV). Moreover, the thematic role of each word in a Japanese sentence is determined by a grammatical particle attached to the word. Since word order itself is not a critical factor that determines the thematic role of a word in Japanese, word order can be scrambled relatively freely as long as particles identify the thematic role of each word. For example, a typical Japanese SOV sentence *Tanakasan ga koen ni itta* (“Mr. Tanaka went to the park”) can also be expressed as an SVO sentence *Tanakasan ga itta koen ni* or even a VSO sentence *Itta Tanakasan go koen ni*. Note that a word and a particle attached to it form a unit, and it is these units that are moved around by scrambling. Therefore, *Tanakasan* (“Mr. Tanaka”) and the nominative marker *ga* always move together. The nominative particle is attached to the subject of the sentence to assign the thematic role of agent to the word. Therefore, although the word order was scrambled, we know that *Tanakasan* is always the agent of the action of going to the park. Similarly, the locative particle *ni* indicates a goal, a destination, or a point of arrival or contact and is always attached to *koen* (“park”) in the sentence. The function of the particle is similar to the English preposition “to” as in “go to” Particles important in the present study are listed in Table 1.
Table 1: Particles used in the present study

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<thead>
<tr>
<th>Particle</th>
<th>Function</th>
<th>English equivalent</th>
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<tr>
<td>ga</td>
<td>The particle marks topic/subject</td>
<td>N/A</td>
</tr>
<tr>
<td>ni</td>
<td>The particle indicates direction of motion.</td>
<td>&quot;to&quot; as in &quot;go to&quot;</td>
</tr>
<tr>
<td>to</td>
<td>The particle indicates comitative relations.</td>
<td>&quot;with&quot; as in &quot;with her&quot;</td>
</tr>
<tr>
<td>o</td>
<td>The particle marks object.</td>
<td>N/A</td>
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</table>

The particle *to* is the comitative particle whose function is similar to the English prepositional “with,” as in *neko to asobu* (“play with a cat”). The particle *o* is the accusative particle which is also known as the object marker indicating the object in a sentence, such as *neko o kau* (“have a cat”). The locative *ni*, nominative *ga*, and accusative *o* are case particles, and comitative *to* is a postposition by definition; however, we will refer to all of them as “particles” in this study for convenience.

**Experiments Involving Particle Processing**

Unlike English, which assigns thematic roles to words in a sentence based on its strict SVO word order, in Japanese, syntactic information conveyed by verbs and particles determine the thematic roles of words. The particles are attached to words to indicate the thematic roles of words in the sentences. Although Japanese particles are well studied in theoretical linguistics, its psychological perspective remains in its infancy (Hashimoto, Yokoyama, & Kawashima, 2014).

In the field of event-related potential (ERP) research, Hashimoto et al. (2014) examined how brains react differently to three particles: nominative *ga*, accusative *o*, and dative particle *ni*. In their fMRI experiment, native Japanese participants performed a particle judgment task and phonological judgment task. In both tasks, a pseudo-noun “X” followed by a single Japanese
character (Hiragana) was presented visually on a screen. The former task required subjects to make a response if “X” was followed by either of the three particles: *ga* (nominative), *o* (accusative), or *ni* (dative). In addition to the experimental items, filler items in which “X” was followed by a single Hiragana *u*, *nu*, *bu*, *za*, *ki*, and *ro*, were used in the study. The phonological judgment task, which served as the control, required participants to judge whether the character followed by “X” had the vowel sound [u] at the end. Because the items using both tasks were all the same and participants were instructed to focus only on the phonology of the postpositional character in the latter task, activation associated with particle processing could be determined by subtracting phonological judgment task-affiliated activation from particle judgment task-affiliated activation. The neuroimaging study revealed that, although nominative and accusative particles significantly activated left middle frontal gyrus (MFG) and inferior frontal gyrus (IFG), which was consistent with a previous study (Kim et al., 2007), greater activation was observed in the right IFG for the dative particle. Therefore, the study confirmed that different particles are processed in different parts of the brain. In addition to the functional brain imaging, behavioral data also confirmed significant differences in reaction times across three particles—in particular, RTs for *ga* were significantly shorter than the other two particles.

**Learners' Nature of Lexical Access and Retrieval**

Before discussing how language learners process Japanese particles in a sentence, it is important to discuss lexical activation models for monolinguals and language learners. Researchers have revealed some properties of learners’ language processing, especially in lexical access and retrieval (e.g., Costa, 2005; Costa & Santesteban, 2004; Dijkstra, 2005). Models of language processing for bilinguals and language learners have been discussed in articles (e.g., Dijkstra & van Heuven, 2002; Kroll & Stewart, 1994). These models base their structures and
assumptions largely on the so-called monolingual lexical activation model. In monolingual studies of lexical access, lexical priming had a significant impact upon retrieval of a target word, showing either facilitative or inhibitory effects depending on the task used in the experiments. Although the results tend to be task-specific, their underlying mechanisms can largely be explained using the theory of spreading activation (SA), originally proposed in cognitive psychology (Collins & Loftus, 1975).

**Theory of Spreading Activation**

SA presupposes that words and concepts in the human mind are represented as a myriad of nodes scattered through a mental network where related nodes are tied together with one another. Nodes with similar phonology, orthography, and semantics are closely located in the system, as well as words tied with collocative or colligative relations. When a person is presented with a word phonologically or visually, both the concept and word node increase their activation levels, and the nodes spread their activation further to adjacent nodes, basically resulting in facilitative effects upon accessing a node close to the activated node. On the other hand, inhibitory or null effects for nodes are located far from the stimulated node upon retrieving these words. Figure 1 shows a set of nodes assumed in the theory of SA. In the example, a node representing the noun “Table” connects to other nodes which are related to it in terms of meaning or form (e.g., Legs, Eat, Chair, Couch, and Tennis). The connection between the node “Table” and its closely connected nodes implies that these words can be co-activated by the SA effect when the single node “Table” is activated. In contrast, the model assumes no mutual SA effect if two nodes are located apart from each other (e.g., “Table” and “Soccer”).
Evidence of Spreading Activation in Lexical Processing

Evidence for SA as a basis of language processing is provided in a series of word association and priming experiments. Van Orden (1987) examined the effect of priming on word retrieval in an experiment in which monolingual students were presented with a category name (e.g., part of a mountain). They were then asked to make a “yes” response if the following target word presented was semantically related to the category name (e.g., PEAK) or a “no” response if the subsequent target word was conceptually unrelated to the category name (e.g., BOIL). The researcher found that participants tended to make errors when homophones (e.g., PEEK) of category-related words (e.g., PEAK) were presented. The result confirmed that a stimulated word in one’s mental lexicon further sends activation to adjacent phonologically related words.

Spreading Activation in Monolinguals and Multilingual Population

Studies have also confirmed that SA effect is not limited to monolingual lexical processing. According to studies that investigated cross-linguistic interference effects, words
from different languages are susceptible to co-activation in many domains, such as reading, listening, and speaking (e.g., Costa, 2005; Spivey & Marian, 1999; Van Heuven, Dijkstra, & Grainger, 1998). One such famous phenomenon is cognate effects. In linguistics, cognates are a set of words with the same etymological origin; thus, most of them share phonology, semantics, and orthography. Cognate effects have been widely observed in experiments when the target words (e.g., English word “explosion”) are presented following primes (e.g., Spanish word “explosión”), irrespective of the format of presentation; they generally result in facilitative effects when accessing the target word (Costa, Caramazza, & Sebastian, 2000).

Concerning bilinguals and language learners, if all words irrespective of languages are stored in a single lexicon, a stimulated word not only awakes similar lexical items in the language being used, but also co-activates words in other languages (Fitzpatrick & Izura, 2011). In this view, the language co-activation is suggested to be independent of structural similarities among the languages involved in the process (Kroll, Bobb, & Hoshino, 2014). However, it is also possible that each mental lexicon represents only one language. To account for the underlying mechanism of bilinguals’ and learners’ lexical access, several models of lexical processing have been proposed. Of these, two of the dominant models are the Revised Hierarchical Model (RHM) presented by Kroll and Stewart (1994) and the Bilingual Interactive Activation (BIA) model maintained by Dijkstra et al. (1998), which was later revised as BIA+ (Dijkstra & van Heuven, 2002). The following two sections briefly review some critical aspects of the two models to facilitate understanding of the nature of bilinguals’ and learners’ lexical processing.
The Revised Hierarchical Model

RHM was originally proposed to account for different reaction time latencies observed in word translation tasks performed by early bilinguals, late bilinguals, and language learners. The model consists of three levels of representations: L1 lexical representations, L2 lexical representations, and concepts. RHM hypothesized that each lexical representation is connected by a unidirectional lexical link where lexical information can be sent from one to another, and a bidirectional conceptual link stretched from each lexical item to its concept (see Figure 2). The model also claims that the link from L1 to L2 lexical items is fragile, especially for infrequent vocabulary; similarly, the link that connects an L2 word to a concept is weaker than other links, which accounts for the longer reaction latencies for forward translation tasks (i.e., L1 to L2) than backward translation tasks (i.e., L2 to L1) and the fact that conceptual access is relatively effortless for L1 words compared to L2 vocabulary. According to the model, translating words from L1 to L2 is more time-consuming than the opposite direction because the direct link from L1 to L2 is so weak that the translation has to be achieved via its concept. The model also claims that frequent vocabulary for both L1 and L2 has a steady link between two lexical items; therefore, direct access from L1 to L2 using the lexical link is possible, resulting in shorter time latencies required to complete the translation process than infrequent words. Ample evidence has been provided in the literature (e.g., de Groot & Poot, 1997) for the effects of word frequency and the subject’s language proficiency on translation task performance. Regarding the bilingual language representation, the model maintains that lexical items of different languages are stored in separate systems, implying that the process is language selective. In other words, bilinguals can inhibit activation level of languages other than the one being used.
Although the model provided an interesting view of L2 language processing, few studies have supported the view of selective language activation. In fact, non-selective language activation was confirmed in a spoken word recognition task (Kroll, Bobb, & Wodniecka, 2006), a spoken word production task (Marian & Spivey, 2003), and a visual word recognition task (Dijkstra, 2005). As far as the separate storage for two languages in bilinguals’ and learners’ lexicon is concerned, it is challenging for RHM to explain the mechanism behind parallel language activation. In their review, Kroll et al. (2011) explained that RHM also failed to account for qualitative differences between word production and word recognition. Indeed, there is a series of studies addressing contrasts between lexical production (e.g., Costa, 2005; Kroll et al., 2006) and lexical recognition (e.g., Carreiras, Armstrong, Perea, & Frost, 2014). Regarding lexical recognition, there is ample evidence that suggests bottom-up parallel language activations of word form information (i.e., orthography and phonology) involve all acquired and learned languages. As for lexical production, experiments have supported the view of top-down parallel
language activations driven by semantic similarity among lexical items, irrespective of language dissimilarities such as orthography or phonology. It is challenging to explain the differences between the mechanism of word production and that of word recognition within the RHM framework. Hence, the model does not adequately represent bilingual lexical processing.

Another model, known as BIA+, appears to accommodate the problems discussed above in a relatively simple way.

**Bilingual Interactive Activation and BIA+ Model**

**BIA Model**

The BIA model developed from a computational model of monolingual lexical processing, which was originally proposed as a word recognition model known as the Interactive Activation (IA) model (McClelland & Rumelhart, 1981). The architecture of the original IA model consists of three hierarchical levels—namely, feature detectors (first level), letter detectors (second level), and word detectors (third level), where a different process takes place at each stage, yet the consequence of the process in each subordinate phase facilitates or inhibits the subsequent lexical processing. In addition to facilitating nodes, the model predicts activated nodes to suppress the activity of other nodes. Suppose the word “TIME” is presented as a stimulus; the model claims that it is first decomposed into feature nodes that make up letters (i.e., strokes of letters), such as “/”, “|”, “\”, and “-”. Corresponding feature nodes are activated in the feature detector stage and send activation or inhibition further to the next level. Based on the strength of the facilitated feature nodes in the first level, letter detectors assemble letters with the activated segments. Here, letters that possess the submitted feature nodes are activated. As with the previous stage, the letter detectors pass the activated letter nodes (e.g., “A”, “N”, “M” “T”, and “I”) to the third stage, where the target word is lexically realized. At the word detector level, lexical items that contain the
facilitated letter nodes increment their activation level, or otherwise inhibit their activity levels, and the most activated node (e.g., TIME) will be recognized as the target lexical item represented by the stimulus (see Figure 3).

Although its architecture and functions are analogous to the AI model, the BIA model consists of four layers of nodes representing progressive levels of language processing: feature level, letter level, word level, and language node level. Each node is interconnected with nodes in subsequent and subordinate levels, capable of not only sending excitatory effects, but also mutually inhibiting activations. Furthermore, the BIA model has a word node (lexicon) for each language and a language node that sends top-down inhibition to a word node of the other lexicon. Suppose one of the language nodes (e.g., English) is activated based on a context. It sends inhibitory signals to the subordinate word node of the other language (e.g., Dutch), suppressing further activation of lexical items in the language so that one can focus on the target language being used (see Figure 4).
BIA+ Model

Although BIA model provided a foundation for theory-based analysis of cross-linguistic lexical activation, Dijkstra and van Heuven (2002) argued that the model can only explain the process of purely orthographic stimuli and cannot account for other types of input information. To account for bilingual lexical access more generally, they proposed the BIA+ model. One of the major revisions made to the model was the inclusion of nodes for phonological representations, along with a node for semantics to account for stimuli other than visual inputs and top-down language activation driven by semantics (see Figure 5). The semantic level activation triggers a SA that is analogous to monolingual language processing, sending excitatory and inhibitory signals to nodes in lexical levels. Moreover, although the BIA model consists of separate L1 and L2 representations, the BIA+ proposes that L1 and L2 are both stored
in a single system. The model also accounts for different linguistic strategies that people adopt based on the contextual information, which is expressed as task schema. Unlike RHM, which supports the language-selective activation, the BIA+ is based on the language non-selective language activation model.

Figure 5: The BIA+ Model (adapted from Dijkstra & van Heuven, 2002)

**BIA+ in Different Script Languages**

Dijkstra and van Heuven (2002) focused primarily on a population whose languages share the same orthography, whereas recent experiments have supported the view that BIA+ can account for different-script bilinguals and learners. Nakayama et al. (2012) investigated the phonological priming effect in Japanese-English learners. Participants in the study were asked to make lexical decisions on English target words (e.g., GUIDE [gáid]) that were visually primed by any of the following three types of English loanwords in Japanese: (1) a phonologically related translation equivalent (e.g., gaido [gaido] “guide”), (2) a phonological neighbor (e.g., saido [sáido] “side”),
or (3) unrelated (e.g., *kooru* [koːru] “call”). The results revealed significant priming effects in phonological neighbor primes and phonologically related translation equivalent primes. However, the effect for the latter primes was modulated by target word frequency and participants’ L2 proficiency. Nevertheless, the study implies that even bilinguals and learners with different scripts store L1 and L2 orthographic, phonological, and semantic representations in the same system.

We have reviewed the nature of lexical representations and the process of word recognition along with several language activation models. Regarding SA, Altmann and Mirkovic (2009) proposed that the theory does not only explain L1 and L2 comprehension and production, but it can also explain the mechanism of predictive sentence processing: an ability to anticipate upcoming words in a sentence based on semantic and syntactic information given in the sentence. In the following section, we will discuss an underlying mechanism of predictive sentence processing in L1 and L2, and how they differ from each other.

**Predictive Sentence Processing**

**Syntactically-motivated Sentence Anticipation in Native Speakers**

In the past decade, studies have proposed that sentence comprehension is not achieved by merely integrating each word into the preceding structure as it comes in, but also forming semantic and syntactic predictions as to which syntactic structure or lexical items come next (e.g., Altmann, & Mirkovic, 2009; Kimball, 1975). Although the concept of predictive sentence processing itself is not new, recent studies have examined its nature with new experimental paradigms. For example, in a study conducted by Altmann and Kamide (1999), participants were shown a visual scene of a boy, a toy train, a toy car, and a cake, and the researchers recorded participants’ eye movements while they listened to sentences such as “The boy will eat the cake”. They found that the listeners shifted their eye movements to the picture of a cake after
hearing “eat” even before the word “cake” was presented in the input. This suggests that people make use of their knowledge of verbs to predict the theme of a sentence. Other studies have confirmed that predictive sentence processing is not limited to semantic anticipation. In fact, a growing number of studies investigating predictive sentence processing have shown that native speakers of a language can predict upcoming words in a sentence by parsing grammatical gender of a word (e.g., Van Berkum et al., 2005), the syntactic category of a word (e.g., Lau, Stroud, Plesch, & Phillips, 2006), and the arguments of a verb (e.g., Boland, 2005).

Recent studies have confirmed that such predictive sentence processing is not limited to Indo-European languages such as English and Spanish. Following Altmann and Kamide (1999), who found that lexical information conveyed by an English verb helps the native speakers to anticipate an upcoming theme, Kamide, Altmann, and Haywood (2003) conducted an eye-tracking experiment in Japanese and English. The study included Japanese to investigate whether predictive sentence processing is available in a head-final sentence construction such as that typically found in Japanese. In their Japanese experiment, they had participants view, for example, a picture of a restaurant where a server is presumably about to reach for a hamburger on a table, and serves it to a customer. Simultaneously, participants listened to one of the two audio inputs related to the situation in a picture. These two audio inputs were, (1) one having a dative construction, and (2) the other having an accusative construction. Examples for these audio stimuli are given below:

(1) ウェイトレスが 客に 楽し気に ハンバーガーを 運ぶ。
weitoresu-ga kyaku-ni tanoshige-ni hanbaaga-o hakobu.
The server merrily brings the hamburger to the customer.
The server merrily teases the customer.

While sentence (1) has a dative particle attached on a noun kyaku “customer”, sentence (2) has an accusative particle attached on the noun kyaku. The results revealed that native Japanese speakers looked significantly more at the items about to be handed to the recipient (e.g., hamburger) in the dative condition than in the accusative condition before hearing the actual word following the target particle in the sentence (i.e., dative and accusative particles). This suggests that native Japanese speakers can make use of particle information to predict upcoming lexical items in a sentence.

**Syntactically-motivated Sentence Anticipation in Non-native Speakers**

Although most studies have confirmed that native speakers use lexical information rapidly to predict upcoming words, studies on the second language (L2) predictive sentence processing are inconclusive. Some studies suggest that such lexical anticipation is not available in L2 sentence processing, especially for those with low L2 proficiency (e.g., Dussias, Valdés Kroff, Guzzardo Tamargo, & Gerfen, 2013; Grüter & Rohde, 2013; Hopp, 2013). For instance, a study conducted by Dussias et al., (2013) suggests that less proficient L2-Spanish learners do not use grammatical gender information to predict upcoming noun in a sentence, which is asymmetrical to results found in native Spanish studies. In their eye-tracking experiment, participants were shown two pictures on a computer screen. While pictures were displayed, an audio sentence which contained one of the names of two pictures was played. Each stimulus sentence had a masculine or feminine target noun preceded by an article that agreed in gender with one of the pictures. After an audio stimulus was played, participants clicked on the picture
mentioned in the sentence. Throughout the task, participants’ eye movements were recorded with eye-tracking equipment. The results indicated that native speakers had more fixation time on the picture containing gender matched with the particle in an audio stimulus before the actual noun was mentioned in the sentence. Bilinguals with high proficiency also showed evidence of using some gender information during sentence processing, whereas less proficient learners did not. This suggests that syntactically-motivated predictive sentence processing in L2 is available if one’s proficiency is sufficiently high; however, learners with low proficiency cannot predict the upcoming lexical items via syntactic information embedded in a sentence. Lines of research confirmed that syntactic information in a sentence could not trigger less proficient learners’ anticipation of upcoming words of the sentence (e.g., Mitsugi, & MacWhinney, 2016; Hopp, 2015). However, whether semantic information triggers predictive sentence processing in learners are less discussed in studies (Hopp, 2015).

Semantically-motivated Sentence Anticipation in Non-native Speakers

Hopp (2015) found that L2-German learners did not use morphosyntactic information (i.e., case marking) to generate anticipations in sentence comprehension, though they could use lexical-semantic information in predictive sentence processing. In this eye-tracking experiment, participants were instructed to listen to a sentence as they looked at a screen and occasionally to answer questions that related to the sentence by directing their gaze to areas of the screen marked “yes” or “no”. All spoken sentences included a sentence-initial noun phrase, a lexical verb, an adverb, and a second noun phrase. Each sentence was either, (1) SVO, or (2) OVS sentence construction, and a particle attached to the first NP was determined by the sentence condition (i.e., nominative particle for the SVO, and accusative particle for the OVS). While a sentence was played, a picture was displayed on the screen. Each displayed picture contained four objects related
to the spoken stimulus: the first NP, a potential agent, a potential patient, and an unrelated distractor. The result showed that native German listeners rapidly integrate particle information on the first NP and semantic information of the verb to anticipate upcoming words. In fact, in the SVO sentence construction, native listeners had significantly longer fixation time for the recipient than agent, while fixation time for the agent was significantly longer than the recipient. However, the pattern was different in the L2 group. All learners made anticipatory looks to the patient object in the display irrespective of word order and particle information. This suggests that while they failed to use the morphosyntactic information to anticipate upcoming words, they relied on semantic information conveyed by the first NP and the verb for the prediction. Therefore, the study confirmed that learners cannot use syntactic information, but can rely on semantic information for predictive sentence processing. This study provided evidence that even beginning learners of L2 can use semantic information to anticipate upcoming words in a sentence; however, few studies have been conducted on this topic. Further studies examining what semantic information triggers the predictive sentence processing will be important in understanding the nature of L2 sentence processing, and testing the generalizability of SA. One factor that could possibly affect semantically-driven predictive sentence processing is a word’s cognate status.

**Cognates and Cognate Facilitation Effect**

Considerable evidence supports that cognates are processed quickly than matched non-cognates in language production tasks (e.g., Hoshino, & Kroll, 2008; Rosselli, Ardila, Jurado, & Salvatierra, 2014), and language comprehension tasks (e.g., Allen, & Conklin, 2013; Duyck, van Assche, Drieghe, & Hartsuiker, 2007; Midgley, Holcomb, & Grainger, 2011). Allen and Conklin (2013) proposed that such cognate facilitation effects are even present across languages that do not share the script. In their experiment, Japanese-English bilinguals and learners were asked to
complete a picture-naming task and a lexical-decision task. The study found that while Japanese and English do not share the same script, the phonological and semantic similarity between an English loanword and its corresponding English word facilitated participants’ language production and comprehension. The results suggest the existence of inter-lingual SA effects caused by loanwords from English. Though few studies have discussed the similarity and difference between cognates and loanword-cognates, some researchers agreed that loanword-cognates resemble traditionally defined cognates to some extent (e.g., Champ, 2014; Daulton, 2008). A question to be addressed by the present study is whether SA effects induced by a loanword in a sentence can also facilitate learners’ predictive sentence processing. The following section presents general information on loanwords in Japanese, and how learners process English-based loanwords.

**How Learners Process English Loanwords in Japanese**

Regarding Japanese orthography, the language has two phonographs (Hiragana and Katakana) and one logographic script (Kanji). Generally, lexical items written in Hiragana or Kanji are either borrowed from Chinese or inherited from Old Japanese. Additionally, the Japanese language experienced a massive influx of foreign words and expressions from languages of the West such as English. These lexical items are mostly transcribed in the Katakana script in Japanese, accounting for approximately six percent of the Japanese lexicon. Note that some of these loanwords borrowed from Western languages can also be expressed in either Chinese borrowings or vocabulary inherited from Old Japanese. In this study, we will use “loanword” to refer to words borrowed from Western languages, and “non-loanwords” to represent vocabulary including both Chinese borrowings and words inherited from Old Japanese. For example, an English word “desk” can be expressed in the loanword desuku or the non-loanword tsukue. Furthermore, most loanwords tend to retain their original pronunciation to some extent. However,
since English and Japanese have different phonetic inventories, English words cannot retain the exact same pronunciation when they become loanwords in Japanese. For example, the English word “gym” [dɪm] was accommodated into Japanese with the similar pronunciation [jimɯ].

Recently, researchers became interested in how learners process these loanwords because they are qualitatively different from non-loanwords in several ways. For instance, L1-English learners of Japanese can make use of pre-existing English knowledge to pronounce the loanwords in Japanese, while they cannot do so with non-loanwords.

**Research on Processing English loanwords**

Contrary to what the SA and BIA+ model predict concerning how English native learners process English loanwords in Japanese, Quackenbush (1977) argued that English loanwords in Japanese are difficult to process because of non-uniformity of Japanization rules applied when words are borrowed from English. For example, some loanwords are only comprehensible in their abbreviated forms, while others can be understood in both complete expressions and abbreviated forms. An English loanword “varnish” is only intelligible in its abbreviated form nisu in Japanese; however, another English loanword “department store” can be expressed in the long form depaamento sutoa [depa:mento sutoa], or its abbreviated form depaato. Another feature of loanwords is the existence of variant forms. In many cases, variants were created by different phonological systems, one being conservative and the other, innovative: /či:mu~ti:mu/ “team”; /inki~inku/ “ink”; /bode:~bodi:/ “body”. Furthermore, the meanings of some English words were completely altered when they were borrowed into the Japanese lexicon. One example is consento which does not mean “consent” but means “electrical outlet” in English. There are more English loanwords that represent different concepts from the original English meanings. Quackenbush (1977) maintained that such non-uniform rules of Japanization make it difficult for learners to
process some English loanwords. Nevertheless, she also agreed that a loanword which shares a form and meaning with its original English word could be processed faster than other types of loanwords.

Daulton (2008) pointed out that loanwords can be categorized into six types based on the semantic similarity between a loanword and its original English word (see Table 2). True cognates are English-Japanese cognate pairs which have an identical definition and denotation meanings. When one English word entails more than one Japanese words, the cognate pair is considered as convergent. For example, a loanword *tsuna* has a limited meaning “boiled-canned tuna” in Japanese; however, the English word “tuna” has a broader definition than Japanese *tsuna*.

The opposite of convergent cognates is divergent cognates. In this type of word pairs, an English loanword has more definitions than the English word. Distant false friends have completely different meanings. Regarding semantic features, there are practically none shared except for a general sense of words. For example, a loanword *wetto* was borrowed from English “wet”; however, while “wet” only refers to a physical sense involving liquid, *wetto* refers to “sentimental” and it is rarely used in the way that “wet” is used. Lastly, Japanese-made English compound words were coined by Japanese people (e.g., *sarari-iman* “office worker”). Though in this example each element of the compound exists in English (e.g., English words “salary” and “man” as in the Japanese-made compound word “salary-man”), there is no such compound word in English. Based on the observations made by Quackenbush (1977), learners may experience the strongest cognate-facilitation effects when processing true cognates rather than other types of cognates because they share both phonology and semantics.
Table 2: Types of cognates and spectrum of difficulty

<table>
<thead>
<tr>
<th>Cognate type</th>
<th>Japanese writing</th>
<th>English translation</th>
<th>Semantic difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>True cognate</td>
<td>hoomushikku</td>
<td>homesick</td>
<td>No semantic discrepancy.</td>
</tr>
<tr>
<td>Convergent cognate</td>
<td>tsuna</td>
<td>tuna</td>
<td>Tsuna refers to canned tuna in Japanese, while English &quot;tuna&quot; has a broader definition.</td>
</tr>
<tr>
<td>Distant false friend</td>
<td>wetto</td>
<td>wetto</td>
<td>wetto has a meaning of &quot;sentimental&quot; in Japanese.</td>
</tr>
<tr>
<td>Close false friend</td>
<td>saabisu</td>
<td>service</td>
<td>saabisu expresses the meaning of &quot;free of charge&quot;.</td>
</tr>
<tr>
<td>Japanese-made English</td>
<td>sarari-man</td>
<td>salary+man &quot;office worker&quot;</td>
<td>sarari-man is a Japanized English word, and it is not used in English.</td>
</tr>
</tbody>
</table>

Note. Read from top to bottom, cognate types move from easier to learn and process, to most difficult to learn and process. Adapted from Uchida (as cited in Daulton 2008).

Chapter Summary

For the last two decades, a numbers of monolingual and multilingual word processing models and theories have proposed. They were developed to explain how people recognize and output words. The validity and generalizability of these models and theories were examined in a number of experiments such as cognate priming, word association, and eye-tracking experiments. However, compared to L2 word-level processing, L2 sentence-level processing is less discussed in research. Nevertheless, exploring L2 sentence processing is important for understanding the nature of L2 language processing in general. It is assumed that many domains of L2 sentence processing can be explained by combining proposed L2 word processing theories and models. For instance, some mechanisms of L2 predictive sentence processing may be explained by the combination of the SA theory, cognate-facilitation theory and language non-
selective language activation models, yet they have not fully tested in empirical experiments. The present study aimed to provide evidence that the theories and models can indeed explain some mechanisms of L2 predictive sentence processing. The following chapter discusses a research method used in this study to investigate research questions proposed earlier.
CHAPTER 3 METHOD

Overview

The present study investigated whether an English-based loanword embedded in a Japanese sentence facilitates predictive syntactic processing of L1 English learners of Japanese (JFL). Participants in this study were 26 JFL learners and eight native Japanese speakers. The study consisted of two sessions: a grammar lecture and experiment. The former session was held to make sure that all participants understood a grammar structure called the right-dislocation construction (RDC) which students do not learn in Japanese coursework at Purdue University. The grammar training was carried out because participants would be asked to judge the grammaticality of RDC sentences in the following experiment. After one week, in the experimental session, participants were asked to complete a sentence judgment task and fill out a biographical and language history questionnaire. The task required participants to judge whether a stimulus sentence has a syntactically and semantically correct noun, adjective, verb or particle at the end of the sentence. Each stimulus sentence was segmented into five fragments (blocks), and they were displayed sequentially one at a time. Participants were asked to click a mouse button if an incorrect word use or particle is detected in the fifth block of each sentence while it is displayed on a screen. The particles used in the stimuli are locative -ni, nominative -ga, accusative -o, and comitative -to. The time interval between the onset of the fifth block and a click response was measured for a statistical analysis.
Participants

A total of 11 male and 15 female undergraduate students whose L1 is English participated in this study. In addition to L1 English students, eight native Japanese speakers were also incorporated into the study to form a baseline. The mean age of the students was 20.9 years (SD = 0.6). All non-Japanese participants had passed at least Japanese 102 offered at Purdue University. At the end of the experiment, participants were asked to fill out a questionnaire about their gender, age, the age of first exposure to Japanese which made them interested in studying the language, and the source of the language exposure. They received $10 as a compensation upon the completion of all the required tasks in the study. All participants signed an informed consent form approved by Purdue University’s Institutional Review Board. No participants withdrew from the study in the middle. A summary of participant information is listed below (see Table 3 and 4.)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age</th>
<th>Age of initial exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>F</td>
<td>20.9 (0.6)</td>
</tr>
<tr>
<td>11</td>
<td>15</td>
<td>17.3(3.8)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source of exposure</th>
<th>Number of people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anime</td>
<td>9</td>
</tr>
<tr>
<td>Manga</td>
<td>6</td>
</tr>
<tr>
<td>University course</td>
<td>4</td>
</tr>
<tr>
<td>Movie</td>
<td>3</td>
</tr>
<tr>
<td>High school education</td>
<td>2</td>
</tr>
<tr>
<td>TV program</td>
<td>1</td>
</tr>
<tr>
<td>Extended reading</td>
<td>1</td>
</tr>
</tbody>
</table>
Materials

Stimulus Sentences

A total of 62 sentences were used as stimuli in this experiment. These sentences are categorized into following five groups:

(1) 20 correct RDC sentences;
(2) 16 RDC sentences ending with an incorrect particle preceded by a non-loanword;
(3) 16 RDC sentences ending with an incorrect particle preceded by a loanword;
(4) Four RDC sentences ending with an incorrect particle preceded by a non-loanword which does not have an equivalent loanword;
(5) Ten non-RDC filler sentences with an incorrect adjective/noun at the end.

Non-RDC sentences are taken from textbooks used in JPNS100 and 200 level courses at Purdue University. These sentences were originally well-formed in the textbooks, but their sentence-final adjectives or verbs were changed in the study to create (5). Sentences in (4) and (5) served as fillers to decrease the risk of participants’ response bias. Each sentence in (2) has a semantically and syntactically identical sentence in (3), though the non-loanword is replaced with its equivalent English-based loanword. Regarding RDC sentences, one of the following particles is placed at the end of a sentence: locative -ni, nominative -ga, accusative -o, and comitative -to. Example sentences from the experiment are provided below:

(1) 映画を/きのう/見たよ、/山田さん/と。
   eiga-wo   kinou   mitayo   Yamada-san   to
   Movie-particle  yesterday  watch-past  Yamada          comitative
   I watched a movie with Yamada yesterday.
Each slash indicates the end of a segmented block of a sentence, and the blocks were sequentially shown to participants one at a time (see Figure 6). (1) is a grammatical RDC sentence. (2) and (3) are syntactically ill-formed RDC sentences because they have an accusative case particle instead of a locative case particle at the end. The only difference between (2) and (3) is the word located before the accusative case particle. While (2) has a loanword * jimu, (3) has its non-loanword counterpart * taiikukan. A summary of experimental items is provided in Table 5.
Table 5: Summary of experimental items

<table>
<thead>
<tr>
<th>word type</th>
<th>particle</th>
<th>Correct</th>
<th>Semantic</th>
<th>Syntactic</th>
</tr>
</thead>
<tbody>
<tr>
<td>loanword</td>
<td>locative (-ni)</td>
<td>2</td>
<td>N/A</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>nominative (-ga)</td>
<td>2</td>
<td>N/A</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>accusative (-o)</td>
<td>2</td>
<td>N/A</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>comitative (-to)</td>
<td>2</td>
<td>N/A</td>
<td>4</td>
</tr>
<tr>
<td>loanword</td>
<td>locative (-ni)</td>
<td>2</td>
<td>N/A</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>nominative (-ga)</td>
<td>2</td>
<td>N/A</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>accusative (-o)</td>
<td>2</td>
<td>N/A</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>comitative (-to)</td>
<td>2</td>
<td>N/A</td>
<td>4</td>
</tr>
<tr>
<td>Fillers</td>
<td></td>
<td>4</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

Note. Correct column, semantic column, and syntactic column indicate the numbers of correct sentences, semantically anomalous sentences, and syntactically ill-formed sentences, respectively.
A fixation cross-mark was also shown for 300ms between a sentence-final block and a sentence-initial block to notify participants that next sentence would appear shortly. With the exception of the sentence-final blocks where participants had to make correct/incorrect decisions, stimulus presentation time of each segment was determined by the number of morae contained in it. More specifically, 400ms was allocated for every mora in a segment, and fixed 3000ms was given for the sentence-final segment. For example, a segment *jimu* “gym” was presented on the screen for 800ms as it contains two morae, while *taiikukan* was shown on the screen for 2400ms because it has six morae. Although all participants went over all the same 62 trials, the order of trials was pseudorandomized from participant to participant in such a way that sentences semantically and syntactically identical to each other were presented at least six trials apart.

RDC sentences were used in this experiment because it is difficult to investigate learners’ particle processing in other sentence structures. In Japanese, one can scramble the constituents of a sentence relatively freely as long as each case particle identifies the function of each noun phrase. Example sentences below show the flexibility of the Japanese sentence structure,

(6) 太郎さんが こうえんに 行く。
    Tarousan-ga      koen-ni       iku
    Tarou-nominative park-locative go

(7) こうえんに 太郎さんが 行く。
    koen-ni       Tarousan-ga iku
    park-locative Tarou-nominative go

(8) 行く、  太郎さんが こうえんに。
    iku          Tarousan-ga  koen-ni
    go           Tarou-nominative park-locative

(9) 行く、  こうえんに 田中さんが。
    iku         koen-ni     Tanakasan-ga
    go          park-locative Tanaka-nominative
Although these sentences differ slightly regarding what is emphasized, they represent the same meaning “A cat goes to the park.” (6) is structured in canonical SOV word order, and it can be scrambled into (7) OSV structure, (8) VSO structure and (9) VOS structure. (8) and (9) are also known as RDC sentences where some phrases appear in the post-verbal position, and usually, have a particle sentence-finally.

Sentence structures of (6) and (7) are unsuitable for a grammatical judgment task, or a sentence judgment task in Japanese; especially if a sentence is segmented into several fragments, and participants must make a correct/incorrect decision as a segment is being displayed one at a time. For instance, one cannot guess (6) is a syntactically correct sentence or not if only tarousan-ga koen was shown because its grammaticality depends on the sentence-final verb. We decided to use RDC sentences such as (8) and (9) whose grammaticality is determined by a sentence-final particle because the aim of the present study was to investigate how learners process particles in a sentence.

In this study, each sentence was segmented into five fragments because five blocks were appropriate in terms of difficulty, sentence variation, and time efficiency. Having RDC sentences with less than five segments would not only make the task too simple, but it would also limit the range of meanings to express. Creating stimuli with more than five segments would allow us to widen the range of sentence expression, though it would take significantly longer time to complete the task, and would increase task difficulty. Therefore, we decided to use sentences with five segments, which turned out to be appropriate for students at this level.
Hardware and Software

A computer and a projector were used for both a grammar training session and an experimental session. Regarding the training session, a Microsoft PowerPoint presentation was used to explain the RDC and instruct students to engage in conversational activities. Concerning the experimental session, a program written in Python was used to control stimulus presentation and record RT data. All PowerPoint slides, instructions, and stimuli in the experiment were shown on a projector screen.

Procedure

The study consisted of two sessions: training session and experiment session. Each session took approximately 25 minutes. In the training session, participants except for the native Japanese speakers received a grammar explanation of the Japanese RDC sentences. In addition to the lecture, each participant was asked to engage in pair activities with another participant to practice using the grammar in a conversational setting to facilitate their understanding of the RDC. The training session was held before the experiment to make sure that all participants understood RDC sentences since they do not typically learn it in formal Japanese coursework at Purdue University.

The experimental session was conducted a week after the training session. In this session, participants completed a sentence judgment task. Every stimulus sentence used in the experiment was segmented into five fragments (blocks), and participants were presented with each block sequentially with an appropriate amount of time interval. Participants were instructed to judge whether the sentence-final segment (fifth block of a segmented sentence) was semantically and syntactically correct, and to indicate their judgment by clicking a mouse button if an incorrect particle or word use was detected. Instructions were given twice; first in Japanese orally before
the experiment, and secondly in written English which was shown on the computer screen (see Figure 7). They were welcome to ask any task related questions when the instructions were given. Five test trials were conducted before experimental trials to familiarize participants with the task.

![Screenshot of English written instruction](image)

**Figure 7: A sample English written instruction presented on the screen**

### Statistical Analysis

We conducted two two-way repeated measures analysis of variance (ANOVA), one in the learner group, and the other in the native Japanese group. In both tests, interaction effects of a loanword and particle processing was calculated. As for testing the assumptions of ANOVA, Shapiro-Wilk test was used to test the significance of normal distribution, and Mauchly’s test of Sphericity was carried out to test the homogeneity of variance across variables. The significance level was set at $\alpha = .05$ for all statistical tests.
Chapter Summary

This chapter discussed the present study’s experimental design, including participants, materials, and procedure. Twenty-six L1-English JFL students participated in the present study. During the experiment session, participants completed a grammatical judgment task, and their behavioral data (RT) were recorded for the following statistic analysis. In the next chapter, the presence of loanword facilitation effects on particle processing will be statistically investigated.
CHAPTER 4 RESULTS AND DISCUSSION

Descriptive Statistics

This chapter presents results of the statistical analysis of RT data obtained in the present study. RT differences across four particles (i.e., locative -ni, nominative -ga, accusative -o and comitative -to) in two sentence conditions (i.e., sentence including a loanword or not) will be analyzed. RT data that contain errors or more than one click responses were removed from the analysis. These removed data points account for 1.8% of the total data obtained in the experiment. Moreover, Little’s MCAR test was performed to assess whether the data points were completely at random (MCAR). Regarding the MCAR test, a non-significant finding provides support for the MCAR assumption, and it suggests that a listwise deletion approach can be reasonably applied to the data set without causing bias in the analysis, $\chi^2(133) = 156.806, p = .078$. Table 6 is a summary of RT data. Figure 8 and 9 illustrate the mean RT for each particle by two groups (i.e., native Japanese speakers and learners) in two sentence conditions.
<table>
<thead>
<tr>
<th>Particle</th>
<th>word type</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>learners</td>
<td>loan</td>
<td>993.857</td>
<td>121.922</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>non-loan</td>
<td>1017.381</td>
<td>127.088</td>
<td>84</td>
</tr>
<tr>
<td>ni</td>
<td>loan</td>
<td>929.583</td>
<td>88.889</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>non-loan</td>
<td>1036.25</td>
<td>89.325</td>
<td>84</td>
</tr>
<tr>
<td>o</td>
<td>loan</td>
<td>1006.904</td>
<td>121.81248</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>non-loan</td>
<td>1045.595</td>
<td>145.93</td>
<td>84</td>
</tr>
<tr>
<td>to</td>
<td>loan</td>
<td>851.321</td>
<td>108.1016</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>non-loan</td>
<td>1068.357</td>
<td>95.534</td>
<td>84</td>
</tr>
<tr>
<td>native</td>
<td>loan</td>
<td>629.3</td>
<td>58.529</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>non-loan</td>
<td>574.633</td>
<td>48.392</td>
<td>30</td>
</tr>
<tr>
<td>ni</td>
<td>loan</td>
<td>540.1</td>
<td>74.592</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>non-loan</td>
<td>527.767</td>
<td>75.019</td>
<td>30</td>
</tr>
<tr>
<td>o</td>
<td>loan</td>
<td>537</td>
<td>41.746</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>non-loan</td>
<td>560.467</td>
<td>90.167</td>
<td>30</td>
</tr>
<tr>
<td>to</td>
<td>loan</td>
<td>581.1333</td>
<td>84.561</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>non-loan</td>
<td>614.067</td>
<td>73.744</td>
<td>30</td>
</tr>
</tbody>
</table>
Figure 8: Mean RT for each particle in two sentence conditions (learners)

Figure 9: Mean RT for each particle in two sentence conditions (native)
Assumptions for the ANOVA

Learner Group

Before proceeding with ANOVA, we tested the following three numerical assumptions which must be met: normality of the dependent variable in each group, detecting possible outliers, and sphericity condition. Concerning normality, the Shapiro-Wilk test of normality found that studentized residuals were normally distributed without exceptions (see Table 7). Regarding outliers in data, there was one minor outlier which had a studentized residual value of 3.03 in loanword locative condition. The outlier was assumed to be neither from measurement errors and assumed to be a genuine data point; therefore, we decided to include it in the analysis.

| Table 7: Results of Shapiro-Wilk test of normality (learners) |
|---------------------------------|--------|-----|-----|
|                                 | Statistic | df | Sig. |
| Studentized Residual for loanword-ga | 0.992    | 84  | 0.872 |
| Studentized Residual for non-loanword-ga | 0.975    | 84  | 0.094 |
| Studentized Residual for loanword-ni | 0.973    | 84  | 0.080 |
| Studentized Residual for non-loanword-ni | 0.977    | 84  | 0.135 |
| Studentized Residual for loanword-o | 0.981    | 84  | 0.262 |
| Studentized Residual for non-loanword-o | 0.983    | 84  | 0.348 |
| Studentized Residual for loanword-to | 0.972    | 84  | 0.063 |
| Studentized Residual for non-loanword-to | 0.083    | 84  | 0.333 |
We also performed Mauchly’s test of sphericity to test the hypothesis of sphericity. As a result, the test indicated that the assumption of sphericity was met for the two-way interaction, $p = 0.134$ (see Table 8).

<table>
<thead>
<tr>
<th>Within Subject Effect</th>
<th>Mauchly’s W</th>
<th>Approx. Chi-Square</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>word</td>
<td>1.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>particle</td>
<td>0.763</td>
<td>17.958</td>
<td>5</td>
<td>0.003</td>
</tr>
<tr>
<td>word*particle</td>
<td>0.831</td>
<td>8.437</td>
<td>5</td>
<td>0.134</td>
</tr>
</tbody>
</table>

In conclusion, these pre-analyses confirmed that the data set qualifies for a two-way repeated-measures ANOVA. Besides the numerical assumptions, there are three experiment-design related assumptions: the dependent variable should be continuous, the independent variables should consist of two or more categorical variables. The present study defined RT as the dependent variable with two categorical factors; hence, these assumptions were met.

**Native Japanese Group**

We also tested whether RTs obtained from the native Japanese group also qualify for a two-way repeated-measures ANOVA. Shapiro-Wilk test of normality indicated that studentized residuals of RTs for each condition were normally distributed (see Table 9). In addition to normality, there was no outlier as assessed by examination of studentized residuals for values greater than ±3. As Table 10 shows, Mauchly’s test of sphericity confirmed the homogeneity of variances in the two-way interaction, $\chi^2(5) = 5.116$, $p = 0.402$. Therefore, pre-analyses indicated that data set from the native Japanese group qualifies for a two-way repeated-measures ANOVA.
Table 9: Results of Shapiro-Wilk test of normality (native)

<table>
<thead>
<tr>
<th></th>
<th>Shapiro-Wilk Statistic</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Studentized Residual for loanword-ga</td>
<td>0.953</td>
<td>30</td>
<td>0.203</td>
</tr>
<tr>
<td>Studentized Residual for non-loanword-ga</td>
<td>0.977</td>
<td>30</td>
<td>0.732</td>
</tr>
<tr>
<td>Studentized Residual for loanword-ni</td>
<td>0.977</td>
<td>30</td>
<td>0.747</td>
</tr>
<tr>
<td>Studentized Residual for non-loanword-ni</td>
<td>0.968</td>
<td>30</td>
<td>0.512</td>
</tr>
<tr>
<td>Studentized Residual for loanword-o</td>
<td>0.970</td>
<td>30</td>
<td>0.555</td>
</tr>
<tr>
<td>Studentized Residual for non-loanword-o</td>
<td>0.968</td>
<td>30</td>
<td>0.484</td>
</tr>
<tr>
<td>Studentized Residual for loanword-to</td>
<td>0.974</td>
<td>30</td>
<td>0.664</td>
</tr>
<tr>
<td>Studentized Residual for non-loanword-to</td>
<td>0.934</td>
<td>30</td>
<td>0.062</td>
</tr>
</tbody>
</table>

Table 10: Mauchly’s Test of Sphericity (native)

<table>
<thead>
<tr>
<th>Within Subject Effect</th>
<th>Mauchly's W</th>
<th>Approx. Chi-Square</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>word</td>
<td>0.763</td>
<td>7.511</td>
<td>5</td>
<td>0.186</td>
</tr>
<tr>
<td>particle</td>
<td>1.000</td>
<td>0.000</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>word*particle</td>
<td>0.831</td>
<td>5.116</td>
<td>5</td>
<td>0.402</td>
</tr>
</tbody>
</table>

Learners’ Particle Processing

A two-way repeated-measures ANOVA was carried out by particle type (i.e., locative, nominative, accusative or comitative) and word type (i.e., whether the word preceding the sentence-ending particle is loanword or non-loanword). The analysis aimed to examine the effects of particle and word type on RT for particle processing. The output of ANOVA is presented in Table 11.

There was a statistically significant two-way interaction between particle and word type, $F(3, 249) = 36.795, p < 0.05$, partial $\eta^2 = 0.307$. Hence, further analyses of a simple main effect of word type were performed with pairwise comparisons with the Bonferroni adjustment. The following sub-sections address within-subject effects for each particle in two sentence conditions (i.e., loanword or non-loanword preceding a particle).
Table 11: Two-way repeated-measures ANOVA output (learners)

<table>
<thead>
<tr>
<th>Source (sphericity assumed)</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>word</td>
<td>1842971.524</td>
<td>1</td>
<td>1842971.524</td>
<td>134.458</td>
<td>0.000</td>
<td>0.618</td>
</tr>
<tr>
<td>Error (word)</td>
<td>1842971.524</td>
<td>83</td>
<td>13706.635</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>particle</td>
<td>790145.601</td>
<td>3</td>
<td>263381.867</td>
<td>19.308</td>
<td>0.000</td>
<td>0.189</td>
</tr>
<tr>
<td>Error (particle)</td>
<td>3396570.649</td>
<td>249</td>
<td>13640.846</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>word*particle</td>
<td>1376262.298</td>
<td>3</td>
<td>458754.099</td>
<td>36.795</td>
<td>0.000</td>
<td>0.307</td>
</tr>
<tr>
<td>Error (word*particle)</td>
<td>3104461.452</td>
<td>249</td>
<td>12467.717</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Nominative and Accusative particles

There was no statistically significant simple main effect of nominative particle processing, $F(1, 83) = 1.503, p > 0.05$. A similar pattern of null simple main effect was detected in accusative particle processing as well, $F(1, 83) = 3.574, p > 0.05$ A summary of simple main effects is presented in Table 12.

Table 12: Simple main effect of nominative/accusative particles (learners)

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>nominative (ga)</td>
<td>23241.524</td>
<td>1</td>
<td>23241.524</td>
<td>1.503</td>
<td>0.224</td>
</tr>
<tr>
<td>accusative (o)</td>
<td>57757.292</td>
<td>1</td>
<td>23241.524</td>
<td>3.574</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Locative and Comitative Particles

As shown in Table 13 and 14, a significant RT difference was found in locative particle processing between two sentence conditions, $F(1, 83) = 56.266, p < 0.05$. The pairwise test indicated that the mean difference for the particle processing was significant between two conditions; with a mean RT difference of 106.667 milliseconds, 95%CI [-134.950, -78.383]. Such a loanword-induced effect was also found in comitative particle processing, $F(1, 83) = 242.102, p < 0.05$. The pairwise test supported the presence of effects. The mean RT was significantly shorter when a loanword preceded the particle, by 251.679 milliseconds, 95%CI [219.507, 283.850].
Table 13: Simple main effect of locative/comitative particles (learners)

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>locative (ni)</td>
<td>477866.667</td>
<td>1</td>
<td>477866.667</td>
<td>56.266</td>
<td>0.000</td>
</tr>
<tr>
<td>comitative (o)</td>
<td>2660368.339</td>
<td>1</td>
<td>2660368.339</td>
<td>242.102</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table 14: Pairwise test for locative/comitative particles (learners)

<table>
<thead>
<tr>
<th>particle</th>
<th>Mean Difference</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval for Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>locative (ni)</td>
<td>106.667</td>
<td>14.220</td>
<td>0.000</td>
<td>-134.950 to -78.383</td>
</tr>
<tr>
<td>comitative (o)</td>
<td>251.679</td>
<td>16.175</td>
<td>0.000</td>
<td>-283.850 to -219.507</td>
</tr>
</tbody>
</table>

**Native Japanese Particle Processing**

Performing a three-way mixed ANOVA by particle type and word type in two groups (i.e., native Japanese and learners) would be the most appropriate analysis to compare two groups; however, since inhomogeneity of variances was detected in the native Japanese group, we could not conduct a three-way mixed ANOVA. Instead, we carried out another two-way repeated-measures ANOVA by particle type and word type in the native Japanese group. The analysis aimed to confirm whether loanword effects observed in the learners group were also present in the native Japanese group.

The two-way repeated-measures ANOVA found a significant interaction between particle type and word type $F(3, 87) = 5.481, p < 0.05, \eta^2 = 0.159$. Concerning main effects (see Table 15), the loanword/non-loanword distinction did not influence particle processing, $F(1, 29) = 0.139, p > 0.05$; however, particle type affected RT latencies in the task, $F(3, 87) = 18.718, p < 0.05$. The pairwise Bonferroni method was used to conduct further analysis on each particle.
Table 15: Two-way repeated-measures ANOVA output (native)

<table>
<thead>
<tr>
<th>Source (sphericity assumed)</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>word</td>
<td>721.067</td>
<td>1</td>
<td>721.067</td>
<td>0.139</td>
<td>0.712</td>
<td>0.005</td>
</tr>
<tr>
<td>Error (word)</td>
<td>150748.433</td>
<td>29</td>
<td>5198.222</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>particle</td>
<td>215517.133</td>
<td>3</td>
<td>71839.044</td>
<td>18.718</td>
<td>0.000</td>
<td>0.392</td>
</tr>
<tr>
<td>Error (particle)</td>
<td>333898.867</td>
<td>87</td>
<td>3837.918</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>word * particle</td>
<td>71856.933</td>
<td>3</td>
<td>23952.311</td>
<td>5.481</td>
<td>0.002</td>
<td>0.159</td>
</tr>
<tr>
<td>Error (word*particle)</td>
<td>380211.567</td>
<td>87</td>
<td>4370.248</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Nominative and Accusative particles

As shown in Table 16 and 17, there was a statistically significant RT difference in nominative particle processing between two sentence conditions, $F (1, 29) = 45.065, p < 0.05$. In contrast, no significant RT difference was detected in accusative particle across two sentence types, $F (1, 29) = 2.217, p > 0.05$.

Table 16: Simple main effect of nominative/accusative particles (native)

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>nominative (ga)</td>
<td>121770.150</td>
<td>1</td>
<td>121770.150</td>
<td>45.065</td>
<td>0.000</td>
</tr>
<tr>
<td>accusative (o)</td>
<td>12412.817</td>
<td>1</td>
<td>12412.817</td>
<td>2.217</td>
<td>0.147</td>
</tr>
</tbody>
</table>

Table 17: Pairwise test for nominative/accusative particles (native)

<table>
<thead>
<tr>
<th>particle</th>
<th>Mean Difference</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>nominative (ga)</td>
<td>54.667</td>
<td>15.777</td>
<td>0.002</td>
<td>22.399</td>
<td>86.935</td>
</tr>
<tr>
<td>accusative (o)</td>
<td>12.333</td>
<td>18.659</td>
<td>0.514</td>
<td>-25.829</td>
<td>50.496</td>
</tr>
</tbody>
</table>
Locative and Comitative Particles

No significant difference was detected in locative, $F(1, 29) = 0.437, p > 0.05$, and comitative particles, $F(1, 29) = 3.410, p > 0.05$, across two sentence types, as shown in Table 18.

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>locative (ni)</td>
<td>2281.667</td>
<td>1</td>
<td>2281.667</td>
<td>0.437</td>
<td>0.514</td>
</tr>
<tr>
<td>comitative (o)</td>
<td>22272.267</td>
<td>1</td>
<td>22272.267</td>
<td>3.510</td>
<td>0.075</td>
</tr>
</tbody>
</table>

Discussion

The previous sections reported the results of the analysis of particle processing in RDC sentences. The aims of the analyses were to answer following research questions,

(1) Do English-based loanwords influence learners’ particle processing?

(2) Is the loanword effect universal across particles?

(3) Is the effect unique to learners, or shared with native Japanese speakers?

In the following subsections, we will answer each research question based on the findings from the statistical analyses.

Facilitative Loanword Effects

The analysis of interaction effects between loanword and particle supported the hypothesis that an English-based loanword in a sentence helps English-speaking learners’ predictive processing of a particle. The statistics confirmed significant interaction effects between loanword and particle.
Particles Susceptible to Loanword Effects

Pair-wise tests for an interaction effect between loanword and particle confirmed that significant RT differences in processing comitative and locative particles between two sentence conditions were found. More specifically, these particles were processed faster when a loanword (e.g., *doa* “door”) preceded a particle rather than its non-loanword counterpart (e.g., *tobira* “door”). In contrast, such effects were not confirmed in the nominative and accusative particles.

Group Difference in Loanword Effects

The two-way repeated measures ANOVA performed on data obtained from native Japanese speakers confirmed that such loanword-induced effects are unique to learners. In fact, the statistics showed that native Japanese speakers did not differ in mean RT for processing particles across two sentence conditions except for the nominative particle. Since learners and native Japanese speakers differ in patterns of facilitative loanword-induced influences on particle processing, the results indicated that the effects were unique to learners at this proficiency level.

Possible Factors behind the Facilitative Effects of Loanwords

In this section, we will address two possible factors behind the loanword facilitative effects. The first interpretation of the facilitation effects bases its assumptions on the theory of spreading activation. For example, when learners are presented with a segmented stimulus sentence one segment at a time (e.g., *issho-ni kimetano watashi-no boot furendo-to* “I decided with my boyfriend”), a loanword (i.e., *booifurendo* “boyfriend”) presumably activates its English translation (i.e., “boyfriend”) triggered by the phonological similarity (booifurendo [bo:iʃʊrɛndo] and “boyfriend” [bˈɔɪfrɛnd]), which further activates English words that frequently appear together (e.g., “talk with”, “meet with” or “go out with”). These activated English words
then co-activate similar linguistic entries in Japanese (e.g., mutually activating comitative particle to via activated prepositional “with”). As a result, since learners can anticipate the comitative particle followed by the loanword faster than the particle followed by the non-loanword, RT was significantly shorter for the loanword than the non-loanword condition.

Another interpretation of the loanword-induced effects is that so-called “particle ellipsis” rules caused RT differences across particles. In Japanese, some particles can be omitted in conversations. For instance, nominative and accusative particles which mark arguments are frequently dropped in conversational Japanese, while locative and comitative particles that mark adjuncts are less likely to be dropped from a sentence. For example,

(1) お湯 (が)
    oyu-(ga)
    hot water-(nominative)
    Water is boiling.

(2) このアメ (を)
    kono-ame-(o)
    This candy-(accusative)
    Can I eat this candy?

(3) 犬と
    inu-to
    dog-comitative
    Play with a dog.

(4) 学校に
    gakkou-ni
    school-locative
    Go to school.

Regarding sentence (3) and (4), comitative and locative particles which mark adjuncts are less likely to be omitted from the sentences. In sentence (1), however, the nominative particle preceded by oyu “hot water” can be either present or omitted from the sentence without losing its acceptability. Similarly, in sentence (2), the presence of the accusative particle preceded by ame
“candy” is optional. Such a particle ellipsis is also accepted in RDC sentences; however, every critical RDC sentence used in the experiment contained a particle. Since some students, especially those with high proficiency, prefer leaving these particles out in conversations as native Japanese speakers do, they may be not used to having nominative and accusative particles in sentences; resulting in longer mean RT for these particles. This interpretation, however, cannot fully explain why mean RTs for locative and comitative particles were shorter in the loanword condition than the non-loanword condition. Therefore, the difference between the argument marker and adjunct marker can only partially explain the result, though it is not the main factor which triggered the loanword-induced effects.

Psycholinguistic Implications of the Present Study

Studies in L1-English predictive sentence processing have confirmed that native speakers can anticipate the syntactic and semantic structures of a sentence being processed. (e.g., Altmann, & Mirkovic, 2009; Kimball, 1975). Regarding experiments that focus on sentence processing in Japanese, Kamide, Almann, and Haywood (2003) found that native Japanese speakers can also use case markers in a sentence to anticipate their following linguistic items. However, few studies have been conducted to investigate the nature of predictive sentence processing in an L2 population. The present study provided evidence that L2 learners can also use word information to anticipate what particle will follow the word. As far as the locative and comitative particles are concerned, the mechanism behind the learners’ syntactic anticipation can be largely explained by the theory of spreading activation. The results also implied that such loanword-induced effects are unique to learners, and native Japanese group did not show any influence of loanwords except for the nominative particle.
Chapter Summary

This chapter reported on analyses of interaction effects between word type (i.e., whether a word preceding a particle is loanword) and particle type (i.e., nominative, accusative, locative, and comitative). The results supported the hypothesis that an English-based loanword helps English-speaking learners’ syntactic prediction of locative and comitative particles. As hypothesized, mean RTs for accusative and nominative particles did not differ across word type. This pattern was different from the native Japanese group who showed no interaction effect between word type and particle type except for the nominative particle.
CHAPTER 5 CONCLUSION

Summary of Findings

The statistical analysis performed on the learner group found that locative and comitative particles are susceptible to a loanword-induced facilitative effect, whereas RT latencies for processing accusative and nominative particles did not differ across two sentence conditions. However, such a facilitative influence on particles was not detected in native Japanese population. In fact, loanwords did not affect RT for processing a particle except for the nominative particle. This asymmetric pattern of the loanword effect observed in two groups suggests that the loanword facilitation effect is a unique feature of learners as far as locative and comitative particles are concerned.

Interpretation of Results

This study assumed that inter-lingual SA effects and cognate-like facilitation effects are involved in the facilitative loanword effect on particle processing. For example, when learners were presented with a sentence segmented into five pieces (e.g., *issho-ni kimetano watashi-no booi furendo to* “I decided with my boyfriend”), a loanword (i.e., *booi furendo* “boyfriend”) presumably activated its English translation (i.e., “boyfriend”) triggered by the phonological similarity (*booi furendo* [bo:iɸuendo] and “boyfriend” [bˈɔɪfrɛnd]), which further co-activated English words that frequently appear together (e.g., “dating”, “talk with”, “meet with” or “go out with”). These activated English words then spread their activation to similar linguistic entries in Japanese (i.e., mutually activating comitative particle *to* via activated prepositional “with”). As a result, since learners can anticipate the comitative particle followed by the loanword faster than
the particle followed by the non-loanword, RT was significantly shorter for the loanword than the non-loanword condition.

**Alternative Interpretation of Results**

One may argue that the results do not necessarily provide a connection between the inter-lingual SA effects and the facilitative loanword effects. In other words, the fact that a particle preceded by a loanword had shorter RT than other conditions does not necessarily mean the process involved cross-linguistic activations. In this view, learners did not co-activate English “cognates” from a presented stimulus; instead other factors such as word frequency may have played an important role in the facilitative effect. In fact, frequency effect can explain RT in some trials, especially for trials which contained unfamiliar words such as *waifu* “wife” and *dokutaa* “doctor”. However, frequency cannot explain the significantly shorter RT in the loanword condition than the non-loanword condition because word frequency was counterbalanced in the experiment. In fact, a loanword was more familiar than its equivalent non-loanword in some trials (e.g., *doa-tobira* “door”), whereas a non-loanword was more familiar than its equivalent loanword in the other trials (e.g., *taiikukan-jimu* “gym”), but still significantly shorter mean RT was observed in the loanword condition. If word frequency was the major cause of the loanword effect, we would expect to see no mean RT difference between the loanword condition and the non-loanword condition.

Another factor which may explain the facilitation effect is the word length. It is expected that longer words require more time than shorter words to process. One may argue that a particle after *jimu* was faster than the particle followed by *taiikukan* because the former word was shorter than the latter word (i.e., 2 morae and 6 morae). However, it cannot explain the different mean RT between the loanword condition and the non-loanword condition because the word length
was also counterbalanced across trials. For instance, some trials had longer loanwords in the loanword condition than equivalent non-loanwords (e.g., *booifurendo* (7 morae) and *kareshi* (3 morae) “boyfriend”), while other trials had shorter loanwords in the loanword condition than equivalent non-loanwords (e.g., *cafe* (2 morae) and *kissaten* (5 morae) “cafe”). Since the word length was counterbalanced across trials, there will be no mean RT difference between the loanword and non-loanword conditions if the word length was the major cause of the loanword effect.

Although these factors can partially explain the results, they cannot fully explain the mechanism behind the loanword effect.

**Limitations of the Present Study**

Some results of the present study must be interpreted in light of some limitations. Firstly, a limited number of native Japanese speakers (n = 8) in this study made the analysis inconclusive to some extent. It is possible that facilitative effects observed in the nominative particle were simply by chance, though the small sample size biased the results. Moreover, such a small sample size hindered us from running a three-way mixed ANOVA because it caused inhomogeneity of variances across groups. If we had conducted the research with a larger native population, we might have obtained different results in the native Japanese group.

Secondly, although the present study showed that loanwords influence some particle processing, there are still more unknowns than knowns. The present study only investigated the predictive processing of four particles (i.e., locative, comitative, accusative, and nominative). It is important to examine how other particles are processed in order to shed light on the nature of L2 predictive sentence processing.
Thirdly, it is possible that some sentences which contain unnatural loanwords might have slightly affected the results. Since students at the Japanese 201 level have limited loanword knowledge, there was no choice but to use loanwords at the cost of native-like expressions. For example, *miruku* “milk” as in *mou nondano, sono miruku-o* “Have you already drunk that milk?” is unnatural because native Japanese speakers will generally use its non-loanword counterpart *gunyuu* “milk” in the sentence.

**Further Research**

The results of the foregoing analysis imply that a loanword in a sentence can help learners to anticipate its following particle, which suggests that predictive sentence processing is also possible in L2. However, since the present study focused on L1-English learners, English-based loanwords, and only four types of particles, the results lack generalizability. Kamide, Almann, and Haywood (2003) pointed out that native Japanese speakers can use case markers in a sentence to anticipate their following linguistic items. Further research should investigate the possibilities of other domains of sentence anticipation including semantics as well as syntax. In addition to different domains, studies should include a population from different L1 backgrounds to improve their generalizability.

In addition to participants, the research method used in this study has room for improvements. In this experiment, participants were asked to click on a screen whenever they found inappropriate use of a sentence-ending word, and do nothing if they thought a sentence-ending word was correct. This method was used in order to make the task as simple as possible for participants. However, following two interpretations arose concerning the null response because of this methodology: (1) they did not click on a screen because they were sure that a sentence-ending word was appropriate, or (2) a time window for responding to a stimulus had
passed while they were thinking about its acceptability. This problem made it difficult to analyze the data. It is suggested that using two buttons, one for “yes” and the other for “no”, will make the behavioral data thorough and feasible to analyze.

Lastly, in the present study, students in Japanese 201 who were considered between beginner and intermediate learners were the majority of participants. However, more proficient learners should also be incorporated; since it is expected that advanced learners will show different patterns of processing particles than beginner and intermediate learners. Including such learners in a study would allow us to investigate how the ability of L2 predictive sentence processing changes as one’s proficiency increases.
REFERENCE


APPENDIX ILL-FORMED SENTENCES USED IN THE STUDY

Locative condition (the correct particle at the end is -ni)

1. きのう 行ったですよ、 あの ジム/たいいくかん *を。
   Kinou ittadesyo, ano jimu/taiikukan o.
   Yesterday went that gym
   You went to that gym yesterday, didn’t you?

2. 行こうよ、 新しく できた カフェ/きっさてん *が。
   Ikouyo, atarashiku dekita kafe/kissaten ga.
   go newly opened café
   Let’s go to the newly opened café.

3. なにが あるの、 その キッチン/だいどころ *の。
   naniga aruno sono kicchin/daidokoro no.
   what-nominative have that kitchen
   What do you have in that kitchen?

4. あしたも きてね この クラスルーム/きょうしつ *は。
   ashita-mo kite-ne kono kurasuruumu/kyooshitsu wa.
   tomorrow-particle come-particle this classroom.
   Please come to this classroom tomorrow as well.
Comitative condition (the correct particle at the end is -to)

1. ともだちが 行ってきたよ、 ぼくの ワイフ/つま *は。
   tomodachi-ga ittekita-yo bokuno waifu/tsuma wa
   friend-particle went-particle my wife
   My friend went there with my wife.

2. いっしょに 話してたの、 びょういんの ドクター/いしゃ *が。
   issyo-ni hanashiteta-no byion-no dokutaa/isha ga.
   together-particle talk-particle hospital doctor
   I was talking with the hospital doctor.

3. いっしょに きめたの、 わたしの ボーイフレンド/かれし *に。
   issho-ni kimeta-no watashi-no booifurendo/kareshi to
   together-particle decide-particle my-particle boyfriend
   I decided together with my boyfriend.

4. ぼくは どうぶつえんに 行ったよ、 ガールフレンド/かのじょ *を。
   boku-wa doubutsuen-ni itta-yo gaarufurendo/kanojo to
   I-particle zoo-particle went-particle girlfriend
   I went to a zoo with my girlfriend.
Accusative condition (the correct particle at the end is -o)

1. さっき 買ったよ、 授業の テキストブック/きょうかしょ *に。
   sakki katta-yo zhugyo-no tekiyoubukku/kyokasho ni
   just before bought-particle course's textbook
   I just bought the course textbook.

2. あけたら しめてよ、 その ドア/とびら *が。
   ake-tara shimete-yo sono doa/tobira ga
   open-particle close-particle that door
   Close the door after you open it.

3. もう のんだの、 その ミルク/ぎゅうにゅう *に。
   mou nonda-no sono miruku/gyuunyuu ni
   already drunk-particle that milk
   Have you already drunk the milk?

4. まだ 見てないの、 その ムービー/えいが *と。
   mada mite-nai-no sono muubii/eiga to
   yet watched-no-particle that movie
   I have not yet watched that movie.
Nominative condition (the correct particle at the end is -ga)

1. けっこう 高かったんだ、このシューズ/くつに。

kekkou takaka-tta-nda kono shuuzu/kutsu ni

very expensive-past these shoes

These shoes were very expensive.

2. おとといこわれたんだ、新しいデスク/つくえの。

ototoi kowareta-nda atarashii desuku/tsukue no
day before yesterday broke new desk

The new desk broke two days ago.

3. きのうからないの、くるまのキー/かぎを。

kinou-kara nai-no kuruma-no kii/kagi o
yesterday-particle absent-particle car-particle key

The car keys have been missing since yesterday.

4. すごくきたないよ、このバッグ/かばんで。

sugoku kitanai-yo kono baggu/kaban de
very dirty-particle this bag

This bag is very dirty.